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Iron Operations in the Chattanooga District

General Conditions Are Similar to Those of Birmingham District; Two of Largest Operating Companies Have Raw Materials close to Furnaces

BY EDWIN HIGGINS

For convenience the Chattanooga district may be said to include the territory 70 miles northeasterly, and 30 miles southwesterly, from Chattanooga, its width varying from 20 to 30 miles. This includes Roane, Rhea and Hamilton, and parts of Morgan, Cumberland, Meigs and James counties, Tennessee; parts of Jackson and De Kalb counties, Alabama, and parts of Dade, Walker and Chattooga counties, Georgia. The southern boundary of the district is not well defined, the iron industry here being more or less intimately connected with that of the northeastern Alabama district.

The Clinton formation, including shales, sandstones and limestones, outcrops at various points north of Chattanooga in the vicinity of the Tennessee valley, and to the south along the northwest slope of Lookout mountain.

As in the Birmingham district, raw materials are found within a radius of a few miles, and conditions generally favor the production of pig iron at a low cost. The cost of mining the ore seldom exceeds $1 per ton, and the cost of producing iron is not much in excess of $10 per ton. Foundry iron is the chief product of the furnaces.

The present production of pig iron amounts to about 25,000 tons per month. This is divided as follows: Roane Iron Company, 12,000 tons; Dayton Coal and Iron Company, Limited, 9000 tons; Citico Furnace Company, 4000 tons. The furnaces of the Southern Steel Company, now in bankruptcy, at Battelle, Ala., Chattanooga, Tenn., and Rising Fawn, Ga., are not in operation.

Toward the close of 1908 only a slight improvement was noticeable in the iron industry of the district. However, there is promise of better times after the first of the year. The demand for iron has shown a gradual increase and this district, in common with the southern field generally, has felt the demand to a greater extent than the iron districts of the north.

Roane Iron Company

The operations of the Roane Iron Company, which are typical of the practice in the Chattanooga district, will be described. This company owns extensive ore and coal lands and limestone deposits in the immediate vicinity of Rockwood, Roane county, at which point the blast-furnace plant is situated. Two stacks are now in blast. Included in the ore lands are important deposits about 10 miles southeasterly from Rockwood and south of the Tennessee river. The map, Fig. 2, embraces the territory covered by the operations of the company. Extending diagonally across the map is a geological section of the country from Waldens ridge through the ore mines in the vicinity of Welker.

The total output of the company's mines is from 1000 to 1100 tons of ore per day, from which there is made from 300 to 350 tons of pig iron per day. With respect to the centralization of the source of supply of ore, coal and limestone, conditions are most favorable for the manufacture of pig iron at low cost.

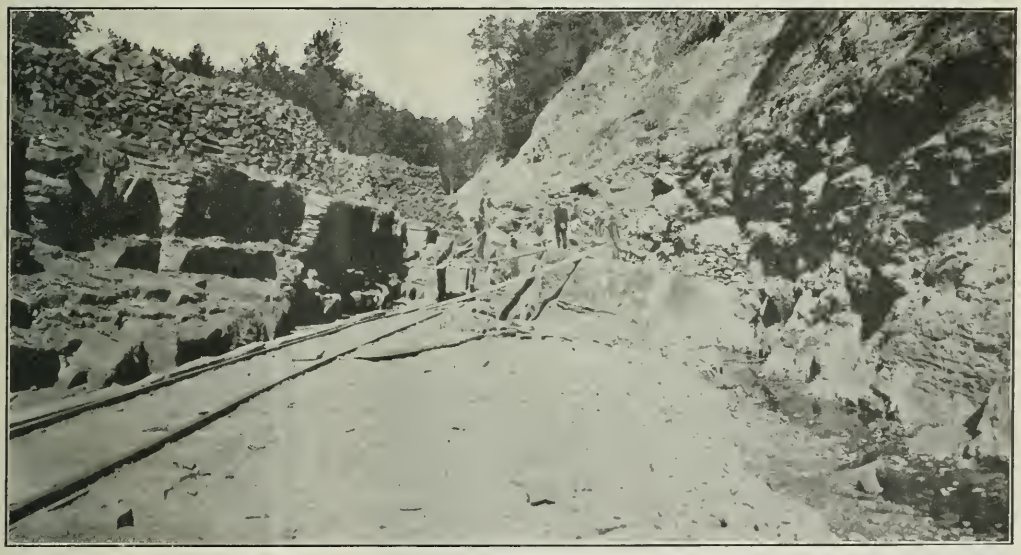

FIG. 1. STRIPPING AT CHAMBERLAIN, OR WELKER, MINE; ORE EXPOSED AT THE SIDES AND AT THE FACE

Rockwood Orebed

The company obtains most of its ore (from 700 to 800 tons per day) from the Rockwood vein, which outcrops at the foot of Waldens ridge, as shown in Fig. 2. This orebed strikes northeasterly and southwesterly, and has an average dip of 30 deg. toward the northwest. The most productive part of the bed is included within a length of about 4 miles, the width of the ore varying from 30 in. to 4 ft. The ore has the following range of composition: Iron, 37 to 40 per cent.; silica, 5 to 8; lime, 10 to 17; alumina, 3 to 6; magnesia, 2 to 4; sulphur, about 0.2; manganese, 0.1 to 0.2; phosphorus, 0.5 to 0.7.

Slopes in Operation

There are eight slopes, all situated in the vicinity of Cardiff, now in operation. Mining is done under contract by the Brown Mining Company. The Baker slope is 800 ft. in length; here 90 men are employed and the output is 175 tons of ore per day. Cardiff slope is 1000 ft. in length, employs 75 men and produces 150 tons per day. Carter slope is 1200 ft. in length, employs 40 men and produces 75 tons per day. Patton slope is 800 ft. in length, employs 60 men and produces 100 tons per day. Wright slope is 600 ft in length, employs 40 men and produces 90 tons per day. Prospect slope is 400 ft. in length, employs 30 men and produces 50 tons of ore per day. Evans slope is 500 ft. in length, employs 20 men and produces 30 tons per day. Clymer slope is 400 ft. in length, employs 15 men and produces 30 tons per day. In Fig. 5 is shown the tipple at one of the slopes near Rockwood. Fig. 6 shows the surface plant.

These slopes are 6x5x7 ft. high; they are all equipped with steam-hoisting plants of capacities varying from 70 to 90 h.p. The amount of water made is not large and in most cases is handled by a Knowles pump with 4-in. discharge for the first lift, and one of 2-in. discharge for the second lift. Ventilation is supplied by Cole fans of varying sizes, depending upon requirements. One shift of 10 hours is worked per day. The cost of mining varies, depending upon the nature of the ground, but may be said to be in the neighborhood of $1 per ton.

General Development and Mining Methods

The ore was originally worked by driving the slope down to the top slate (known as the north slate) at the angle of dip. Lifts, or entries, were turned off to the ore from this slope at distances of from 100 to 200 ft.; a parting here formed the north and south end of the lift. Recently, however, owing to the harder nature of the south slate, it has been found more permanent to drive the slope under the ore, although the first expense by this method is greater. Entries are driven at 100-ft. centers. On the entries, airways, or rooms, are turned up to the lift above about every 30 ft., leaving a pillar of 20 ft. between the rooms. One 15-ft. pillar is left standing half-way between lifts, and pillars 10 to 20 ft. thick are left under the lifts, being broken only by small air-holes driven through. Most of the ore is robbed from these pillars on returning.

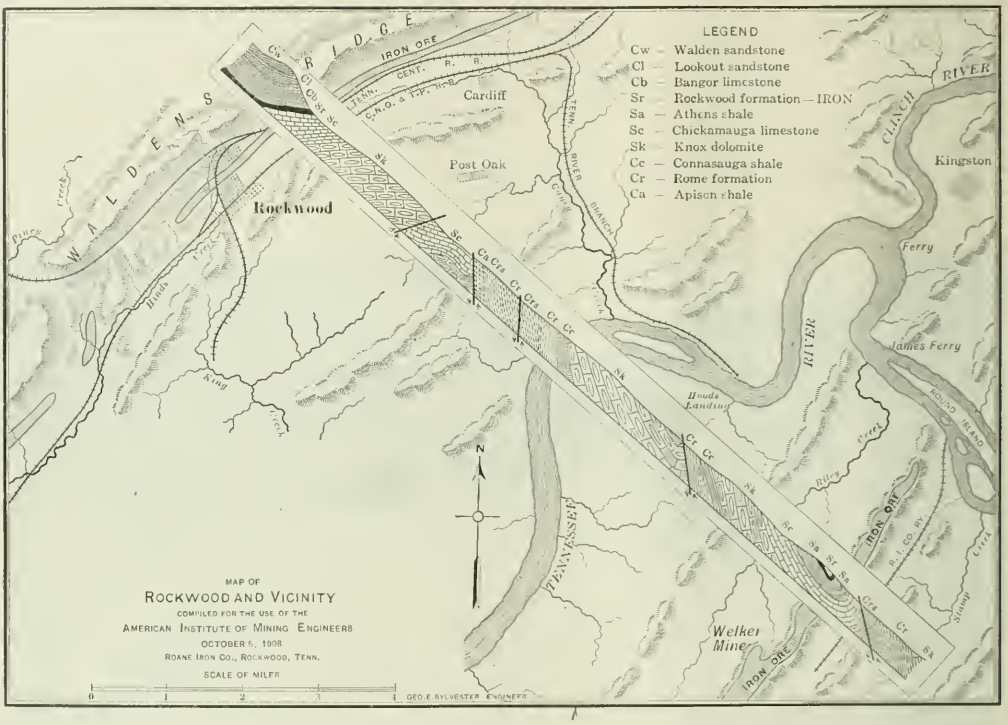

FIG. 2

Iron-ore Mines South of the Tennessee River

The company's ore land south of the Tennessee river lies in two tracts about 4 miles apart. Chamberlain, or Welker, mines (Fig. 2) are the only ones being worked to any great extent. These mines are producing about 200 tons per day of soft brown fossil ore and 100 tons of hard brown fossil ore. The soft ore has about the following average composition: Iron, 47.0 per cent., silica, 12.10; alumina, 6.27; lime, trace; phosphorus, 0.53; manganese, 0.32. The hard ore shows the following analysis: Iron, 25.20 per cent; silica, 3.48;

alumina, 3.25; lime, 25.20; phosphorus, 0.32; manganese, 0.15.

Here the orebed occurs in the form of a trough as may be noted in the geological section, Fig. 2. Most of the ore comes from the south end, or "upright," which is worked by driving adits from both sides of the hills until they meet; then the ore is stoped down to the country below. There are 14 openings on the "upright."

On the north side the ore rises from the syncline on a dip of about 10 deg. The ore is stripped along the outcrop until the overburden attains a thickness of about 30 ft.; eventually, underground mining will be carried on here. This orebed, shown in Fig. 1, is about 8 ft. in thickness, and has a parting near the center of from 10 to 15 in. of slate. Fig. 3 is a closer view of the orebed, taken a short distance back of the work shown in Fig. 1.

FIG. 3. A CLOSER VIEW OF THE OREBED AT CHAMBERLAIN MINE

The change from the soft to the hard ore occurs just below or at the permanent ground-water level, which in most cases is very close to the surface at the foot of the ridges. A striking example of the change is given in the stripping operation. In Fig. 1 the ore on the left-hand side of the cut is soft on top, grading into a semi-hard near the bottom. On the right-hand side, which is only a few feet lower, the ore is practically all hard.

At present about 150 men are worked at these mines. The cost of production is less than $1 per ton. The method of transporting the ore to Rockwood is interesting. The ore from the different openings is trammed to tipples and dumped into railway cars; the tipples are from 1 to 4 miles from the landing near Round Island. These cars are hauled over the railroad of the Roane Iron Company to the river, where they are loaded onto barges, and towed down the river a distance of about 8 miles to Hood's Landing. Here they pass onto the tracks of the Tennessee branch of the Cincinnati, New Orleans & Texas Pacific Railroad, going thence to the furnace at Rockwood. Fig. 7 shows two of these barges loaded with two ore cars and a passenger train. Each barge is laid with a double track and has a capacity of four carloads of ore. This passenger train is the special which left Chattanooga October 5, 1908, carrying the members and guests of the American Institute of Mining Engineers on their visit to the operations of the Roane company. The boat which tows these barges is a shallow draft stern-wheeler.

FIG. 4. LIMESTONE QUARRY AT ROCKWOOD

Coal and Limestone

The Roane company owns about 8000 acres of coal lands along Waldens ridge, of which 2000 acres are under development. The bulk of the coal is mined from slopes directly behind the furnace stacks at Rockwood. Here the seam lies in the form of a large trough, pitching into the mountain in a northerly direction. The slope is driven in the bottom of this trough on an average grade of 14 per cent. Entries are driven to right and left of the slope with sufficient grade to allow for drainage toward the slope. Where the coal shows sufficient thickness to be mined, rooms are turned right and left on such grades as to allow mule haulage. The bed varies from a few inches to 30 ft. in thickness, its average being about 4½ ft. Although nearly the whole area developed is more or less disturbed, practically all coal over 3 ft. is worked. As depth is gained under the mountain the bed becomes more level and more regular, but even here squeezes are common.

For some time ventilation at this mine gave trouble, owing to leaks through old rooms, defective brattices and fallen air courses. The mine is dry and requires regular sprinkling to lay the dust. The coal is gaseous and the workings require careful inspection. The rolls and squeezes which characterize the bed sometimes cause the shooting down of large quantities of slate in the entry work.

The coal is bituminous and has the following average composition (washed): Volatile matter, 31.07 per cent.; fixed carbon, 59.66; ash, 9.27; sulphur, 0.59. Coke from the washed coal shows the following average consumption: Volatile matter, 2.59 per cent.; fixed carbon, 83.69; ash, 13.73; sulphur, 0.56. This is an excellent grade of coke for blast-furnace work. The company has in

operation at Rockwood 350 coke ovens of the bee-hive type. The coke ovens are shown in Fig. 9. The furnaces appear in the background.

The principal limestone quarries of the company are situated about 1¼ miles southwest of the furnace, and are reached by a narrow-gage railroad. The supply of rock is practically inexhaustible. Following is the average composition: Silica, 1.94 per cent.; iron and alumina, 2.20; lime, 51.70; magnesia, 1.61. Fig. 4 shows one of the quarrying operations.

Furnace Plant

The furnace plant of the Roane company, situated at Rockwood, consists essentially of 2 modern blast furnaces, 17x 80 ft., equipped with skip hoist and modified Walter Kennedy top; 6 Macbeth blowing engines; 8 Kennedy hot-blast stoves; and boiler plant. Haulage from bins to skips is done with 4 trains of 5 side-dump cars operated with endless cable drive.

Each furnace makes from 150 to 175 tons of pig iron per day of the following analysis: Silicon, 1.50 to 3.50 per cent.; phosphorus, 1.35 to 1.50; manganese, 0.50; sulphur, 0.02 to 0.05. The furnace plant is shown in Figs. 8 and 9.

Dayton Coal and Iron Company, Limited.

The furnaces of the Dayton Coal and Iron Company, Limited, are situated at the town of Dayton, Rhea county. Here there are two stacks, 75x17½ ft., one of which is being run to full capacity. The output is about 4500 tons of foundry pig per month.

This furnace is running on Georgia brown ores and Tennessee red fossil ores. The company owns 34,000 acres of coal and iron land, the iron being in Meigs county and the coal in Rhea county.

The ores used are nearly self-fluxing; what flux is needed is quarried from the Bangor limestone deposits back of the furnace. Coal is mined near the furnaces in Rhea county. The company has 367 coke ovens at Dayton.

Citico Furnace Company

The Citico Furnace Company operates one stack at Chattanooga. The plant consists essentially of one furnace, 69 ft. high, 17 ft. bosh and 10 ft. hearth; three 350-h.p. engines; and four Whitwell stoves. The hoist is vertical and the furnace is hand-filled. The pig is handled from the casting house by a cradle of 1 ton capacity. This cradle deposits its load on a platform outside of the casting house, whence it is loaded into cars. The output is about 4000 tons of foundry iron per month. The furnace is shown in Fig. 10.

This furnace is running chiefly on custom ores, consisting of brown and red hematites. It has one red-ore mine at Citico, Ala., about 6 miles from Gadsden, on the Chattanooga Southern Railway. This mine is now under development and will soon be ready to produce a considerable tonnage. The ore has the

FIG. 5. TIPPLE AT IRON-ORE MINE NEAR ROCKWOOD

FIG. 6. SURFACE PLANT AT IRON-ORE MINE NEAR ROCKWOOD

FIG. 7. TRAIN LOADED ON BARGES AND TOWED BY A SHALLOW-DRAFT STERN-WHEEL STEAMER

following composition: Iron, 40 per cent.; silica, 16; manganese, 14. The figure for phosphorus was not ascertained. Some of the ore used comes from the Tecumseh Iron Company, at Tecumseh, Ala., and from the Etowah Development Company, with mines at Emerson, Ga. Some ore is also shipped in from Attalla, Ala.

The limestone used comes from a point about 18 miles from Chattanooga on the Queen and Crescent Railway. This is the same flux as that used at the Dayton furnace. Coke is obtained chiefly from the ovens of the New Soddy Coal Company and the Fox Coal Company, about 20 miles north of Chattanooga. The small balance required comes from Virginia and points west of Chattanooga in Tennessee. At this furnace little flux is required, it being possible to make from the brown and red ores used a mixture which is almost self-fluxing.

FIG. 8. FURNACES AT ROCKWOOD

FIG. 9. COKE OVENS AND FURNACES AT ROCKWOOD

When a shaft is sunk deeper than 600 ft. the Victoria, Australia, mining law requires that one compartment, having an area of at least 10 sq.ft., must be partitioned off and used only for purposes of ventilation, being kept clear of ladders, platforms and pipes.

The Broken Hill Proprietary Company

SPECIAL CORRESPONDENCE

This company, the head office of which is at Melbourne, Victoria, was formed in 1885 to work the well known silver-lead deposit of Broken Hill on the Barrier range, New South Wales. The capital of the company has been increased since the original issue and now stands at £384,000 in 960,000 shares of 8s. each, fully paid up. The report for the half-year ended May. 31, 1908, has recently been issued. It contains a detailed account, both technical and financial, of the operations and is accompanied with useful tables showing the fluctuations in the prices of the mine products—silver, lead, zinc and copper—for some years past, as well as plans of the workings and photographs of the new engineering workshop of the Carmichael-Bradford desulphurizing plant and of the new spelter furnace. Besides the usual auditors' certificate, the accounts are further indorsed by a certificate, signed by the secretary, which is required by the Australian companies act. This sworn certificate gives particulars as to the capital of the company, stating how much of the share capital is paper and how much has been actually paid up in money. A detailed list of the assets and liabilities is also included, together with particulars of the investments securing the reserve and insurance funds. The names, addresses and occupation of the directors are also stated in full. The compulsory publication in Australia of so much explanatory detail, as regards the accounts and the financial position generally, is a practice that might be followed with advantage to shareholders by the directors of many mining companies in England and the United States, who often issue reports which contain but meager information as to the financial position of the undertakings they direct.

The most important event in the period under review was the completion of the first unit of a spelter plant at Port Pirie. The first trials have been satisfactory, and the directors have decided to erect a plant capable of producing 8000 tons of spelter yearly, at an estimated cost of £100,000.

The sales of the company's products in the East are expanding. For the half-year ended Nov. 30, 1906, the sale of lead to India, China and Japan amounted to 4537 tons, while for the six months ending May 31, 1908, the sale was 9777 tons. The total sales for the six months were 35,085 tons, of which 21,486 tons went to Europe and 3822 tons were sold to Australia and New Zealand.

Experiments have been made with the Carmichael-Bradford process for roasting concentrates, on different lines from experiments made in former years. A new plant has been put up at a cost of £3300, capable of dealing with 200 to 250 tons a day. A feature of this plant is that, instead of using coal, the only combustible material used is straw, at the rate of about 10 lb. straw to one ton of concentrates. The Port Pirie smelting works carried on operations with nine furnaces. Three of the furnaces have been rebuilt in order to raise the water-jackets, a step made necessary by the more intense blast from the turbo-blower. The tonnage treated was as follows:

	Tons Treated.	Percentage.
Kaolin and siliceous ores (including purchased ores)	10,968	10.02
Sulphide concentrates and slimes	72,195	65.94
Sintered slimes	26,319	24.04
Total	109,482	100.00

In addition there were re-treated 5784 tons of flue-dust and refinery dross.

The refinery dealt with 37,133 tons of bullion, producing 2,102,559 oz. fine silver, 796 oz. fine gold, 36,140 tons soft lead and 335 tons antimonial lead. The doré plant treated 28,610 oz. doré bullion producing 796 oz. gold. As a result of a visit to America, the general manager, Mr. Delprat, erected a small experimental bag-house for filtering the smoke going to the stack. It has been found that the losses of lead in this direction had been considerable. The experiments have been encouraging and a bag plant estimated to cost £3500 is to be erected. The material gathered in the bags is chiefly sulphide of lead, which burns readily into a well sintered product, containing about 70 per cent. lead and practically no silver.

Owing to the low price of metals, the company's operation resulted in only the small net profit of £22,776 as compared with £137,642 for the previous half-year. The price of lead averaged £12 10s. 11d. per ton and silver 27.9375d. The low price of metals and the small profits earned call for a revision of the rate of wages. The present agreement with the workers expires on Dec. 31 next, and unless the metal markets improve before that date a reduction in the rate of wages will probably be demanded.

As regards the ore-dressing mills it is only necessary to remark that the use of tube mills for re-grinding is extending. Two tube mills of an improved pattern, with four Wilfley tables, have been installed, and two more are in course of erection, while eight additional mills with further improvements are shortly expected from Europe.

The centrifugal pumps for raising slimes, tailings and water are being replaced by bucket elevators, a considerable saving in power and repairs being thereby effected.

The ore-dressing mills treated 262,165 tons of crude ore during the six months. As regards the mine the position is reported to be satisfactory. The deepest level—1400 ft.—has been opened up, the orebody showing at first 6 ft. of fair ore, but at a point 50 ft. to the north it suddenly widened out to 44 ft. of high-grade sulphide ore. The bottom levels—1300 and 1400 ft.— have not yet been systematically sampled, but bulk samples indicate an average value of 16.18 per cent. zinc, 20 per cent. lead and 14 oz. silver.

Part of the mine is still on fire, but the fire is, however, at present well under control, and the directors consider that no serious apprehension need be felt that any interference with the general work of the mine can take place. The expenditure on account of the fire has amounted to £40,000 in all.

The fortunes of the company are dependent, of course, on the prices of zinc, lead and silver. With lead at £13 per ton and silver at 20d. per oz., it is not possible to cover working expenses under present conditions. A revival in the world's trade is required for the prosperity of the company.

FIG. 10. FURNACE OF CITICO IRON COMPANY, CHATTANOOGA

S. Pearson & Son's Uncontrollable Oil Gusher

San Diego de la Mar Well No. 3, near Dos Bocas, Which Burned for Nearly Two Months and Defeated All Efforts to Save the Oil

SPECIAL CORRESPONDENCE

During last summer press despatches in the newspapers reported the progress of a series of attempts on the part of S. Pearson & Son to gain control of a remarkable burning oil well opened near Dos Bocas, Mexico, in one of the extensive operations of that firm. When news came on Sept. 1 that the fire had been extinguished, it was generally supposed that the company's engineers with the aid of a battalion of troops supplied by the Mexican government had gained control of the well; the force of the gusher was then far from exhausted. The violence of the outflow continued to increase until on Nov. 1, when all efforts to save the oil had to be abandoned.

The San Diego de la Mar property is situated in the northern part of the State of Vera Cruz, about 75 miles by water from Tampico, on the Tamiahua lagoon. The lagoon is separated from the Gulf of Mexico by a narrow strip of land less than a mile in width. The subsoil rights to the lands were leased in 1901 by the Pennsylvania Oil Company, of Mexico, an American company, and a well was drilled on the property at a point on the lagoon known as Dos Bocas, but without result. In 1907 the English firm of S. Pearson & Son, Ltd., acquired the controlling interest in the Pennsylvania Oil Company, of Mexico. The first well drilled on the estate by the Pearsons came in at 2005 ft., with an estimated production of 5000 bbl. of oil daily.

San Diego well No. 3, the second well drilled by the Pearsons, came in on July 4, 1908, at a depth of 1824 ft. The drilling for some time prior to the blowout had been in the hard marl, when all at once it passed into soft shale. This created no surprise on the part of the driller, as similar soft shale formations had been encountered in this same well, and he continued to "make hole." After having made about 3 ft. in this formation the internal pressure began to exert itself, coming back through the 4-in. drill stem and bursting the hose. When this happened the driller remained at his post, raising the stem a considerable distance in the well, thinking that possibly it might be only a gas blowout and would soon be over. It gradually became stronger, however, and within 15 to 20 minutes the well was flowing at the rate of about 12,000 bbl. daily, causing the ground round the well to tremble considerably and to open up in several places. One of these fissures was immediately underneath the boiler, having started by first throwing out gas and then coming in oil. The fissure suddenly burst into flame, the fire working its way toward the well. A strong breeze was blowing, which made it

LOOKING FROM THE HIGHEST POINT ON THE EDGE OF THE CRATER TOWARD THE OUTLET. DISTURBANCE NEAR OPPOSITE SHORE ON THE LEFT, CAUSED BY FLOW FROM THE WELL

impossible for the men to get between the boiler and the well. The fire ignited the gas coming from the well, and simultaneously the whole country surrounding the well was enveloped in a mass of flames. The flow of the well increased in strength and volume until it was making between 75,000 and 100,000 bbl. of oil daily.

Effects of the Blowout

At the time of the blowout there were 43 ft. of 11⅝-in. casing and 1283 ft. of 8-in. casing in the hole. About half an hour after the well caught fire the pressure increased to such an extent that the drill stem was blown out of the hole, through the top of the derrick, to a hight of 150 ft., where it bent over like a piece of rubber tube and fell to the ground. The whole 1825 ft. of 4-in. drill stem was blown entirely out of the well.

On July 13, nine days after the fire started, the hight of the flames was estimated by engineers to be 1500 ft. At a hight of 800 ft. the flames were 90 ft. wide, all of the oil being consumed in the flames. The fire could be seen 200 miles at sea from the Gulf of Mexico. At night a newspaper could be read by the light of the fire 20 miles away. The noise of the fire was rather muffled, somewhat like the roar of Niagara falls. Monster volumes of black oil vapor or smoke would be picked up and rolled over and over again in the flames up to 1500 ft. and more into the air. When it was gushing at its strongest the well was making more than 100,000 bbl. of oil daily.

Extinguishing the Fire

The first plan decided upon for extinguishing the fire involved the use of a drag made of the heaviest plates of a 2000-bbl. steel tank, riveted together and weighted down with 30 tons of rails, this to be dragged over the hole with steam winches and wire cable. This plan had to be abandoned, however, because the orifice became too greatly enlarged, a crater apparently having formed.

The second plan adopted was to sink an inclined hole at an angle of about 45 deg., with the idea of intersecting the burning well at about 300 or 400 ft. from the surface, when a charge of nitro-glycerin was to have been inserted and discharged, with the idea of choking off the flow of oil. On July 17 the well tore itself loose, formed an immense crater. The solid column of flame began to weaken, and a part of the oil fell to the ground, burning in the "ciénaga," or marshy land, on the edge of which the well was situated, forming a lake of fire about 300 ft. wide round the well. On July 25 the crater was more than 150 ft. in diameter, the great area of the opening making it necessary to abandon the project of drilling angle wells.

It was then decided to install centrifugal pumps and to pump sand and gravel into the crater to choke the well. This was carried into effect, and on the night of Aug. 30, after having burned for 57 days, the fire was extinguished, the gushing in the meantime having become intermittent, at times ceasing almost entirely. It was during one of these periods when the pressure was weakest that the fire was extinguished by the continued caving, aided by the sand and gravel pumped into the crater.

On Oct. 1 the flow from the well was estimated to be about 3,000,000 bbl. of water and 15,000 bbl. of oil daily.

Attempts to Save the Oil

The Mexican government sent engineers and an entire battalion of 450 sappers to aid in extinguishing the fire and in saving the oil from the well. The battalion

THE BURNING OIL WELL NEAR DOS BOCAS, MEXICO. THE COLUMNS OF FLAME AND SMOKE ROSE TO A HIGHT OF 1500 FEET

Three weeks after the fire was out the diameter of the crater was 400 ft. Soundings taken 30 ft. from the sides showed a depth in places of 200 ft. Approximately two acres of earth dropped into the crater at one time. The immense flow of water and oil had forced an outlet into the Tamiahua lagoon, and for miles the surface of the water was covered with oil

of sappers remained at San Diego until Nov. 1, when the continued caving of the crater made it necessary to abandon entirely the plans for saving the oil.

The work of building dikes, sluices and earthen storage reservoirs for saving the oil has been surrounded with great difficulties. Fully one-third of the working time was lost due to the noxious gases

from the crater, the fumes making it impossible for the men to work when the wind was from the west. Excessive heat and mosquitoes added further to the difficulties.

The plans for saving the oil were based upon a careful study of the conditions and an estimate of the probable future behavior of the well. On Sept. 12 it was believed that the caving of the sides of the crater and the flow of water, mud and oil might soon be limited or interrupted by natural causes. The record kept during the sinking of the well shows that at 330 ft. hard rock was struck, and no change in record until 422 ft. was reached, indicating a stratum of rock approximately 100 ft. thick. It was believed that the opening through this stratum must be restricted, because the hard rock would resist erosion better than the looser *choy,* or marl, which was carried out of the well in immense volumes by the water. The solids in the mud ejected from the crater amounted to 17.06 per cent. by weight and 6.81 per cent. by volume.

BUILDING DIKES FOR STORAGE OF OIL

BATTALION OF SAPPERS SENT BY THE MEXICAN GOVERNMENT

If the opening in the hard stratum at 330 ft. remained fairly restricted the width of the crater at the surface would be limited by a definite angle. The caving banks contained a certain amount of gravel in addition to the loose material floated out into the lagoon. It was believed that this gravel might settle and choke the well at the narrow orifice long enough for the finer *choy* to settle and form a temporary plug in the well.

Another hard stratum of rock was encountered by the drill at 1128 ft., and it was believed that much of the enormous volume of solids carried out of the well was derived from the soft strata between this and the hard rock nearer the surface. The second plan for plugging the well contemplated sinking an inclined well to the bore in the upper hard stratum and then choking the opening by shattering the rock with explosives. The third plan for controlling the flow involved the introduction of thousands of tons of gravel into the conical crater by means of powerful centrifugal pumps. This plan was successful to the extent that it extinguished the fire, or at least aided in quenching the flames by rendering the flow so intermittent that the oil on the surface had time to burn itself out before a fresh outburst from below could supply additional fuel; but it failed to control the flow permanently. No plan could take sufficiently into account the enormous forces which developed as the caving of the crater progressed.

Plans for Storage

The ingenious plan adopted for saving the oil was based upon the reasonable assumption that the 100 ft. of rock, 330 ft. down, would hold the bore to fairly narrow dimensions, and that the caving of the sides of the crater would, therefore, cease. Hundreds of men and many mule teams with scrapers were set to work to throw up a dike inclosing the opening. A flume with a suitable gate was to be built at the surface to draw off the water and mud into the lagoon while the layer of oil, which was expected to separate in the crater itself, was to be drawn off at a higher elevation into storage reservoirs. But the walls of the well continued to cave and the flow to increase. Apparently the hard stratum at 330 ft. had been undermined and was breaking up. Finally the fumes from the well became so serious and the crater encroached upon the earthwork to such an extent that the well had to be abandoned.

Some idea of the enormous forces at work in this remarkable well may be gained from the estimates of the flow. While the daily flow on Oct. 1 was approximately 3,000,000 bbl. of water and 15,000 bbl. of oil, on Nov. 1, when the well was finally abandoned, the total volume had risen to 14,000,000 bbl., the oil being thoroughly emulsified with water and mud. On Sept. 12 the oil ejected from the well covered an area of about 20 sq.m. on lake Tamiahua. On Oct. 12, the approximate volumes of solid matter carried from the well into the San Geronimo river and into lake Tamiahua was from 30,000 to 50,000 cu.m. At that date a captain of a steamer plying these waters reported that the wheel of his vessel stirred up *choy,* mud and asphalt four miles off the mouth of Dos Bocas.

Beyond Hope of Control

The following extract from a letter from one of the engineers on the ground dated Oct. 12, suggests the helplessness of engineering science when confronted with the extraordinary forces manifested in this remarkable gusher:

"Every morning we wake up wondering what new phase of the situation will force the adoption of changes in our plans, or the inauguration of new measures. The bigger the hole bores out the more water comes; and the more water comes, the greater the quantity of solids thrown up. I saw the well belch yesterday up to a hight of 30 ft. beyond the normal surface and over an area as big as the patio of the office building. If the water continues to come under the same pressure as formerly, and such seems to be the case, more water is but a question of the enlargement of the orifice through which it reaches the surface, and this orifice is periodically enlarging itself by washing away and caving in the walls of the well. As fast as they cave in the water conveys the cavings to the *cienega* and the lake.

"Where this condition will stop no human being can predict, but if the pressure continues to come as the orifice opens, cavings will continue indefinitely. The force that is moving the immense volume of water outward must be expended before this well will permanently choke itself.

"The oil flow since the cave of last night has been almost *nil,* but it is entirely possible that it is so heavy with *choy* emulsion that instead of floating it sinks, and passes outward in the lower levels of the flowing stream, in some places 6 ft. deep, and running at the rate of 4 ft. per second.

"After every heavy caving the oil comes in heavy emulsion and gradually clears itself to pure oil as the well purges away the cavings. The periods when pure oil has been flowing have been very few and of short duration during the past 10 days. While I believed that the cavings would become greater as the arch in the perimeter of the well flattened, I never believed that they could become as rapid as they have in the past week or so, and the water flow is carrying away the cavings as rapidly as they come in."

The Rare Metals, VI —Titanium

By Charles Baskerville*

Titanium is almost invariably present in igneous rocks and in the sedimentary material derived from them. It occurs in soils and clays, and 784 out of 800 igneous rocks analyzed in the laboratory of the United States Geological Survey contained titanium. The titaniferous minerals, which seldom occur in considerable quantity in any one locality, are named in the accompanying table. However, extensive deposits of titanium ores are known.

TITANIUM MINERALS.

	Titanium Dioxide Content.
Rutile, titanium dioxide	90–100%
Edisonite, a variety of rutile	
Iserite, a variety of rutile	70%
Dicksbergite, a variety of rutile	90–100%
Brookite, titanium dioxide	90–100%
Octahedrite, titanium dioxide	90–100%
Ilmenite, iron titanium oxide	3– 59%
Titanite, calcium titanium silicate	35– 43%
Pseudobrookite, a ferric titanate	44– 53%
Perofskite, calcium titanate	59%
Geikielite, magnesium titanite	68%
Senaite, composition uncertain	57%
Zirkelite, a titanic thorio-zirconate of iron and lime	15%
Knopite, a titanate of calcium, iron and cerium	54– 59%
Derbylite, a doubtful iron, antimony and titanium oxide	34.5%
Lewisite, a titano-antimonate of iron	11–12%
Manzeliite, a titano-antimonate of lead and calcium	7– 8%
Neptunite, a titano-silicate of iron and alkali metals	17– 18%
Hatmite, a silicate of sodium, calcium, titanium, etc	———
Polymignite, a niobate and titanate of cerium, iron, etc	19%
Aeschynite, a niobate and titanate of the cerium metals	21%
Pyrochlore, chiefly a niobate of the cerium metals, etc	5 14%
Dysanalyte, a titano-niobate of calcium and iron	40– 60%
Rinkite, a complex silicate of titanium, calcium, etc	13%
Mosandrite, a complex silicate of cerium, etc	5–10%
Johnstrupite, a complex silicate of cerium, calcium, etc	7– 8%
Astrophyllite, an orthosilicate of titanium, etc	7– 14%
Lamprophyllite, composition doubtful	———
Keilhauite, a titano-silicate of calcium, yttrium metals, etc	26– 37%
Schorlomite, analogous to garnet	12– 22%
Guarinite, calcium titanium silicate	34%
Tschelfkinite, uncertain composition	16– 21%
Euxenite, a niobate and titanate of yttrium, uranium, etc	20– 35%
Polycrase, a niobate and titanate of yttrium, etc	25– 30%

The important titanium minerals are rutile, brookite, octahedrite, perofskite, ilmenite and titanite

Uses of Titanium

The addition of titanium in minute amounts to iron and steel increases the tensile strength greatly; ferro titanium is useful in cases where a metal of considerable density and hardness is required, as in the manufacture of car wheels. Titanium steel is employed for cutting tools. The addition of titanium to steel containing 0.8 to 1.2 per cent. of carbon scarcely increases the hardness, but greatly raises the elasticity On account of the beautiful light effect it produces during combustion, titanium has been used in pyrotechnics. It is also used in the manufacture of filaments for incandescent electric lamps, and for incandescing media for gas lights. With the development of the electric furnace treatment there will be a market for titaniferous iron ores.

Titanium dioxide has been used for some time in the manufacture of artificial teeth, and in the preparation of a glaze for earthenware; more recently it has been employed as a mordant for wool and cotton. Titanium mordant yields bright and fast colors intermediate in shade between the colors produced by chromium and aluminum. Titanium dioxide has also been utilized in the manufacture of a protective paint for iron and steel. Titanium sesquioxide and its salts are employed as reducing agents, sodium titanous sulphate and titanous chloride having been found most useful. Titanium tannate may be utilized as a self-color for fibers or the material may be further dyed with basic coloring matters. Titanium oxalate, potassium titanium oxalate, "tanno-potassium titanium oxalate," and the double tartrates and lactates of titanium with alkali metals are used in leather dyeing. Titanium ferrocyanide is employed as a substitute for the poisonous Schweinfurth green and other arsenical pigments.

Rutile

Rutile, or nigrine, occurs in reddish brown to nearly black prismatic crystals, which are often acicular in form and as such included in other minerals. It is found occasionally massive, especially when black and ferriferous. Rutile occurs as a pyrogenic mineral in eruptive rocks, but is more common to gneiss, mica schist, and the phyllites. It also is found as a secondary mineral derived from ilmenite and titanite. Rutile is a brittle mineral, having a hardness of 6-6.5, and a specific gravity of 4.18-4.25. Its luster is adamantine to almost metallic, and the cleavage is prismatic and pyramidal. The streak is pale brown. It is found in Maine, New Hampshire, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, North Carolina, Georgia, Arkansas, Colorado, and in the Black Hills, Dakota. The most prominent of these localities are Lincoln county, Ga., Habersham county, Ga., Warwick, N. Y., Warren, Me., and Magnet Cove, Arkansas.

Rutile is infusible before the blowpipe. It dissolves very slowly in salt of phosphorus in the oxidizing flame to a yellowish bead, which assumes a violet color in the reducing flame on cooling. Ferriferous varieties give a brownish yellow or red bead in the reducing flame, so that a violet color is only obtained after treating the bead with metallic tin on charcoal. It is insoluble in acids However, it dissolves by fusion with an alkaline carbonate; the solution, after the addition of an excess of acid and tin-foil, yields a violet color on boiling.

Rutile is of a more decided red color and of lower specific gravity than cassiterite; and may readily be discriminated from garnet, pyroxene, vesuvianite, and tourmaline by its luster, weight and infusibility.

Brookite

Brookite is found in thin, tabular, brown crystals, or in black opaque crystals, habit varied, in the Ozark Mountains, Ark., North Carolina, Ulster County, N. Y., and at Paris, Me. Its hardness is 5.5-6, and the specific gravity is 3.87-4.07. The luster is submetallic to adamantine, and the streak may be uncolored, gray, or yellow. Arkansite, as the variety from Magnet Cove, Ozark Mountains, Ark., is called, occurs in stout crystals, brown to black in color, associated with elaeolite, black garnet, schorlomite, and rutile, to which it alters on the surface by paramorphism. At Ellenville, N. Y., brookite is found on quartz with galena.

The pyrognostic deportment of brookite is the same as rutile.

Octahedrite

This mineral occurs in light brown, deep blue and black pyramidal crystals at Smithfield, R. I., and Brindletown, N. C. At the latter locality, it is found in transparent tabular crystals. The luster of octahedrite is metallic to adamantine, and the fracture is subconchoidal. It is brittle, and the hardness is 5.5-6 and the specific gravity is 3.82-3.95. The streak is white. Octahedrite is never primary, but is formed by the alteration of other titanium minerals.

Octahedrite behaves like rutile before the blowpipe. Its specific gravity increases to about that of rutile on heating.

Perofskite

Perofskite, or perovskite, occurs in pale yellow to grayish-black cubic crystals and in reniform masses. It has been noted as a rock constituent in the form of very small octahedral crystals. It is found in Elliott county, Ky., and at Syracuse, N. Y. The hardness is 5.5, and the specific gravity is 4.01-4.04. The luster is adamantine, and the streak is colorless or grayish. It is transparent to opaque.

Perofskite is infusible before the blowpipe. With salt of phosphorus it dissolves readily in the oxidizing flame to a greenish bead while hot, but which becomes colorless on cooling; in the reducing flame the bead assumes a violet blue color on cooling. It is decomposed by sulphuric acid, but is insoluble in hydrochloric acid.

Ilmenite

Ilmenite, menaccanite, or titanic iron-ore, is an iron-black mineral, which is found usually massive, in thin plates, in embedded grains, or loose as sand. It occurs in Orange county, N. Y., Massachusetts, Litchfield, Conn., Troy, Vt., and

*Professor of chemistry, College of the City of New York.

in California. Extensive beds of ilmenite occur in Quebec, Canada. Its hardness is 5-6, the specific gravity is 4.5-5, and the luster is submetallic. The fracture is conchoidal. The streak is black to brownish red. Ilmenite slightly influences the magnetic needle.

Ilmenite is infusible in the oxidizing flame, but is rounded on the edges in the reducing flame. It reacts for iron with borax and salt of phosphorus in the oxidizing flame, and yields a brownish-red bead in the reducing flame with the latter salt; this changes to a violet-red color when treated with tin on charcoal. The powdered mineral is soluble in hydrochloric acid to a yellow solution, which assumes a blue or violet color when boiled with tin. It is decomposed on fusion with sodium or potassium disulphates.

Ilmenite is distinguished from magnetite and hematite by the titanium reactions described above. It is used in the preparation of a lining for puddling furnaces, but is not very desirable as an iron ore on account of the difficulty in reducing it.

Titanite

Titanite occurs in brown, gray, yellow, green, rose-red, and black, wedge-shaped or tabular monoclinic crystals. It is sometimes found massive, and rarely lamellar. The luster is adamantine to resinous, and the streak is white. The hardness is 5-5.5, and the specific gravity is 3.4-3.56. It occurs in Maine, Massachusetts, Trumbull, Conn., Lake George, N. Y., Franklin Furnace, N. J., Bucks county, Penn., and in Iredell, Buncombe, and Alexander counties, N. C. At Green River, N. C., large crystals of sphene, or titanite, occur completely or partially altered into xanthitane. Good gem stones of titanite have been found at Brewsters, N. Y., Bridgewater, Penn., and Magnet Cove, Arkansas.

Before the blowpipe, some varieties change color, becoming yellow, and fuse to a dark glass with intumescence. Titanite gives a violet bead with salt of phosphorus in the reducing flame. The borax bead is clear yellow-green. It is partly soluble in hydrochloric acid, and if the solution is concentrated after the addition of tin, it assumes a violet color. It is completely soluble in sulphuric acid.

Aluminum Coins in France

M. Caillaux, French Minister of Finance, is shortly to place before the Chamber a bill in which he proposes to replace the small old-time copper coins by new coins of aluminum. He has had some aluminum coins struck at the mint, which have met with approval. The new 5- and 10-centime coins are to be of exactly the same size as the copper coins now being used, the only difference being in weight.

Zinc Mining in New Jersey*

By Henry B. Kummel†

The zinc mines at Franklin Furnace and Ogdensburg, both controlled by the New Jersey Zinc Company, are the only mines of this character in the State, and during 1907, as for a number of years past, only the Franklin deposit was worked, the mines at Ogdensburg having been indefinitely closed down a number of years ago. The richness of this ore, the great size of the orebody and the large rewards awaiting the discoverer of additional deposits, have led, first and last, to the expenditure of large sums of money in prospecting the adjoining territory. The zinc deposits occur only in the white crystalline limestone, the limits of which are accurately known. It is safe to say that every foot of this belt has been carefully examined on the surface without revealing any evidence of additional deposits. In addition to this thousands of dollars have been spent in diamond drilling on all sides of the known deposits, but without avail. It is unquestionably true that in some instances the drilling ceased before the ground had been thoroughly tested, i.e., before the holes reached the bottom of the limestone, but since the holes were in some instances at least 1300 or 1400 ft. deep, it was demonstrated that no zinc deposits occurred within easy reach of the surface where they were drilled. The absence of any surface indications of zinc ore, and the utter failure of all the drilling to reveal a deposit other than those which have been mined for many years, afford at least very strong presumptive evidence that no other deposits exist. And, while there is always the possibility that zinc ore similar in character to the Franklin ore may occur somewhere within the limits of the white limestone, yet the probabilities of finding it by a few diamond-drill holes put down at random are so remote that any exploration of that character must be regarded as a highly speculative venture in which the chances are against success. It seems advisable to make these emphatic statements in view of the large sums of money recently obtained by a mining company on the alleged occurrence of valuable zinc deposits on property adjacent to the established mines.

The New Jersey Zinc Company reports its production in 1907 as 329,205 tons of ore, a little less than half of this having been taken from the open cut at the south end. This is a decrease of 32,120 tons as compared with 1906. The Palmer shaft, started in 1906, enters the blue limestone of the footwall, near the mill, at an angle of 47½ deg. At the close of the year, it had been sunk 580 ft. and was in the gneiss underlying the white limestone. Since the blue limestone and associated sedimentary beds dip to the westward at an angle of about 50 deg., the shaft crosses the bedding planes nearly at right angles. The gneiss was reached 230 ft. from the collar of the shaft, and from that point to 580 ft. and beyond the rock was gneiss, the foliation and fracture planes of which dip eastward at an angle of 70 degrees. At 402 ft. from the collar of the shaft, a small vein of zinc blende, which dipped about 50 deg. to the west, was struck. It measured from 1 to 3 in. in width and was associated with quartz and fluorite.

[The emphatic remarks of Doctor Kümmel are highly praiseworthy and ought to do much to prevent the inception of fraudulent and visionary schemes such as have frequently been dangled before unwary investors in the past. This is an exemplification of one of the highest functions of a State geologist.—Editor.]

*From Annual Report of the State geologist for 1907.
†State geologist of New Jersey.

Pulverized Shale for Prevention of Coal Dust Explosions

Experiments at Lieven, France, in the laboratory maintained by the Comité Central Des Houilliéres de France, recently demonstrated the value of a new explosive, "grisoutine couche," to overcome the danger of secondary explosions of coal dust, and also that coal dust mixed in the proportion of six to four with pulverized shale cannot be exploded. A gallery constructed of armored concrete fitted with protected glass observation holes was used to show the progress of explosions. Nothing has yet been said about the industrial value of the discoveries, as some experiments have yet to be made in order to discover to what extent local applications of shale dust will prevent explosion.

The laboratory is making experiments with apparatus of all kinds intended for preventing disasters in the mines, or for making it possible to inaugurate intelligent relief work very soon after any disaster has occurred. Among the specialties of the laboratory is a department for testing and mending anemometers which are used for recording the draught caused in different parts of the mines by the ventilating fans.

In Victoria, Australia, the State mining law requires 70 cu.ft. per minute of air to be supplied to each miner working in the mine and that the air in the mine shall not contain less than 20 per cent. oxygen, nor more than 0.3 per cent. carbon dioxide. The Western Australian Mining Commission in 1905 considered that not more than 0.15 per cent. carbon dioxide should be allowed and that it should not be difficult for mines to meet that demand. Dr. Angus Smith, of the English Mining Commission, recommends 0.24 per cent. carbon dioxide as the limit of impunity in mine air.

Views Respecting Coal Mine Explosions

Engineers Discuss Statements of Mr. Haas, Mr. Page and JOURNAL Editorial of Dec. 12, Relative to Colliery Accidents, Cause and Prevention

A SYMPOSIUM OF OPINIONS

The following letters, including the longer article by Mr. Stow, have been written in reply to recent arguments advanced to explain the chief causes of coal-mine explosions. The authors differ radically in some of their views; however, it is only through the fearless expression of such personal opinions that the maximum benefit will result.

Blown-out Shots and Miners' Negligence Cause Many Explosions

By Carl Scholz*

I have read with interest your editorial in the issue of Dec. 12, on "Colliery Accidents." If you will compare the accidents which existed prior to the adoption of the mine-run basis, or when coal was mined in this country very much on the same basis as it is now produced in England, Belgium, Germany and France, which countries are held up as examples, you will note that our accident ratio then was very much lower than it is now. While Mr. Mitchell stated that 60 per cent. of the fatal accidents are due to rock falls, it is well known that increased rock falls are due to excessive use of explosives and shooting from the solid.

The Mine Workers' organization has been forcing the majority of the mining fields to use the mine-run basis, and in some sections this has resulted in the adoption of mining machines to prevent excessive waste. Even if not a single explosion could be prevented, but I think they can, if we could reduce the accidents from rock falls to one-half by cutting the coal before blasting it, the greatest possible step in the direction of saving lives and preserving the coal will have been made. There might have been some good reason to adopt the mine-run basis, but once it is proved to be detrimental, it seems to me that the mine workers should be willing to change their attitude.

In talking with a number of officials, I find that, individually, they are favoring the readoption of pick mining, and it seems to me this will place a premium on the good miner and force out of the mines such men as are not qualified to be miners and are a menace to the safety of their fellow employees.

Electric shot-firing is a great safeguard and shot-firers reduce the risk to a smaller number of men, although as long as the coal was properly mined and undercut, there was no necessity for this course. Blown-out shots generally result where coal is not properly mined, or where it is shot from the solid; there is no excuse for blown-out shots where mining machines are used and the coal is properly snubbed. Solid-shooting is responsible for an increase in the cost of production and requires the consumer of domestic coal to pay the greater part of the expense. In coking-coal districts, this feature is not of as much importance as in territories where domestic coals are produced and where the small coals command lower prices, as is the case in Illinois and Indiana.

Why should the operators be compelled to go to the expense of inspection and installation of expensive apparatus, when the miners, merely as the result of a fad, continuously and daily force the assumption of risk of life and property?

*Mining engineer, Chicago, Ill.

Facts Disproving Recent Statements Relative to Mine Fatalities

By Joseph Virgin*

In reference to the article of Wm. N. Page in your issue of Dec. 5, Major Page says, "After a careful study of the Paper of Mr. Haas and the Report of Foreign Experts, etc.," two facts seem to be established: 1. That dust as dust is not explosive. 2. It is physically impossible to moisten dust to the point of safety in high velocity currents. After a careful study of Mr. Page's paper, and the other papers mentioned by that gentleman, as well as your editorial of Dec. 5, six facts seem to be established: First, dust in a quiescent state is not explosive. Second, dust is not quiescent in a high velocity. Neither is it quiet after a slight concussion, such as accompanies falls of roof, or the concussion from shots or moving trains. Third, Mr. Haas is an advocate of fine spray moistening with water or steam, or any method that is convenient, and is practicing it. Fourth, Messrs. Watteyne and Meissner concur in this. Fifth, the statement that 60 per cent of all mining fatalities are due to roof falls, is not borne out by figures, especially West Virginia, and more especially in that same State for the years ending June 30, 1905, 1906, 1907, and 1908. Sixth, moisture in the air does not seem to be a particular cause of the fatalities in West Virginia or Pennsylvania.

As to the first consideration, fine dust in a quiet state is not explosive because it is *en masse*. You cannot get a flame around it, neither is there enough oxygen around it to make a flame with it. But upon the least provocation it is stirred up and is surrounded by its own atmosphere of air and Professor Abel says it will ignite at 700 deg. F. Such being the case, it is immaterial whether it detonates, bursts into flame or explodes; the result is the same, the men are killed.

Concerning the second fact, dust won't stay quiet. You may shut down your fans and let all the dust settle, but just as soon as you start them up again the dust begins to move; furthermore, the air acts on the rocks, and falls occur, forcing the very finest and the most dangerous dust out on any flame that may be near; the dust is also disturbed by any movement of cars, and the high velocity of rope trips or motor trains causing the gauze of safety lamps to be clogged, making them pass the flame at a much less velocity, thereby greatly intensifying the danger.

Third, Mr. Haas not only advocates steam and fine sprays to moisten dust in high velocities, but is contemplating a long steam line to warm the winter air to assist it in getting the moisture from the sprays or steam more quickly. However, if you clean up the dust and do not allow it to accumulate, you will not have any dust to water, and it will only be necessary to keep the fine coal damp so that it can be removed before it becomes dust.

Fourth, at the meeting of the West Virginia Mining Association, Doctor Holmes and the foreign experts gave us strong advice on the good results to be obtained from watering, and the results of the investigation tests in Europe.

Fifth, let us take the West Virginia reports for the years 1897-1907, inclusive; the following results are shown:

Total lives lost	1699	
Falls of roof, coal, etc	928, 54 per cent, was due to falls of roof, etc.	
During 1905, lives lost	176	
Due to falls of roof, etc		105
During 1906, lives lost	250	
Due to falls of roof, etc		99
During 1907, lives lost	324	
Due to falls of roof, etc		139
	750	343

Take the year ending June 30, 1905, we find 50 lives were lost in all kinds of

*Mine superintendent, Plymouth, West Va.

explosions. Then for the year ending June 30, 1906, we find 113 lives lost from the same cause. In the year ending June 30, 1907, there were 147 lives lost from mine explosions.

FATALITIES IN WEST VIRGINIA

	Tota Lives Lost.	By Explosions of All Forms.	Due to All Kinds of Explosions.
1905...	176	50	28 per cent.
1906...	250	113	45 per cent.
1907...	324	147	45 per cent.
1908...	will probably show		60 per cent.

As Mr. Page's open letter was directed to the mine managers of West Virginia, Mr. Page being an operator in this State, his figures are somewhat misleading. Mr. Paul, in his report for 1907, to the Governor of West Virginia, makes the following statement: "For the third time in the history of the State, the number killed by explosions exceeds that of persons killed by falls of roof."

The elaborate report of the Pennsylvania mining department for 1904, and covering the bituminous mines of the State, shows that the loss of life due to falls of roof, was 37.98 per cent. Again referring to the last mentioned report, for the year, 1904, I submit a few figures to show that moisture as appearing in the summer months is no more dangerous, from a standpoint of lives lost, than when occurring in the colder months.

FATALITIES IN PENNSYLVANIA

Month.	Killed by Falls of Roof and Slate		
Dec.....	20	47	Cold months, least saturation.
Jan.....	14		
Feb.....	13		
March...	14	57	Slightly warmer months, a little more moisture.
April....	20		
May....	23		
June....	13	53	Extremely warm months, highly saturated.
July....	19		
August..	21		
Sept....	12	48	Normal temperature, average humidity.
Oct.....	19		
Nov....	17		

In the years 1905, 1906, 1907, ending June 30, I produce the following from the West Virginia Mine Reports:

MEN KILLED BY FALLS OF ROOF FOR THE THREE YEARS.

Month.	Total Fatalities.		
Dec.....	32	88	Winter months.
Jan.....	26		
Feb.....	30		
March...	17	64	Spring months.
April....	23		
May....	28		
June....	17	64	Summer months, most moisture.
July...	25		
Aug....	22		
Sept....	24	64	Fall months, normal temperature.
Oct.....	21		
Nov.....	19		

All the figures gleaned from the bituminous mine reports of Pennsylvania and those of West Virginia, prove that as far as the mines of those two States are concerned, that the months in the year containing the most moisture are not particularly dangerous; in fact West Virginia seems to be safer in the hot months.

The foregoing figures also disprove the statements that 5 per cent. of our accidents are due to dust explosions, and 66 per cent. to falls of roof. Mr. Page probably means all kinds of mines, not coal mines alone. In conclusion, I desire to approve of the policy of keeping dust damp and using large currents of air. West Virginia allows only 60 men in each split, and it follows, therefore, that in a mine of 300 men, there must be 5 splits, or the law is violated, consequently, it appears that Mr. Page's advice to split, is ancient.

Timely Suggestions as to Shot-firing in Coal Mines

By R. J. J.*

I have read with great interest your editorial of Dec. 12, on "Colliery Accidents," also the description of the events connected with the Marianna explosion. I am glad to note your reference to the action of the National Institute of Mine Inspectors, at the Pittsburg meeting of the Mining Congress. The inspectors, as a rule, are underpaid, if one considers the character of their duties, and should be encouraged in their work rather than censured. The press bulletins issued during the past year may have been necessary in order to influence public sentiment so that appropriations for the work of the Federal Technologic Division would be forthcoming; however, I believe that they have tended to throw an air of mystery around mine explosions in the minds of the general public. We all know that mine gas and air will explode; there is no use to erect expensive apparatus to demonstrate this fact, but we do not know just what explosives at present on the market are safe, and the investigation of such substances, by the Survey authorities, is to be commended.

THE EMPLOYMENT OF SHOT-FIRERS IS ADVISABLE

As to the employment of shot-firers, I believe that you have not grasped the full significance of Mr. Mitchell's remarks. I have not read his address, and can only gain an idea of what he said as you refer to it. He doubtless refers to the Illinois Shot-firer's Law. This was necessary, as the inspectors found that explosions were becoming more frequent. They reasoned that it would be better to employ shot-firers to shoot the shots than to allow the miners to shoot their own shots. These shot-firers would shoot the holes when they were alone in the mine, after all the miners had left the workings. Since the adoption of this plan, there have been numerous small explosions, many of them undoubtedly due to powder poorly placed in the holes, and a number of the shot-firers have been killed. Had these explosions taken place under the old rule of allowing every miner to shoot his own shots, when the entire force was in the mine, the loss of life would have been in many cases, I venture to assert, at least as great as that in the Marianna explosion.

As it was, only the shot-firers, of which there are rarely more than 6 or 8 in number, and usually but 2, were lost. It seems to me that the Illinois law, so far as it has been enforced, is a good one, and should be extended to other States. But, it has its imperfections. Usually, active men are required for the work of shot-firing, as the men must be able to quickly traverse the entire mine workings in order to shoot all the shots in a short space of time. For this reason the older and more experienced miners will not do the work, and it is often relegated to younger and less experienced men; often, indeed, to drivers, who are proverbially prone to take chances. Moreover in some cases, the practice has been to allow the shot-firers a shift's wages for shooting a certain amount of shots, and, as a consequence they have hurried through the work, sometimes taking reckless chances which resulted to their sorrow. This is not general, but such cases have occurred. However, this is the fault of the men, not of the system, and where it is wisely carried out, it will prove in the end a life-saving innovation.

PROBABLE CAUSES OF EXPLOSIONS

One thing that has been a source of wonder to many, is why we are of late years, having more and more explosions, where we never had any before, and where the method of mining is the same as it has been for 30 to 40 years past, and the men are experienced in the system used. I refer more especially to solid-shooting mines. Is it because the general run of miners are not now as skilled as formerly, or is it because the powder manufacturers now use different ingredients in their powder, than they did formerly? In support of the first question, I have recently heard of instances where the shot-firer found cartridges placed for him to shoot, which were longer than the hole was deep. As to the second question, the use of an ingredient with greater flame-producing powers than that formerly employed might cause explosions.

Another factor which I think is neglected, is the element of time. Formerly, the men fired their shots under the ten-hour day custom, anywhere from 4:30 to 6 p.m. Now, under the eight-hour day, the shots are fired nearly all in the

*Mining engineer, Baltimore, Md.

space of time varying from 15 to 30 min., or from 3 to 3:30 or from 4 to 4:15 or 4:30 p.m. Many more men are now employed to produce a given output than was formerly the case, and more powder is used per ton of coal than formerly; all this powder is exploded in from 15 to 30 min., where shot-firers are not employed, and occasionally when they are, although the time formerly required for such work was from two to three hours. The liberation of such a great volume of gas from powder explosions in such a short space of time, may be a contributory cause.

As to the Marianna explosion, you do not say so, but I presume that there was indiscriminate shooting, that is, the men fired when they wished, at any time during the shift, and not at the close of the shift, as they should. Perhaps this was the case also at Monongah.

Now from your sketch I note that there was no wide work under way at the Marianna mine at the time of the explosion, all the men being engaged in driving headings. If such was the case, and the coal was thick, say 8 to 10 ft. in thickness, and the narrow entries were passing a large current of air at a high velocity, the only factors necessary for trouble was the presence of some gas, a coal making a fine dust, and some entryman shooting a gripping shot. The large volume of air at a high velocity would accentuate the explosive force of the powder on the air. If some men were working ahead of the air, and the entryman and crosscutman fired at the same time, an explosion might easily result. I have known of such instances. Incidentally, I believe that no man should be allowed to work "ahead of the air;" the distance between the crosscuts between entries should be established and rigidly adhered to, and the mine foreman or inspector should be allowed no option in the matter. Brattice work is all right, but a good crosscut is better.

As bearing on the question of intelligence of miners and frequency of accidents, I would refer you to the Maryland coalfields, where, in 1907, the death rate per 1000 employees was 0.64. Some 6201 miners are employed and over 1,000,000 tons mined for each fatal accident. Moreover most of the coal worked is quite thick, and a poor roof covers the coal, so that the miner must use great care in his work. It is also true that no gas is encountered in the mines. The miners are nearly all Americans of a high order of intelligence. The inspector and companies in most cases work in harmony, and there is good discipline in the mines. The above is presented for your consideration, as it may lead to some changes in the present system of shot firing in use in portions of Pennsylvania. The attention of those who compare the death rate in American mines with those in European countries, is directed to Inspector Murphy's reports for Allegheny and Garrett counties, Maryland, for the past three years.

High Currents in Mine Ventilation

By W. C.*

It is most disgusting to read and hear the flow of "rot" that is being spread over the land, as to mine accidents and their prevention. The whole question resolves itself into one of candor or hypocrisy. The men who know most about the subject are thrust into the background, and if they say anything it is drowned by bellowings of mediocrity.

Accidents don't happen in pits where people are looking for them, but generally in those workings where the best management is said to prevail. Throughout the entire world the highly gaseous mines are well looked after. The new craze that pits are getting too much wind, is simply an endeavor to justify those who have too little, and who wish to continue to work dangerous mines with open lights.

It is perfectly true that in the case of ignition a vigorous current of air lends force to the blast; it is also true that the air can be so split and directed that its velocity will be kept down to a safe limit, in working places. No one will deny that a vigorous air current will remove the finest particles of dust; but they will be deposited in wide places in returns, where they constitute far less of a menace to safety than they do while they remain in the main haulways and the chambers that are being worked.

Dust as a Factor in Mine Explosions

By C. S.†

I note in your issue of Dec. 5, the letter written by William N. Page, on "Dust as a Factor in Mine Explosions," and also note your editorial comment on the Marianna explosion. I concur with you in your analysis of Mr. Page's letter, especially that part referring to the increased rock falls due to the introduction of moisture, having given this subject close attention for two years.

In the first place the accidents due to rock falls occur at the face of the rooms and are due either to careless timbering, or excessive use of explosives; the effect of the moisture, where it is noticed in mines, occurs on the intake entries. I have found, however, that where the air is fully saturated constantly, the rock falls in the summer are not nearly so great during the sweaty season; the change from wet to dry causes disintegration of rocks and decaying of wood, whereas if constantly submerged or kept dry, this material is not affected by the action of the atmosphere. What applies to rock outside, undoubtedly applies in the mine as well, and it is noted that such places in the mines as have seepages throughout the year usually have a better roof.

The increase in humidity in the winter months in my opinion is by far the most effective measure to prevent, or at least diminish explosions. In machine mines care should be taken to load out the cuttings, and it is possible that one spray should be used in the rooms which are cut just before shooting, in order to remove the flying dust from the air current.

One or two accidents which have occurred recently, have been in mines that produced practically no gas, and it is almost safe to assume that the explosions were due entirely to the dust in the air. In mines where shooting from the solid is practiced, the excessive use of explosives creates much flying dust; as a whole, the mining conditions today are quite different from what they were, say fifteen years ago, when all of the coal was undercut, whereas it is now either shot from the solid or mined by machines. These two modern practices have brought about a change in the mining conditions, the importance of which is perhaps not appreciated, because the changes were made gradually.

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The Control of Coal Mine Explosions

By Harvey J. Nelms*

In your issue of Dec. 5, you print an article by Wm. Page, of West Virginia, on "Dust as a Factor in Mine Explosions." In my experience with coal mining, as a mining engineer, I cannot believe that the fatal accidents resulting from falls of slate are caused by the disintegration of the slate by water. The faults in coal seams, such as clay partings, etc., generally denote a wet entry, and I am sure superintendents of coal mines will agree with me in saying that 75 per cent. of the fatal accidents due to falls of slate, etc., may be explained by the old text, "death due to error of judgment on the part of the injured in setting post wrong." As to splitting air currents, etc., I cannot regard this plan as being a possible preventive of the so-called dust explosions

Dust Only Ignited by Firedamp

In a mine which generates firedamp in dangerous quantities, I am sure the smaller factor of the two to guard against is dust. We know what gas will do if allowed to reach a proper mixture, while dust is only dangerous when the firedamp sets it off. I cannot believe that a dust explosion will take place when started by anything but a firedamp explosion.

Everybody working in coal mines knows

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of entrymen who work from 10 to 100 ft. ahead of the air, although their entry is making gas, and they have 10 or 12 small explosions each day. It is reasonable to believe that once in a while the dust will be so distributed and in proper condition to explode when started by a firedamp explosion. In controlling the ventilation of coal mines, I believe the vapor and so-called wetness or dryness of the air, making up the air currents, should be tested at several places in the mines; by this I mean that if we go on the theory that coal dust will explode when conditions are favorable, then it appears to me that the proper thing to do is to keep the mines from getting in a condition where the dust will be dangerous. In the first place, the miner should not be allowed to load the slack coal made by a mining machine in one car. A room 23 to 27 ft. wide, and cut 6 ft. deep usually makes just a 2-ton car of slack, the slack filling the car bed full. It often occurs that as soon as the room is cut the miner will load this slack all in one car and by transporting this car to the outside by mule and locomotive power, the dust will impregnate the air as the car passes along the entries.

I believe a better plan would be to load half the slack and then fill the car with loose coal, the latter more or less protecting the air from the slack. It is also advisable that trips should not be hauled at a speed exceeding 10 miles per hour when the mines are very dusty. These are but a few suggestions showing the practical side of controlling coal dust.

I do not altogether believe in Mr. Hass' theory of steam, although steam used for wetting the air currents in coal mines is far better than sprinkling. I feel sure much good will result if we act on the supposition that the only thing to do to prevent coal-dust explosions, is to keep the atmosphere of the mines always in the same condition and not allow any change of atmospheric condition, due to sudden changes of temperature outside, such as the difference between winter, summer, etc. If ventilation is not in any way stopped, and if we keep the absolute amount of water vapor in the air currents always the same, never allowing them to change, then coal dust will not and cannot explode, because as long as these conditions are observed, the chemical reaction necessary for a coal-dust explosion cannot occur.

All Air Currents Should be Regularly Tested

It is a simple operation to measure the amount of water vapor in a given quantity of air, and it seems to me all coal superintendents would be making a good investment if they would install a small testing station at their mines, so tests could be made three or four times a day. The mine manager could be kept informed of the condition of the atmosphere in the different plants under his care, and when the water vapor fell too low, steam could be admitted to the intake air until the mine atmosphere would again come up to the proper standard. As long as the air in the mines is kept at one standard, as regards water vapor, the coal dust will be a minor factor and will not explode. Swift air currents are the best, as they will not deposit their water vapor as fast as slow-moving currents. An aspirator and drying tubes are the only devices necessary to measure the amount of water in a ventilating air current.

Practical Methods for Testing the Air

One plan is to fill a jar with water, the jar having a stop cork at the bottom; U-shaped drying tubes are also filled with pumice stone soaked with sulphuric acid. The stone is carefully weighed before the experiment, and when the stop cock is turned on and the water is allowed to run out of the jar, this draws an air current through the drying tubes. The volume of air which passes through the apparatus can be found by measuring the water that has run out of the aspirator, and the weight of water in this volume of air can be found by again carefully weighing the pumice stone. The difference in weight between the first and second weighing of the pumice stone gives the weight of water contained in the volume of air which passed through the drying tube.

Another and easier way to test the air is to get some $Ca\ CL_2$, and place it in a saucer; this attracts the water out of the air, the salt gradually becomes wet and eventually dissolves in the water which it attracts from the air. If taken every morning a person would soon notice any difference in the amount of water contained in the air and could remedy the condition by adding steam if too small, and reducing velocity of air currents, if too much. The standard condition of the vapor in the air should be previously determined by careful investigations, the first and foremost idea being not to allow any change to take place in the condition of the mine air as regards the amount of water contained in the air currents.

We are not going to find a new theory or system for working our coal mines, and consequently, we must make the best use of the knowledge we already possess.

Using a Booster Fan

Mr. Page is wrong in his theory of providing several fans of smaller capacity. If the main fan outside has too much work to do, it can be easily helped by installing an 8- or 10-ft. fan of the Stine type 3000 or 4000 ft. in along the main return airway, providing, of course, that the outside fan works as an exhaust. This booster fan should be operated electrically and belt connected preferably by a three-phase, 440-volt induction motor, if the alternating current can be got. This motor gives the least amount of trouble on the market, and will operate under most severe conditions for any speed at which it is rated. The speeds usually vary from 150, through nine speeds, to 600 r.p.m.; the motor being belt connected and running the fan at any desired velocity. These fans, when installed, give most excellent satisfaction. The main fan under these conditions works only from the exhaust of the inside fan.

Splitting air currents and the liberal use of overcasts will be most helpful to any mine. It may here be mentioned that the recent coal-mine explosions have only occurred in those mines under the care of the so-called and high-priced expert. The small fellows manage to get along without paying for explosions. It may be well for some of the others to take notice.

Ventilation Is a Question of Quality Rather than Quantity

By P. J. D.*

Mining engineers were no doubt surprised at the proposition advanced by A. B. Fleming of West Virginia, at the recent meeting of the American Mining Congress at Pittsburg. Mr. Fleming then said: "I wonder sometimes if there is such a thing as too much ventilation in the mines?" This question seems to have arisen in Mr. Fleming's mind for the reason that recent mine explosions have occurred in workings that were supposed to be among "the best ventilated in the world."

Our Mines Do Not Get Too Much Ventilation

The speaker, and those who apparently agreed with him according to newspaper reports, appears to have overlooked the fact that the reason especially elaborate ventilation installations exist is that mines so equipped are (in the majority of cases) known to be dangerously gaseous, and therefore liable to be the scene of explosions. It is a strange conclusion, however, that in such cases the cause of explosions lies in the fact that there is too much ventilation. It is much more likely that the ventilation, though perhaps unusually good, was still not good enough, or that gaseous workings were not properly ventilated, even though the mine as a whole was amply supplied with air. Explosions most often occur when the barometer is low, for the reason that the explosive gases are liberated from coal in larger quantities whenever the atmospheric pressure falls, and the greater the volume of air that can be supplied by fans, the more gases are diluted and the smaller the chance of an explosive mixture being formed.

It would seem that Mr. Fleming's doubt

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should have been directed not so much at the existence of too great an amount of ventilation, as at ventilation of a particular kind. Experience and the writings of experts on such matters may be searched in vain for rules against "too much" ventilation. Ventilation is not a question of quantity, but of quality, and that there is room for improvement in ventilation admits of little doubt.

The suggestion made above that explosions are likely to occur in gaseous workings, even though at the same time the rest of the mine is well supplied with fresh air, is borne out not only by general experience, but it is the point especially dwelt upon by the most recent writers on this subject. Speaking of the prevention of coal-mine explosions, W. B. Williams, in the ENGINEERING AND MINING JOURNAL of April 18, 1908, says: "The only remedy in the first instance will be proper ventilation; for this purpose I believe that the splitting of the air at each cross or room entry is the best system to follow, making crosscuts between entries and rooms as often as necessary to carry the air to the working faces at all times."

President William N. Page, of the West Virginia Mining Association, has also had something to say on this subject recently (ENGINEERING AND MINING JOURNAL, December 5, 1908). Mr. Page thinks that so far as the prevention of dust explosions is concerned, slowing down the ventilating currents to a velocity at which they will not carry dust in dangerous quantity, is the most effective measure against the dust danger. It is evident, however, from Mr. Page's following remarks, that what he believes in is not less, but better ventilation. He says:

"The tendency heretofore has been to regulate by statutes the specified volumes of air per minute for each man, animal and light, without any limit beyond the statutory specifications; the mine inspectors have all considered high velocities as the most desirable attainment, the higher the better, with an eye single to firedamp and pure air for the miner. It seems to me, however, that the time has come when the law makers and mine experts should study consequences, as too much of any good thing must always be harmful.

"Instead of forcing 200,000 cu.ft. of air per minute through restricted airways and passages by a single fan, under sufficient pressure to permeate every part of a tortuous mine, necessitating high velocities in many passages, I would suggest that the current be split as often as possible, and a number of auxiliary fans be substituted for one powerful single unit. Five fans delivering 40,000 cu.ft. will be preferable to one delivering 200,000 cu.ft., not only because of the slower velocities, but from an actual saving of power through less friction. Such small units placed within the mine will operate as force and suction at the same time, and since electricity is now almost universally employed underground, there is no mechanical or other difficulty in the way of installation. The cost of the small units combined will be little, if any, greater than a single unit of equal capacity.

"Where there is more than one intake and outcast, there is no problem involved, and in shaft mines with limited entrance, the difficulties would be neither great nor costly, as the necessary intake and outcast where the velocities might be high, could be easily isolated from all danger. In other words, the currents could be passed through auxiliary fans and slowed down, just as an electric force can be stepped up or down through a rotary converter. With such an arrangement, a uniform volume of air, under slow velocity, could be more satisfactorily distributed across all working faces, and a small motor-driven fan could be moved from place to place, with little loss of time or money."

With the introduction of comparatively small centrifugal fans of the turbine type, the ventilation of mines in such a way as that recommended by Mr. Page no longer presents the insuperable difficulties that existed in the days when the Guibal fan was the best known means of mine ventilation. Among other advantages of the newer types of fan, their speed and output can be nicely regulated in accordance with especial demands. There appears, therefore, as has been said above, no reason for fearing "too much" ventilation. There is, however, reason to demand ventilation that will not merely supply a fixed volume of air, but which will be adapted to the special requirement of given mines, and be so arranged as to reach those parts of mines that are especially dangerous, instead, as often happens at present, of being mainly confined to areas of the mine that perhaps need no ventilation at all to prevent gas or dust explosions.

Explosions in Coal Mines

By MEL BUTLER*

Some time ago in these columns I expressed the belief that it was impossible for mechanical devices alone to make coal mines free from explosions. The recent disaster at Marianna, where every effort had been made to perfectly equip the plant mechanically, and where the property was known as the "model" mine, further confirms my opinion.

Improved living conditions will not immediately produce more intelligent and responsible people. The standard of the coal-mine worker has for years, been going lower, and it will require years to make an appreciable general improvement.

It is hard to understand why so many coal-mining companies will spend any amount of money for equipment to make the mines safe and to reduce costs, but will not put on shot-firers, allowing indiscriminate firing by all miners regardless of their experience. Prevent "blown-out" shots, and mine explosions will rarely occur. Certified fire-bosses, mine-bosses, engineers and superintendents do not prevent explosions, and alone, never will; the unions have not accomplished anything in this respect, being solely absorbed in the membership list and the collection of dues.

Apprenticeship is the system required to make better mines and thereby safer miners; this, and being required to pass a suitable examination before a certificate is issued, will teach them what should be done, as well as what should not be done, to prevent explosions, and also reduce the number of accidents at the face. I sincerely hope to see something on these lines before long.

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Patent Legislation in Washington

SPECIAL CORRESPONDENCE

At an important meeting of the House Committee on patents on Dec. 12, the subject of patent legislation for this session was considered in executive meeting with the Commissioner of Patents. It was determined to prepare and place before Congress a bill relating to the so-called "manufacturing question." Specifically the bill is to provide some means for encouraging the manufacture of goods protected by American patents in the United States. In case foreign owners of American patents manufacture exclusively abroad the goods protected by such American patents it is designed either to provide for the forfeiture of the patent rights, or else to leave the maintenance of the patent rights to private litigation making it a special defense against infringement to show that the goods protected by American patents are not produced in this country, but are exclusively manufactured abroad.

New Zealand Production

The Mines Department states the exports of gold from New Zealand for the nine months ended Sept. 30 at 382,081 oz. bullion in 1907, and 390,442 oz. in 1908; an increase of 8,361 oz. The bullion reported this year was equal to $7,515,258, or 363,583 oz. fine gold. Silver exports for the nine months were 1,207,389 oz. in 1907, and 1,238,317 oz. in 1908; an increase of 30,928 oz. The silver comes chiefly from the gold mines of the Ohinemuri district.

Is Coal Dust, as Such, Explosive?

A Study of the Chemical Reactions That Occur in Dust Explosions, and a Percentage Estimate of Fatalities Due to Falls of Roof and Side

BY AUDLEY H. STOW*

Of all the perplexing questions that have puzzled the minds of the most intelligent observers, at one time and another, dust and dust explosions, probably compare quite favorably in the number of widely diverse, and often clearly contradictory theories that have been advanced, for the solution or explanation of the various phenomena accompanying these occurrences.

In attempting to forge a chain of deductions, to prove a certain theory, or to contravert the opposition theory, one of which must be wrong, we only too often find that there is a missing link, and that we lack the necessary information to arrive at a definite conclusion, thus leaving the adherents of the two theories secure in their loyalty to their views.

The amount of evidence to prove that dust, in the absence of all gas, has exploded, on almost numberless occasions, seems amply sufficient to settle the question; yet it is also claimed by many, at least this is the impression, that dust is not explosive, *per se*. We now have in addition Mr. Haas' theory that dust, as such, is not explosive. This appears rather a technical distinction, interesting it is true, but not clearly having a practical bearing on the question as to whether dust is, or is not explosive.

It is not quite clear from the arguments in support of the last-mentioned theory whether it is conceded that explosions have resulted from dust in which no firedamp was present, or whether the position is taken that a dust explosion is an impossibility, in the absence of all gas, as such, immediately prior to the instant of ignition. However this may be, the line of argument advanced in support of this addition to the already long list of our theories on dust, is one of some interest, and appears to admit of being carried still farther, although unfortunately we lack the necessary information to reach a definite conclusion, thus leaving the result still a matter of personal opinion.

The quantities used by Mr. Haas are substantially correct, for the purpose, although somewhat different values appear more nearly correct, at least in regard to the relative weights of air and coal, if we are to use the point of maximum explosive force.

The relative quantities will also depend on whether we assume that the fixed carbon does not take part in the reaction, or whether we assume that the dust is entirely consumed. In many dust explosions the deposits of coke are certainly extensive, yet it will be assumed for the present that such deposits are due to the lack of air, or the excess of dust, as may be preferred rather than the inability of the fixed carbon to take part in the reaction.

The Reactions that Occur

Again, the relative quantities will depend somewhat on the variety of coal under consideration, more particularly in regard to the per cent. of volatile matter. As the exact chemical structure of coals is far from having been exactly determined, we will assume certain structures that agree, near enough with observed results.

If the coal has such a structure that when subjected to destructive distillation, it yields 3 atoms of fixed carbon and 1 molecule of methane, we have, disregarding the ash, 31 per cent. volatile matter and 69 per cent. fixed carbon.

Air may be considered as 1 atom of oxygen, and 4 of nitrogen; we thus have:

$$\underset{52}{\overset{\text{Coal.}}{C_4H_4}} + \underset{+}{\overset{\text{Air.}}{10\,(o) + 40\,N}} = 4\,co_2 + 2\,H_2o + 4\,ON$$
$$52 + 720 = \text{Sum of atomic weights}$$

or 1 part by weight of coal to 13.84 parts by weight of air.

If we assume that the coal consists of 6 atoms of fixed carbon to 1 of CH_4 we have 82 per cent. fixed carbon and 18 per cent. volatile matter, exclusive of ash.

$$\underset{88}{\overset{\text{Coal.}}{C\ H_4}} + \underset{+}{\overset{\text{Air.}}{16\,(o) + 64\,N}} = 7\,co_2 + 2\,H_2o + 64\,N$$
$$88 + 1152 = \text{Sum of atomic weights,}$$

or one part by weight of coal to 13.09 parts of air.

J. T. Beard, in his "Mine Gases and Explosions" gives 1 to 9.57 as the maximum explosive mixture. If we take the specific gravity of methane as 0.559, we have

$$0.559 : 9.37 :: 1 : X, \text{ therefore } X = 17.12,$$

or 1 part by weight of marsh gas to 17.12 parts of air.

It has been figured that 1.359 lb. of coal containing 20 per cent. volatile matter, will replace 1 lb. of marsh gas; we thus have

$$1.359 : 17.12 :: 1 : X, \text{ or } X = 12.59.$$

That is, 1 part by weight of coal of the composition stated, will require 12.59 parts of air. For present purposes, 1 part of coal to 13 of air is near enough.

If we take the specific gravity of bituminous coal as 1.2, the weight of a cubic foot of water as 1,000 oz., and the weight of this same volume of air as 1.2 oz., we have that the weight of a given volume of coal is 1,000 times that of an equal volume of air. As an amount of air 13 times the weight of the coal is necessary to maximum explosive force, we thus have 13,000 volumes of air required per volume of coal.

Standardization of Screens

The tendency seems to be to adopt the 200-mesh screen as the definition of dust proper. The standardization of screens has been discussed at intervals, for some years past; however, there appears to be difficulties, largely mechanical, in the way of the desired degree of exactness of the smaller sizes. As proposed by the committee in standardization of screens, appointed by the council of the Institution of Mining and Metallurgy, London, the aperture of the 200-mesh screen should be 0.0025 of an inch, corresponding to the 0.0002083 part of a foot. The radius of the sphere that would exactly fit this aperture would be 0.0001042. In order that the sphere should pass through the screen without clogging, a certain amount of clearance will be required. If we allow 0.00000042 for clearance, we thus have the 0.0001 part of a foot as the radius of the largest sized sphere that will pass through a 200-mesh screen.

If we denote the radius of the sphere by r, and the radius of the hollow spherical shell, surrounding the particle of dust, and having 13,000 times the volume of the sphere, by R, we have

$$\tfrac{4}{3}\ R^3 = 13{,}001 \times \tfrac{4}{3}\ r^3, \text{ or}$$

$$R = r\ \sqrt[3]{13{,}001} \quad \therefore\ R = 23.51\,r.$$

The radius of the hollow spherical shell of air surrounding the particle of coal dust, expressed in fractions of a foot, is thus 0.002351.

It need hardly be said that the relation of the radii would have been the same, had the sphere been one foot for instance, in diameter, but we are not discussing lump coal.

We have now reached the point where further exact progress is barred by the lack of exact information. We can only surmise the possibilities in the case.

It may be argued with good reason, that

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in the spherical shell of air, the radius of which is 23.5 times that of the particle of dust, it is a physical impossibility for all the atoms of oxygen to be in actual contact with the particle of coal dust. Quite probably this is correct, yet there appears to be at least a few words that can be said in favor of the opposite view.

If the atoms of oxygen and nitrogen were of the same relative sizes, and the same distance apart, as the molecules of coal, we would have approximately 13,000 of the former in the spherical shell surrounding our one particle of coal dust. Necessarily only a negligible proportion could be in actual contact with the coal.

As far as noticed, we have no definite information as to the relative sizes of the atoms of the different elements. It appears somewhat plausible that there is a considerable difference in the relative sizes of the atoms of oxygen in the air and the molecules of coal.

It seems not improbable that the molecules of water and the molecules of coal are at least approximately about the same size. In the same way, the atoms of oxygen, as liquefied oxygen, are possibly of somewhat the same size as the molecules of coal. It however requires about 320 atmospheric pressures to liquefy this gas. If the atoms of oxygen, when the gas is in the liquid state, are the same size as the molecules of coal, the atoms of oxygen in the gaseous state should occupy 320 times the space they do in the liquid form. They are not, however, necessarily 320 times as large. On this basis, there could be only about $\frac{1}{320}$ the number in the spherical shell that there would be, if the atoms of oxygen occupied only the same space as the molecule of coal. This would equal 40 atoms of oxygen and nitrogen per molecule of coal.

We, however, get a somewhat different figure by another method. Suppose instead of a sphere of coal 0.0002 ft. in diameter, the coal has been reduced in size until we have a single isolated molecule of coal. The relative proportions of the radii, and the relative volumes, will remain the same.

Under Certain Conditions, Coal Dust, as such, can Explode.

According to our formula for coal containing 20 per cent. volatile matter, we have that a molecule of coal contains 11 atoms of carbon and hydrogen together with 80 atoms of oxygen and nitrogen. If, however, we assume that the oxygen and nitrogen in the atmosphere exist in a sort of a double state, as molecules consisting of 2 atoms each, we have 40 molecules of oxygen and nitrogen, as before.

If we have only 80 atoms in our spherical shell, the contents of which is 13,000 times that of the molecule of coal, it seems reasonable to suppose that they must be in a state of intense vibration, while also having a range of motion many times greater than their actual diameters. If such a state of affairs actually exists, it is not unreasonable to suppose that every atom of oxygen and nitrogen actually touches the molecule of coal, not necessarily at the same moment, but in such rapid succession that the intervals between are so close together as to be far past our comprehension. For all practical purposes, all the atoms of oxygen would be at all times in immediate contact with the molecule of coal. Under these circumstances, no reason is evident why coal dust, as such, cannot explode, depending, however, somewhat on the size.

If now we replace our single molecule of coal by a particle of dust containing 5 molecules, we have, on the assumed basis, 200 molecules of oxygen and nitrogen in the surrounding spherical shell. In this case, it is still possible that all the molecules of oxygen come into actual contact with the particle of dust, although the interval between the time any one molecule of oxygen comes in contact with the particle of dust, and the time of its next contact, is probably much greater.

If this process be continued until we have 13,000 molecules of oxygen and nitrogen in the spherical shell, we have, in one way, reached the same state of affairs as if the molecules of oxygen and nitrogen had occupied the same space as the molecule of coal. One point of difference however is, we should have a particle of coal dust containing approximately 320 molecules of coal, and in the other case, only a single molecule.

If it be thought plausible that a single molecule of coal can result in an explosion, whether the explosion result from the molecule as a whole, or from its component parts, it seems that one point has been made. It has long been conceded that dust becomes dangerous in proportion to its state of subdivision. The foregoing theory is a possible explanation of the observed fact.

All that has been said may, however, be absolutely disregarded, without seriously impairing the case of the prosecution against the supposed deduction, on the score of relative volumes, that an explosion of coal dust is an impossibility. It is possible that no such deduction has been intended. This may altogether be a mistake, although if it is not, the line of argument on the score of relative volumes appears seriously defective in one important respect.

This may be illustrated in the case of our particle of coal dust containing 320 molecules of the carbon compound usually known as coal, by introducing within the spherical shell containing 13,000 molecules of oxygen and nitrogen, 300 additional particles of coal dust, preferably of the one molecule size, in order to prevent crowding out too many of the molecules of oxygen and nitrogen. We thus have a large excess of dust, it is true, over and above that required from a chemical standpoint, yet as far as the molecules of oxygen being in practically direct contact with the particles of dust, it appears at least plausible that we have much the same situation as with the one molecule particle of dust in a spherical shell containing 40 molecules of oxygen and nitrogen.

In other words the interesting relation of the relative volumes of coal and air, necessary to produce an explosion, appear to prove, not that an explosion is an impossibility, but that a large excess of dust is required, depending, however, upon the sizes of the particles of dust, measured in molecules, as well as upon the absence of such internal motion as results from a blown-out shot.

Distillation of Volatile Hydrocarbons During an Explosion.

Bituminous coal certainly gives off volatile hydrocarbons at a temperature below which the coal actually begins to burn. In the case of dust, which is in the act of exploding, if the fixed carbon did not take part in the reaction, the distinction that dust as such, does not explode, would have practical significance.

As far as we know, however, it is not at all clear that the fixed carbon should not, or probably does not, take part in the reaction. If the temperature of the dust, and of the air in which it is suspended, is sufficiently high to distill the volatile hydrocarbons, previous to the actual ignition, certainly the combustion of the hydrocarbons thus distilled will raise the temperature of the air, and the resulting coke, to a temperature far above that necessary for the combustion of the latter substance. It is hardly supposed that there is any question that the initial temperature may be that found underground, and yet the combustion of the distilled hydrocarbons be sufficient to raise the fixed carbon to the point of ignition. If coke is deposited in quantities, as it often is, it seems more plausible to assume that the supply of oxygen was insufficient for the combustion of all the dust. That such hydrocarbons as were volatilized but not consumed, owing to lack of air, remained in suspension, while that portion of the fixed carbon not consumed from the same cause, was deposited, owing to its greater specific gravity.

If the fixed carbon does not take part in the reaction, we would thus have two varieties of gas explosion. Even in this case, it would be appropriate to retain the name, dust explosion, as applied to that variety of gas explosion in which the hydrocarbons were distilled from coal dust suspended in air.

If the fixed carbon does take part in

the reaction, it would comply more nearly with the facts to describe it as a gas and coke explosion, although clearly, in this case, an explosion which has resulted from dust suspended in air.

Excess of Air and Water Theory

It has been estimated that the total number of deaths resulting from explosions is 5 per cent. or less, of the total number of fatalities, while we have it on good authority that the deaths resulting from falls of roof is 66 per cent. of the total. It appears to have been assumed that the 66 per cent. is due entirely to the slacking or disintegration of the roof by moisture, during the wet or summer season. As far as noticed we lack the data to mathematically demonstrate this view to be incorrect.

For the past 15 or 20 years it has been the general belief among old miners that it is advisable to pay the closest possible attention to the roof, as soon as the drops of moisture begin to appear in the spring. The time has been when these evidences of the approaching wet season, which make their first appearance at the drift mouth, were looked upon with no little fear and trembling. These sensations became a thing of the past, and were replaced by the growing conviction that there are no substantial grounds for the common belief of the miner that the summer season results in a material increase in the number of falls of roof.

That a large proportion of the slates which form the roof in many of our mines disintegrate rapidly on exposure to the air, on the slate dumps, cannot be denied; However, it is not clear but that the distintegration is evidence of the inherent weakness of the slate, the lack of cohesion of the latter being the true cause of the fall, and the disintegration being merely an indication of lack of strength.

It has been estimated that the proportion of slate or fireclay roofs in West Virginia, will average 90 per cent. or better. This appears somewhat high, if the territory adjacent to the Norfolk & Western Railway may be taken as an average for the State. This, however, is again one of the numerous points in regard to which it is only possible to give an opinion. The percentage will depend no little on the classification.

For present purposes, it appears justifiable to class as sandstones, all thin-bedded sandstones, or sandy slates. These latter usually form nearly as good roof as true sandstones. The slates, so-called, have been looked upon as more properly shales than true slates. Under this classification, for the territory stated, 50 per cent. sandstones, and 50 per cent. shales appears a probable figure. If, however, 40 per cent. sandstones and 60 per cent. shales, be taken, we have of the 66 per cent. mortalities, about 40 per cent. occurring under slate or shale roof, and 26 per cent. under sandstone.

Many Fatalities from Robbing Pillars

Anyone who has spent much time on pillar work cannot but admit that about one-half of the fatal accidents occur in their recovery. Certainly the falls of roof on the pillars cannot be attributed to the effect of too high a percentage of moisture in the air. On this basis, we have 20 per cent. of the total number of fatalities that occur under shale roof, in other portions of the mines than the pillars.

Certainly "draw slate" is the cause of a large number of deaths each year. Draw slate, although a somewhat indefinite term, may be said to occur more generally in mines with sandstone roofs. Under this head is often included a layer of shale immediately overlying the coal, but less firm in structure than the shale next above, and from which it is usually separated by a parting plane. Even the novice in the business knows that the dreaded draw slate does not wait for the wet season. The number of cuts that the draw slate will stand, after the coal has been removed, can usually be counted on the fingers of one hand, although in a few sections or districts, if well timbered, it will stand for years. While most of the fatalities due to draw slate are properly chargeable to sandstone roof, certainly a small percentage at least should be charged to slate or shale roof.

We have still to account for the treacherous kettle bottom, which knows no law, and is no respector of persons. Kettle bottoms and horse-backs occur in slate roof rather than sandstone. If we allow only 5 per cent., which appears rather an underestimate, for draw slate under shale roof, and for horse-backs and kettle bottoms under the same class of roof, we have but 15 per cent. unaccounted for.

If this 15 per cent. is due to the causes under consideration, excess of air and water, it is at least a possible view that the general effect should be that the roof would scale off in thin layers, as that immediately exposed to the action of the agencies under discussion, had become disintegrated, thus exposing a fresh surface. Certainly the appearance of a large proportion of the falls does not indicate any such action. Again we have a small proportion of coal top, upon which air and water appear to have no effect. If we deduct 5 per cent. for falls of coal top, and for falls in mines in which the top comes down in somewhat rectangular blocks, we thus have but 10 per cent., which may be charged to excess of air and moisture, although there are still other minor classes of accident that might be deducted.

These figures will probably be considered grossly incorrect by some, possibly by many; yet whether the per cent. be 10 or 66, it appears largely at least, chargeable to inherent weakness of our shales, in the territory mentioned. As far as it has been possible to judge from prospecting in advance of actual mining, as shown by nearly 1000 sections of record in Wyoming, Logan, Boone and Wayne counties, W. Va., Pike and Johnson counties in Kentucky, and a portion of Buchanan county, Va., the roof has appeared to average much the same as in the territory adjacent to the Norfolk & Western Railway, in which mining is being carried on, in Mercer, McDowell and Mingo counties.

It is by no means contended that strata immediately overlying the coal are not in instances, seriously affected by water. Such is understood to be the case in some of the mines in the anthracite field of Pennsylvania. A roof that appears to be so affected has been noticed in the vicinity of Middlesborough, Ky., however the impression is that these are the exception and not the rule.

If the 66 per cent. of deaths was due to the excess of water alone, we would have this situation: From the 34 per cent. due to other causes 5 per cent. due to explosions would have to be deducted, leaving 29 per cent. equally distributed throughout the year, or 15 per cent. in winter during the dry season, the remaining 14 per cent. occurring during the wet season, which with the 66 per cent. due to moisture, would make 80 per cent. during the summer and 15 per cent. during the winter, exclusive of explosions. Any such increase confined entirely to one season, could hardly have passed unnoticed. That a difference in the volume of air passing can have any material effect of itself, other things being equal, appears less plausible than the excess of water theory.

The distintegration on the outside is more likely due to the daily changes of temperature than to exposure to the air, which would occur in the mines were the fan not running.

It is realized that the several views herein expressed are only personal opinions, which may in part at least be seriously incorrect. Yet if mining men and engineers would aid, with their ideas and experiences, we should in time make material progress in the control of dust.

In hydraulic mining in Victoria, Australia, gravel is being elevated to great hights. At the Creswick Black Lead the tailings are being raised to a hight of 102 ft. by a three-port runner pump in one lift, the depth of gravel worked being 70 ft. At the Cock's Pioneer mine, where a 80-ft. bank of gravel is being worked, the tailings are being raised to a hight of 123 ft. in two lifts.

Utilizing Blast Furnace Gases at Gary

A Great Power Plant to Be Operated by Gases Which Were Formerly Considered Waste and Allowed to Escape. Gas Engine Development

SPECIAL CORRESPONDENCE

Frequent references have been made in the columns of the JOURNAL to the utilization of blast-furnace gases in furnishing power. In this development in iron making German and Belgian metallurgists have been far ahead of those in the United States. The latter, however, have taken up this question with energy. The first important plant of this description installed in this country was at the works of the Lackawanna Steel Company at Buffalo. The metallurgists of the United States Steel Corporation some time ago began to study out the application of this economical development, and have used it in the alterations and improvements made at the various Carnegie works at and near Pittsburg, and the Illinois works at Chicago. The most important use of blast-furnace gases, however, is found at the new works of the Indiana Steel Company at Gary—a general description of which was given in the JOURNAL of Dec. 26—where the largest plant of the kind ever designed or built will shortly be in operation.

VOLUME OF GAS AVAILABLE

It is unnecessary here to go into the general subject of the utilization of the waste gases. As a general rule, only part of them have been used heretofore, in two ways: First, in heating the stoves through which air for blast is passed to raise its temperature; and second, to a small extent, in boiler furnaces for making steam. These uses are still continued, but the balance of the gases which in most blast furnaces is allowed to escape, are here used to generate power through the medium of the gas engine.

Speaking generally, a 500-ton coke furnace of the type built at Gary will pass off in 24 hours about 2,800,000 cu.ft. of gas. When all the 16 furnaces are in operation, this will give about 44,800,000 cu.ft. daily. Of this supply approximately 30 per cent. will be used for heating the blast stoves, 7.5 per cent. under boilers for raising steam, while 5 per cent. will be consumed for various auxiliaries, or lost in the cleansing process. This leaves 57.5 per cent. of the total to be used in generating power, of which 12.5 per cent. will be required for the blowing engines, leaving 45 per cent. of the total available to generate power for the operation of the works. This 45 per cent. will be equivalent, when all of the 16 furnaces are in blast, to over 200,000 horsepower.

CLEANSING THE GAS

The first step is to free the gases from the large quantity of dust carried over by them from the furnaces, and also to cleanse them from other impurities so far as possible, and to bring them into proper condition for use in the gas engines. The gas from each furnace, escaping from four outlets, passes into the two downcomer pipes, which lead into a reservoir 30 ft. in diameter by 40 ft. high, called the dry-dust catcher. Then a considerable part of the impurities settles to the bottom, and the gas passes into another large pipe, which leads upward some distance to increase the quantity of dust dropped and then turns down again, emptying into a supplementary tank 14 ft. in diameter by 25 ft. high, one of which serves each pair of furnaces. This structure not only provides an additional dust catcher, but also acts as a valve, being divided into two compartments partially filled with water. By increasing the hight of the water in either one, the furnace on that side can be cut off as desired, and there will be no back flow of gas from the mains beyond. The two chambers of this tank discharge into a pipe 10 ft. in diameter, which carries the gas and remaining impurities into the primary wet washers. There are three of those to each pair of furnaces and each has sufficient capacity to take care of the gas from a single furnace, thus providing a spare washer for use while one is being cleaned or repaired. The primary washers are cylindrical in form, with cone bottom and cone top, and are about one-third full of water, a proper overflow maintaining the required level. Here the gas and dust are discharged against the surface of the water from pipes with fluted edges and then escape around these edges into openings from a larger main. At this point a small percentage of the gas is diverted to special furnaces under a battery of Rust boilers used for making steam, and about 30 per cent. is taken for heating the stoves. The remainder continues on to the secondary washers. First of this group are the vertical scrubbers, drums about 14 ft. in diameter by 50 ft. high. A torrent of water cascades down through it, and from near the bottom of the drum comes the stream of gas against it. Rising to the top the gas again passes on into what are known as Thiessen washers, of which there are four to each pair of blast furnaces. In each of these it is led between the wall of a cylinder and a revolving drum, armed with a series of paddle-like blades. A stream of water is spread into a film on the surface of the cylinder and the whirling drum throws such impurities as the gas still holds out against the water film, where they are caught and held. From these final washers the gas is conveyed under slight pressure to the holders, each of which has 200,000 cu.ft. capacity; from there it goes, as required, to the electric-power station and blowing-engine houses. The water for the various processes described above is furnished by four large Platt turbine pumps.

THE BLOWING ENGINES

For the eight furnaces thus far erected there are two blowing-engine houses. One is 600 ft. long and 104 ft. wide, and the other is of the same width, but only 530 ft. long. The difference is due to the fact that the first house includes a central pumping and hydraulic power plant, equipped mainly by the Snow Steam Pump Works, of Buffalo, N. Y. Besides gas engines each house contains two steam-driven Tod blowers, but, when the plant is in full operation, these will not be used, but held in reserve in case of accident.

Each of the 16 blowing engines consists of a horizontal, twin-tandem gas engine of 2500 horsepower, having cylinders 42 in. diameter by 54 in. stroke, and two direct-driven blowing tubs having a capacity to deliver 30,000 cu.ft. of free air per minute against a pressure of 18 lb. per sq.in., and so designed and proportioned that they can be operated at any pressure up to 30 lb. These blowing tubs are of the Slick type, the patents for which are controlled by the Allis-Chalmers company. By using this type an inlet-valve area of 25 per cent. and over is easily attainable, thus insuring that the cylinder will fill completely at any speed at which the engine is able to operate it. The gas and air cylinders are located at opposite ends of the engine frame. Eight of these engines were built by the Westinghouse Machine Company and eight by the Allis-Chalmers Company.

THE GENERAL POWER STATION

The power station, which is 966 ft. long and 105 ft. wide, with forty-two 23-ft. bays, is adjacent to the blowing-engine houses and between the blast furnaces and open-hearth furnaces. This places it advantageously for fuel supply and insures minimum lengths of transmission lines to the various departments using electric power.

In this central station are installed 17 horizontal, twin-tandem, double-acting gas engines, turning at a speed of 83⅓ revolutions per minute; 15 of which are designed

for coupling to alternating-current generators and two to be connected to direct-current generators. The former are 25-cycle, three-phase, 6600-volt machines, and the latter deliver current at a pressure of 250 volts. The engines have a rating of 4000 horsepower and the generators 2000 kw., but they are capable of carrying continuously 30 per cent. overload. The 17 units were built complete by the Allis-Chalmers Company. These are the largest engines in the world to operate on blast-furnace gas, being practically duplicates of the units built for the Illinois Steel Company, operated in parallel. The successful working of that plant insured the success of the Gary installation.

Features of the Engines

The distinctive features of the engines are the simplicity of design, the solidity of construction and the quiet operation. Maximum overloads are handled in practice as easily and with the same freedom from vibration that characterizes their operation under normal condition. While the engines are, as a whole, exceptionally rigid and heavy, the weight is concentrated in the frame cylinders and tie pieces in the direct line of stresses to which an engine of this type is subjected. In the frame is illustrated the principal difference between European and American design. This frame is designed for a side crank in place of the double-throw crank which represents the standard practice abroad. The stresses transmitted to the frame in a side-crank engine are very great, but, even in the largest sized gas engines, they are no greater than builders have for many years successfully provided for in steam-engine practice.

The jaw, which is subjected to peculiarly severe stress, is made in a form to insure maximum strength of the casting and is further strengthened by two steel tie bolts carried above the shaft, which are made of sufficient size to carry their proportion of the load without appreciable elongation. This construction eliminates entirely any bending stresses in the frame at this point. The engine frames weigh approximately 90 tons each, and one-half of each frame is buried in the foundation, in order to raise the floor line to a point which will make the rods on the valve gear readily accessible.

The floor space occupied by one engine is 70x44 ft., and the weight approximates 1,700,000 lb. The cylinders are 44 in. diameter by 54 in. stroke; the crank pins are 20 in. in diameter; the shaft is 30 in. in diameter in the bearing, and the fly-wheel is 23 ft. in diameter, weighing 200,000 lb. The pistons and rods are water-cooled, water being introduced at the center and flowing forward to a discharge in the frame for the front piston and backward to a discharge in the tail guide for the rear piston, each piston having its separate supply. For dismantling or for cleansing, the rod is made in two parts, joined at the central slide, the rear half going out at the back of the engine and the other half going out through the frame, which is made open at the top for convenience.

The Valve Gear and Other Details

The valve gear is located between the engines, concentrating on a twin-tandem in such a way as to make it very convenient for the operating engineer. The gear is of the builder's standard stratification type and the engine operates with constant compression, thus tending to insure smooth running under the highly variable loads to which it is subjected.

The igniters are electrically controlled and so arranged that the time of ignition may be regulated by a single hand wheel. Direct current at 80 volts is used in the ignition system. Duplicate independent igniters are provided at each end of the cylinder to insure prompt firing of low-heat gases and also to avoid the danger of shutdown due to short-circuit. The entire ignition system, from the motor generator set which furnishes the current to the electrically operated igniters, is solidly built.

The air-starting device consists of a small poppet inlet air valve at each end of each cylinder, operated by the layshaft. Air is admitted to each cylinder, in turn, at what would be the working stroke. As the high compression carried prevents the engine from stopping on the dead center, this arrangement insures the prompt starting of even a tandem engine without the use of a barring gear. These engines being twin tandem will, of course, start from any position.

All wearing surface, including the main bearings, slides, crank and crosshead pins, are arranged for a continuous oiling system and the cylinders are lubricated by carefully timed admission of the cylinder oil, sight-feed oil pumps being used.

The exhaust from the gas engines is conveyed to a tunnel 12x9 ft., located immediately outside the building and beneath the ground level. This runs the length of the building and is provided at each end with a stack 9 ft. in diameter by 92 ft. high. The same method of muffling the exhaust is provided for the blowing-engine houses.

The Generators

The alternating-current generators are of a type developed by the Allis-Chalmers Company for use with these engines. The laminated stator core is held in a heavy box yoke designed to allow full circulation of air around all parts. The core punchings are held in place by means of dovetails and the armature windings are placed in open slots in the inner periphery of the stator core. The coils are held firmly in place by wedges and, on account of the open-slot construction, can be readily replaced in case of damage. The field poles are mounted on a cast-iron spider and so arranged that they can be removed; the exciting coils are of copper strip wound on edge. The revolving fields are special in construction, with field poles of solid cast steel bolted to a heavy cast-iron spider; they can, therefore, be readily removed in case it is necessary to get at a field coil. The field windings are held in place partly by the projecting pole tips and partly by brass rings running completely around the rotor on each side and fastened to the top of the poles by long brass screws. The construction, combined with the solid poles, gives a large damping effect, prevents hunting and aids in securing parallel operation.

The direct-current generators have also been designed with particular regard to this service, but in general are similar to the Allis-Chalmers standard engine type machines.

In connection with the generators the company has furnished Cutler-Hammer remote-control field rheostats and field switches. The controlling apparatus is located in the basement as near as possible to the generators and is operated from the bench board located in the power-house gallery. These rheostats are of a unique design, being what the manufacturers call the crosshead type. They are driven by means of vertical motors and are provided with automatic devices which insure the stopping of the motor at either limit of the crosshead travel; that is to say, either when all resistance has been cut in or cut out of circuit. Means are provided, also, for operating these field rheostats by hand in case of damage to the motor.

The Electric Motor Drive for the Plant

The power generated will be distributed throughout the works and used to operate the heavy induction-motor-driven rolls, the tilting and feed tables for the various passes, the hot saws, hot and cold pull-ups, hot rolls, transfer tables, straightening and drilling machines, cold saws, elevators, conveyers, pumps and a multitude of machines and mechanical devices auxiliary to the operation of the rolling mills. Several of the motors built by the General Electric Company for these works are of 6000 h.p. each, being designed for driving the rolls, and from this they range in size down to machines of the smallest capacity used to operate switches in the power house.

The problems of control presented by the multitude of motors installed at this plant involve many interesting features, the solution of which was largely intrusted to the engineers of the Cutler-Hammer Manufacturing Company, of Milwaukee, and the automatic devices now installed at Gary represent the most recent developments in electric control as applied to steel mill machinery.

The electrical system as a whole is subject to central control at a switchboard operated from a gallery 16 ft. high. This switchboard, which was designed by the

Western Electric Company, has the usual complement of instruments of standard types.

Storage Battery

To aid in securing maximum economy under heavy fluctuations of load, by utilizing the full value of the generating power of the gas, without regard to the amount of current required at any given time for the operation of the mills, a storage battery installation furnished by the Electric Storage Battery Company, has been housed in a two-story building 87 ft. long by 47 ft. wide, located near the power station. The batteries will be kept charged as nearly as possible to their full capacity, in order to assist in meeting, for a considerable period of time if need be, any demands for excessive power made upon the gas-engine-driven generators. These can, in themselves, be heavily overloaded but the best power factor is, of course, to be secured at about their rated capacity. The battery also aids in maintaining, at light loads, a constant pull on the generating equipment. The control of the battery charge and discharge in respect to the 250 direct-current bus is effected by means of two motor-driven boosters which may be operated singly or in parallel.

The various motor generator sets, converter, etc., comprising this regulating system may be started and stopped from the bench board in the switching gallery by means of Cutler-Hammer remote-control starting apparatus and the fields of the various machines may be varied by means of remote-control field rheostats. One of these remote-control starters is notable for its size. It is used in connection with a motor generator set which is started from the direct-current end, and although the starting current is not abnormally high, the rheostat is designed to carry 10,000 amperes under maximum working load conditions. This is believed to be the largest ever made.

Construction of the Power House

The subfoundation of the power station, as well as of each blower house, is a solid mass of concrete underlying the entire structure on the level of lake Michigan, and having a depth of 5 ft. Above this are separate foundations for each of the generating and blowing units. The arches forming the roof of the power station have a clear span of 85 ft., providing head room at the dome of 73 ft. above floor level. The station is served by two 50-ton cranes.

General Considerations

While the utilization of blast-furnace gases for the production of power has well passed the experimental stage, its adoption on so large a scale as that indicated above shows a high degree of confidence. The same thing may be said of the wide use of electric power throughout the plant, especially in the operation of the large rolling mills. As was said in the previous article, the Gary plant possessed one great advantage, in that it has been built up entirely on a new foundation. There was no old plant to be considered, no alterations to be made, and everything could be designed absolutely in accordance with the latest practice. No other steel plant of the first order has been built in this country under quite the same conditions. Moreover, the designers apparently have not been limited by any considerations of first cost, but had a free hand in introducing any improvements which could be expected to reduce operating costs, and help to secure the maximum output of finished steel.

The Cullinan Diamond

Special Correspondence

References have been heretofore made to the Cullinan diamond, believed to be the largest ever found. This stone, which was found in the Premier mine, near Pretoria in the Transvaal, on Jan. 26, 1905, was described and illustrated in the Journal of March 23, 1905. It was too large to be sold to any individual purchaser.

Over two columns of the London *Times*, of Nov. 10 are devoted to a full description—the first authentic description published—of the history of this great diamond from the date of its discovery up to the completion of cutting and polishing. The diamond, as will be remembered, was presented to King Edward on his birthday Nov. 9, 1907, by the Transvaal government. Since its arrival in England the most elaborate precautions have been taken for its safety. In traveling to Amsterdam, where it was cut it was in the care of three guards and to avoid risks of shipwreck it was conveyed across the channel by the shortest route, the Calais Dover. Such elaborate precautions were not adopted in its infancy, so to speak, the stone having been forwarded to London from Johannesburg by ordinary registered letter post.

The cutting and polishing were carried out by the firm of Joseph Asscher & Co., of Amsterdam, who put up special machinery for the work. The stone was divided at first into two and subsequently into several pieces. The first cleaving of the stone was a delicate and risky operation. There are two processes for dividing diamonds, sawing and splitting. In splitting a steel knife is used to part the stone along its natural cleavage planes, and it is only along these planes, which are four in number and lie parallel to the faces of the octahedron, that the division can be effected. The diamond is held in cement at the end of a strong wooden stick. The operator holds the knife—a wedge-shaped piece of steel resembling a toilet comb in its general form and size—in a groove, which must first be cut by a diamond, with his left hand, while in his right hand he delivers a blow with a steel hammer.

In splitting the Cullinan diamond the knife broke at the first blow, but the second blow was successful. It is always possible that this operation may break the stone into pieces not calculated on, owing to some flaw in the stone. There was therefore, much anxiety about the operation on this large stone. After splitting, the largest piece was cut and polished. The second piece was again divided and altogether a large number of brilliants were obtained. The following is a complete list of the stones with their weights:

1. A pendeloque or drop-brilliant weighing 516½ carats. The extreme dimensions of this stone are 2.322 in. long and 1.791 in. broad.
2. A square brilliant weighing 309 3/16 carats; 1.771 in. long and 1.594 in. broad.
3. A pendeloque weighing 92 carats.
4. A square brilliant weighing 62 carats.
5. A heart-shaped brilliant weighing 18⅜ carats.
6. A marquise brilliant weighing 11¼ carats.
7. A marquise brilliant weighing 8 9/16 carats.
9. A pendeloque brilliant weighing 4 9/32 carats.
10. Ninety-six brilliants weighing 7⅜ carats.
11. A quantity of unpolished "ends" weighing 9 carats.

The two larger stones are by far the largest in existence. The next in size is the Jubilee, weighing 239 carats, belonging to Wernher, Beit & Co. The famous Kohinoor weighs only 106 1/16 carats. All the Cullinan stones are, in spite of their size, of great beauty, being absolutely without flaw and of the finest blue-white color.

The two larger stones are cut with 74 and 66 facets respectively; an innovation on the usual practice of cutting 58 facets.

Transvaal Gold Mines

Gold production in the Transvaal in November is reported by the Chamber of Mines at 614,371 oz. fine, which is 3,373 oz. less than in October, but 64,570 oz. more than in November, 1907. The decrease from October was entirely due to the shorter month, the daily average having increased from 19,818 oz. in October to 20,479 in November, a gain of 661 oz. For the 11 months ended Nov. 30 the total output was 6,393,974 oz. fine gold, or $132,163,443. This is an increase of 425,836 oz. over last year.

The total number of Kafir laborers at work in the mines Nov. 30 was 141,326, an increase of 2161 over Oct. 31. The number of Chinese was 12,293, a decrease of 10 only during the month.

Examining and Fitting up a Hydraulic Mine—II

The Construction of Sluices, Undercurrents, Grizzlies, Flumes and Penstocks, and the Building of Ditches Are Discussed in Detail

BY H. A. BRIGHAM*

The details of the design of a sluice are shown in Fig. 1. For the bottom of the sluice 1½-in. boards will answer and for the sides 1¼-in. The bottom planks should be surfaced on the top, the side planks should be left in the rough. The sills may be 4x5 in. for sluices up to 5 ft. wide, and 4x6 in. for wider sluices. The posts or standards are suitable if made from 4x4-in., and the post braces from 1½x4-in. timber. The bottom ties must be firmly laid so that no settlement will occur if the sluice should become filled with gravel. All joints in the bottom should close perfectly so as to prevent leakage of quicksilver and consequent loss of fine gold.

If there are springs along the line of the sluice, their water should not be allowed to back up and run over the top, since the pressure may force up the bottom, especially while cleaning up. Cutting a vent hole near the end of the side board, ½ in. above the bottom board, with the bottom side of the hole sloped upward toward the outside of the sluice to prevent the quicksilver from running out, will overcome this difficulty. Several of these holes should be made along the sluice, especially where there is danger of water backing up on the outside.

A longitudinal cap or running board, say 1½x6 in., should be placed on the top of the sides and nailed flush with the inner edge of the side board to prevent this from bulging into the sluice. The sides should be well braced against inward or outward bending. The sluice must be anchored down so that water outside will not lift it bodily.

Pavement

If suitable timber may be obtained at reasonable prices, a block pavement is generally the most desirable, especially for the upper end of the sluice where the principal portion of the gold particles will settle, and where the pavement will have to be removed more frequently for this reason. If the sluice must be longer than is necessary for the simple saving of the gold, it may be desirable to pave the lower portion with other material, if a suitable kind is obtainable at reasonable cost.

Rocks or boulders make a lasting pavement and, under favorable conditions, may be desirable if they are very hard and of such shape that they may be securely held in place, particularly if they do not present too uneven a surface for the gravel and boulders to travel over. Rocks blasted by dynamite are not suitable for pavement, owing to the shattering effects of the dynamite.

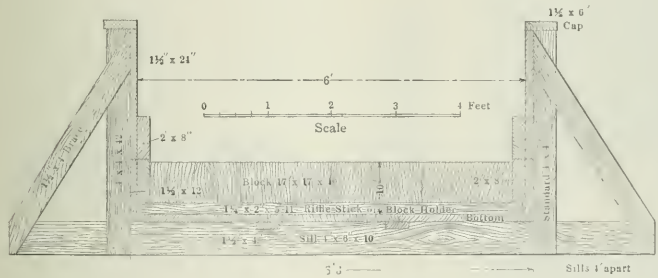

FIG. 1. END VIEW OF SLUICE

It will be almost impossible to pave a sluice with stones and to make a surface so smooth and even that the same amount of gravel and boulders can be run over it that will run over a block pavement on the same grade; therefore the portion paved with rock should have a proportionate increase of grade. This is of great importance as the volume of gravel and boulders that can be run through the sluice depends upon the amount that can pass its section of least transportability; that is, that particular portion which has the least grade or the most uneven surface.

If hard rock is used in the pavement it will probably wear at least five times as long as any block pavement before requiring to be changed by reason of uneven wear.

Steel bars and old railway iron make a very good pavement, for as much fine material and more boulders can be run over them than over a block surface. This iron pavement is generally more expensive, especially if the mine is situated at a great distance from a railway and lacks cheap transportation facilities. But it has the advantage of wearing much longer than blocks, and it needs less changing in consequence, an operation that always constitutes one of the largest expenditures and delays in hydraulic mining, especially where there are block pavements in long sluices.

Block Pavement

Blocks for pavement are generally made by sawing them from the trees in lengths suitable for the purpose for which they are to be used, say from 4 in. long, where a small head of water is to be used, to 12 in., or even more, where a large volume of water is run. These blocks are squared to such a size that a given number will reach across and just fill the sluice from side lining to side lining. Several different sizes may be used for the same sluice, but each size should be square, so that when replacing the pavement the blocks may be turned around in any manner best suited to make the smoothest surface possible.

It is very essential that the blocks be hewn squarely and truly and placed so tightly together that no crevice is left parallel with the current, for a small crack, more particularly if two or more are in line, will soon become larger by wear and will compel a cleaning-up and a change of the block system sooner than if this had been properly laid the first time; the wear, in that case, will be so irregular that it will be found most difficult to relay a satisfactory and smooth surface again without eliminating the uneven blocks.

Side Lining

The side lining of the sluice, shown in Fig. 2 as two 2x8-in. planks on each side, has two purposes—to protect the permanent side of the sluice from being worn, and to hold the blocks and prevent them from rising and floating away. The thickness of the side lining will depend

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upon the width of the sluice and the quantity of water used.

With a narrow sluice and a small head of water, 1-in. lining will answer, while with a wide sluice and large volume of water, 2- to 3-in. lining is required, and this should reach sufficiently above the blocks to prevent the wear of the permanent side planking.

Boards are generally used for this purpose, but where there is a large amount of wear, blocks are sometimes utilized, especially if the sluice is located in a tunnel or at other places where it is inconvenient to change the lining. These blocks are made somewhat similar to block pavement by sawing them in 2½ to 3-in. lengths from the tree, dressed to uniform sizes for top and bottom, and of any convenient length for the sluice. They are nailed to the side similarly to board lining.

Riffle Strips or Block Holders

The riffle strips or sticks answer two purposes also: To hold the blocks in place and prevent their floatage, and to create the intervening space, crosswise in the sluice, between two series of blocks, known as the riffle, whose office it is to hold the quicksilver and to catch and retain the gold particles.

The dimensions of the sticks vary under different conditions and according to differing opinions of miners. They must be strong enough to prevent the blocks from lifting and broad enough to furnish a receptacle between the blocks ample in size to catch the gold. The thicker or broader they are, that is, the wider the space beween the blocks, the greater and the more uneven will be the wear on the block edges, and, consequently, the rougher will be the surface of such a pavement after the blocks have been turned and changed around.

If large boulders, especially angular ones, be run over a pavement, it will become manifest that the wider the riffle, the more will the lower edge of the blocks be broomed and split off; this will make a very rough surface upon turning.

If the riffle pieces are too high, the receptacle for the gold will become shallow and sometimes obliterated when the pavement is worn thin. A 1¼x2-in. riffle strip is sufficiently strong for a sluice 5 ft. wide; a wider sluice requires a 1¼x3-in. strip.

Laying a Block Pavement

A good method in laying a block pavement is to nail the side lining against the permanent side of the sluice, leaving the lower edge 2¼ in. above the bottom, where a 2-in. riffle strip is to be used; this will allow the end of the riffle strip to be inserted under it freely for the purpose of preventing the strip from lifting with the blocks when the water is turned on.

After the side lining is properly secured to the permanent side of the sluice, a row of blocks, all of the same size, is placed across it and wedged tightly together and against one of the side linings; thereupon a riffle stick is slipped under the side lining and pushed against the side of the blocks, raised up tightly against the bottom of the lining and nailed to each block with headless or small-headed nails, leaving ⅝ in. of the nail projecting for insertion into the next row of blocks.

After one row is properly secured in the manner described, another row of blocks is placed across the sluices, the blocks are pried close together and set up tight against the side lining that was not wedged to in the case of the preceding row, thus breaking joints in the blocking system. The blocks are thereupon driven solidly on to the nails and against the riffle stick. Another riffle stick is inserted after this, and the process is repeated in the same manner as just described and continued in both directions, up and down the sluice, provided there is no running water in it to interfere with the laying up stream.

After the entire sluice is properly paved and everything is in readiness for the water to be turned on, washing should be commenced with a small head of water, but when all the spaces are solidly filled with sand and fine gravel the full head of water can be used. In beginning to wash through a new sluice, where the ground on the outside is higher than the top of the pavement, caution must be used that the water does not collect on the outside to a greater hight than on the inside, unless the sluice has already been properly

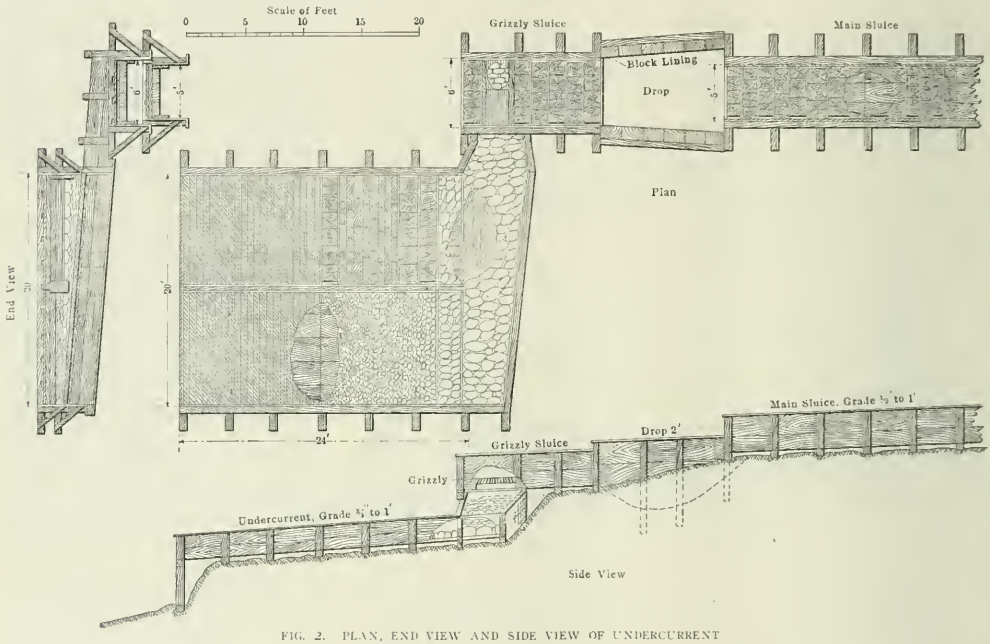

FIG. 2. PLAN, END VIEW AND SIDE VIEW OF UNDERCURRENT

anchored or weighted down. Unless it has been filled solidly with rock or dirt to the top exteriorly, it should at once be made to overflow until the outside is filled completely with dirt, even with the top, if possible; if this is properly done, there is no further danger of the sluice's being lifted.

If the channel or face of the gravel deposit to be worked is too wide to be washed through a single sluice or cut, one or more branches in the sluice are necessary. These should start near the head of the main sluice.

The distance between these branch cuts or auxiliary sluices will depend upon the character of the gravel deposit; in the case of a deposit containing much hard clay to be broken up, or large quantities of boulders to be conveyed, these branches should be nearer together than in a case where the deposit is composed entirely of fine gravel and sand.

If the deposit contains adhesive clay, especially near its bottom, so that it cannot be worked separately and apart from the pay-gravel, then the branches should be close to each other and placed at such a steep grade that they will keep themselves entirely clear, allowing nothing to collect therein while washing this pay-gravel; or, what may be still better, the sluices should be built up as closely to the bank as possible, to secure the gold quickly from the clay, for the reason that the sticky clay has a decided tendency to take up all the gold that it may come in contact with, and it will carry all this, or nearly all that it has once picked up, entirely through the sluice and away from the undercurrents at a total loss to the mine. Where the deposit is very deep and extensive it may be advisable to hydraulic it off in two or more successive benches, as this will give a steeper grade for working the upper levels.

Speaking generally, a bank 250 to 300 ft. thick is as high as can be conveniently hydraulicked in one bench, although, under favorable conditions, it may be practicable to work with safety from a single bench a bank that exceeds 300 ft. in hight. These conditions are: A large pressure for the giants; compact gravel, that will not run to any great distance from the bank when falling from the top in slides or avalanches, jeopardizing the safety of the giants; and also a wide open and roomy pit.

Cleaning Up

Cleaning up consists in removing the pavement, collecting and separating the gold from the sand and from the material lodged in the riffles or interstices of the sluice pavement. A clean-up is resorted to whenever it is deemed necessary to collect the yield of the mine. A clean-up is always required whenever the pavement is so worn by gutters that its surface becomes so uneven that it cannot be relaid to a sufficiently smooth surface without the use of additional paving material.

While the pavement is being removed during a clean-up the flow of water is reduced to a very small quantity. The work is commenced at the upper end of the section to be cleaned up. As the pavement is removed, the fine material will be washed down slowly along the bared bottom of the sluice, leaving in its wake the separated gold, which is taken up in pans by scoops made for this purpose. The process is finished by panning the remaining sand from the gold, or amalgam, if quicksilver is used.

Undercurrents

Undercurrents should be placed wherever the hydraulic miner may deem them most effective. An ideal location for an undercurrent is created by placing a section of sluice 12 to 20 ft. long, and 1 ft. wider than the main sluice, at an elevation 2 ft. lower and about 10 ft. distant from the end of it. Near the lower end of this wide section of sluice, and at right angles across it, a set of steel bars, called grizzlies by the hydraulic miner, is laid. (Figs. 2 and 3.)

To prevent choking, these bars must be so placed that the space between them is wider at the bottom than at the top. Ordinary bars, 1x4 in., can be laid with a little care in this manner; from 10 to 20 of these, spaced from 1 to 2 in. apart are used according to the character of the gravel and the volume of water used in the main sluice. Steel bars, made for the purpose, with one edge thicker than the other, make good grizzlies. The construction and location of these details are shown in Figs. 1 and 3.

Directly under these grizzlies, and parallel to them, a box from 2 to 4 ft. wide is provided, for the purpose of leading the water and fine material that has passed down between the grizzly bars into the undercurrent proper. The undercurrent should be from three to five times as wide as the main sluice, 24 to 36 ft. long, and should have about 50 per cent. more grade than the main sluice.

The number of grizzly bars, their distance apart, and the width and grade of the undercurrent will depend upon the amount of water used in the main sluice and the character of the gravel washed; the larger the head of water and the finer the material, the greater the number of bars, and the narrower the space between them; also, the wider the undercurrent, the steeper the gradient. Where there is a very large amount of fine material, the undercurrent should have still greater width and grade than under ordinarily normal conditions. All the fine material, with sufficient water to run it over the undercurrent, must be allowed to pass through the grizzlies.

The purpose of the 2-ft. drop in grade below the main sluice is to reduce the current while passing over the bars; this will allow the fine gold to settle more readily and pass through between them, and it will also increase the life of the bars and make them last much longer than if they were placed at the end of the main sluice.

A good pavement or riffle floor for an undercurrent may be made of strips 4

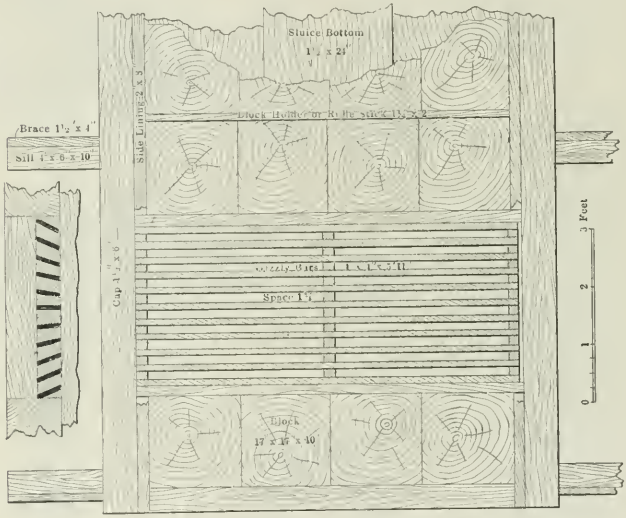

FIG. 3. PLAN AND END VIEW OF SLUICE

in. wide and from 1½ in. to 4 in. thick, lined on top with ¼-in. steel plates held by countersunk nails. These riffles should be laid on edge, spaced 1¼ or 1½ in. apart; they may be laid either crosswise or longitudinally. Blocks also make a very good pavement.

If the richer portion of the gravel should be very hard or cemented, it is advisable to add more undercurrents if conditions will permit. To break up the cement, a high perpendicular drop is excellent. If on account of the filling of the dump with tailings that finally back up into it or some other cause, it becomes necessary to extend the main sluice from its lower end, the policy of placing an undercurrent at the lower end may be questionable; still it is impossible to operate one midway in a sluice without sacrificing at least 5 ft. of the grade in order to get the water and the fine material that passes over the undercurrent back into the main sluice again.

Water Storage.

The necessity of receiving or distributing reservoirs has been referred to before. They furnish facilities for regulating the head of water for the giants, and, in case it becomes necessary to turn off the water at the mine, they furnish an immediate supply of water when hydraulicking begins again. The capacity of these reservoirs must be determined by the daily quantity to be used by the mine; this again depends on so many other contingencies that one must consider them all before deciding upon the practical amount of storage. The details of construction are matters of engineering that must be dealt with as they come up.

Pressure Box or Penstock

A pressure box should be built at the head of the mine pipe-line. Fig. 4 shows a structure of this kind in plan and side and end views. It is more or less of a settling basin and strainer, intended to prevent sand and solids and also air from entering the pipe. A screen is provided to catch sticks, limbs and other floating débris too large to pass through the nozzles, while a sand box of ample proportions holds the sand and other heavy material and prevents that from getting into the pipe.

A spillway *O* is arranged on one side of the pressure box to prevent any damage from the surplus water. This should be wide enough to take care of any possible surplus due to clogging of the screen or variation of the flow. If the water is taken out of the main ditch directly into the pressure box, and the ditch continues past it, a spillway is unnecessary.

The screen *S* should be fine enough to prevent anything from passing through it that may choke the nozzles, and should be so constructed that it can be readily cleared. It should also be strong enough to withstand the pressure in case it is fully choked with branches, leaves and other matter of this kind, for that is liable to occur during a windstorm.

The sand box should be amply large; it has a gate at the side to sluice out the sand and to turn the water out of the pipe whenever it may be necessary to dry it. If a larger head of water is used than can be accommodated by the sand gate, a waste-way must be provided near the bulkhead, so that the pipe may be dried quickly in case of accident, or in case there may be any necessity for changing the water suddenly.

Mine Pipe-line

Where it is possible to bring all the water to one point to suit the conditions of head and locality, and in such a manner that one line may be made available for all the giants, a single line of ample capacity to convey all the required water is to be preferred.

A suitable gore or taper should be provided at the head of the pipe-line, at the point of intake from the pressure box, and this should be of such dimensions that the water in entering the pipe is not retarded. The lower the grade at the upper portion of the pipe-line, the larger and the longer the gore that will be necessary. In any event, it should be of ample size not to create needless friction, which reduces the pressure at the giants.

The main pipe-line should, if possible,

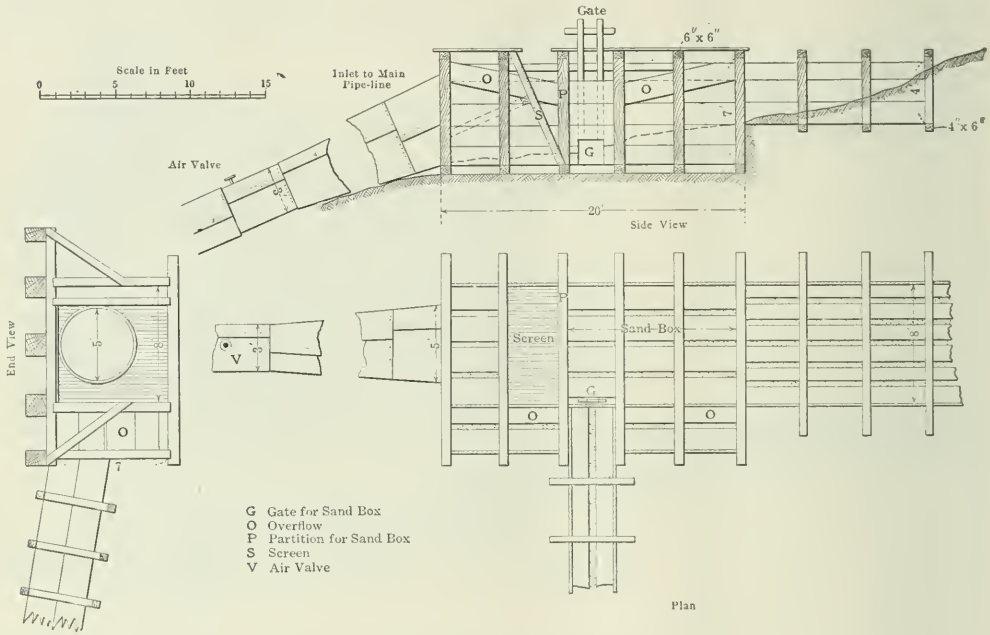

FIG. 4. DETAILS OF PRESSURE BOX

be laid away from the ground to be washed, and preferably, also, on a downward grade for the entire distance; long stretches of slack grade should be avoided, if practicable. As the pipe approaches the vicinity where washing is to be done, suitable branches should be inserted where required until the end of the main line is reached; there a gore must be inserted, tapering to the size of the branches, or a fork provided for two branches. Each branch should have a gate or cutoff.

The branches and gates should be placed as near to the commencement of operations as practicable in order that the working area of the giants may be extended from time to time without the necessity of moving the branch pipes and gates, which is expensive and causes much delay.

If, on account of the width of the gravel, two or more giants are to be used at some distance from the main line and away from the vicinity of the other giants, it becomes advisable to make the branch of the same diameter as the main line—with a gate attached—and to extend this branch line to the neighborhood of the giants; this will eliminate much of the friction due to long reaches of the smaller branch pipes.

All turns, gates and gores should be substantially braced to withstand the pressure, and the whole line should be anchored at short intervals to prevent its creeping downhill by expansion and contraction due to changes of temperature. Air valves of liberal area should be placed wherever they are needed along the line of the pipe to prevent collapse from any sudden withdrawal of the water below. There should be one at every point where the grade increases materially, and one below each cutoff, if the pipe below it has considerable grade.

It is necessary to provide more than one pipe-line where the contour of the country will not permit a satisfactory site for a distributing reservoir, but where one at a lower altitude is available; or, where a part of the water supply must be brought in a lower ditch system, too low to give a satisfactory pressure and yet furnishing valuable water; or, where the deposit of gravel to be worked is so extended and isolated that a branch from the main line cannot well be utilized for it

In the case of two available pressures at different heads, the higher pressure system should be used for the greater part of the cutting and the lower one for regulating the flow to the sluices of the gravel taken from the softer strata, or from the material that has caved under the force of the higher pressure.

Giants

The number and size of the giants will be governed by the amount of water used, the width of the face of the gravel to be worked, the pressure of the water at the giants, and the character of the gravel to be piped. It is better to use as large giants as practicable, for much more can be accomplished with one large giant than by running the same amount of water through two; besides, this saves the pay of one man.

The giants should be set as near the bank as safety from the falling bank will permit. If more than one is to be utilized at one point, they must be placed so that they will command as much of the bank as possible, and be in such a position that two or more may work together advantageously in a combined attack toward one point.

Deflectors are indispensable for the larger sizes of giants. A deflector is comparable to a delicate steering apparatus; by its aid the stream may be guided from one direction toward another. They are of two kinds. One consists of a short flexible coupling, inserted between the nozzle and the end of the discharge pipe; the other is a short section of pipe, a little larger than the nozzle, attached loosely to its end and projecting over the stream. Both of these deflectors turn on a gimbaled joint, free to move in any direction; a lever is attached for moving the deflector.

A light pressure against the lever in any direction bends the stream slightly; this, in turn, moves the discharge pipe, which follows it, as it were, until the stream strikes the desired point. The pressure is thereupon released, and the unmolested stream becomes normal, retaining this direction until the deflector is moved again.

Derricks and Overhead Trolleys

If there are many large boulders that have to be broken up in order to run them through the sluice, and if the grade of the sluice is light and the dump room scarce, it may be advisable to use overhead trolleys or derricks for handling boulders, provided of course, that the conditions are favorable.

The derrick is an awkward and cumbersome thing to use around a hydraulic mine, especially if the bank is high and the pressure for the giants light, for it is necessary to have the derrick in the rear of the giants; this places it too far from its work, unless it has a very long mast and boom.

An overhead trolley is generally preferable, as this interferes little with the giants; and while its reach is restricted sidewise, it has unlimited range from the boulder dump in the rear to the face of the mine; also, it seldom needs shifting as the working of the mine progresses.

Where there are large numbers of boulders requiring blasting in order to dispose of them through the sluice, and where the dump room is restricted, and where the conditions are favorable for utilizing derricks or overhead trolleys, it will be found much cheaper to dispose of these boulders in this manner than to run them through the sluice and choke up the dump.

Hydraulic Elevators

Hydraulic elevators may be used to good advantage at times; indeed, in some cases the conditions are such that this is the only method by which hydraulic mining can be successfully carried on. In the case of valuable gravel deposits, free from quantities of large stones, pipe clay, stumps, etc., situated near or below the level of the surrounding country, which require removal by hand, if a large quantity of water under the required pressure is at hand, the hydraulic elevator becomes a necessity. The elevators are placed near the head of the main sluice and at a lower elevation, depending upon the hight necessary to raise the gravel.

A hydraulic elevator, so called, consists of a pipe of suitable dimensions to convey or lift the water and gravel from a pit (sunk below the bottom of the deposit to be worked) into the main sluice above. It is generally built at a small vertical angle; the top reaches into the main sluice, while to its bottom in the pit is attached the elevator throat. A nozzle, set in line with the center of the elevator pipe, and parallel to it, is placed a short distance below the throat; water from the main pipe-line escaping through this nozzle forces the gravel and water from the pit up into the head of the main sluice.

One or more giants may be utilized for washing the gravel from the mine into the elevator pit in a manner similar to ordinary hydraulic mining, but all stones, clay, stumps, etc., too large to pass through the throat of the elevator, must be removed before reaching the pit. The elevator must be run continuously while the mine is in operation, for the pit becomes flooded immediately, whenever the water is turned off from the elevator nozzle. Any boulders, stumps, etc., that will run through the sluice can be elevated by this process equally as well as the fine gravel.

A giant under heavy pressure, placed at the lower end of the main sluice, may be used to great advantage in stacking or elevating the tailings wherever the dump room is ample in area but deficient in grade.

This giant at the dump may be utilized at any time, whether the sluice be running or not, whenever there is a surplus of water, or whenever it may be turned off from the mine. By using either a hydraulic elevator or a giant at the dump a larger grade for the main sluice can be obtained.

If there should be a depression in the bedrock of the mine below the grade of the sluice, or if the sluice as it extends ahead into the mine should pass over

valuable deposits, this gravel can be elevated and forced up into the sluice in a manner similar to the elevation of the tailings at the dump. This, of course, should be done after the top gravel has been worked down to the sluice grade.

The depth from which gravel can be elevated by this process depends upon the giant pressure. With a pressure of 300 ft. there should be no difficulty in forcing it up from a depth of 15 ft. or more.

Ditches

The old hydraulic miner became an expert in the location and design of a ditch to convey the necessary water to meet his requirements. He was remarkably successful in overcoming difficulties of topography, and mechanical difficulties as well, and he usually overcame them without scientific instruments or scientific formulas, guided alone by his keen sense of the practical and by his ever-resourceful mind.

While the hydraulic miner knew by experience how to arrange the fall, the grade and the size of the ditch, the engineer now has recourse to the elaborate formulas that have been devised to help him. The Kutter formula and its modifications furnish engineers with the means to design ditches of proper capacity and gradient in any material. A few practical hints, however, by an old hydraulic miner will not be amiss.

In laying out the line of the ditch care should be taken to avoid any abrupt turn, unless this be absolutely unavoidable. In making a turn around a sharp point, the line should be carried into the hill somewhat, in order to insure a strong embankment. In turning around such points, it may be desirable to raise the grade for the top of the ditch to correspond to the hight of the permanent roadway along the ditch, thus leaving a solid embankment to the full hight of the roadway.

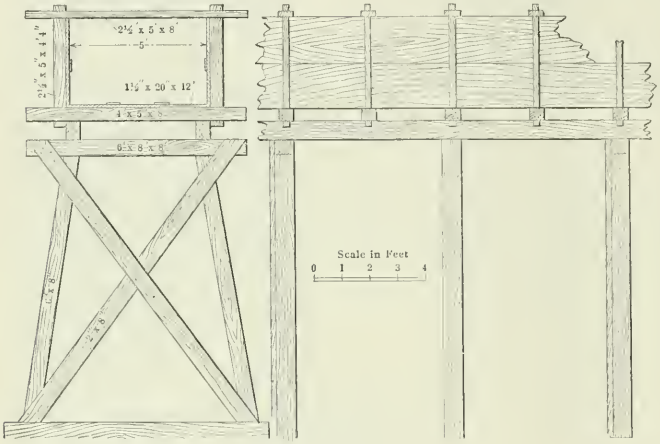

FIG. 5. DETAILS OF FLUME

Many of the old mining ditches bear testimony to his skill, to his perseverance and to his audacity. Mining and ditch building were almost synonymous terms in early days in California, and on the experience of the hydraulic miner much that we know today of the behavior of the flow of water in ditches and in pipes has been based. The investigations of Hamilton Smith are considered of great importance today, for Mr. Smith added no inconsiderable knowledge to what was at that time a rather barren field.

A ditch must convey the required quantity of water. To do so, it must have capacity and grade, or fall. These elements are interdependent and need to be placed in proper relation. The flow through a given cross-section of the ditch must be of a speed to permit the number of miner's inches to pass and yet not too swift to erode the material into which the ditch is cut.

The slope of the bank will be governed by the character of the ground along its course; the upper bank should be sloped back far enough so that the current cannot undermine it and cause slides or caves; accidents of this kind will occur during the rainy or flush-water season, if they occur at all, causing bad breaks, and entailing great expense, loss of water and delay while making repairs.

All trees liable to fall and damage the ditch ought to be cleared away. The surface below the ditch should be stripped of all brush, leaves, débris, etc., before commencing the excavation, in order that the material taken from the ditch and deposited on its lower bank may unite firmly with the undisturbed ground, making, after settlement, a solid and permanent bank; this will permit the miner to raise the water level in the ditch later on, thereby increasing the capacity considerably.

After the ditch is excavated the lower bank should be leveled down in such a manner as to leave a good roadway; this roadway should be considerably higher than the grade line so as to act as a protection against breaks, when, for any reason, small obstructions back the water slightly above the grade.

Flumes along the line of the ditch should be avoided as much as practicable, particularly if the water supply be partially or wholly cut off during the dry season; at such time the lumber will shrink and crack, damaging it more or less, and shortening its life considerably. Where conditions are favorable, a double wall may be built, filled between its two faces with clay or suitable dirt, by which a permanent bank is secured; and while this will increase the original cost, the extra expense may be justifiable.

Even in quite hard bedrock, it may be perfectly reasonable to do considerable blasting in order to avoid a flume and to insure a permanent ditch.

The Flume

This is so well known and has been used so extensively in California that it seems almost needless to refer to it here. But however that may be, practice is gained by contact and experience, and errors are frequently committed in the earlier history of a work that might have been avoided if it had been possible to impart the experience acquired by those who have had to do similar work.

The author, in his long contact with many different types of flumes, had under his immediate charge for several years one which so completely answered the requirements that it seems justifiable to call attention to it here. This flume was about 8 miles long, 4 ft. wide, 38 in. high, and lay on a steep hillside on a narrow bench that was graded just enough to afford a resting place for the inside of the flume; the outer side was held by props from the bank. This was the condition for nearly all of its length.

This flume (Fig. 5) was built of common yellow-pine lumber, with 1½-in. boards for bottoms and sides; 4x5-in. bottom ties, 6 ft. long; 2x5-in. top ties, 6 ft. long; and 2x4-in. posts, or standards, 4 ft. long; no braces; bottom and top ties mortised for the posts, which were unframed.

This flume was in constant use for 30 years. The portion that rested but partially on the ground was kept in repair at small expense, and its use could have been continued at a nominal expense for several years longer had the market for its water still existed. Aside from renewals due to accidental causes, practically all of the flume that rested on the ground was still the original construction after its long use, and the greater part

of it had not required the replacement of as much as a bottom tie in all that time.

It shows the possibility of a simple construction that one might not have ventured upon, preferring some more elaborate foundation at almost prohibitive cost. The risk proved the perfect practicability in the long and useful life of this simple flume.

A flume may be laid on an excavated bench on sills, projecting over the bank, or it may be erected on a partial trestle work for the support of the outer side. Gulches or deep ravines must be crossed on trestle bridges, as shown in Fig. 5. These bridges, when there is no other alternative in making the crossing, often become very formidable structures.

Short sections of flume should have the same area as the ditch, but long sections may be somewhat smaller, owing to the decreased friction of the water. It is questionable, however, whether a change of size is always justifiable, unless the reach of flume has considerable length, for the reason that it is inconvenient to keep various varieties and sizes of lumber in stock for repairs. If there is considerable repairing to be done, it is better to have only a few different sizes, thereby reducing the stock of lumber kept on hand for repairs. It may be quite practicable to plan the size of the flume in such a way that the same-size lumber answers for both sides and bottoms.

For a conventional flume of the type under discussion, the bottom boards and the sides, where the depth of water does not exceed 3 ft., should be 1½-in. planks; if much deeper, 2-in. boards will be necessary, especially for the bottom. For sills, or bottom ties, 4x5-in. pieces will answer for flumes up to a width of 4 ft. containing a 3-ft. depth of water; for a wider flume, 4x6-in. pieces may become necessary; for a flume 10 ft. wide, with a 4-ft depth of water, it will be well to make them from 6x6-in. lumber. For the top ties, or caps, take 2x5-in. pieces for a 5-ft. flume; 2½x6-in. pieces will answer for one 8 ft. wide where there is little snow. If much snow has to be provided against, the top ties must be correspondingly heavier.

For standards, or uprights, use 2x4-in. lumber for a 2½-ft. depth of water; 2½x 5-in. for a 3½-ft. depth; and 3x6-in. for water 4½ ft. deep. These sizes are all desirable, as they need no framing, the bottom and top ties being mortised through. The standards, cut to proper length, are driven firmly into the bottom tie, which acts as a brace, eliminating the ordinary diagonal brace necessary where the standard is set into a gain in the top of the sill. Another advantage over the latter is that, as the flume becomes old and weak from decay, it is much more stable and also more easily repaired, and it will last longer than the flume in which the side ties are gained into the sills and caps.

In order to prevent the clear water from running over the sides of the flume abrupt turns are to be avoided as far as possible. Where a flume joins the ditch, especially at the upper end of the flume, a small gore should be inserted into one box-length, making it bell mouthed. This will prevent the water from backing up into the ditch, and it will have a tendency to prevent lumber, sticks and floatage from catching across its head. A flared box at the lower end of the flume having a swift current will prevent the ditch immediately below from undue erosion.

Waste-Ways

Waste-ways for turning the water out of the ditch in case of accidents, oversupply from rains or melting snow, or other causes must be provided at intervals along the ditch. They should be placed at points where the escape of the waste water will not result in cutting away the ground below the ditch and endanger its safety.

If the ditch is in a cold country where large amounts of snow will collect in it faster than they can be run through it, or where snow is likely to fill up the ditch when the water is not running, which would have to be sluiced out later, the waste-ways should be at frequent intervals, for it is necessary to get the water out quickly and in time before they become clogged up and break.

All waste-ways should be so constructed that the entire flow can be quickly turned out, and they should be so located that the water may escape without endangering any part of the ditch. Some provision should also be made to keep the freshet water from ravines out of the ditch; if it be impracticable to place these waste-ways at or near the ravines, in order to use them for that purpose, other means must be found to prevent this serious inflow.

In conclusion it may be said that the important point in hydraulic mining is to get as much material into the water as the current will transport through the sluice, and to convey this volume without interruption.

Gold in Western Australia

The Council of Mineowners reports the production of gold in Western Australia in November at 137,000 oz., an increase of 620 oz. over October, but a decrease of 8825 oz. from November, 1907. For the 11 months ended Nov. 30 the total gold output was 1,543,097 oz. in 1907, and 1,508,752 oz.—or $31,185,004—in 1908; a decrease this year of 34,345 oz., or 2.2 per cent

The Pittsburg Experimental Station

The station for the investigation of mine explosion of the technologic branch of the U. S Geological Survey, at the Government arsenal grounds, Pittsburg, Penn., which was opened Dec. 3, 1908, comprises the following equipment:

Gas and dust gallery No. 1, 100 ft. long by 6 ft. 4 in. in diameter, has 15 sections of boiler-plate steel, three sections being ½-in. plate, the rest ⅜-in. plate. In each section is a 6x6-in. window of ¾-in. plate glass and a release pressure door. At each lap joint inside is a circular angle iron for holding paper diaphragms to confine air and gas mixtures. Natural gas, from the city mains, containing about 80 per cent. methane and ethane, is used. It is measured by a meter, distributed by a 2-in. pipe, and mixed with air by an electrically driven exhauster. Coal dust is put on rows of shelves on both sides of the gallery.

In the concrete head, is a steel cannon 36 in. long and 24 in. external diameter, having a nickel-steel lining with a 2¼-in. bore 21½ in. deep. The charge is fired electrically from an observation room, about 60 ft. distant, having a window of ½-in. plate glass 6 in. wide and 37 ft. long, protected by external guards.

Gas and dust gallery No. 2 is a round boiler-plate tube, 10 ft. in diameter and 30 ft. long, open at either end.

The flame-testing apparatus comprises a vertical cannon, like that in gas and dust gallery No. 1, in a concrete base, below a boiler-plate stack having a vertical slit from which a light-tight conduit leads to a dark room where the length and duration of the flame from an explosive are photographically recorded on a rapidly-moving sensitive film.

The ballistic pendulum is a United States 12-in. mortar, weighing 31,600 lb., hung by steel rods from an iron beam having nickel steel knife edges resting on nickel-steel plates on massive piers The length of swing of this mortar from a charge placed in a cannon like that in gallery No. 1, is a measure of the strength of the explosive.

A cable from Johannesburg, dated December 3, 1908 to *The London Mining Journal* announces details of an amalgamation plan embracing the Crown Reef, Robinson Central Deep, Crown Deep, South Rand, Langlaagte Deep and Pearl Central. When the merger is completed, the company will be the largest gold producer on the Rand.

According to *La Nature* a gold-bearing district has been discovered near Tamative, Madagascar.

The Tariff Hearings at Washington

SPECIAL CORRESPONDENCE

A considerable number of additional briefs relating to duties on iron and steel and products thereof have been filed during the past week with the House Ways and Means committee.

PIG IRON

Walter Wood for R. D. Wood & Co., Philadelphia, Penn., presents argument showing that $3 per ton duty above the tariff on pig iron is sufficient protection for the cast-iron pipe business but that a reduction to less than $2 per ton would be unwise. He further asserts that any considerable reduction in the cost of pig iron must come from the lowering of the price of Lake ores and urges that a thorough scheme of drawbacks will tend to bring into the United States a large amount of trade which it could not otherwise obtain. E. C. Felton, President Pennsylvania Steel Company, submits detailed estimates of steel costs and urges that the present rate on steel rails is none too high for the protection of the seaboard manufacturer. A. S. Patullo, secretary of the Oregon Iron and Steel Company, Portland, Oregon, advocates a reduction of the duty on pig iron. Leonard Packitt, Catasauqua, Penn., rebuts the arguments of Colne & Co., New York, against duties on silicon iron. He maintains that there is an abundance of "low phosphorus pig iron"—an identical product. Nelson Lyon, Tarrytown, N. Y., submits an elaborate supplemental argument in favor of free pig iron and free raw material in the coarser products of iron and wire, and detailed data on cost of production. John O. Pew, Vice-President the Youngstown, Iron and Steel Roofing Company, Youngstown, O., suggests a moderate reduction in all the iron schedules and urges the substitution of specific for ad valorem duties in Section 135. R. M. Boutwell, Treasurer Portland Iron and Steel Company, Portland, Me., requests the placing of scrap iron on the free list. Chas. Eugene Clark, Covington, Ky., an iron-founder, asks adequate protection for the smaller producer on the ground that he works at a disadvantage. Hon. Chas. Dick has filed a letter from Edwin G. Hough, Secretary of the Chamber of Commerce, Mansfield, O., in which an advance of the duty on iron shot, steel shot, grit and other iron abrasives from 45 to 75 per cent. is urged. W. F. Boardman, treasurer the Calais Shot Works, Calais, Maine, requests a duty of 1c. per pound on chilled shot of all sizes. W. H. Bowker, Boston, Mass., asks to have sulphate of ammonia and basic slag placed on the free list.

The Bessie Ferrosilicon Company, New Straitsville, O., asks that proper protection be granted to ferrosilicon by removing it entirely from the class of pig iron and putting it with such other ferro-alloys as are made by both the blast furnace and the electric processes. Ferrosilicon whether produced in the electric furnace or by chemical process or otherwise should have a duty of 37½ per cent. on the foreign valuation. W. S. Puling, treasurer the Northern Iron Company, Philadelphia, files charges that the statements of Colne & Co., New York City, relative to silicon iron "are untrue" and urges that there be no tariff discrimination against silicon iron.

LEAD AND ZINC ORES

Marshall J. Smith, Georgetown, Colo., has filed supplemental evidence regarding the need of an adequate duty on lead. C. F. Kendall, manager of the Pay Rock mines, Silver Plume, Colo., furnishes statistics on mining costs pointing to the need of a tariff on lead. Silas Frank, Creede, Colo., urges the retention of the present duties on lead. Frederick Burbidge, representing the lead producers and miners of Idaho, asks the retention of the present duties on lead ore and bullion and supports his argument by citing data from "Lead and Zinc in the United States," by W. R. Ingalls, and from the ENGINEERING AND MINING JOURNAL. A body of citizens of the Cœur d'Alene district urges that the present duty on lead bullion and lead ores be not decreased. Thomas L. Wood, Denver, Colo., has filed a lead-ore settlement sheet showing the proceeds of a carload of concentrates and requests the maintenance of the present tariff on lead.

In a supplementary letter S. S. Palmer, president of the New Jersey Zinc Company, rebuts the arguments of the Joplin interests in behalf of a protective duty on zinc. Charles H. Morris, manager of the Altura Mining and Milling Company, and others, Denver, Colo., protests against any reduction of the tariff on lead and demands duties on zinc. James E. Pope, Jersey City, files a denial of statements made by Edward Brush, of the American Smelting and Refining Company, as to the production and marketing of lead. J. W. Marsh, Pittsburg, Penn., general manager of the Standard Underground Cable Company, urges reduction of the duty on lead ores to 0.75c. per pound and on refined lead to 1.125c. per lb. John B. Winfield, Pueblo, Colo., complains of the difference between Canadian and American prices on white lead. The Hanna Paint Manufacturing Company, Columbus, O., complains of the duty on dry white lead and resulting monopoly.

Axel O. Ihlseng, general manager of the Oronogo Circle Mining Company, Joplin, Mo., submits a lengthy analysis of zinc-ore costs in support of his demand for a duty of 1.5c. per lb. on the zinc contents of imported ores. A. B. Cockerill, Nevada, Mo., modifies his statement about Mr. Ihlseng's relation to foreign zinc interests. The H. H. Franklin Manufacturing Company, Syracuse, N. Y., submits additional material in support of its argument for the reduction or total abolition of the duty on aluminum.

MISCELLANEOUS

The Beckton Chemical Company, Philadelphia, Penn., submits a supplemental brief petitioning that the duty on crude manufactured barytes earth suitable for lithopone manufacture be entirely removed, or at least not advanced beyond the present rate. The W. D. Gilman Company, Sweetwater, Penn., corrects some misstatements and asks for a protective duty of $5 per ton. The Retail Confectioners and Ice Cream Manufacturers Protective Association of New York recommends removal of the duty on rock salt. Hon. Peter A. Porter files a letter from the Rock Glen Salt Company, Rock Glen, N. Y., asking the retention of present duties or increase of 2 or 3c. per 100 lb. on salt above present rates of 8 to 10c. per lb. H. C. Higginson, president of the Higginson Manufacturing Company, Newburg, N. Y., asks retention of the present duty on refined chalk. George W. Grote, importer, New York City, asks that chalk be placed on the free list. Henry Howard, president of the Merrimac Chemical Company, Boston, Mass., submits detailed argument for placing bauxite on the free list. Hugo Reisinger, New York City, urges that the specific duty system as applied to carbons be abandoned and the rate be 20 per cent. ad valorem. H. Y. Seidel, Philadelphia, requests that crucible clay be retained on the free list. A considerable number of manufacturers support this position. The Glidden Varnish Company, Cleveland, O., protests against any increase of duty above the present $1.50 per ton on asphaltum. The Southern Fullers Earth Company, Warren, Penn., urges the need of increased duties on fullers earth and supports the views of Harry A. Auer, who appeared before the committee.

Charles Weiler, Milwaukee, Wis., urges an increase of duty on gypsum rock from 50c. to $1 per ton. The Roman Nose Gypsum Company, Bickford, Okla., requests an advance in the duty on gypsum. Frank W. Wilder, for the Southern Gypsum Company, North Halston, Va., urges that reduction of duties to 25c. per ton would be inadvisable. The Warner-Miller Company, New Haven, Conn., advocates abolition of the duty on gypsum. The Virginia Portland Cement Company, Fordwick, Va., urges free admission of gypsum. The same request is made by a large number of dealers in building supplies. The Best Brothers Keen's Cement Company, Medicine Lodge, Kan., urges that the duties on Keene's cement be raised and be equalized with those on the chemicals used in its production. John C. Lehman, for the Kielgass Lehman Company, Chicago, asks that the tariff on pumice be reduced or certainly not advanced.

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South African Mining Reports and the Life of the Mines

While the reports issued by the South African Mining companies generally supply the stockholders with ample statistics as to the working of the mines, there is one point on which nearly all of them are deficient. Mining and milling costs and bullion recoveries are given with much detail, and no one can reasonably complain that the results of the year's work are not sufficiently explained. The serious omission is that no information is given as to the probable life of the mine. It is true that in a few cases some estimate is given of the probable date of exhaustion of the ore; but this is the case with only a few of the older mines—such as the Crown Reef, the Ferreira and the Robinson—which have had their lives officially determined, so to speak. This omission is especially to be deprecated in a district like the Witwatersrand, where the determination of ore reserves is more easily made than in any other gold-mining district known.

The dividends of the mines may be regarded as terminable annuities, and unless the reports give some indication of the number of claims to be worked and the probable tonnage, the shareholder is very much in the dark as to the present value of his holdings. Of course, no one who understands how much the tonnage available for mining depends on the cost of working can expect more than an approximate estimate; since the cost must fluctuate according to the labor supply and other causes. It is reasonable, however, that shareholders should obtain from their directors and the engineers they employ the best information possible as to the probable life of their property. The claims worked out and the tonnage obtained are known quantities; so also is the area of claims still unworked. It is, therefore, inexcusable that official reports, while giving copious information about past results and current work, should be totally silent as to the future. It is also remarkable that meetings are held in which shareholders ask many questions, but no one calls for information of the kind indicated.

Of course, the available resources of a mine will vary as conditions change; and a reduction in working costs may make valuable ore formerly considered unpayable. Revaluations must be made from time to time. Moreover, no one can blame engineers for not foreseeing such reductions in cost; or, on the other hand, variations in average ore value, the occurrence of dikes and faults and other factors that may affect the reserves unfavorably. Stockholders have, however, an undoubted right to expect from their engineers and directors a general report on the probabilities, based on conditions existing at the time the report is made; and indicating to the best of their knowledge and experience what may be reasonably expected.

Another phase of the same question relates to the accounts of the companies. In the balance sheets property account remains at the same, or an increased figure year after year, although the value necessarily depreciates with the ore taken out each year. If these property accounts had been debited each year with the ore taken from the mine—as is done by many coal companies in Europe and the United States—either the capital would be reduced to conform to the estimated future profits, or a sinking fund provided for the benefit of stockholders. Either method would provide for the amortization of the capital, and its extinction when the life of the mine was ended.

Ventilation of Mines

Ventilation in metal mines in the United States is a subject that is commonly dismissed from consideration, or rather it seldom enters into consideration at all; at least, not until the air becomes so bad that candles will not burn. Consequently, there is no well developed practice in this important phase of mining. No arguments should be necessary to prove that it is an important phase, because it is axiomatic that the better are the conditions for the men underground, the greater is their efficiency. Nevertheless, operators are frequently blind to such matters that directly affect their own interest, and it is necessary to insure the welfare of their employees by law. So largely has the subject of ventilation been disregarded, there is only one law—that of New York—that in any way prescribes that good ventilation shall be provided, or even refers to it. Fortunately, several of the States require that every mine shall have at least two exits, which in themselves usually effect fairly good ventilation, although not intended specifically for that purpose.

The simplest means for ventilating a mine is the establishment and proper direction of air currents through it. This can usually be effected, when there are two openings to the mine or connection with some other mine, by the exercise of engineering knowledge and the expenditure of nothing but a little thought and the cost of a few doors, brattices, etc. The results of intelligent consideration of the principles governing air currents are strikingly manifest in the mines of Butte, Mont., which through the decomposition of timber and sulphide ore, and the heat generated by pressure in the fissured and fractured ground are as hot as any mines now operated in the United States. Some of the mines at Butte are so hot that an ordinary candle quickly softens in the fingers, and their atmosphere is exceedingly uncomfortable, both because of the heat and the deficiency of oxygen by absence of circulation; other mines near by, while warm, are not uncomfortable to the men, a proper circulation of air through the workings having been established.

A mine having only one opening can, of course, be ventilated only by a mechanical movement of the air, and when the drives attain long distances from the shaft it is necessary to provide air pipes extending nearly to the breasts, and either force in or exhaust air by means of a fan. In some metal mines opened in a flat-lying deposit, where the workings may cover a large area on one level, a simple and effective means for ventilation is to put down one or more 6- to 8-in. holes with an ordinary churn drill and connect them on the surface with a fan which will exhaust air from the mine through the drill holes. Such drill holes are very cheaply put down to depths of several hundred feet.

The subject of ventilation underground is one that should be given a good deal more attention than it gets. It is not right to compel miners to work under conditions which may injuriously affect their health, even if the men themselves be willing to work in such places without complaint. But aside from this moral aspect of the case, it is the common experience that the better are the conditions for work, the more is the work done. Many managers of mills who neglected for years to clean the windows, found to their astonishment that the better light coming from the removal of the dust and dirt increased efficiency to such an extent that window cleaning proved to be one of the best investments ever made. The provision of good air is also a fine investment.

Secrecy in the Arts

The best explanation and defense of this mistaken policy, as we consider it to be, that we have seen, have been given by Edgar Hall, of Australia, in a communication published in the September bulletin of the American Institute of Mining Engineers, wherein he discusses the paper of Dr. Douglas, presented at the Toronto meeting of the Institute. Dr. Douglas attributed the decline of the copper-smelting industry in Swansea to the secrecy maintained by the concerns there engaged in smelting.

Mr. Hall argues that the decline of copper smelting at Swansea was due to quite different causes and was inevitable. He points out that Swansea never smelted what is now considered low-grade ore, and never could hope to do so, because even with the advantage of cheap ocean-carriage, nothing but rich ores and matte could stand the freight. With the introduction of the bessemer process matte could be more cheaply treated at or near the mines.

The smelting industry at Swansea was essentially conducted on a custom basis. Today the great producers of copper are the mining companies which do their own smelting, and as Mr. Hall remarks, "It matters little who knows what is being done, for those who may copy their methods cannot take the mine, and it is decidedly of advantage to the smelter to know what others are doing, since every improvement adopted is pure gain and an increase in the value of the mine. But to the custom smelter very often the possession of a 'wrinkle' means the difference between profit and loss, and in the case of the Swansea firms, if they showed their methods freely, it meant that they would be promptly deprived of their supply of raw material."

Undoubtedly there is some truth in this argument, but its mistake on the whole lurks in what Mr. Hall himself says, namely that it is of advantage to the smelter to know what others are doing, since every improvement adopted is pure gain. Such advance in knowledge is only to be secured through an exchange of information. We should feel sorry for the metallurgical firm whose chief capital was a trade secret, always at the risk of betrayal of a venal employee. The concern which has failed to develop an organization and a guiding policy that will permit it to discard its old clothes to less enterprising competitors, from whom nevertheless it may obtain fragments of valuable experience in exchange, is not likely to keep a position near the head of the procession. This, we think, is verified by the often repeated experience, that when after much trouble an opening is finally gained to previously inaccessible works, it turns out that the veil of mystery has concealed defects in practice rather than the perfection supposed.

The Low Price for Silver Affects the Cost of Producing Lead

We are apt to fall into error of speaking of silver as a by-product that will be turned out irrespective of the price in so far as it is derived from lead and copper ores, but whether the silver of such ores be let go scot-free, or the silver be charged with all it realizes in order to make the copper and lead stand at a low cost, or expenses be proportioned among these various metals, is merely a matter of bookkeeping. The fact is, of course, that a decline in the value of silver has a highly important effect upon the cost of producing the other metals, particularly important in the case of the lead mines of the Cœur d'Alene.

Thus, it was computed in an article in the JOURNAL of Jan. 4, 1908, that if the price for silver should fall from 68c. per oz. to 50c., the cost per pound of lead to the Federal Mining and Smelting Company would increase approximately 0.67c., while the Bunker Hill & Sullivan company which at 67.5c. per oz. for silver realized for that metal alone an amount much in excess of the total cost of mining and milling, would fall far short of that exceptional and desirable result if the price for silver should be only 50c. per ounce.

However, with silver at a little less than 50c. per oz. the wolf is not howling at the door of these great lead producers, which on the basis of 50c. per oz. can deliver lead in New York at 3@4c. per lb., including all charges for maintenance, amortization, etc., while if those items were neglected for a time as would be done at a pinch, the cost of production would be 0.5c. per lb. less.

Patent Legislation

SPECIAL CORRESPONDENCE

Representative Stephens has introduced in Congress a bill requiring any citizen of a foreign country who may procure a copyright or letters patent from the United States to pay to the United States for such copyright or patent the same amount of fees and to subject himself to the same laws, rules and regulations relating to such patent, its use and control, as the government of such foreign country exacts by its laws and regulations from citizens of the United States. This is the same proposal which was brought up last spring and at that time received considerable attention from the House Committee on Patents. It was then seriously antagonized by the patent attorneys of the United States on the ground that it would require an immense enlargement of the work of the patent office and throw upon our courts the necessity of familiarizing themselves with the patent legislation of many foreign countries, in addition to numerous technical objections to the proposed measure. The same position is now being taken by the patent attorneys and they are expecting to have hearings before the House Committee on Patents probably during January at which the Stephens bill will be considered and there will be general discussion of methods of retaliation against foreign countries which accept legislation aimed at American interests.

The Conservation Commission

SPECIAL CORRESPONDENCE

It has been determined to send to the President the *verbatim* proceedings of the conservation conference as a part of the report of the Conservation Commission. President Roosevelt will then transmit the whole mass of documents to Congress early in January, and this will insure the publication of the whole as a government document. The President will also make recommendations for a permanent body to take charge of the conservation movement, but no legislation is expected at this session.

Mr. Pinchot will shortly appoint the permanent conservation committee (of voluntary type) which was provided for at the recent meeting of the conservation conference. This consists of six members of State conservation commissions and three members of the national body. It is expected that this joint organization will begin operations at once in conjunction with the various State conservation commissions and will aid in formulating uniform legislation to be urged upon the several State legislatures that will be in session this winter.

Chronology of Mining, December 1908

Dec. 2—American Mining Congress met at Pittsburg, Penn.

Dec. 3—Experimental station of the U. S. Geological Survey at the Arsenal grounds, Pittsburg, Penn., formally opened by Secretary Garfield. Guanajuato-Jalisco Development Company organized in New York.

Dec. 7—Congress reassembled.

Dec. 8—National Conservation Commission made its first report. President Roosevelt and President-elect Taft advocated the issue of bonds to protect the natural resources of the country.

Dec. 10—President Roosevelt withdrew from entry all public lands containing phosphate rock in Wyoming, Idaho and Utah. Conference of steel manufacturers at New York, but no action as to prices. Violent break in price of Rawhide Coalition stock.

Dec. 11—Announcement that Phelps, Dodge & Co., Incorporated, capital $50,000,000, is to take over all the interests of the firm of the same name. The President-elect, William H. Taft, announced that there will be thorough tariff revision. Announced that on Jan. 1, 1909, the railways will raise freight rates an average of 10 per cent. on east-west shipments and 18 per cent. on west-east.

Dec. 15—Mexican Congress adjourned until April without taking action on new mining regulations. Federal Mining and Smelting Company resumed dividends on common stock.

Dec. 16—Fire in quarters of the U. S. Geological Survey at Washington destroyed a quantity of field notes and other valuable documents. C. W. Bray, president of the American Sheet and Tin Plate Company, resigned. Edward Brush, treasurer of the American Smelting and Refining Company, declared before the Ways and Means committee that American lead producers need protection against Mexican producers.

Dec. 17—Announcement that Cole & Ryan will organize new smelting company to compete with American Smelting and Refining Company.

Dec. 18—Copper producers met at New York to consider revival of statistical association. Giroux smeltery at Kimberly, Nev., burned. E. H. Gary, of the U. S. Steel Corporation, before the Ways and Means committee pleaded for the retention of the present tariff on steel products.

Dec. 21—Andrew Carnegie declared before the Ways and Means committee that the American iron and steel industry no longer needs protection. Incorporation of International Smelting and Refining Company (the Ryan-Cole company), with capital of $50,000,000, all common stock. Manufacture of steel begun at Gary, Ind.

Dec. 26—President Roosevelt appointed commissioners to consult with authorities of Canada and Mexico regarding the conservation of natural resources.

Dec. 28—Earthquake in southern Italy and Sicily destroyed thousands of lives and millions of property.

December Dividends

The accompanying table shows the dividends paid in December, 1908, by mining and industrial companies in the United States and by some foreign mining companies.

U. S. Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Acacia	Colo.	$0.01	$15,000
Am. Smelters, pfd. A	U. S.	1.50	225,000
Am. Smelters, pfd. B	U. S.	1.25	375,000
Bunker Hill & Sull	Ida.	0.25	75,000
Calumet & Arizona	Ariz.	1.00	200,000
Calumet & Hecla	Mich.	5.00	500,000
Colorado	Utah	0.08	80,000
Doe Run	Mo.	1.50	93,720
Federal Sm'ting, pfd.	Ida.	1.75	210,000
Homestake	S. Dak.	0.50	109,200
Mary McKinney	Colo.	0.02	26,185
North Butte	Mont.	1.00	400,000
North Star	Cal.	0.75	187,500
Old Dominion	Ariz.	0.50	146,622
Old Dominion M. & S.	Ariz.	1.00	162,000
Quincy	Mich.	1.00	110,000
Round Mountain	Nev.	0.04	10,000
Sioux Con	Utah	0.02	10,000
Standard Con	Cal.	0.10	17,839
Tomboy	Colo.	0.48	144,000
Uncle Sam	Utah	0.02	10,000
Utah (Fish Sp'gs.)	Utah	0.04	4,000
Utah Copper	Utah	0.50	362,975
Total			$3,484,041

U. S. Industrials.	Location.	Amt. per Share.	Amt. Paid.
Gen. Chem., com.	U. S.	$1.00	$74,103
Maryland Coal, pfd.	Md.	2.50	47,125
National Lead, pfd.	U. S.	1.75	260,820
Northern Coal and Coke	W. Va.	3.50	87,500
Sloss-Sheffield, com.	Ala.	1.00	100,000
Standard Oil	U. S.	10.00	9,700,000
U. S. Steel, com	U. S.	0.50	2,541,513
Total			$12,811,061

Foreign Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Granby	B. C.	$2.00	$270,000
Kerr Lake	Ont.	0.15	90,000
Mines Co. of America	Mex.	0.02	40,000
N. Y. & Hond. Ros.	C. A.	0.10	15,000
Silver Queen	Ont.	0.03	45,000
Trethewey	Ont.	0.10	94,545
Total			$554,545

The lead-smelting works now in operation in Colorado are those of the Ohio & Colorado Smelting Company, at Salida, and the Globe, Pueblo, Arkansas Valley and Durango plants of the American Smelting and Refining Company. The Grant works, at Denver, and the Philadelphia plant, at Pueblo, are permanently abandoned. The chances are also that the Eilers plant, at Pueblo, now idle, will never run again.

The Simmer & Jack Gold Mine in the Transvaal

SPECIAL CORRESPONDENCE

During the year ended June 30, 1908, at this mine 785,310 tons were crushed, yielding gold to the value of £1,267,410, an average of 7.672 dwt. or $7.75 per ton. The working expenditure was $3.89 per ton. During the year 4000 Chinese laborers were replaced by negroes, a change which entailed heavy expenditure. The mill consists of 320 stamps and four tube mills, the average duty being 6.969 tons per stamp day.

During the year underground work on night shift was gradually reduced until at the end of June practically the whole mine was operated on day shift only, resulting in general improvement in efficiency.

One notable omission from the report and from the chairman's speech at the annual meeting is any statement regarding the life of the mine. No attempt has been made to indicate the claims exhausted, or what remains. For additions and renewals of machinery and plant a reserve fund is maintained. For the period under review the sum of £52,500 was appropriated for this fund, which stood at £83,630 at the end of the financial year.

The net revenue on working account was £601,067. Two dividends of 7½ and 10 per cent., as well as a bonus of 2½ per cent. were declared, absorbing £600,000 in all.

The following statement shows the working costs per ton since 1905.

Year to June 30:	1905.		1906.		1907.		1908.	
Tons milled	475,181		624,507		717,524		785,310	
	s.	d.	s.	d.	s.	d.	s.	d.
Mining, hauling and pumping	14	2.759	12	4 147	11	0 527	8	10.774
Transport of quartz, crushing and sorting		11.425		10 039		9 634		6 080
Milling and cyanide	4	1.106	3	8 592	3	5 625	3	7 948
General expenses, including maintenance	1	6 362		11 984	1	6.515	1	4 926
Development	2	6 000	2	6 000	2	6.000	1	8 918
Total costs	23	3.652	20	4 762	19	4 301	16	2 646

Development account is a book entry, calculated from the tonnage developed in the mine divided by the cost. On June 30, 1908, excess development stood in the books at £115,417, against a tonnage of 1,902,000 tons valued at 7.6 dwt. equal to $0.29 per ton.

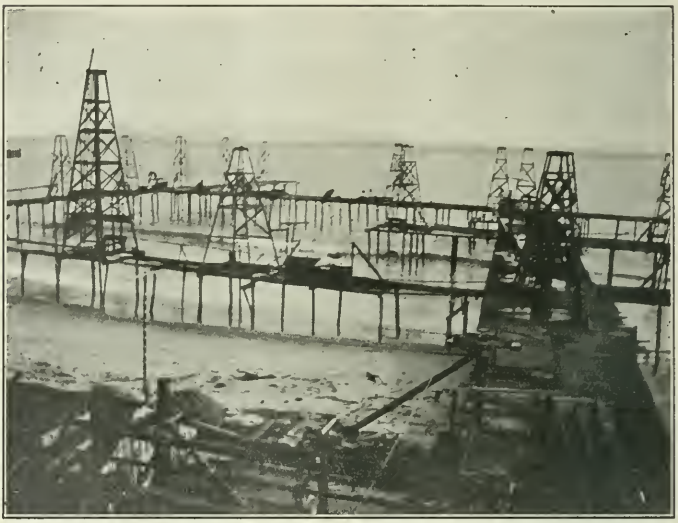
Since 1905 the total tons developed have been as follows:

	Tons.	Value.
1905	1,216,064	8.44 dwt.
1906	1,215,291	8.4 dwt.
1907	1,694,000	7.7 dwt.
1908	1,902,000	7.6 dwt.

It is usual on the Rand to aim at the extinguishment of development expenditure in the balance sheet by writing off every year to working costs a somewhat larger amount than has actually been spent during the year. Shafts and property, on the other hand are not written down and the expenditure remains the same in the balance sheet from year to year unless additions are made.

Submarine Petroleum

The story of the present article is told in the engraving from a photograph which accompanies it. This shows an oilfield at Summerland, Cal., where petroleum is obtained from submarine wells. So far as we are aware the situation of these wells is unique in the petroleum industry.



SUBMARINE OIL WELLS, SUMMERLAND, CAL.

Proposed Tax on Mining Stocks

SPECIAL CORRESPONDENCE

In considering new revenue legislation, the Ways and Means Committee is being urged to investigate the question of a tax on the stocks of corporations engaged in interstate business, and in this connection the McHenry bill introduced May 12, 1908 (H. R. 22,267), as well as other measures aimed at stock speculation, will be pressed upon the committee. The McHenry bill provides "that on and after the approval of this act all corporations engaged in the mining of asphalt, copper, gas, gold, graphite, iron, lead, oil, radium, silver, tin or zinc, or corporations organized for the purpose of mining or producing those minerals and offering stock of such corporations for sale either in commercial exchanges, boards of trade, or by private subscription and solicitation, shall pay into the treasury of the United States a tax of 0.1 per cent. upon the market value not reckoned below par, of the authorized capital stock of such corporations." The Ways and Means Committee has not committed itself thus far to any scheme of revenue enlargement, but the pressure for the McHenry bill or some measure of the same sort is likely to be strong.

Rhodesian Mines

The gold production of Rhodesia in October is reported at 48,847 oz., or 274 oz. more than in September. For the 10 months ended Oct. 31 the total was 503,447 oz. This year nearly all the mines report in fine gold, but last year the statements were made in bullion. By values the gold outputs for the 10 months was $8,786,515 in 1907 and $10,278,512 in 1908; an increase this year of $1,491,997, or 17 per cent.

The production of other metals and minerals in October included 24,615 oz. silver, 9 tons copper, 85 tons lead, 7 tons wolframite, 386 tons chrome ore and 16,312 tons coal.

West African Gold Mines

The West African Chamber of Mines reports gold production in Ashanti and the Gold Coast in November at 24,437 oz., an increase of 656 oz. over October. For the 11 months ended Nov. 31, the total was 260,287 oz. bullion in 1907, and 272,742 oz. in 1908; an increase of 3455 oz. The bullion reported in 1908 was equal to $5,205,323, or 256,184 oz. fine gold.

New Publications

THE MOUNT FARRELL MINING FIELD. By L. K. Ward. Geological Survey Bulletin No. 3. Pp. 120, illustrated. 5½ x8½ in.; paper. Hobart, Tasmania, 1908: Department of Mines.

BUECHER-VERZEICHNIS DES VEREINS FUER DIE BERGBAULICHEN INTERESSEN IM OBERBERGAMTSBEZIRK DORTMUND ZU ESSEN. Third Edition. Pp. 491. 7½ x10½ in.; cloth. Berlin, 1908: H. S. Hermann.

REPORT OF THE PENNSYLVANIA DEPARTMENT OF MINES, 1907. Part I—Anthracite; Part II—Bituminous. Pp. 603-938, illustrated. 6x9½in.; cloth. Harrisburg, Penn., 1908: Harrisburg Publishing Company.

MARYLAND MINERAL INDUSTRIES, 1896-1907. By William B. Clark and Edward B. Mathews. Vol. VIII, Part II. Pp. 223, illustrated. 7x10 in.; paper. Baltimore, 1908: Maryland Geological and Economic Survey.

INFORME PRELIMINAR SOBRE LA ZONA PETROLIFERA DEL NORTE DEL PERU. By V. F. Marsters. Boletin Del Cuerpo de Ingenieros de Minas del Peru, No. 50. Pp. 150, illustrated. 6¼x9¾ in.; paper. Lima, 1907: Ministerio de Fomento.

THE COPPER-MINING INDUSTRY AND THE DISTRIBUTION OF COPPER ORES IN NEW SOUTH WALES. Second Edition. By J. E. Carne. Mineral Resources No. 6. Pp. 425, illustrated. 6x9¾ in.; board covers. Sydney, 1908: Department of Mines.

PRELIMINARY REPORT ON THE COALINGA OIL DISTRICT, FRESNO AND KINGS COUNTIES, CALIFORNIA. By Ralph Arnold and Robert Anderson. U. S. Geological Survey, Bull. No. 357. Pp. 142, illustrated. 6x9 in., paper. Washington, 1908: Government Printing Office.

THE KETCHIKAN AND WRANGELL MINING DISTRICTS, ALASKA. By Fred E. Wright and Charles W. Wright. U. S. Geological Survey, Bull. No. 347. Pp. 210, illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

COAL: Part I—Coals of the Monongahela Formation or Upper Productive Coal Measures; Part II—Chemical Analyses and Calorific Tests of the Clarion, Lower Kittanning, Middle Kittanning and Upper Freeport Coals. Geology by J. A. Bownocker; Chemistry by N. W. Lord and E. E. Somermeier. Pp. 342, illustrated. 6½x9½ in.; cloth. Columbus, Ohio, 1908: Geological Survey of Ohio.

A TEXT BOOK OF PHYSICS. Edited by A. Wilmer Duff. Pp. 680; illustrated. 5½x8 in.; cloth, $2.75. Philadelphia, 1908: P. Blakiston's Son & Company.

This work is the result of the collaboration of seven distinguished American physicists, the idea being that its important subject would best be treated by specialists. Such an undertaking is apt to be characterized by lack of coördination. In the present case the editor deserves congratulation upon his success in welding the contributions into a uniform treatise. Mechanics and properties of matter are treated by Professor Duff; heat by Professor Guthe; wave motion and sound by Professor Hallock; light by Professor Lewis; electricity and magnetism by Professor Goodspeed; electromagnetic induction by Professor Carman; and conduction of electricity through gases and radioactivity by Professor McClung. The work is in all respects uptodate and is a valuable contribution to knowledge. It appears to us as likely to meet the needs of students for a modern textbook of this science.

ROCKS AND ROCK MINERALS. By Louis V. Pirsson. Pp. 414; illustrated. 5x7½ in.; cloth, $2.50. New York, 1908: John Wiley & Sons, London, Chapman & Hall, Ltd.

Contents: Scope of petrology; historical; methods of study. Chemical character of the earth's crust and its component minerals. Important properties of minerals. Description of the rock-making minerals. Determination of the rock-making minerals. General petrology of igneous rocks. Description of igneous rocks. Origin and classification of stratified rocks. Description of stratified rocks. Origin, general characters and classification of the metamorphic rocks. Description of metamorphic rocks. The determination of rocks.

This is an uncommonly good book upon a subject that is troublesome to all but the trained petrologists. It will be particularly useful to geologists and mining engineers because of the table for determining rocks like those for determining minerals by their physical properties.

STEAM POWER PLANT ENGINEERING. By G. F. Gebhardt. Pp. 816; illustrated. 6x9¼ in.; cloth, $6. New York, 1908: John Wiley & Sons; London, Chapman & Hall, Ltd.

Contents: Elementary steam power plants. Fuels and combustion. Boilers. Smoke prevention, furnaces and stokers. Superheated steam and superheaters. Coal- and ash-handling apparatus. Chimneys. Mechanical draft. Steam engines. Steam turbines. Condensers. Feed-water purifiers and heaters. Pumps. Separators, traps and drains. Piping and pipe fittings. Lubricants and lubrication. Finance and economics; cost of power. Testing and measuring instruments. Typical specifications. Typical plants. Tables. Bibliography.

The author of this work is professor of mechanical engineering at the Armour School of Technology. It is intended to be primarily a textbook for engineering students, but it is hoped that it will also be of interest to practicing engineers. It will be. It is indeed a monumental work, which, while covering much of the same ground as Professor Hutton's classic, looks at its subject from a different viewpoint and contributes important supplemental information.

ELECTRO-METALLURGY. By John B. C. Kershaw. Pp. 303, illustrated. 5½x8½ in.; cloth, $2. New York, 1908: D. Van Nostrand Company.

This book is interesting in many respects and a good deal of valuable information may be obtained from it if the reader be sufficiently well informed to sift out and reject the frequent inaccuracies and belated data. The plan of the author has been too ambitious. In writing a treatise on electrometallurgy in 297 pages and going into such subjects as glass, graphite, carbon bisulphide and others that do not belong to electrometallurgy, there remains obviously an inadequate space for the important subjects like aluminum, copper and iron.

The author's treatment is purely descriptive; in no respect critical and analytical. For example, in his chapter on zinc he describes certain of the hydro-electrometallurgical processes, but fails to indicate the causes of the failure of most of these, or point out that they are bound to fail unless the anode reaction can be utilized, as in the Hoepfner process, or extraordinarily cheap power be available. His explanation of the failure of the Ashcroft process at Cockle Creek is woefully inadequate. Similarly in the matter of the electrothermic processes the data cited are visionary and the great metallurgical difficulty experienced by De Laval, who is the only one that has commercially produced zinc in this way, is not even mentioned.

The chapters on copper and lead are hopelessly out of date. Merely as illustrations we may mention that the Anaconda refinery has not been operated for years, while in the case of the Betts lead process the most important works employing it, namely, Grasselli, is not referred to. Indeed, Mr. Kershaw's book has the appearance of preparation several years ago and publication after a long delay without any serious attempt at revision. In the meanwhile progress has been rapid. The book is obviously to a large extent a compilation, but the best authorities have not always been consulted although their works have been available. The estimate that it costs 25c. per lb. to produce aluminum will provoke a smile in these days when it is selling for 13½c. If such errors were few and obviously mere slips on the part of the author, who cannot be expected to show omniscience, we should not so strongly call attention to them, but unfortunately the book is permeated with them, which deprives it of value except to the discriminating reader, and he is likely to decline to do the sifting that the author ought to have done

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

S. F. Shaw is in Tombstone, Arizona.

W. de L. Benedict is in San Francisco.

Henry S. Washington has returned from Brazil.

Paul R. Hare is managing a dredge at Pierce, Idaho.

Walter H. Bunce has gone to Argentina on professional business.

Rene Hazard is operating a hydraulic mine near Medellin, Colombia.

Lester W. Strauss has been examining coal and copper in southeastern Peru.

E. B. Kimball and Louis Decoto are investigating mines near Zaragoza, Colombia.

Raymond Linton is examining quartz and placer mines near Tuquerres, Colombia.

F. J. Siebel is superintendent of the Burlington mine at Sutter Creek, Amador county, California.

F. T. Havard has opened an office as consulting mining and metallurgical engineer at Helena, Montana.

Hugh Rose, superintendent of the Guanajuato Development Company, Guanajuato, Mexico, is visiting New York.

James Gallagher has resigned his position as manager of the Joplin Mining Exchange at Joplin, Mo., to go into private business.

P. L. Williams, Jr., general superintendent of the Daly-West mine at Park City, Utah, has returned to Utah from a business trip to Chicago.

Lafayette Hanchett, general manager of the Newhouse interests in Utah, has returned to Salt Lake City from a business trip to New York and Boston.

John V. N. Dorr, of Pluma, S. D., is acting as consulting engineer for the Golden Reward Mining Company in the installation of a Moore process plant.

Joseph Wharton, the veteran ironmaster and blast-furnace operator, has presented a tract of 25 acres at Fern Rock to the city of Philadelphia, to be used as a public park.

H. C. Cutler, consulting engineer for Nixon & Wingfield, has returned to Goldfield, Nev., after three weeks spent in examining mining claims in Sonora, Mexico.

W. F. Battersby, of the Kingston School of Mines, has been awarded the prize of $100 offered by J. B. Tyrrell, mining engineer, Toronto, for the best collection of Ontario minerals made during the past season.

F. W. Ridley has been appointed superintendent of the Allouez and Centennial mines in the Lake Superior copper district. Mr. Ridley has had charge of the Superior, LaSalle and Gratiot properties since they came under the management of the Calumet & Hecla.

Dr. George E. Ladd has been appointed president of the new Oklahoma School of Mines, at Wilburton, Okla., and will take charge soon of the organization. Dr. Ladd was formerly in charge of the Missouri School of Mines at Rolla, but for some years past has been engaged in zinc mining in the Joplin district.

John Laing, of Sharon, Kanawha county, president of the Wyatt Coal Company, and for several years interested in the Rush Run operation on New river, has been appointed chief mine inspector of West Virginia in place of James W. Paul, who resigned some time ago to accept a position with the United States Geological Survey. Mr. Laing began life as a miner and gradually worked his way up until he became an operator on a considerable scale.

Obituary

Henry Wallace Caldwell, president of the H. W. Caldwell & Son Company, of Chicago, and founder of the business, died Dec. 22, at Redlands, California.

Societies and Technical Schools

American Institute of Mining Engineers—The following committee on the Conservation of Natural Resources has been appointed to coöperate with the National Commission; John Hays Hammond, chairman; T. H. Watkins; Gardner F. Williams; James Douglas; Walter Renton Ingalls; Charles Kirchhoff; Theodore Dwight; Joseph Struthers.

Colorado School of Mines—President Victor C. Alderson, of this school at Golden, Colo., announces that a number of courses will be added, beginning with the college year 1908-1909. They are intended for technical graduates who wish to specialize along various lines. The new courses include coal mining; coal testing; mine-plant testing; advanced general metallurgy; metallography; gas-engine design; kinematical drawing of mining machinery; advanced mine and mill design; advanced hydraulic design; ceramic geology; cements and clays; chemistry of the rare metals; electrochemical analysis and experiments; radio-activity and spectroscopy; practical astronomy; precise surveying and geodesy; microscopic petrography; electricity applied to mining.

Imperial Pei-Yang University—The professor in charge, N. F. Drake, has issued an excellent pamphlet of instructions for the use of the students in the mining school of this institution at Pei-Yang, China, who are engaged in field work. The course of study required comprises careful and detailed observations, note-taking and sketching of metallurgical and mining methods and plant and geological features, such as will lead to a general practical knowledge of the subject. It is intended that the work as outlined shall be divided among these subjects as local conditions and opportunity may offer. The list of subjects covered is comprehensive, and is divided as follows: 1. Metallurgy, including: (*a*) Iron and steel plants; (*b*) Coal washing and coking plants; (*c*) Lead and copper smelters; (*d*) Cyanide plants; (*e*) Ore-dressing plants. 2. Mining, including: (*a*) Drilling and blasting; (*b*) Stoping ore and breaking coal; (*c*) Development and working the mine; (*d*) Handling and transporting ore; (*e*) Timbering; (*f*) Shaft sinking; (*g*) Drainage; (*h*) Ventilation; (*i*) Lighting; (*j*) Surface plant; (*k*) Handling men; (*l*) Water supply; (*m*) Organization; (*n*) Supplies and material. 3. Geology includes: (*a*) Local geology and topography; (*b*) Ore deposits; (*c*) Coal beds; (*d*) Miscellaneous economic products.

American Chemical Society—The 39th general meeting was held in Baltimore, Dec. 29-Jan. 1, in connection with that of Section C of the American Association for the Advancement of Science. The meeting was divided for the reading of papers and discussion into nine sections. Among the papers read in the division of Industrial Chemists and Chemical Engineers were the following:

1. Walter O. Snelling. The Munroe Crucible.

2. Percy H. Walker and H. A. Whitman. Rapid Analysis of Babbitt Metal.

4. Allerton S. Cushman. Acceleration Tests of the Resistance to Corrosion of Iron and Steel.

5. David T. Day. The Changes in Crude Petroleum Effected by Diffusion through Clay.

6. George Auchy. Further Remarks on Vanadium and its Estimation.

7. Paul N. Clancy. Iron, from a Chemical and Commercial Standpoint.

9. W. H. Walker. Principles Underlying Efficient Grinding and Separating.

10. H. J. Skinner. The Purchase of Material on Specification.

14. E. G. Bailey. Accuracy in Sampling Coal.

20. Charles E. Munroe. The Commercial Manufacture of Amorphous Calcium Phosphide.

21. Charles E. Munroe. The Distribution of Nitrate of Soda in the United States.

In the Fertilizer Chemistry division papers were presented by George D. Leavens on Determining the Availability of Phosphoric Acid in Basic Slag; by F. P. Veitch on Determination of Iron and Aluminum in Phosphate Rock; by Lucius P. Brown on the Chemistry and Geology of the Inland Phosphates of the United States.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Goldfield, Nev., and London, England

REVIEWS OF IMPORTANT EVENTS

San Francisco

Dec. 24—The counties around the bay of San Francisco have been experiencing unusually cold weather the past week and a thermometer at 36 deg. has been giving many a surprise. In the mountain and foothill counties there have been heavy snows, greatly to the delight of the mining communities, for this insures a summer water supply. Some of the power plants have been frozen up for a time. In the oilfields of Kern and Fresno counties they have had temperatures of 20 and 27 deg., which is most unusual. The miners throughout the State are hoping for more snow and cold weather so that the snow supply may be added to and none now fallen melted. Cold weather has been experienced throughout the State, south as well as north. A few small but unwelcome earthquakes have been experienced in the bay region, just as a reminder that we are still on that "fault line" which slid so badly in 1906.

The Anti-Débris Association at Sacramento is again active in beginning suits against miners who are hydraulicking or ground-sluicing. Agents or "spies" of the association have been bringing in reports of operations of the miners. The district attorney of Sacramento has agreed to prosecute the suits instituted, and proceedings have been commenced against 65 miners at Gold Run, Placer county. The suits are to enjoin the miners from depositing débris in the American river and petition for a writ of injunction; this injunction has been issued against all these men. Not only hydraulic miners operating under a federal license issued by the California Débris Commission are involved, but those working with ground sluices. These latter do not come under the provisions of the Caminetti law, but are to be prosecuted under the common law.

Suits are also to be brought in Sutter county against miners along the Bear, Feather and Yuba rivers in three different counties. A large number of gravel mines will be affected by these suits. It has come to such a pass that numerous miners have written to the Anti-Débris Association asking whether they would be allowed to mine by hydraulic process and under what conditions. Yet the Anti-Débris Association has no official standing and is composed merely of private citizens opposed to mining. Meanwhile there is in existence a federal commission appointed by the President of the United States under instructions from Congress, which is authorized to issue permits to mine by hydraulic process when suitable restraining works are built. The Anti-Débris Association ignores these legal permits or licenses, pays no attention to them, and brings suits where licenses to mine have been issued with all due forms of law. And now the miners go to the association instead of to the commission to find whether or not they can mine. The association intends during the winter to carefully control the hydraulic field and see that no new hydraulic mining is commenced.

Several creditors have filed a petition in the U. S. District Court asking that the Northern California Gold Mines Company be adjudged an involuntary bankrupt.

Mining affairs are more than active in certain portions of Inyo county at present. The Monster mine near Big Pine has been sold to Eastern men. L. T. Oddie, of Tonopah, has bonded and leased the Wright lead-silver mine in the White mountains about 12 miles from Big Pine. Ore will be shipped to the new smelter of the Four Metals Company at Keeler. Hagerman & Todd, of Colorado Springs, Colo., are opening a copper claim in the Argus range near Ballarat. In the Argus range a new district is being formed to be known as Custer. Chedago, the Shive Unthank lease, is beginning to pay. This lease is in the Taylor & Cummings property. New silver-lead prospects are being opened in the Modoc group lying north of Cerro Gordo. At Skidoo there is more ore ready than the custom mill can handle.

There is a good deal of activity in Butte county especially on the Magalia ridge. Several large companies are at work in the gravel channels of that vicinity. The Mesilla Gravel Company is about starting in on its property on the same channel where the Cape Horn company is operating. The Cohen property on the same channel is being exploited.

The old Hewel ranch on the upper Stanislaus river, eight miles above Oakdale, opposite and above the Orange Blossom colony, has been sold to H. C. Norris and Chas A. Marsh, of Los Angeles and John Horning, of Chicago. The property consists of 1600 acres, of which about 400 acres are supposed to carry auriferous gravel in paying quantities if mined by dredges. The ground has been partially tested and the purchasers intend to install a gold dredge.

The Payne ground near Trinity Center in Trinity county is being prospected by Oroville men with a view to purchase should the gravel be rich enough to pay for dredging.

W. S. Kendall has brought suit to enjoin the El Dorado Dredging Company, of Folsom from asserting any right or title to certain lands owned by him. He says he entered into an agreement with the company giving it the right to dredge the Ingleside fruit farm and the Home farm for gold. He alleges that the company did not begin work according to the agreement and because of this failure he says the agreement became null and void. The El Dorado company recently sold its entire interest to the new Consolidated Company.

Goldfield, Nevada

Dec. 22—Figures from the office of the State bullion-tax collector show that during the first 9 months of 1908 Esmeralda county produced $3,886,257. Of this total the Florence Goldfield produced $2,132,225; the Goldfield Consolidated produced only sufficient ore to run the Combination mill, for no general stoping will be done until the new 600-ton mill is running. The Florence Goldfield has produced no ore on company account during this time; all its production came from leases.

The oil excitement between Goldfield and Blair continues, although only one company is doing any extensive drilling. It claims to have obtained a small quantity of oil and feels confident that the hole is about to enter the oil-bearing stratum. An accident to the drilling outfit will delay work for about two weeks.

The first ore to be stored in bank vaults in Goldfield in several months is that being mined by Mitchell & Fairfield from the Daisy-Florence lease. Some of this ore is valued at $5 per pound. Only ore that shows ribbons of free gold is being taken to the bank, although the ore as it is broken averages between $200 and $500 per ton. Another rich strike in the company workings of the Florence centered public attention again on this property, which since its discovery in 1904 has produced nearly five and a half million dollars, all but about half a million of which has come from leases.

Mina has been visited by a fire which swept the central portion of the town. The damage was about $100,000.

The Great Western mine at Hornsilver, which, from a rich silver mine, is developing into a rich gold mine, is being exam-

ined by engineers hired by Baltimore and Kansas City men.

The Clermont shaft of the Goldfield Consolidated company has cut the Mohawk vein at a vertical depth of 856 ft. This is at a depth of 1250 ft. on the plane of the vein which dips 35 deg. The ore along the hanging wall is reported to assay $22 per ton.

Butte

Dec. 24—E. P. Matthewson, general manager, and C. H. Repath, construction engineer, of the Washoe smelter at Anaconda, have returned from a trip to Tooele, Utah, where they were engaged in laying the plans for the new Cole-Ryan smelter. They state that arrangements have been made for laying out the site of the smelter and for erecting temporary quarters for those carrying on the work.

Announcements of the annual meeting of the Montana Society of Engineers have been sent out by Secretary C. H. Moore, of Butte. The society will meet at Great Falls and will be in session Jan. 7, 8 and 9. Nominations for officers for the coming year are as follows: For president, Charles H. Bowman; for vice-president, Frank M. Smith; for second vice-president, F. W. C. Whyte; for secretary and librarian, Clinton H. Moore.

Deputy State Mine Inspector W. B. Orem, in charge of the Butte district, has made his report for the year 1908. The report calls attention to the remarkable increase in the use of electric power for hoisting and pumping purposes in the Butte mines within the past year, and the consequent betterment of ventilation, especially in the deeper mines. It is stated that the substitution of electric power for steam has in several instances reduced the temperature in the mines as much as 20 deg. F. Among the 10,000 men working during the past year but 10 have met death by accident, a decrease of almost 50 per cent. from 1907.

The case of the United States against the Northern Pacific Railway, the Northwestern Improvement Company and the Rocky Fork Coal Company, will be heard in the Federal Court at Helena on Jan. 11. The action is brought by the Government for the purpose of setting aside the title of the defendants to certain coal lands in Carbon county, Mont., valued at $100,000. In the complaint it is alleged that the lands were obtained from the Government by fraud.

London

Dec. 21—In the JOURNAL of Sept. 26 the litigation between the British Ore Concentration Syndicate, Ltd., and A. Stanley Elmore and the Minerals Separation, Ltd., was referred to, and your readers were informed that the Ore Concentration Company failed to prove that the Mineral Separation process was an infringement of its patent, but that the case would be appealed in a higher court. The judgment of the Court of Appeal has now been given and is in favor of Elmore and the British Ore Concentration Syndicate. There were two patents involved in this action, that granted to Francis Edward Elmore, No. 21948 of 1898, in which concentration of metalliferous particles in ores is to be effected by the use of thick oil; and second, that granted to Alexander Stanley Elmore, No. 6519 of 1901, in which the use of all oils thick and thin, though preferably thick, is referred to, as well as the advantage of using a small quantity of acid. The 1901 patent is a much wider specification than that of 1898. Both the lower and upper courts decided that the Elmore patent of 1898 was valid, but the process of the Minerals Separation company did not infringe it. The decision turned principally on the point that the Elmore process was limited to the use of heavy oil, while the Minerals Separation company used a thin oil.

As regards Elmore's patent of 1901 the lower court decided that it was not valid and consequently the question whether the Minerals Separation process was an infringement or not, did not arise. But in the Court of Appeal, the judgment was that Elmore's process of 1901 was valid and that the Minerals Separation process was an infringement. To upset the validity of the 1901 patent, the defendants brought forward the specification of Everson's American patent of 1886, and the specification of an English patent granted to Joseph William Sutton in 1892. The court decided that there was nothing in the Sutton specification which was remotely relevant. As regards Everson's specification, the court decided that it was entirely different from the Elmore process. In the Everson process the ore and oil, with or without an acid or neutral salt, are mixed into a stiff mass and the gangue is then washed out. In Elmore's patent there must be a flowing pulp of ore and water. This feature is vital. The result of the appeal is therefore that the Elmore patent of 1901 is held valid and that the Minerals Separation process, which employs thin oils and acid and is considered to be substantially the same process as Elmore's, is held to be an infringement.

West African Mines—Much interest has been aroused in the announcement made during the week that the Consolidated Goldfields of South Africa, Ltd., had decided to invest a large sum of money in West Africa. Arrangements have been made for providing the Effuenta (Wassau) Mines, Ltd., the Fanti Mines, Ltd., and the Wassau West Amalgamated mines with working capital. These mines are situated in the Tarkwa district and own a large stretch of outcrop of the banket reef, and are neighbors of the Tarkwa, Abosso and Abbontiakoon Block 1 mines, which are producing gold on a large scale. A reduction in working costs has taken place in the last year or two and further reductions are anticipated.

It is no doubt on the strength of the improved position of the existing mines that the Consolidated Goldfields are taking a large interest in properties as yet only developed on a small scale. The goldfield has up to the present given disappointing results. There is a large output of gold, amounting last year to over £1,000,000; but owing to the heavy expenditure, caused by the unhealthiness of the climate, the profits are small. The goldfield has no doubt great possibilities and if the expectations of reduced costs, which some engineers claim can be made, are realized, more prosperous times for shareholders in Gold Coast mines may be seen.

Tanganyika Concessions—The report of the Tanganyika Concessions, Ltd., for the year ending June 30, 1908, has been issued. A provisional arrangement has been made for the construction of a railway to connect the Rhodesian railway system, which has now reached Broken Hill, with the Star of the Congo in the Congo State. Ultimately the railway is to be continued to the Ruwe mine and linked up with the Benguella Railway, thus affording access to the west coast.

For the near future the outlet for the copper of the Congo will be through Rhodesia at Beira on the east coast. At the Kansanshi mine in northwestern Rhodesia a furnace is smelting about 500 tons of ore a month, yielding an output of about 90 tons of copper in the form of ingots. It is proposed to send out a larger furnace to treat at least 1250 tons of ore per month, which will give an output of from 200 to 250 tons of copper. Allan Gibb, the engineer of the company, writes that under present conditions the cost of producing copper is £16 per ton. With the proposed new plant, the cost of producing copper will be £12 10s. per ton. Smelting commenced in April and up to September 500 tons of copper have been produced.

At the Kambove and Star of the Congo mines, situated in Belgian territory, large quantities of copper ore are said to be available for mining, and the installation of a smelting plant is being considered. Transport is at present the main difficulty.

A consignment of 50 tons of copper was brought by wagon from Katanga to Benguella, while transport between Kansanshi and the end of the railroad at Broken Hill is being carried out by traction engines.

The Tanganyika company has purchased a coal property, plans of which are attached to the report, from the Zambesia Exploring Company.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

GILA COUNTY

Miami—Drifts on the 570-ft. level have again run into high-grade ore. This accounts for the recent rise in the stock.

Old Dominion—The plant made a record production of copper during December. The full battery of six furnaces has been in operation part of the time, turning out copper at the rate of about 4,000,000 lb. per month. One of these furnaces is shut down at present undergoing repairs, but it will be put in operation again in a short time. It is believed that the Old Dominion will produce for the year 1908 not less than 38,000,000 lb. of blister copper.

Eureka—H. B. Howland and Hoval A. Smith and associates have taken over this group of claims owned by D. D. Sullivan, of Globe, J. Warren Young, of Chihuahua, and Frank Tabinski and Patrick D. Sullivan, of Calumet, Mich. The property is seven miles southwest of Globe, and consists of 10 claims. The consideration is $300,000.

California

AMADOR COUNTY

Amador Queen—George Hambrick and associate leasers have shipped a quantity of rich ore to the smelter and have had their leases renewed for two years.

Bunker Hill—This mine has just made its best record for a month—$23,000 for November. An extra dividend has been declared for Christmas. E. H. Harrington is superintendent.

Original Amador—This mine, which has been idle several years, is being opened by a new company.

Treasure—In this mine, Amador City, prospecting operations have reached a depth of 400 ft. under superintendency of L. R. Poundstone. Good milling ore has been found.

BUTTE COUNTY

Mesilla Valley Gold Gravel Mining Company—This new company is to mine on an extensive scale near Pentz on the Magalia ridge. E. C. Wilson, of Pentz, and A. M. Wilson, of Cherokee, are among the incorporators. This was formerly a hydraulic mine, but it is now to be drifted.

CALAVERAS COUNTY

Benson—This quartz mine, near Altaville, after a year's idleness, is being reopened. The property has a 20-stamp mill and 20-drill compressor plant driven by electric power. George Walker is superintendent.

Red Gold—J. Campbell is arranging to reopen this quartz mine at Angels.

EL DORADO COUNTY

California-Manhattan—In this mine, near Nashville, an 8-ft. ledge has been crosscut which carries about $14 per ton. A mill is to be put up on the property.

Independent—Albert Shafsky, of Placerville and Seymour Hill, of El Dorado, in reopening an old prospect near El Dorado, have taken out about $30,000 within 20 ft. of the surface. The vein found is about 8 in. wide.

HUMBOLDT COUNTY

Orleans—At this place, on the Klamath river, Luther Heacock recently made a strike on Ten Eyck creek in a rich seam of rock. At the Harvey & Pierpoint mine, owned by Mr. Head, a mill is now running. The Doney & Little claims are being developed and the mill will soon be started on ore.

INYO COUNTY

Custer—This is the new camp in the Argus range about 14 miles off the line of the new railroad the Southern Pacific is building to Keeler. The Custer Mining Company has 50 claims in the district, and has already built a five-stamp mill.

NEVADA COUNTY

Lion and Torpie & Schroder—H. M. Black, superintendent of the Ironclad mine, has bonded these two claims in Rough and Ready district and will shortly commence work upon them.

Rose Hill—This Grass Valley company is about to install machinery so as to sink 500 ft. on the ledge.

Yuba—At this mine, C. A. Marriner, manager, the 30-stamp mill has been started up.

PLACER COUNTY

Cash Rock Dredge—This dredge has quit work for the season and the divers have been discharged. Many large boulders interfered with the work this year, and they had to be drilled and blasted under water.

Colorado

OURAY COUNTY

Camp Bird, Ltd.—A report from the London office shows that for the quarter ended Oct. 31 last the mill crushed 20,791 tons dry ore. Receipts from bullion sold were $402,330; concentrates, $75,269; total, $477,599. Working expenses of all kinds were $143,139; construction accounts, $9306; London office, $4500; total, $156,945, leaving a balance of $320,654. A dividend of 1s. per share, requiring £41,000, was paid Nov. 7. In the mine development work was 1058 ft.; cubic feet stoped, 158,000. On Oct. 31, the total dry ore broken in the stopes amounted to 79,636 tons.

The report further says: "The general manager, W. J. Cox, at the suggestion of the consulting engineer, John Hays Hammond, came to London to lay before the directors their recommendations regarding the future developments at the mine, advised by the geologist, J. E. Spurr, in his reports on the property. The directors, after careful consideration, have decided to adopt these recommendations, among which, in brief, are: (1) To discontinue developments in depth, and exploit the upper horizon of the Camp Bird vein and other veins on the company's property. (2) To drive a crosscut to the Coronado and other veins from the second level, and drift extensively in both directions on the veins when cut. With this end in view, the manager, on behalf of the company, has acquired the Trilby, Tiptop, Minnie Lee, and claims Nos. 1, 2, 3, 4, and 5, which the directors are pleased to report he has been able to do on very favorable terms."

LAKE COUNTY

Chrysolite—In this mine, Fryer hill, P. McGreevy and associates are leasing several blocks of ground at the 200-ft. level and for some time past have been shipping a good grade of iron, at the same time carrying on development work. In one drift where this work was being done at 180 ft. from the shaft a vein of ore 12 ft. wide was caught and driven for several feet when a streak was noticed in the center of the orebody, samples were taken from it giving high returns in silver and 67 per cent. lead. The find was made in virgin territory, and will no doubt prove to be an extension of one of the shoots that made the mine famous in early days.

Cleveland—In this mine, South Evans

gulch, preparations are now being made to start sinking the shaft another 100 ft., and work will be commenced by the first week in January. When the contract is completed and the drifts to the north and south opened it will give the company sufficient ground to work for another two years. The fissure vein continues to produce some rich gold ore, and it is expected with depth that the ore will carry greater values.

Favorite—In this mine, South Evans gulch, for several days a small streak of ore has been followed at the 175-ft. level.

Michigan

Copper

Ojibway—No. 2 shaft of this company has reached the third, or 650-ft. level, and a station is being cut preparatory to crosscutting to intercept the lode. No. 1 shaft is down about 630 ft. and will probably strike the lode about the same time as No. 2 owing to the close proximity of the lode to this shaft.

Centennial—No. 1 shaft of this property is sinking below the 34th level and No. 2 shaft is at the 32d. These shafts start 90 ft. apart at the surface and diverge, and at this depth they are about 600 ft. apart. Drifting to the north of No. 1 is opening up some good-looking ground.

Allouez—At No. 1 shaft sinking has been discontinued just above the 13th level. No. 2 shaft is now at the 12th level, and the pitch of the shaft is being changed to conform with the dip of the formation. It is calculated that this shaft will cut the lode in about a month. Drifts from the lower levels of No. 1 shaft to the south are opening a good grade of rock.

North Lake—This company has not yet reached the ledge with the sand pipes that it is sinking preparatory to diamond drilling; the overburden at these points is between 400 and 500 ft. thick.

Lake—The new hoisting engine at this property has gone into commission and a four-ton skip is now doing duty in the shaft. Sinking continues and the shaft is nearing the third level, with the same rich ground in evidence throughout. The new air compressors will, in all probability be ready to do duty as soon as this level is reached and additional drills are added.

Elm River—This company has begun crosscutting toward the east from the bottom of its exploratory shaft, a distance of 200 ft. from surface. The crosscut is being driven to intercept the various formations believed to traverse the tract and can be extended a distance of about 2000 ft. or to the eastern boundary of the property.

Calumet & Hecla—This company has begun the erection of its electrically driven subshaft hoist. This hoist will be placed at the end of a drift from the 57th level of No. 5 shaft and the subshaft will command the ground tributary to the five forties north of the Tamarack, Jr., property. The rock will be hoisted to surface through the Red Jacket shaft.

Missouri

Zinc-lead District

Church-Mitchell—This mine at Duenweg has resumed operations after being shut down for five months.

Isabel—This mine at Alba lost its mill and most of the machinery by a cave of the workings.

Kaliton—This company has put drill holes to one more novel use in sending timber into the mine through them.

Lehigh Circle—This company has been incorporated with a capital stock of $50,000. The stockholders are F. A. Brown, of Duluth, Minn., and Squires & Strohm, of Joplin. C. F. Strohm, of Joplin, is secretary. The company has a lease on 206 acres of land in Center Creek valley, near Lehigh, on a 10-per cent. royalty.

Mattes Brothers—This company has nearly completed moving the 400-ton San Gabriel mill from Duenweg to its land southwest of Joplin.

Oronogo Circle—This company at Oronogo has installed a dredge boat, equipped with a large centrifugal pump and driven by electric power, to clean out the settling ponds and return the sludge to the mill.

Pinnacle—This company, of Joplin, has leased the Hill Top tract at Oronogo from the Granby company and has let a contract for the erection of a 350-ton mill. J. H. Tonkin, of Joplin, is manager.

Sturgis Mine—This property, adjoining the K. C. Bradford lease at Carterville, has been sold to C. C. Playter, of the United Zinc Company; M. A. Shepard, of Chicago, and G. M. Burke, of the Bull Frog company, Joplin.

Montana

Butte District

North Butte Extension—John A. Ryan has returned from New York, where he has been in conference with the directors of the new North Butte Extension Development Company. Mr. Ryan now represents both the old and the new company and will have entire charge of operations at the company's properties in Butte. He states that the work of unwatering the shaft will be begun by the first of the year.

Jefferson County

Corbin Copper Company—This company has recently been formed under the laws of Michigan for the purpose of operating a group of 28 claims in the Corbin district. The company has 150,000 shares of capital stock. Of this amount 90,000 were given in exchange for the property and 60,000 placed in the treasury: 25,000 shares of the treasury stock will be sold at $5 per share for development purposes. The property has been developed by tunnels having an aggregate length of 1000 ft. The directors are Stephen R. Dow, Richard M. Edwards, George E. Learnard and N. W. Jordan.

Kelly Smelting and Refining Company—The Alta group, consisting of seven patented claims, will be actively worked by this company which has recently secured control of the claims. The Kelly company has been operating at the Kelly camp in New Mexico, where it owns a number of mines and a smelter. It is stated that two 3-compartment shafts will be sunk and a concentrator erected on the property. The company's directors are L. O. Hedden, S. W. Traylor, Warren Curtis, Marcus Hewett and ex-Governor Hauser, of Montana.

Fergus County

Half Moon Pass Mining Company—The company has recently been formed to operate a group of six gold claims situated about 30 miles from Judith. Seven men are now employed at the property under the direction of Thomas Stigen. It is proposed to erect a mill next spring.

Carbon County

Frank L. Clark, Dr. M. Souders and Louis Chapman have sold 480 acres of coal lands situated in the Bear Creek district to Thomas Ryan, representing Nebraska capitalists. Mr. Ryan has been on the property with a corps of engineers for several months making an examination.

Nevada

Esmeralda County—Goldfield

Daisy-Florence—This lease on the Florence operated by Mitchell & Fairfield is sacking high-grade ore. The sacked ore is being stored in the vaults of the Registration Trust Company pending shipment.

Atlanta—The Cherokee lease has installed a hoist; sinking will be resumed as soon as financial arrangements now under way are completed.

Consolidated Mill—The mill bins now contain 4000 tons of low-grade ore ready for the initial run of the stamps which is scheduled for Dec. 26. The entire mill will now be able to operate to full capacity for about 60 days.

Florence Goldfield—In a drift driven from the main company workings to connect with the Engineers Lease shaft on the 500-ft. level an entirely new body of bonanza ore has been found. The extent of this orebody has not been determined.

Kewanas—Two new leases have been let on this claim about 400 ft. from the main workings where the company is doing considerable development work. Block 6 was leased to Elliott & Company, of Chicago, who agree to sink a two-compartment shaft to a depth of at least 500

ft. The lease runs eight months. Block No. 5 was leased to Charles Harrison, of Omaha. No stipulations were made as to depth required; this lease runs 18 months.

Old Kaintuck—The Iconoclast shaft has been retimbered to a depth of 180 ft. When these repairs reach the 200-ft. level, Hardy Brothers, who have leased the property, will start active development work.

C. O. D. Consolidated—The Gold Bar shaft, now 300 ft. deep, shows a wide body of gold-copper ore too low in grade to work at the present price of copper, but sufficiently mineralized to encourage further development.

Smith Florence Mining Company—This company has taken over the old sub-lease let to Mitchell & Fairfield on the Hall-Florence ground. The sub-lease contract called for the sinking of the Hall-Florence shaft from the 300-ft. to the 500-ft. level; this work is now in progress. The Smith block of ground will be entered by a drift only 10 ft. long from the shaft. Both the Smith and the Hall leases will be worked from this shaft.

Booth—The Murphy-Sweeney lease on the Booth has found ore of good shipping grade in a winze sunk from the north drift on the 400-ft. level.

Hazel Goldfield—At this lease on the Last Chance claim of the Laguna, the broken-up orebody, which was found some weeks ago on the 720-ft. level, has been found in place in the southwest drift about 30 ft. from the shaft. A 4-ft. body of ore in the breast of this drift averages $42.50 per ton.

Esmeralda County—Lodi

Illinois Mine—A 100-ton smelter is being installed. All the machinery equipment for the smelter and shops has arrived at Luning on the Southern Pacific and is being hauled 50 miles to Lodi by the company's traction engine.

Esmeralda County—Silver Peak

Silver Peak Valcalda—The 10-stamp mill, now running to full capacity is to be increased to 40 stamps so as to have a capacity of 200 tons per day. M. J. O'Meara is president of the company.

Bay State & Nevada Oil Company—This company, which is drilling for oil near Blair has lost its string of tools at a depth of 517 ft. just subsequent to the securing of the first sample of oil from the hole. Fishing tools have been ordered from Los Angeles.

Goldfield Silver Peak Mining Company—At this property about 25 miles northwest of Goldfield at Coyote Springs in the Silver Peak quadrangle a ten-stamp mill and cyanide equipment is to be built. The property is controlled by the officials of the Clark railroad.

Esmeralda County—Hornsilver

Great Western—At this mine, which has been developing very well as a silver property, a vein of gold ore has opened up on the 300-ft. level. This gold discovery appears to be more important than the silver orebodies discovered in the past. The gasolene traction engine for hauling the ore to Cuprite has arrived.

Humboldt County—Chafey

Black Hole Mine—The new shaft is down to the 105-ft. level where a station will be cut and drifts started on the ore. Sinking will be resumed as soon as possible. The main drift in the upper tunnel after passing through a pinch for 20 ft. has again come into a solid breast of ore. Another Huntington mill is being installed; this will increase the capacity of the mill to 50 tons.

Esmeralda County—Rawhide

Victor—The Victor shaft is 300 ft. deep and is still in good ore. Ten feet of the ore averages $34 per ton.

Rawhide Rector—In the Cooks and Waiters lease a crosscut is being driven to the vein.

Kerns No. 2 Lease—Recently ore has been found on the 200-ft. and 400-ft. levels so that now ore is developed on all the levels of the lease. In the nearby St. Ives lease milling ore has been found.

Hooligan Hill Leases—The Truett and the Miller leases are sacking ore for shipment.

Humboldt County—Seven Troughs

Seven Troughs Mining Company—A test run on ore from this company's mine is being made at the Kindergarten mill to determine the best method for treating the ore. The company plans to build a ten-stamp mill.

Vernon Gold Prize Mining Company—A tunnel has been started on the west side of Gold Prize hill which will be run 250 ft. to prospect the hill.

Wihuja Gold Mines Company—The Wihuja lease on the Therein ground of the Seven Troughs Coalition Company has cut the rich Kindergarten shoot at a depth of 320 ft. in the incline shaft, or at a vertical depth of about 200 ft. This corresponds to the depth in the Kindergarten mine at which this vein has proved rich.

Nye County—Tonopah

Production for the week ending Dec. 12 amounted to 5268 tons, having an estimated value (shipping ore valued at $60 per ton and milling ore at $25 per ton) of $131,700. The Tonopah Mining Company sent to the mill 3000 tons; Belmont, 700; Montana-Tonopah, 593; Midway, 100; MacNamara, 375; West End, 150; Jim Butler, 350 tons.

Tonopah Mining Company—An advance of 10 ft. was made during the week in the Mizpah shaft, the total depth now being 1274 ft. The flow of water recently struck, and which was the first water found in the Tonopah mines, has impeded work. The flow has increased now to such volume that all sinking has stopped until pumps can be installed. The drill hole from the 740-ft. level is down 217 ft.; there is a slight change in the rock that the drill is passing through. At the mill at Millers 99 out of the 100 stamps during the week ending Dec. 12 treated 3210 tons of ore having an average value of $23.50 per ton. Shipments consisted of 72 bars of bullion, weighing 77 lb. each, and worth $815 per bar, and 50,000 lb. of concentrates valued at $11,500. The extraction was 88 per cent.

German-American Mining Company—Arrangements are being completed to resume work on this property about a mile northwest of town. A contract has been let for sinking a new shaft at a point where surface indications are most favorable. The old shaft is 680 ft. deep.

Montana-Tonopah—The tonnage produced and milled this week was smaller than usual, due to necessary repairs in the mill. The tonnage treated was 970 tons, 593 tons coming from the company's mine and the rest from the MacNamara.

West End—Much development work is being done on the 200-ft. and 400-ft. levels. Quartz is being found in many different places; not all of this is rich enough to mine, but streaks of pay ore and large bunches of milling ore are being found.

Nye County—Helena

Broken Hills—Tests are now being made in Denver on the ore so as to determine the process to be used in the 50-ton mill which the company intends to erect. J. C. McCormack, of Goldfield, is president and general manager.

Nye County—Bullfrog

Mayflower—Grab samples of the ore in the cars coming from the two raises on the 300-ft. level assay $52.60 per ton. Similar samples of the ore coming from a length of 150 ft. along the main drift on the 300-ft. level average $15.25 per ton.

Churchill County—Wonder

Jack Pot Consolidated—The Jack Pot management assures the mine owners of the camp that they will put up a custom mill, and have asked for data that will enable them to decide the question of capacity.

White Pine County

Giroux—The smelter burned Dec. 18. It had never been in operation.

New Mexico

Grant County—Sylvanite

Americus-Sylvonite Mines Company—This company has been organized to work three claims adjoining the Nederland property. The officers of the company are F. R. Berbower, of Cripple Creek, president; A. F. Hartman, of Sylvanite, vice-president and manager; M. E. O'Brien, of Cripple Creek, secretary and treasurer, and James F. Gray and E. J. Carlin, of Denver, are on the board of directors.

Sylvanite Consolidated Mining Company—This company has been organized to operate the eight claims known as the Holcomb property, southeast of Sylvanite. E. A. Wheeler and Milton Ish, of Goldfield, Nev., control the company. The stock of the new company will be placed on the market at once. It has four open cuts on its Clemmie claim from which rich ore is being sacked, and on which a two-compartment shaft was started this week. This property has the most extensive showing of any in the district. The vein from 10 to 30 ft. wide extends the full length of the property and can be traced to the Broken Jug and the Big John claims. The latter claim is being developed by the King Solomon Mining Company, which is sinking a shaft and driving two tunnels on its two claims. The work is in direct charge of Leonard Loehr, of Bisbee, manager of the company.

Wood Mine—The Pierson brothers, of Ouray, Colo., and W. E. Irwin, of Bisbee, Ariz., the new owners of the Wood mine, have closed a contract for hauling the ore from the mine to Hachita. From there the ore will be shipped to the smelters at Douglas. The whole breast of the tunnel, now 300 ft. long, is in ore.

Pennsylvania

Anthracite Coal

Hillside Coal and Iron Company—The fire which destroyed the carpenter, blacksmith and machine shops at the Butler colliery Dec. 24 is a severe blow to the company, although the loss is partly covered by insurance. The building was a large wooden structure, complete in every detail and equipped with the latest machines and tools, the company having recently installed a large lathe and several other small machines in the machine shop in order to do the machine work at the colliery instead of sending it to local shops. The carpenter shop was connected with the blacksmith shop, and in it was done the work of repairing and rebuilding mine cars. All the tools belonging to the workmen were destroyed or ruined by the fire, besides many tools belonging to the company.

Bituminous Coal

John W. Boileau, representing a Pittsburg syndicate, has bought a tract of 6000 acres of coal land in Greene county, at a price said to be $250 per acre. The tract included in this purchase is in what is known as the North Waynesburg field, in Morris, Washington and Franklin townships, to the northeast of Waynesburg and along the Waynesburg & Washington railroad, the center of the tract being in the vicinity of Sycamore station. Geologically, the tract lies in what is known as the Waynesburg syncline, similarly located to that of the Pittsburg & Westmoreland Coal Company to the north, and adjoining the holdings of Frank M. Osborne & Co., and on the west of the tract lately purchased by the Emerald Coal Company. It is the last large tract available in this field.

South Dakota

Custer County

Ruberta—Superintendent W. W. Olds, of Custer, is employing a good force of men in sinking the two shafts west of Custer. One is down 180 ft. and the other 100 ft. and some ore showing has been made. The stamp mill is to have an addition of five stamps before spring.

Lawrence County

Branch Mint Operating Company—The 800-ton mill is making test runs of mine and dump ores, and if results are satisfactory, will be run steadily. President John Ohmeis, of New York City, is expected here shortly.

Homestake—The Pocahontas mill has just changed its equipment and is now operated with electricity instead of steam. The other mills will soon be under the same motive power. Sinking in the Ellison shaft, the deepest in the Black hills, will probably soon be commenced again. It is now down 1750 and is to be deepened 150 ft. more.

Queen Esther—The shaft is now down 60 ft. and will be sunk to quartzite by Stewart Conners and associates of Deadwood. A good mineralization is showing in the present formations.

Tinton—The mill has closed for the winter, after a successful run. Superintendent E. W. Noakes, of Chicago, announces that a plant will be built in the spring.

Victoria Extension—New officers were elected at the annual meeting as follows: President, J. C. Carson, Deadwood; vice-president, W. M. Glass, Omaha; secretary and treasurer, A. J. Maltener, Deadwood; directors, A. B. Smith and T. L. Kounts, Omaha.

Victoria—It was decided at the annual meeting held here recently to start up the 200-ton cyanide mill again on a test run under the management of O. N, Brown. The ore reserves that show plenty of good-grade cyaniding ore will be sampled thoroughly and if practical, the mill will be kept in steady operation. The new officers elected are: President, A. B. Smith; vice-president, Arthur C. Smith, Omaha; managing director, W. M. Glass, Omaha; secretary, treasurer and general manager, A. J. Maltener, Deadwood.

Pennington County

Pilcher—Charles and Joseph Pilcher have discovered a ledge of free-milling gold ore near Rochford, and are preparing to develop it.

Utah

Beaver County

Cedar Consolidated Mines Company—This company has been formed by the consolidation of the Cedar and the Talisman companies.

North American—The new shaft being sunk by contractors is now 100 ft. deep.

Salt Lake County—Alta

South Columbus Consolidated—Some time ago No. 1 drift east from the adit struck a broken-up body of copper ore. A raise driven from the adit has found this orebody in place. The vein is from 2½ to 3½ ft. wide and rich in copper. A winze has been started from the adit to catch this vein.

Columbus Consolidated—A body of good ore 4 to 10 ft. wide has been developed on the 400-ft. level for a distance of 80 ft. A raise has been started from that level to develop this orebody.

Summit County

Shipments—Shipments from the Park City mines during the week ending Dec. 19 amounted to 1812 tons. The Silver King shipped 825 tons; Daly-West, 575; Daly-Judge, 304; American Flag, 109 tons.

Ontario Tunnel—There has been an increased flow of water coming through this tunnel the last few weeks. Evidently this is coming from the Daly-West mine, for the water in the Daly-West shaft is being lowered. The water course was struck in Ontario ground. The tunnel has been turned so as to follow this fracture which leads toward the Daly-West shaft.

Tooele County—Tintic

Shipments—The Tintic mines shipped 131 cars of ore during the week ending Dec. 18. The Sioux Consolidated shipped 14 cars; Iron Blossom, 4; Colorado, 16; Dragon Iron, 19; Black Jack, 1; Brooklyn, 3; Lower Mammoth, 3; Ajax, 3; Swansea, 2; Eureka Hill, 1; May Day, 1; Centennial Eureka, 44; Bullion Beck, 1; Yankee, 2; Uncle Sam, 6; East Tintic Development Company, 1; Utah Consolidated (leasers), 1; Grand Central, 9 cars. The cars from the Colorado, Dragon Iron, Brooklyn and Swansea mines were 20-ton cars, the rest 30-ton cars.

West Tintic—This mine belonging to the Nevada-Utah Development Company and in the West Tintic district made its first shipment last week. About 25 men are working at the mine.

Centennial Eureka—A sinking pump has been ordered to handle the water cut in the main shaft at a depth of 2100 ft. The shaft is making about 60 gal. of water an hour. Apparently this is a surface flow of water.

Opohonga Mining Company—This company has arranged to develop its property through the shaft workings of the Black Jack company. The 300-ft. and 1000-ft. levels of the Black Jack will be extended into Opohonga ground.

Iron Blosson—Copper ore has been found on the 800-ft. level.

TOOELE COUNTY—OPHIR

Lyon Hill Consolidated Mining Company—The first shipment from the orebody recently found in the adit assayed 255 oz. silver, 0.06 oz. gold and 7 per cent. lead per ton. In the winze below the adit the orebody is 14 ft. wide. The high-grade streak is in the center of the vein.

Ophir Hill and Cliff Mines—Twenty-five teams are hauling ore from the Ophir Hill mine, belonging to W. A. Clark, of Montana, and 20 teams from the Cliff property.

Canada

Arrangements have been entered into between the Ontario government, the town of Sudbury, and Mackenzie & Mann, of the Canadian Northern Railway, by which Mackenzie & Mann undertake the construction of a wagon road between Sudbury and Gowganda, a distance of 80 miles. A gang of men has been started on the work. Mackenzie & Mann are also surveying the country with a view to extending the Canadian Northern Ontario Railway into the Gowganda district.

Alfred von Hammerstein, who has been carrying on extensive petroleum development in northern Alberta, calls attention to the enormous waste of natural gas which has been going on for many years in that region. Fifteen years ago when drilling for oil was undertaken by the Canadian government at Pelican Portage on the Athabasca river, a tremendous flow of gas was struck at a depth of 800 ft., which made it impossible to proceed with operations; the flow has continued ever since, the government, in spite of the representations of those interested in the development of the district, having done nothing to stop it. An extended area is being drained.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Dec. 19 were as follows: Buffalo, 54,980 lb.; Crown Reserve, 120,000; City of Cobalt, 60,000; La Rose, 195,000; McKinley-Darragh, 115,800; Nipissing, 130,760; Right of Way, 62,100; Silver Queen, 67,000; Silver Cliff, 44,000; Temiskaming, 60,000; Trethewey, 131,000; total, 1,040,640 pounds.

Cobalt Central—The company is enlarging the capacity of its concentrating mill, and will soon begin the treatment of custom ores, having already made some contracts with neighboring mines.

La Rose—A rich vein recently struck on the O'Brien property runs into La Rose ground parallel to No. 3 vein; it will be worked from No. 3 shaft. No. 3 vein has widened at the bottom of the shaft to 4 in., and is yielding 5000 oz. of silver to the ton. At the University mine the shaft on No. 4 vein is down 50 ft. with ore showing all the way averaging 3000 oz. to the ton.

Nipissing—A new vein has been encountered in crosscutting at the 75-ft. level from the Fourth of July shaft; it is thought to be vein No. 100; it is 3 in. wide and carries high-grade ore. The shaft is being sunk to the 150-ft. level. The new ore house at this shaft is completed. At the 75-ft. level of the Meyer shaft the vein, averaging 5 in. wide, has been drifted on for 150 ft., and is yielding well. No. 6 shaft, near the Temiskaming & Hudson Bay boundary, is down 75 on a wide calcite vein. In drifting 300 ft. east of the Kendall shaft at the 145-ft. level a new cross-vein, carrying between 3 and 8 in. of good ore was struck. A quarterly dividend of 3 per cent. with a bonus of 2 per cent. has been declared, payable Jan. 20, 1909.

ONTARIO—LARDER LAKE DISTRICT

Dr Reddick—The closing down of the stamp mill was caused by a bad break in the Gates ore crusher, weighing between three and four tons. Owing to transportation difficulties, some time will elapse before the crusher can be put in working order.

ONTARIO—WELLAND COUNTY

Coniagas Smeltery—About two tons of silver, the output of this smeltery at Thorold, were shipped to New York this week.

Big Six—Six veins have been found, two of which look promising. The main shaft is down 50 ft. on an 8-in. calcite vein, assaying 700 to 800 oz. silver to the ton. A 6-in. cobalt vein carries argentite and native silver.

ONTARIO—SOUTH LORRAINE DISTRICT

Jacobs Exploration Company—On the Wiltsey property, owned by this company, a 3-in. smaltite vein carrying native silver has been found, and ore is being taken from a test pit.

ONTARIO—GOWGANDA LAKE DISTRICT

McIntosh and McLaughlin Location—F. A. McIntosh and Samuel C. McLaughlin have disposed of their claim, said to be a rich one, to a syndicate of British and American capitalists; the price is reported to be about $500,000. The property will be known as the Bartlett mine.

NOVA SCOTIA

Nova Scotia Steel and Coal Company—The output of coal for the 10 months ending November was 601,294 tons, as compared with 575,693 tons for the corresponding 10 months of 1907.

Mexico

GUANAJUATO

Shipments—The value of the shipments for the week ending Dec. 17 amounted to $290,000 including concentrates, bullion and high-grade ore. Bullion shipments amounted to $180,000. The closing of the mill announced last week will make little difference in the total production; the loss will be made up by the increased output of the Perigrina mine.

El Cubo—The tunnel driven to tap the Villalpando shaft has been completed. The tunnel which is 7000 ft. long was started from both ends; it will be used to facilitate handling the ore and the water from the lower levels.

Tepeyac Incline—The double-track surface incline from the patio of this mine of the Guanajuato Reduction and Mines Company has been completed. It will carry the ore from the San Antonio dump to the head of the aërial tramway which will deliver it to the Bustos mill.

Providencia—The foundations for the mill are nearly completed and plans for the equipment are practically finished. The plans call for stamps weighing 1350 lb. There will be 40 stamps, three tube mills, concentrating tables and a cyanide department. Work will be started shortly after the first of the year and rushed to an early completion, in order to handle the ore that is being taken out.

TEPIC

Guanajuatillo—A hydroelectric power plant will be installed to unwater this old mine of the Castellana group which has been abandoned for 100 years.

SONORA

Greene-Cananea—The fifth and sixth furnaces were blown in last week. Not an extra man was required in the operating of the ore-handling machinery. The only increase was a few men to attend each furnace. The contributing factors to the increased output following the blowing in of the two stacks are the Capote, Oversight, Cananea-Duluth and Cananea Central. The Capote output is a sulphide ore, while in the upper levels of the Oversight there have recently been made available large orebodies of higher than average grade. The Cananea-Duluth is now opened for supplying 500 tons daily for a period of five years. The company is treating 3000 tons of ore daily, from which the gold and silver recovery are equal to 1½c. per lb. of copper produced.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Dec. 30—The coal trade in the West improves slowly, if at all, and the closing week of the year brings reports of only moderate activity. Continued mild weather keeps down domestic demand, and the call for steam coal is not large. Operators hope that cold weather and the opening of the new year will bring more orders.

The Seaboard bituminous trade is also quiet, and business is only of a moderate character. The steam-coal demand is not improving, but some of the dullness reported is due to the holidays.

Anthracite continues to be a weather market mainly, and not much improvement can be expected until colder weather sets in throughout the East.

Discrimination in Anthracite Rates—M. J. Healey, of Wilkes-Barre, Penn., this week was successful in his contention before the Interstate Commerce Commission that the Lehigh Valley Railroad Company had discriminated against him in rates in the haulage of coal from the Miner's Mills colliery, of which he has the management. Healey had two complaints against this corporation, one as the result of the business done at Miner's Mills and the other in the alleged unfair treatment of the Reliance Coal Company at Pittston, a concern of which he has control. It was on the first grievance the commission heard testimony. The latter one will be gone into later. The argument of the Plains operator was so well substantiated that the attorneys representing the company decided to settle and thus save themselves from the punishment provided for rate discrimination. As a result the Miner's Mills Coal Company will be reimbursed for the excess in rates which has been paid during the entire time in which it shipped coal, a period of four years. The outcome of the protest of Healey is the first instance in which an individual anthracite-coal operator has carried his objections to a successful issue.

Coal Traffic Notes

Tonnage originating on Pennsylvania lines east of Pittsburg and Erie, year to Dec. 19, in short tons.

	1907.	1908.	Changes.
Anthracite.....	5,543,327	5,047,146	D. 496,181
Bituminous.....	38,907,473	33,153,039	D. 5,754,434
Coke.....	12,932,012	7,006,528	D. 5,925,484
Total.....	57,382,812	45,206,713	D. 12,176,099

The total decrease this year to date was 21.2 per cent.

The total coal passing through the Sault canals up to the final close of the season was, in short tons:

	1907.	1908.	Changes.
Anthracite.....	1,506,668	1,384,743	D. 121,925
Bituminous....	9,893,427	8,517,717	D. 1,375,710
Total.....	11,400,095	9,902,460	D. 1,497,635

Coal receipts at Milwaukee by Lake for the season were: Anthracite, 1,076,812 tons, an increase of 194,943 tons; bituminous, 2,584,355 tons, a decrease of 642,696 tons; total, 3,661,167 tons, a decrease of 447,753 tons.

Coal receipts at St. Louis, 10 months ended Oct. 31 were 6,597,393 tons in 1907, and 5,618,083 in 1908; a decrease of 979,310 tons.

Coal shipments by water from Seattle and Tacoma, Wash., 10 months ended Oct. 31, were 502,907 short tons in 1907, and 350,945 in 1908; a decrease of 151,962 tons. Nearly all these shipments are coastwise, to California and Alaska ports.

Coastwise coal shipments from Atlantic ports, 10 months ended Oct. 31, long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York....	12,368,886	8,361,263	20,730,149	62.4
Philadelphia	1,756,989	3,886,655	5,643,644	17.0
Baltimore....	203,046	3,032,942	3,235,988	9.7
Newp't News	.....	2,259,934	2,259,934	6.8
Norfolk.....	.....	1,374,701	1,374,701	4.1
Total.....	14,328,921	18,915,495	33,244,416	100.0
Total, 1907.	16,031,621	20,419,383	36,451,004	.....

Total decrease this year was 3,206,588 tons, or 8.8 per cent. New York includes all the New York harbor shipping ports.

New York

Anthracite

Dec. 30—The hard-coal market is lifeless, and little business is being done either in prepared or small steam sizes. Schedule prices are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam prices are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50. All prices are f.o.b. New York harbor points.

Bituminous

The soft-coal trade, as a whole, continues dull. The all-rail trade is a little more active than tidewater, and along the Sound more coal is being taken than in the far East. New York harbor is at a standstill.

Consumers are holding off until after Jan. 1, or, if they agree to take coal, they ask that part of the consignment be billed against the new year. Transportation is good and cars are plentiful. Prices in New York harbor remain at $2.45@2.65 per ton.

In the Coastwise vessel trade vessels are scarce, but the demand is light. Freight rates are slightly firmer as follows, from Philadelphia: To Boston and Portland, 75c.; Salem, Lynn and Bath, 85c.; Newburyport, 95c.; Portsmouth, 80c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Dec. 28—The coal operations throughout Alabama will resume on a firm basis next week. It is understood that there will be a resumption at several of the mines which have been idle for some time, while mines which have been in operation will add to their force of employees. Miners are looking forward to the coming month for steady work. Sales agents report that there has been a good inquiry for coal and that orders are in hand or promised that will keep the mines going through the better part of the coming year.

Coke is still in strong demand and the production is being kept at a high mark.

Chicago

Dec. 28—Mild weather and partial suspension of steam needs because of the holidays have made demand for steam coals light in the last week, but shipments to this market have also been light on account of closing of the mines for Christmas and there is little trouble about oversupply. Domestic coals are in general lagging because of the weather. Steam coals show increased demand from week to week and Illinois coals are stronger than for several weeks.

Lump and egg from Illinois and Indiana mines sell for $1.80@2.60; run-of-mine brings $1.05@1.75 and screenings are in good demand at $1.20@1.50. Fine coals are exceptionally strong.

Of coals from east of Indiana, smokeless is weakest, receipts being large and sales lagging. Pocahontas and New River smokeless bring $3.80@4.05 for lump, and $3.05@3.15 for run-of-mine. Lower-grade smokeless is abundant at as low as $3.15 for lump and $2.75 for run-of-mine. Hocking has been overabundant, but is firmer in tone with the surplus well disposed of, and holds well above the $3 mark, though selling last week for 10 or 15c. less. Youghiogheny is quiet at $3.15 for ¾-in. gas.

Anthracite is in plentiful supply and light demand and all sizes are in good supply.

Cleveland

Dec. 29—Business looks a little better, owing to some improvement in purchases of steam coal. The demand for slack just now is better than that for lump and screened coal. Prices for slack are, therefore, relatively higher. Pittsburg No. 8 and Middle District slack bring 70@75c. at mine; Massillon slack, 60@65c. at mine. Domestic coals are quiet, with light demand. Massillon lump is $3.10@3.15, Cleveland.

Pittsburg

Dec. 29—Holiday stops and other conditions have combined to make a very dull market for the close of the year. It is difficult to make an estimate of the conditions at the mines, owing to the cutting out of several working days. Prices are nominally maintained at $1.15 for run-of-mine coal at mine; but sales have been small. The best demand has been for slack.

Connellsville Coke—No change in coke conditions can be reported, as consumers still hesitate about placing contracts for 1909. Present indications, however, are that they will not gain anything by holding back, as prices likely will not decline. Furnace coke for first-half delivery is quoted at $2; foundry at $2.25@2.40, f.o.b. ovens. For spot shipment these prices may be shaded a little, though the disposition to shade is gradually disappearing. Production is increasing; the *Courier* reports this week 251,903 tons, the highest weekly report for the year. The total, by these reports, for the year to Dec. 19 was 9,117,898 tons. To the corresponding date in 1907 the total was 19,155,971 tons, the decrease this year being 10,038,073 tons, or 52.4 per cent. Production is better now than last December, however, this week showing an increase of 113,651 tons over the corresponding week in 1907. Shipments for the week were 9,305 cars, divided as follows: To Pittsburg district, 3310; to points west of Pittsburg, 5248; to points east of Connellsville, 747 cars.

Foreign Coal Trade

Belgian Coal Trade—Imports and exports of fuel in Belgium, 11 months ended Nov. 30, metric tons:

	Imports.	Exports.	Excess.
Coal	4,884,110	4,356,999	Imp. 527,111
Coke	267,335	835,713	Exp. 568,378
Briquets	167,010	448,486	Exp. 281,476
Total	5,318,455	5,641,198	Exp. 322,743
Total, 1907	5,296,712	5,542,721	Exp. 246,009

Imports are chiefly from Germany and Great Britain; exports principally to France and Luxemburg.

French Coal Trade—Imports and exports of fuel in France, 10 months ended Oct. 31, metric tons:

	Imports.	Exports.	Excess.
Coal	12,242,100	894,210	Imp. 11,347,890
Coke	1,520,180	114,020	Imp. 1,406,160
Briquets	875,660	108,210	Imp. 767,450
Total	14,637,940	1,116,440	Imp. 13,521,500
Total, 1907	14,518,570	1,191,100	Imp. 13,327,470

Included in the exports this year are 134,260 tons of coal and briquets furnished to steamships in foreign trade.

Nova Scotia Coal—Shipments of Nova Scotia coal for the 11 months ended Nov. 30 are reported as follows, in long tons:

Company:	1907.	1908.	Changes.
Dominion	3,018,155	3,049,104	I. 30,949
Nova Scotia Steel	575,693	601,294	I. 25,601
Cumberland	242,150	332,225	I. 90,075
Acadia	294,557	294,403	D. 154
Inverness	221,104	240,871	I. 19,767
Intercolonial	251,823	226,067	D. 25,756
Total	4,603,482	4,743,964	I. 140,482

One company showed a decrease and one was about stationary. The total increase was 3.1 per cent.

German Coal Trade—Imports and exports of fuel in Germany, 10 months ended Oct. 30, metric tons:

Imports:	1907.	1008.	Changes.
Coal	11,358,689	9,765,314	D. 1,593,375
Brown coal	7,422,418	7,157,580	D. 264,838
Total coal	18,781,107	15,922,894	D. 1,858,213
Coke	346,946	360,756	I. 13,810
Briquets	154,992	155,981	I. 989
Exports:			
Coal	16,457,105	17,442,980	I. 985,875
Brown coal	17,334	22,600	I. 5,266
Total coal	16,474,439	17,465,580	I. 991,141
Coke	3,137,723	3,011,127	D. 126,596
Briquets	1,006,932	1,258,570	I. 251,638

Exports this year include 23,775 tons coke to the United States.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices as follows on Dec. 19: Best Welsh steam, $3.48; seconds, $3.36; thirds, $3.24; dry coals, $3.60; best Monmouthshire, $3.18; seconds, $3.06; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Dec. 30—The volume of business transacted has continued light, even less than last week. This is due in large part to the holiday season, when there is always a lull in trade. It is to be observed, however, that specifications on contracts are coming in slowly, which is not a good sign. Business also has been affected by the tariff discussion, and the general belief that the iron and steel schedules will be revised, if there is any change at all. The impression is that Congress will feel compelled to do something to satisfy popular demand for revision. The discussions before the Ways and Means Committee have undoubtedly given an impetus to this feeling.

Pig iron orders have been few this week and generally small. Foundries have been buying only for immediate needs, and seem to be in no hurry to provide for the future. There is a little more call for basic iron, but it is hardly to be called active. Southern furnaces seem to be better provided with orders than Northern; at any rate they are not hunting for business.

In finished material orders and specifications are both slow. There is talk of contracts, but actual sales are put off to next month. This is the result of the holiday season, probably, and so only a passing condition. There is reason to believe that structural material will soon make a better showing, especially if there is no attempt made to advance prices, or to enforce nominal quotations. Contrary to general belief, it is probable that the amount of structural business in 1908 will make a good showing, compared with the previous year. This cannot be said of any other branch of the iron and steel trade.

Other railroads are slow in following the example of the Pennsylvania, and no considerable orders for rails have been placed. Several roads are said to be figuring on large orders, but they are not yet ready. In view of the comparatively light repairs and renewals made in 1908, it is evident that a large tonnage for 1909 will be needed.

Lake Superior Iron Ore—The *Marine Review*, of Cleveland, reports that the final shipment of ore for the season of 1908 was taken by the steamer "W. D. Rees" from Escanaba to Milwaukee, consisting of 5349 tons. December shipments were therefore 78,924 tons. Shipments for the past three years by ports have been as follows:

Port.	1906	1907.	1908.
Escanaba	5,851,050	5,761,988	3,351,502
Marquette	2,791,033	3,013,826	1,487,487
Ashland	3,388,112	3,437,672	2,513,670
Superior	6,083,057	7,440,386	3,564,030
Duluth	11,220,218	13,415,977	8,808,168
Two Harbors	8,180,125	8,188,906	5,702,237
Total	37,513,595	41,288,755	25,427,094

The season of 1908 shows a decrease of 15,861,661 tons, or 38.4 per cent., as compared with 1907; and a decrease of 12,086,501 tons, or 32.2 per cent., as compared with 1906.

Baltimore

Dec. 29—Exports for the week included 2,747,500 lb. steel billets to Liverpool; 429,129 lb. structural steel and 2,288,165 lb. steel plates to Panama; 287,360 lb. spelter to Liverpool. Imports included 420 tons ferromanganese from Germany, and 4950 tons iron ore from Cuba.

Birmingham

Dec. 28—Southern pig-iron manufacturers look for a decided change again in the general conditions, both as to buying and as to quotations before the middle of January. There is some inquiry for iron for future delivery, but the holiday quietness has been on for three or four days. However, there is a good feeling prevailing; the order books are supplied for the

coming three months and some sales have already been booked for the second quarter. A few lots of iron were sold before the quietness set in at prices above $13 per ton, No. 2 foundry. The make during the holiday season in the Birmingham district was not disturbed. The furnace records were maintained, and only for a day or two did the common labor appear to be restless. Pay days were arranged with the labor at the ore mines, coke ovens, limestone quarters and at the furnaces so that there would be no trouble in providing for the usual festivities of this season. The Tennessee Coal, Iron and Railroad Company has arranged to blow in its No. 6 furnace at Ensley this week while preparations are being made to start other furnaces in this territory.

Chicago

Dec. 28—Buying of pig iron is very light, the holiday effect being perceptible in every line of business. Inquiries are very few and the small amount of buying being done is on early deliveries. There is said to be no weakening of prices, for the reason that furnace agents as well as users of pig iron are contented to await the developments of the new year. With both sides waiting, the general iron market shows no other signs of weakness, the outlook in finished products being good, though business is dull generally.

Southern No. 2 holds to $13 Birmingham ($17.35 Chicago) as a minimum, and Northern No. 2 to $17, with Lake Superior charcoal selling at $19.50@20, for delivery within the next three months. For the second quarter 25@50c. more is asked, though the lack of any good-sized transactions makes it difficult to say what a good contract could be placed for.

Coke remains weak, being in large supply and poor demand at $4.90 for the best Connellsville.

Philadelphia

Dec. 30—Basic pig iron is in active demand, the largest transaction of the past week being for the delivery of 20,000 tons as called for monthly, the entire delivery to be completed by June 30, if desired. Business into which basic pig enters is improving steadily, and negotiations are pending for additional sales. Forge demand is increasing at central and eastern Pennsylvania mills, but these requirements are filled only as new orders for material come in. Foundrymen have been poor buyers for several weeks, and as furnacemen are not driving after business, sales are moderate and mostly on furnace terms. Southern furnaces are not a threatening factor at present, but when they get hungry for business along in February or March there may be some developments unfavorable to Pennsylvania furnace interests. The volume of business since Oct. 1, when averaged up, shows a steady increase under the policy of buying only what was needed.

Pipes and Tubes—A sharp improvement has taken place in tubes. Boiler-repair work and new boiler work is coming along nicely.

Plates—The favorable conditions in Western mills are reflected in Eastern. The past week has been quiet, but there is a large amount of work in sight.

Structural Material—No large orders have been placed. Several are pending, mostly for bridge and general construction work.

Old Material—In a general way scrap is held too high to induce consumers to buy more than they are obliged to. Dealers are slow to sell, except at their own terms, and they are urgently gathering in all the good qualities they can get, particularly heavy steel scrap. No. 1 yard scrap is held high. There is no railroad scrap offered, and the companies are refusing to sell at present.

Pittsburg

Dec. 29—The iron and steel markets this week have shown little or no change from the previous week. Sales have been light, as might be expected in a holiday week. No estimate can be made of mill operation, as most of the active works were closed down over the Christmas holiday. Some plants closed for the week, but quite a number have stopped until after New Year's, to give them a chance to make necessary repairs. Orders in most of them are not urgent enough to compel an early resumption.

Little news has developed on the rail question. It is understood that several companies are preparing to place rail orders, but none has yet followed the Pennsylvania example, and most of them are still waiting. Several railroad orders for equipment are pending, however, which will require large quantities of material.

Structural business shows no new developments, none of the large contracts pending having been closed this week. New trade continues good, and much activity is expected in January. Tinplate also shows a continuation of the good run of trade recently reported.

Pig Iron—Transactions have been very light, but inquiries are reported to be coming in, so that sellers are inclined to be firm in their views as to price. The starting up of some of the new furnaces at the big Gary plant of the Steel Corporation will not have any effect on the market, as the product will be used by the corporation. Prices show no material change. Quotations for first quarter are as follows: Standard bessemer, $16.50@17; No. 2 foundry, $16@16.25; malleable bessemer and basic, $15.75@16; gray forge, $14.50@15; all f.o.b. Valley furnaces.

Steel—There have been but few transactions in crude steel, and moderate deliveries made on contract. The price of both bessemer and open-hearth billets remains firm at $25, Pittsburg. Tank plate is quoted at 1.60c. and merchant-steel bars at 1.40 cents.

Sheets—The sheet trade continues good for a dull period and prices are strong. Black sheets are quoted at 2.50c. and galvanized sheets at 3.55c. for No. 28 gage.

Ferro-manganese—There is no change in the ferro market and quotations continue around $47 per ton.

Foreign Iron Trade

Belgian Iron Production—Pig-iron production in Belgium in October was 105,060 metric tons; for the 10 months ended Oct. 31 it was 1,185,270 tons in 1907, and 987,570 in 1908; decrease, 197,700 tons.

German Iron Production—The German Iron and Steel Union reports pig-iron production in Germany in November at 930,738 metric tons, being 10,844 tons less than in October. For the 11 months ended Nov. 30 the production was, in metric tons:

	1907.	1908.	Changes.
Foundry iron	2,063,069	2,058,775	D. 4,294
Forge iron.....	717,949	585,537	D. 132,412
Steel pig.....	947,891	836,830	D. 111,061
Bessemer pig.....	432,517	339,295	D. 93,222
Thomas(basic)pig	7,777,959	6,976,548	D. 801,411
Total.....	11,939,385	10,796,985	D. 1,142,400

The total decrease was 9.6 per cent. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

Metal Markets

New York, Dec. 30—The metal markets are still rather quiet as the end of the year is reached. Some speculative activity is manifest, and sales to consumers have been fair.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Nov. 1908..	$ 2,967,795	$ 2,892,225	Exp. $ 75,570
" 1907..	615,169	63,574,871	Imp. 62,959,702
Year 1908..	73,857,749	45,105,993	Exp. 28,750,846
" 1907..	54,211,240	98,949,557	Imp. 44,738,317
Silver			
Nov. 1908..	3,931,987	3,275,609	Exp. 676,378
" 1907..	4,187,378	3,602,405	" 584,973
Year 1908..	47,111,682	37,814,676	" 9,296,706
" 1907..	57,212,168	41,690,324	" 15,521,844

Exports of specie from New York, week ended Dec. 26: Gold, $901,010, to Paris and Panama; silver, $684,007, chiefly to London. Imports: Gold, $171,828; silver, $64,099, from Australia, the West Indies and Mexico.

The Bank of France continues to take gold from this country and from the open market in London. Partly this is due to

the prospective placing of a new Russian loan shortly, a considerable part of which will be taken in Paris. The Bank of France in its reserves this week reported $697,678,100 gold and $177,925,925 silver; a total of $875,604,025 specie. The gold held is $159,490,455 more than at the same time last year.

Gold—The open-market price reported for bar gold in London is 77s. 9¾d. per oz.; for American eagles, 76s. 5d. per oz. Most of the gold offered went to France. No more gold is reported taken in New York for export abroad, and none, probably, will be taken until exchange hardens.

Platinum—This has been naturally a quiet week, but the market is strong, and an advance is expected. Dealers quote the same prices, however, as for some weeks past: $24 per oz. for refined platinum, $26.50 for hard, and $20@21 for scrap; in some cases 25c. more.

Our special correspondent reports that in Russia prices are firm, owing to increased demand, especially from abroad. At Ekaterinburg—center of the Ural platinum industry—crude platinum, called in Russia light platinum, and carrying 83 per cent. pure metal, is quoted at 5 rubles 10 kopeks per zolotnik, equivalent to $19.16 per troy ounce. In St. Petersburg the principal dealers are offering considerable quantities of the same grade of metal at 5 rubles 20 kopeks per zolotnik, equivalent to $19.57 per ounce.

Silver—Silver seems to have touched bottom for the present. A more cheerful feeling in India, with buying by the China banks and covering by speculators has taken the edge off the bearish tendency. Advices received here are that the outlook for 1909 is more hopeful than was recently believed.

SILVER AND STERLING EXCHANGE.

December.	24	25	26	28	29	30
New York....	49¾	.....	49¼	49¾	49¾	50⅛
London.....	22¾	.....	.....	22⅛	22⅛	23⅛
Sterling Ex..	4.8700	.....	4.8690	4.8700	4.8665	4.8700

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Dec. 17; reported by Messrs. Pixley & Abell, London:

	1907.	1908.	Changes.
India.....	£10,531,354	£8,412,390	D. £2,118,964
China.....	417,350	641,400	I. 224,050
Straits.....	691,150	164,885	D. 526,265
Total.....	£11,639,854	£9,218,675	D. £2,421,179

Imports for the week £6000 from Mexico, £5000 from the West Indies, £184,000 from New York; total, £195,000. Exports £1500 to Egypt, £35,000 to India; £36,500 in all.

The United States Mint has resumed purchases of silver. On Dec. 23 the treasury Department bought 125,000 oz., 75,000 oz. for delivery at New Orleans and 50,000 oz. at Denver. The price paid was 49.118c. per oz., delivered.

Copper, Tin, Lead and Zinc

Dec.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
24	14⅜ @14⅝	14 @14⅛	63¾	29¾	4.12½ @4.15	5.12½ @5.15	4.97½ @5.00
25	.....	.....	....	....	.....	.....	.....
26	14⅜ @14⅝	14 @14⅛	....	29	4.12½ @4.15	5.12½ @5.15	4.97½ @5.00
28	14⅜ @14⅝	14⅛ @14¼	63⅞	29	4.12½ @4.15	5.12½ @5.15	4.97½ @5.00
29	14⅜ @14⅝	14⅛ @14¼	63¾	29	4.12½ @4.15	5.12½ @5.15	4.97½ @5.00
30	14⅜ @14⅝	14⅛ @14¼	63⅞	29	4.12½ @4.15	5.12½ @5.15	4.97½ @5.00

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—A persistent buying movement has developed in the market, resulting in a rather heavy business in electrolytic copper both for domestic and foreign account. As a result, prices have advanced and the close is firm at 14⅜@14⅝c. for Lake copper; 14⅛@14¼c. for electrolytic copper in ingots, cakes and wirebars. The average for casting copper has been 13⅞@14⅛ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb. Wire 15¾c. base, carload lots at mill.

The improvement in the London standard market has made further progress and the close is cabled firm at £63 16s. 3d. for spot, £64 12s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £67; best selected, £66@67; strong sheets, £78@79.

Copper exports from New York and Philadelphia for the week, 5102 long tons. Our special correspondent states exports from Baltimore for the week at 1288 long tons of copper.

Exports of copper in metallic form from the United States for the 10 months ended Oct. 31 were divided as follows, in pounds:

N. American countries.....	3,430,075
Germany and Holland.....	282,511,770
Great Britain.....	106,698,108
France.....	94,936,974
Other European countries.....	64,594,885
China.....	13,735,899
Other countries.....	2,437,553
Total.....	568,345,269

Exports of ores and matte were: Canada, 48,802; Mexico, 620; other countries, 715; total, 55,726 long tons. The renewal of shipments to China is a feature of the present year of which little notice has been taken.

Tin—The market has been in a very unsatisfactory state, and London quotations show rather a disposition to sag. This condition no doubt is brought about by apprehension of an unfavorable statistical position to be exposed at the end of this month. The market closes weak at £131 7s. 6d. for spot, £133 for three months.

Buyers in the domestic market continue to be very reluctant with regard to placing larger orders, and the little business that is being transacted is done at about 28⅞@29 cents.

Lead—Transactions in this metal have been a negligible quantity. Some inquiries are reported for distant delivery, which have not yet developed into actual business. It would, however, indicate that the impression is gaining ground that present prices cannot be far from bottom. The market closes unchanged at 4.12½@4.15c., New York, and 3.97½@4c., St. Louis.

The London market is somewhat lower, but steady at the decline, the close being cabled at £13 for Spanish lead, £13 2s. 6d. for English lead.

Spelter—Consumers have shown little interest in the market during the entire week. On the other hand, there is not much offered for sale on account of orders already booked by the smelters and the high prices for raw material. The market closes unchanged at 5.12½@5.15c., New York, 4.97½@5c., St. Louis.

The London market is firmer at £21 per ton for good ordinaries, £21 5s. for specials.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—No sales were made during the week and prices remain unchanged. Quotations are 8.15@8.25c. for Cookson's; 8@8⅛c. for Hallett's and 7⅝@7¾c. for ordinary brands.

Aluminum—Prices continue unchanged. The Aluminum Company of America quotes 24c. per lb. base for No. 1 ingots, and 33@34c. base for sheets. Offers of foreign metal are still made at 22c. Actual sales are reported to be small. The foreign market is still demoralized, with prices low.

Nickel—Large lots, contract business, 40@45c. per lb. On retail business the price ranges from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Quicksilver—A slight degree of activity has developed during the week, but the market is only moderately active. New York prices are unchanged, at $45@46 per flask of 75 lb. San Francisco quotations are $45 per flask for domestic orders and $43 for export. The London price is steady at £8 10s. per flask, with £8 8s. named by jobbers.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Spanish Metal Exports

Exports of metals and ores from Spain, 10 months ended Oct. 31, metric tons, as reported by *Revista Minera*:

Metals:	1907.	1908.	Changes
Copper	7,085	11,744	I. 4,659
Copper precipitate	15,601	16,789	I. 1,288
Zinc	1,294	1,386	I. 92
Lead	158,479	158,000	D. 479
Quicksilver	1,497	1,504	I. 7
Minerals:			
Iron ore	7,444,274	6,339,310	D. 1,104,964
Copper ore	1,022,578	986,714	D. 35,864
Zinc ore	128,994	100,844	D. 28,150
Lead ore	4,742	2,603	D. 2,139
Manganese ore	57,717	18,843	D. 38,874
Pyrites	1,116,462	1,228,576	I. 112,114

Exports of salt, 423,262 tons in 1907, and 495,842 in 1908; increase, 72,580 tons.

Sault Ste. Marie Canal Traffic

The total traffic through the Sault Ste. Marie canals for the season was 58,217,214 short tons of freight in 1907, and 41,390,557 in 1908; a decrease of 16,826,657 tons, or 29 per cent. The number of vessel passages in 1908 was 15,181, showing an average cargo of 2726 tons. The mineral freights included in the totals were as follows, in net tons, excepting salt, which is in barels:

	1907.	1908.	Changes.
Coal	11,400,095	9,902,460	D. 1,497,635
Iron ore	39,594,044	24,650,340	D. 14,943,704
Pig and manuf. iron	307,941	289,308	D. 18,633
Copper	89,959	101,735	I. 11,776
Building stone	898	1,019	I. 121
Salt, bbl	460,802	547,223	I. 86,421

The United States canal was open in 1908, April 27-Dec. 13, inclusive, or 231 days. The Canadian canal was open April 21-Dec. 15, or 239 days. There were no serious blocks or delays during the season.

Lake Freight Rates—The *Marine Review*, of Cleveland, reports the season average of freight rates on coal and iron ore as follows, in cents per ton:

Anthracite:	1906.	1907.	1908.
Lake Erie ports to Chicago	46.20	40.78	40.00
Lake Erie ports to Duluth	35.19	31.26	30.00
Bituminous Coal:			
Lake Erie ports to Chicago	46.05	40.00	40.00
Lake Erie ports to Duluth	34.85	30.00	30.00
Iron Ore:			
Escanaba to Lake Erie ports	60.00	60.00	50.00
Marquette	70.00	70.00	60.00
Duluth	75.55	75.00	65.00

This season there were practically no wild rates, all the business being done on contract.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 26—The highest price paid for zinc ore this week was $44.50, on a basis of $41@42 per ton of 60 per cent. zinc. For 80 per cent. lead ore $50 per ton was paid.

SHIPMENTS, WEEK ENDED DEC. 26

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	718,670	.....	126,100
Linden	498,430	127,720	.....
Cuba City	357,890	.....	.....
Galena	343,800	.....	.....
Harker	332,340	.....	.....
Highland	261,800	50,000	.....
Strawbridge	238,800	.....	.....
Benton	228,840	.....	.....
Livingston	170,000	.....	.....
Hazel Green	159,800	152,100	.....
Mineral Point	90,000	.....	.....
Days Siding	89,000	.....	.....
Dodgeville	80,000	.....	.....
Elmo	72,770	.....	.....
Total	3,642,140	329,820	126,100
Year to Dec. 25	114,944,360	10,786,340	5,072,604

In addition to the above there was shipped to the Joplin Separator Works, 315,000 lb.; to the Platteville Separating Company, 605,900 lb. zinc ore.

Joplin, Mo., Dec. 26—The highest price paid for zinc ore during 1908 was $47 per ton, two weeks ago. The lowest price of high-grade ore was $36.50 the second week of June, and the average price, all grades, for the year, was $34.34. The highest price of zinc sulphide ore the past week was $45 per ton, on an assay base price ranging from $39 to $42 per ton of 60 per cent. zinc. The highest price for zinc silicate was $23, on an assay base price of $17@18 per ton of 40 per cent. zinc. The average price for the week, all grades, was $38.38 per ton. The highest price paid for lead ore was $50, declining to $48 at the week-end, averaging for the week, all grades, $48.82 per ton.

Christmas observation reduced the output about 30 per cent., and, with an average shipment, the reserve stock was reduced approximately 1300 tons, the first important decrease since the beginning of the heavy purchases. The decrease of the year is 29,417 tons of zinc, at a decrease in value of $3,691,615 and 3701 tons of lead, at a decrease in value of $791,906. The total decrease in value was $4,483,521 for the year.

SHIPMENTS, WEEK ENDED DEC. 26

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,152,070	526,180	$75,931
Joplin	2,168,110	216,010	49,630
Galena	917,530	19,830	19,436
Prospertiy	501,010	339,780	18,343
Duenweg	614,750	16,340	12,685
Alba-Neck	466,590	15,550	9,712
Aurora	479,100	37,280	9,173
Badger	239,160	.....	7,122
Spurgeon	122,660	57,070	6,617
Granby	550,000	20,000	6,500
Miami	326,070	63,950	6,490
Seneca	.....	240,000	6,948
Carthage	171,630	15,850	3,820
Zincite	167,070	.....	3,341
Sarcoxie	142,040	.....	2,023
Carl Junction	83,440	8,580	1,858
Cave Springs	83,010	.....	1,702
Reeds	63,350	.....	1,267
Totals	10,677,590	1,576,440	$241,498
The year	514,240,360	77,065,510	$10,936,305

Zinc value, the week, $203,002; the year, $8,829,808
Lead value, the week, 38,496; the year, 2,106,498

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1907.	Zinc Ore. Base Price. 1908.	Zinc Ore. All Ores. 1907.	Zinc Ore. All Ores. 1908.	Lead Ore. All Ores. 1907.	Lead Ore. All Ores. 1908.
January	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February	48.30	36.63	47.11	34.92	84.58	49.72
March	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	68.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60.34
September	41.00	37.63	40.11	34.44	53.52	54.59
October	41.75	35.95	39.83	33.28	51.40	52.63
November	38.60	39.13	35.19	35.02	43.40	54.53
December	31.50	42.75	30.87	39.63	37.71	49.68
Year	$44.36	$36.63	$43.68	$34.31	$68.90	$53.93

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Dec. 30—The market is steady and trading is quiet. The possible revisions of the tariff tend to restrict business for the time being. On the whole business is up to expectations.

Copper Sulphate—The market is firm and outside dealers are not shading standard prices which are $4.75 per 100 lb. for carloads and up to $5 for smaller lots.

Nitrate of Soda—The market is steady and business is restricted to a small volume. Quotations are unchanged at 2.17½c. per lb. for spot and futures.

Mining Stocks

New York, Dec. 30—The market on the Stock Exchange this week was rather active, considering that it was broken by a double holiday, and that another is coming. At the close the tendency is rather upward, with prices strong, notwithstanding an attempt of some large operators to bring about a general break. A few stocks sold off sharply, but most of the issues largely dealt in held firm.

On the Curb the copper stocks lead in dealing. Some of them advanced, others held their prices and only a few declined. On the whole the market was rather irregular, but with no decided weakness. Such declines as occurred at the close were due to profit taking. The Cobalt stocks were irregular, but showed a good buying demand. The Nevada gold stocks were the weakest of any dealt in. For a holiday week the total volume of business was fair.

Boston, Dec. 29—The market has been on the mend, although the week has included but four days, as the Exchange was closed Christmas and the following Saturday. Prices show a material improvement and considerable activity was generated in spots, particularly in some of the Lake issues. Isle Royale was conspicuous with a $3.02½ advance to $26. Atlantic is up $1.25 to $17.02½; Centennial $1.75 to $33.25; Allouez $1 to $37.50; Franklin $1.75 to $17.50; Mohawk $3.25 to $70.25; Osceola $5.75 to $34.75; Quincy $2 to $95; Tamarack $8.50 to $85, the latter reacting to $82; Wolverine $2 to $152. Copper Range sold up $3.37½ to

$82.50. Two $1 dividends are announced by the Champion, one-half of which is owned by Copper Range and the other half by the St. Mary's Mineral Land Company.

Amalgamated has been paid and has risen $4.50 during the week to $84.62½. The declaration of 50c. quarterly dividend by the Anaconda presages the usual Amalgamated dividend next month. Miami has been a feature with an advance from $12.50 to $15.50. Superior Copper has been neglected, compared with late activity, and is off $1.37½ to $34. This stock was bulled pretty hard a few weeks ago. Arizona Commercial rose $2 to $39.50, losing half of it, and Boston Consolidated stiffened $1.37½ to $17.

Announcement is made that a new contract has been made by the Boston Consolidated with the Garfield smelter of the American Smelters' Securities Company. Calumet & Hecla has advanced $15 to $675 and Calumet & Arizona touched $119. North Butte rose $3.37½ to $86; Old Dominion $2.87½ to $58.62½; Parrot $1.25 to $30; Shannon $1.25 to $18. Word comes of the starting of the Balaklala smelter and the renewal of regular Trinity shipments.

United States Smelting has risen $2.25 to $45; and Utah Consolidated $3.37½ to $47. North Lake Mining has been taken from the Curb and put on the unlisted department of the Stock Exchange.

Curb features have been the strength of First National, and the weakness of Consolidated Arizona Smelting.

STOCK QUOTATIONS

NEW YORK	Dec. 29	BOSTON	Dec. 29
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	⅜	Adventure	9½
Amalgamated	83½	Allouez	37½
Anaconda	49½	Am. Zinc	25¾
Balaklala	‡2 1/16	Arcadian	3¼
British Col. Cop.	8⅝	Arizona Com	38¼
Buffalo Mines	‡3½	Atlantic	17⅝
Butte Coalition	26⅞	Boston Con	17
Colonial Silver	7/16	Calumet & Ariz	118
Cum. Ely Mining	8⅞	Calumet & Hecla	675
Davis Daly	3¼	Centennial	33¼
Dominion Cop	⅝	Con. Mercur	‡.38
Douglas Copper	2⅞	Copper Range	81⅝
El Rayo	3⅝	Daly-West	10⅛
Florence	4 1/16	East Butte	9¼
Foster Cobalt	.47	Franklin	17
Furnace Creek	.13	Greene-Can	12½
Giroux	6⅝	Isle Royal	25¼
Gold Hill	½	La Salle	14½
Goldfield Con	8 1/16	Mass	6¼
Granby	106½	Michigan	13½
Greene Gold	¼	Mohawk	70
Greene G. & S	7	Nevada	19⅝
Greenw'r & D.Val.	‡.75	North Butte	85¼
Guanajuato	2	Old Colony	‡.60
Guggen. Exp	180	Old Dominion	58
Hanapah	.15	Osceola	134¾
McKinley Dar	1.04	Parrot	30
Micmac	2¼	Quincy	95
Mines Co. of Am	⅞	Rhode Island	15½
Mitchell Mining	⅜	Santa Fe	2½
Mont. Sho. C.	¾	Shannon	17¼
Nev. Utah M. & S	3	Superior	34
Newhouse M. & S.	6	Superior & Pitts	17⅝
Nipissing Mines	10⅜	Tamarack	82
Old Hundred	⅞	Trinity	17
Silver Queen	1.02	United Cop., com.	13¾
Stewart	⅝	U. S. Oil	‡28¾
Tennessee Cop'r	45¼	U. S. Smg. & Ref.	44½
Tri-Bullion	1/16	U.S.Sm. & Re.,pd.	46¾
Union Copper	¾	Utah Con	46⅞
Utah Apex	5⅛	Victoria	4
Utah Copper	47½	Winona	15¼
Yukon Gold	4⅞	Wolverine	152
		Wyandotte	22½

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem	33½
Am. Smelt. & Ref.	83¼
Am. Sm. & Ref. pf.	103
Colo. Fuel & Iron	39⅞
Federal M. & S., pf.	83
National Lead	78½
National Lead, pf.	‡105¾
Pittsburg Coal	13¾
Republic I. & S.	26
Republic I.& S., pf.	87½
Sloss-Sheffield	78
Standard Oil	690
U. S. Steel	54⅝
U. S. Steel, pf.	112⅞
Va. Car. Chem	45

BOSTON CURB	
Ahmeek	135
Black Mt	3
Chemung	22¾
Globe Con	7¾
Hancock	14⅞
Helvetia	4½
Keweenaw	5½
North Lake	7½
Ojibway	14¾
Superior & Best	17¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	Dec. 26	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	2.00	1.50
Cent. C. & C.	79.00	78.00
C.C. & C. pd.	88.00	86.00
Cont. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	21.00	19.00
Doe Run	125.00	110.00
Gra. Bimet.	.30	.20
St. Joe	15.00	12.50

LONDON	Dec. 30		
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton'sInd.	0	3	3
Camp Bird	0	16	0
Esperanza	3	6	0
Tomboy	1	0	7½
El Oro	1	6	0
Oroville	0	8	0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Dec. 30.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.10
Belcher	.38	St. Ives	.17
Best & Belcher	.46	Triangle	.03
Caledonia	.16	BULLFROG STOCKS	
Chollar	.08	Gibraltar	.03
Comstock	.27	Homestake King	.09
Con. Cal. & Va	.70	Mont. Shoshone C.	.87½
Crown Point	.38	Tramp Cons	.09½
Exchequer	.35	MISCELLANEOUS	
Gould & Curry	.09	Bonnie Clare	.06
Hale & Norcross	.31	Lee Gold Grotto	...
Mexican	.81	Nevada Hills	1.37½
Ophir	1.47	Nevada Smelting	1.00
Overman	.20	Nevada Wonder	.35
Potosi	.13	Nevada-Utah	2.87½
Savage	.22	Penn-Wyoming	.13
Sierra Nevada	.22	Pittsburgh S. Pk	.86
Union	.30	Rawhide Coal	.45
Utah	.04	Round Mt. Sphinx	.16
Yellow Jacket	.64		
TONOPAH STOCKS			
Belmont	.75		
Extension	.48		
Golden Anchor	.02		
Jim Butler	.18		
MacNamara	.32		
Midway	.21		
Montana	.65		
North Star	.03		
Tono'h Mine of N.	3.50		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.18		
Booth	.34		
Columbia Mt	.17		
Comb. Frac	1.56		
Con. Red Top	.12½		
Cracker Jack	.04		
Dia'dfield B. B. C.	.11		
Goldfield Belmont	.07		
Goldfield Daisy	.68		
Great Bend	.25		
Jumbo Extension	.20		
Kendall	.08		
Lone Star	.05		
May Queen	.05		
N. Y. C. O. D.	.07		
Oro	.12		
Red Hill	.19		
Roanoke	...		
Sandstorm	.17		

COLO. SPRINGS	Dec. 26
Name of Comp.	Clg.
Acacia	5⅝
Black Bell	....
C. C. Con	13½
Dante	5⅞
Doctor Jack Pot	8¾
Elkton	69
El Paso	50
Findlay	‡17⅛
Gold Dollar	9¼
Gold Sovereign	13½
Isabella	26¾
Index	....
Jennie Sample	6
Jerry Johnson	4
Mary McKinney	33
Pharmacist	3½
Portland	1.05
Un. Gold Mines	4⅞
Vindicator	80
Work	7

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev	Jan. 8	Feb. 2	$0.10
Caledonia, Nev	Jan. 8	Jan. 29	0.05
Challenge, Nev	Dec. 11	Jan. 5	0.05
Choltar, Nev	Jan. 11	Feb. 3	0.10
Copper King, Ida	Dec. 10	Jan. 15	0.01
Ely Cons., Nev	Nov. 28	Jan. 11	0.02
Exchequer, Nev	Dec. 30	Jan. 20	0.05
Federal-Ely, Utah	Jan. 9	Feb. 1	0.01
Iowa, Utah	Jan. 5	Feb. 2	0.02
Julia Con., Nev	Dec. 21	Jan. 15	0.03
Lower Mammoth, Utah	Dec. 18	Jan. 8	0.05
Mountain Dell	Dec. 24	Jan. 12	0.02
New York Con., Nev	Dec. 18	Jan. 8	0.03
Ore Cobre, Cal	Dec. 31	Jan. 16	0.02
Savage, Nev	Jan. 6	Jan. 28	0.10
Silver King Con., Utah	Jan. 6	Jan. 26	0.10
Union Con., Nev	Dec. 23	Jan. 14	0.10
Wabash, Utah	Jan. 7	Jan. 30	0.10
Yellow Jacket, Nev	Dec. 28	Feb. 3	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1907.	New York. 1908.	London. 1907.	London. 1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.796	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.514
August	68.745	51.688	31.637	23.858
September	67.792	51.720	31.313	23.877
October	62.435	51.431	28.863	23.725
November	58.677	49.647	27.154	22.933
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1907.	Electrolytic 1908.	Lake 1907.	Lake 1908.	LONDON. 1907.	LONDON. 1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
Febrnnary	24.869	12.906	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.698	26.072	12.788	102.375	57.387
June	21.665	12.676	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	60.500
September	15.565	13.388	16.047	13.600	68.375	60.338
October	13.169	13.354	13.651	13.646	60.717	60.139
November	13.391	14.130	13.870	14.386	61.226	63.417
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
Februnry	42.102	28.978	August	37.667	29 942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.620	29 444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.926	.....
			Av. yonr.	38.160	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1907.	New York. 1908.	London. 1907.	London. 1908.
January	6.000	3.891	19.828	14 469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12 938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.376
September	4.813	4.515	19.775	13.125
October	4.750	4.351	18.531	13 375
November	4.375	4.330	17.281	13.538
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York. 1907.	New York. 1908.	St. Louis. 1907.	St. Louis. 1908.	London. 1907.	London. 1908.
January	6.732	4.513	6.582	4.363	27.125	20 563
February	6.814	4.788	6.664	4.638	25.938	20 875
March	6.837	4.665	6.687	4.527	26 094	21 075
April	6.685	4.645	6.535	4.495	25.900	21 344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19 031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19 563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20 875
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—	
Bort, good drill quality, carat	$85.00
Carborundum, f.o.b. Niagara Falls, powd. lb.	.08
Grains "	.10@.17
Corundum "	.07@.10
Crushed Steel, f.o.b. Pittsburg "	.05¼@.06
Emery, in kegs; Turkish flour "	.01½@.02½
Grains "	.03½@.04½
Naxos flour "	.01½@.02½
Grains "	.03½@.04½
Chester flour "	.01½
Grains "	.03½@.04½
Peekskill, f.o.b. Easton, Pa., flour "	.01½@.01½
Grains, in kegs "	.02¾@.03
Garnet, per quality sh. ton	25.00@35.00
Pumice Stone, Am. Powd., 100 lb.	1.60@2.00
Italian, powdered "	.01½@.01½
Lump, per quality "	.03@.20
Rottenstone, ground "	.01⅞@.04
Lump, per quality "	.05@.25
Rouge, per quality "	.05@.30
Steel Emery, f.o.b. Pittsburg "	.07½@.07⅞
ACIDS—	
Acetic 28% lb.	.021 up
Boric "	.07
Hydrofluoric, 30% "	.02¾@.03
" 48% "	.06
" 60% "	.10
Hydrochloric acid, 20°, per lb.	1.25@1.50
Nitric acid, 38° per lb.	4.25@4.62½c.
Sulphuric acid, 50°, bulk per ton	$12 up
60°, 100 lb. in carboys.	.85@1.12½
60°, bulk, ton	16.00@18.00
66°, 100 lb. in carboys.	1.00@1.25
66°, bulk, ton	18.00
Oxalic "	.06½@.06¾
ALCOHOL—Grain 95% gal.	2.63
Denatured "	.47@.49
Refined wood, 95@97% "	.50@.55
ALUM—Lump 100 lb.	$1.75
Ground "	1.85
Chrome Alum "	.03¾@.04
ALUMINUM—Sulphate, com'l. lb.	1.10@1.75
AMMONIA—24 deg. lb "	.04½@.05½
" 26 deg. lb "	.04¾@.05¾
AMMONIUM—	
Bromide lb.	.28
Carbonate "	.07⅞@.08
Muriate grain "	.05⅝@.06½
Lump "	.09½@.09¾
Sulphate, 100 lb. "	3.05@3.10
Sulphocyanide com "	.30
" " chem. pure "	.40
ANTIMONY—needle, lump "	.03½@.03¾
ARSENIC—White "	.03½@.03¾
Red "	.07½@.07¾
ASPHALTUM—	
Barbadoes per ton.	40.00@80.00
West Indies "	20.00@60.00
Egyptian lb.	.10@.11
Gilsonite, Utah ordinary per ton.	32.00
Trinidad "	22.50@30.00
California "	21.00@27.00
BARIUM—	
Carb. Lump, 80@90% lg. ton.	30.00@35.00
Precipitated 96@98%	36.00@40.00
Powdered, 80@90% lb.	.02@.02½
Chloride com'l ton.	39.00@41.00
Nitrate powdered, in casks lb.	.05½@.06
Blanc Fixe per lb.	.02¾
BARYTES—	
Am. Ground sh. ton.	14.00@17.50
Floated "	18.00@21.00
Foreign floated "	19.50@22.50
BISMUTH—Sub-nitrate lb.	1.50
BLEACHING POWDER—35%, 100 lb.	1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.	4.75
BONE ASH lb.	.02¾@.04
BORAX, sacks "	.04½
CALCIUM—Acetate, gray, 100 lb.	1.50@1.55
Acetate, brown lb.	1.00@1.05
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J. sh. ton.	65.00
Chloride, f.o.b. N. Y. "	11.00@14.00
CEMENT—	
Portland, Am. 500 lb. bbl.	1.55@1.60
Foreign "	2.25@2.90
"Rosendale," 300 lb. "	.85
(in sacks) "	.65
Slag cement "	.75@1.25
CHROME ORE—	
New Caledonia 50% ex. ship N. Y. per lg. ton.	17.50@20.00
Bricks, f.o.b. Pittsburg, M ton	175.00
CLAY, CHINA—Am. common ex-dock, N. Y. ton.	8.00@9.00
Foreign "	10.00@17.50
COBALT—Oxide lb.	1.40
COPPERAS—Bulk 100 lb.	$0.9
In bbls. "	.65@.75
In bags "	.60@.70
CRYOLITE lb.	.06½@.06¾
FELDSPAR—Ground best sh. ton.	10.50@15.00
FIRE BRICK—	
American per M.	30.00@40.00
Imported "	30.00@45.00
St. Louis No. 1 "	18.00
" No. 2 "	15.00
Extra "	20.00@23.00
FIRE CLAY—F.o.b. St. Louis.	
St. Louis, extra quality per ton.	5.00
" ordinary "	2.50
Dowestie f.o.b. shipping port:	
FLUORSPAR—	
Domestic f.o.b. shipping port:	
Lump lg. ton.	8.00@10.00
Ground "	11.50@13.50
Foreign crude ex. dock	8.00@10.00
FULLER'S EARTH—Lump, 100 lb.	.75@.85
Powdered "	.75@.85
GRAPHITE—Ceylon.	
Flying dust, finest to best lb.	.02½@.04
Dust "	.02½@.05
Chip "	.04@.08
Lump "	.05½@12
Large lump "	.08½@.10½
GYPSUM—	
Feritlizer sh. ton.	5.00
Ground "	4.00@7.00
INFUSORIAL EARTH—	
Ground Am. Best lb.	.01¾
German lb.	.02½@.02¾
LEAD—Acetate (sugar of) brown, lb.	.07¾
Nitrate, com'l "	.08½@.08¾
MAGNESITE—Greece.	
Crude (95%) lg. ton.	8.00@10.00
Calcined, powdered sh. ton.	26.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg M.	160@200
MAGNESIUM—	
Chloride, com'l 100 lb.	.90@1.25
Sulphate (Epsom salt) 100 lb.	.85@1.00
MANGANESE—	
Foreign, crude, powdered:	
70@75% binoxide lb.	.01@.01½
75@85% binoxide "	.01½@.01½
85@90% binoxide "	.01½@.05
90@95% binoxide "	.06½
Ore, 80%-85% sh. ton.	16.00@32.50
MARBLE—Flour sh. ton.	8.50@10.00
MINERAL WOOL—	
Slag, ordinary sh. ton.	19.00
Selected "	25.00
Rock, ordinary "	32.00
Selected "	40.00
MONAZITE SAND—	
Guar. 97%, with 5% Thorium oxide, nominal lb.	.08 and up
NICKEL—	
Oxide, crude, lb. (77%) for fine metal contained	.47
Sulphate, single lb.	.09@.11
Sulphate, double "	.06½@.08
NITRATE OF SODA—100 lb. 95% for '08	2.17½
95% for 1909	2.17½
95% for 1910	2.17½
96% is 2½@7½c. higher per 100 lb.	
OZOKERITE—best lb.	.14@.17
PAINTS AND COLORS—	
Litharge, Am. powdered lb.	.06¾@.07
English glassmakers' "	.08½@.08¾
Lithopone "	.03½@.07
Metallic, brown sh. ton.	16.50@22.00
Red "	14.00@18.00
Ocher, Am. common "	8.50@9.00
Best "	16.00
Dutch, washed lb.	.02½@.03
French, washed "	.01½@.02½
Paris green, pure, bulk "	.21½
Red lead, American "	.06¾@.07
Foreign "	.08¼@.08½
Turpentine, spirits bbl., per gal.	.41½
White lead, Am., dry lb.	.05¾@.05½
American, in oil "	.06½@.06¾
Foreign, in oil "	.10½@.10¾
Zinc white, Am. extra dry "	.05½@.05¾
French, red seal, dry "	.08¾@.08½
French, Green seal, dry "	.10¾@.10¾
PHOSPHATES—Acid	60c. per unit
*Fla., hard rock	10.00@10.25
land pebble 68%	4.25@4.50
†Tenn., 78@80%	6.00@6.50
75%	5.00@5.50
68@72%	4.00@4.50
‡So. Car. land rock	6.75@7.00
" " river rock	5.00@5.50
POTASSIUM—	
Bicarbonate crystal lb.	$.08½@.09
Powdered or granulated "	.09@.09½
Bichromate, Am. "	.08½@.08¾
Scotch "	.10½
Bromide "	.20
Carbonate (80@85%) "	.03¾@.04
Caustic, ordinary "	.04½@.05¾
Elect. (90%) "	.05½@.06
Chloride (muriate), 100 lb.	1.00
Chlorate, powdered "	.09½@.09¾
Crystals "	.09@.09½
Cyanide (98@99%)	
Carloads (30,000 lb.) "	18c.
5-ton lots "	18½c.
Less than 5 tons "	19c.
Kainite, long ton, bulk, 8.50; bags, 9.50.	
Permanganate lb.	.09½@.10
Prussiate, yellow "	.13@.13¾
Red "	.30@.33
Sulphate 100 lb.	2.18½@2.21½
PYRITE—	
Domestic, non-arsenical, furnace size, f.o.b. mines per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines	10@10½ c
Imported non-arsenical, furnace size, per unit	.12½
Imported, arsenical, furnace size, per unit	.12
Imported fines, arsenical, per unit.	.08½@.09
Imported fines, non-arsenical, per unit	10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl.	.72@1.13
N. Y. agricultural sh. ton.	3.80@4.50
SALTPETER—Crude 100 lb.	4.00@4.50
Refined ,crystals "	5.50@6.00
SILICA—	
Ground quartz, ord'ry. lg. ton.	10.00@15.00
Silex, ground "	13.00@15.00
Silex, floated "	35.00@40.00
Lump quartz "	5.00@6.00
Glass sand "	2.75
SILVER—Nitrate, crystals oz.	.37½@.40
SODIUM—	
Acetate lb.	.04@.04½
"Alkali," per 100 lb., 58/48	.80@.87½
Bicarb. soda, per 100 lb	1.00@1.30c.
Soda, caustic, per 100 lb., 76/60	1.75@1.85
Soda, caustic, powdered	.02¾@.03½
Salt cake, per 100 lb., bulk	.40
Salt cake, bbl	.65@.85
Soda, monohydrate, per lb.	1.4@1.75c.
Bichromate lb.	.06½@.07
Bromide "	.13@.14
Chlorate, com'l "	.09@.09½
Cyanide ("100% KCN")	
Carloads (30,000 lb.) "	18c.
5-ton lots "	18½c.
Less than 5 tons "	19c.
Hyposulphite, Am. "	1.35 up
German "	1.60@1.70
Phosphate 100 lb.	2.00@2.20
Prussiate "	.08@.08½
Sal soda, f.o.b. N. Y. "	.65@.70
Foreign, f.o.b. N. Y. "	.80@1.00
Silicate, com'l "	.80@1.15
Sulphate, com'l (Glauber's salt) 100 lb.	.60@.75
Sulphate, com'l, calcined	.65@.85
STRONTIUM—Nitrate lb.	.07½@.08
SULPHUR—	
Louisiana (prime) to New York, Boston or Portland lg. ton.	22.50
To Philadelphia or Baltimore "	22.50
Roll 100 lb.	1.85@2.15
Flour "	2.00@2.40
Flowers, sublimed "	2.20@2.60
TERRA ALBA—French & Eng. 100 lb.	.85@1.00
TALC—Domestic sh. ton.	15.00@25.00
French "	16.00@25.00
Italian, best "	35.00@40.00
TIN—Bi-chloride, 50% lb.	.09½ up
Crystals "	.21 up
Oxide, lb "	.33@.35
URANIUM—Oxide "	3.50
ZINC—	
Chloride solution, com'l 20° "	.02½
Chloride, granular "	.04½@.05
Dust "	.04½@.05
Sulphate "	.02@.02½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites, and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

The Engineering and Mining Journal

VOL. LXXXVII. NEW YORK, JANUARY 9, 1909. NO. 2.

Mineral and Metal Production in 1908

Statistics of the Output of the More Important Substances. Commercial Movements. Market Conditions. Mining and Metallurgy

SOME INCREASES, MANY DECREASES

In the accompanying table we summarize the production of the more important minerals and metals in the United States in 1908 so far as it has been possible to collect the statistics at so early a date. The figures for copper, lead and spelter are based on reports received directly from the producers, who have communicated their actual output during the first 11 months of the year, together with their estimates of probable production in December; in many cases the estimates are for only the last few days of December. The other statistics are based chiefly on the reports of producers, State mine inspectors, and special correspondents. The statistics for the production of gold and silver in the United States are the preliminary estimates of the Director of the Mint.

Even under these conditions, it is impossible to insure accuracy. Among other difficulties, there are always likely to be duplications or omissions in the reports of the producers, which can be corrected only by careful investigation involving considerable time. However, we are confident that the statistics which we are able to present at this early date are close approximations to the truth.

It will be observed that in some cases there are differences between the statistics given by the various contributors to this number and our editorial statistics. This is because the articles of our outside contributors were necessarily written and put into type before our own statistics were available, which in some cases was not until Jan. 6, 1909, and consequently the statistics of our contributors are generally estimates. This explanation will account for discrepancies, though the reason will be so obvious to our readers that an explanation is hardly required.

We thank the producers of metals and minerals for their courteous coöperation by promptly and fully furnishing us with statements of their production in 1908 and we thank many other persons who have aided in the preparation of this number.

The metal industries suffered in 1908 from the general commercial depression that began in 1907. This has proved to be more far-reaching than was at first supposed. Indeed, the setback began earlier than people in general were aware. Probably the threatening of adverse conditions was apparent to the great international banking houses before the end of 1906—perhaps before the Cobalt boom was punctured. During the first two months of 1907 prices continued to rise, but as early as March it was manifest that industrial activity was on the downward grade. A stock of unsold copper began to accumulate in May, but it was not until after the middle of July that many prominent industrialists, who should have been better informed, awoke to the fact that a general recession in business was not merely impending, but had actually proceeded far.

The year 1908 began with the panic conditions a matter of history, but with demand for the metals at low ebb, as was naturally to be expected, and the accumulation of large unsold stocks, the latter being unequally distributed among the producers, although there was scarcely one who did not have something on hand. During the falling market in the last quarter of 1907, some producers sold steadily for what could be realized; others held aloof, expecting all the time a recovery, only to be obliged finally to sell at a sacrifice when necessity compelled; others who missed the market on the decline, but were able to finance their accumulations, were carrying large stocks at the beginning of 1908.

MINERAL AND METAL PRODUCTION OF THE UNITED STATES.

PRELIMINARY STATISTICS, SUBJECT TO REVISION.

Product.	Customary Measure.	1907. Quantity.	1907. Value. Total.	1907. Value. Per Unit.	1908. Quantity.	1908. Value. Total.	1908. Value. Per Unit.	Changes in Quantity.
NON-METALLIC:								
Coal, bituminous	Short ton	388,222,868	$463,654,776	$1.20	338,688,000	$390,103,984	$1.15	D. 49,534,868
Coal, anthracite	Short ton	86,341,832	198,653,218	2.30	80,280,000	184,682,317	2.30	D. 6,061,832
Iron ore	Long ton	52,955,070	117,560,255	2.22	34,202,000	61,563,100	1.80	D. 19,339,030
Limestone flux	Long ton	15,722,801	7,480,121	0.475	9,650,000	3,860,000	0.40	D. 6,072,801
Petroleum	Barrel	164,347,930	123,260,948	0.75	184,734,678	131,779,288	0.71	I. 20,386,748
MANUFACTURED:								
Coke	Short ton	36,993,622	99,055,150	2.687	22,697,000	53,926,887	2.376	D. 14,296,622
Copper sulphate	Pound	44,867,650	2,804,228	0.0625	45,144,000	2,198,513	0.0487	I. 276,350
Lead, sublimed white	Short ton	8,700	1,026,600	118.00	9,100	973,700	107.00	I. 400
Zinc oxide (a)	Short ton	85,390	7,731,100	90.54	65,100	5,876,040	90.28	D. 20,290
METALLIC:								
Copper	Pound	879,241,766	181,660,142	0.20661	952,395,477	127,849,569	0.13424	I. 73,153,711
Gold	Oz. fine	4,375,215	90,435,700	20.67	4,659,562	96,313,256	20.67	I. 284,347
Iron, pig	Long ton	25,442,013	580,077,896	22.80	15,828,000	268,284,600	16.95	D. 9,953,327
Lead	Short ton	350,130	37,288,845	106.50	323,841	27,202,644	84.00	D. 26,291
Quicksilver	Flasks	20,932	780,506	37.29	20,000	840,000	42.00	D. 932
Silver	Oz. fine	56,514,700	36,919,358	0.65327	51,798,053	27,382,523	0.52864	D. 4,716,647
Zinc	Short ton	249,612	29,763,735	119.24	207,735	19,635,112	94.52	D. 41,877

(a) Includes zinc-lead pigment.

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January 9	14,000

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Metal Markets

New York, Jan. 6—The metal markets generally show some revival of activity at the opening of the year, but no marked changes from the previous week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Nov. 1908..	$ 2,967,795	$ 2,892,225	Exp. $ 75,570
" 1907..	615,169	63,574,871	Imp. 62,959,702
Year 1908..	73,857,749	45,105,993	Exp. 28,750,846
" 1907..	54,211,240	98,949,557	Imp. 44,738,317
Silver:			
Nov. 1908..	3,951,987	3,275,609	Exp. 676,378
" 1907..	4,187,378	3,602,405	" 584,973
Year 1908..	47,111,382	37,814,676	" 9,296,706
" 1907..	57,212,168	41,690,324	" 15,521,844

Exports of specie from New York, week ended Jan. 2: Gold, $31,250, to the West Indies and Panama; silver, $723,796, chiefly to London. Imports: Gold, $77,612; silver, $90,761, both from Central and South America.

Gold—The London price of gold in the open market is about the same as last week, 77s. 9¾d. per oz. for bars, and 76s. 5d for American eagles.

Platinum—Prices are strong. Dealers quote $24.25 per oz. for ordinary metal, $26.25 for hard, $20@21 for good scrap.

SILVER AND STERLING EXCHANGE.

Dec.-Jan.	31	1	2	4	5	6
New York....	50¼	.....	50⅛	50⅜	50⅛	50⅝
London.....	23⅞	23 9/16	23⅝	23¾	23⅝	23¾
Sterling Ex..	4.8700	.....	4.8710	4.8705	4.8680	4.8690

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—Owing to a variety of causes the tone of silver has improved, and price has advanced to 23⅜d. Chief among these causes are a better feeling in India owing to the uptake of silver for the interior; buying on China account; covering by speculators, and some purchases on long account by those who are hopeful of business this coming year.

Copper, Tin, Lead and Zinc

Dec.-Jan.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
31	14⅜ @14⅝	14⅛ @14⅜	63⅝	29	4.15 @4.20	5.12½ @5.15	4.97½ @5.00
1	.....	.....	....	....	.....	.....	.....
2	14⅛ @14¾	14⅛ @14⅜	....	29	4.17½ @4.22½	5.15 @5.17½	5.00 @5.02½
4	14⅛ @14¾	14⅛ @14⅜	63⅞	29	4.17½ @4.22½	5.15 @5.20	5.00 @5.05
5	14⅛ @14¾	14¼ @14⅜	63 15/16	29	4.17½ @4.22½	5.15 @5.20	5.00 @5.05
6	14⅛ @14¾	14¼ @14⅜	63¾	28¾	4.17½ @4.22½	5.15 @5.20	5.00 @5.05

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The demand to which reference was made last week continued up to the close of the year, and round quantities of both electrolytic and Lake copper were sold to foreign and domestic consumers. Since the beginning of this week a much quieter tone prevails. The market closes higher and steady at 14½@14¾c. for Lake copper; 14¼@14⅜c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 14@14⅛ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb. Wire, 15¾c. base.

The London Standard market fluctuated within narrow limits and closes a fraction lower than last week, quotations being cabled at £63 15s. for spot, £64 10s. for three months.

Statistics for the second half of December show an increase in the visible supplies of 2000 tons.

Refined and manufactured sorts we quote: English tough, £67; best selected, £66@67; strong sheets, £78@79.

Tin—Transactions in the London market have been of small volume, but at rather steady prices. The close is somewhat softer at £131 for spot, £132 5s. for three months.

The domestic market displayed no special features. Interest among consumers is still lacking. At the close tin is offered at 28.75 cents.

Statistics for the month of December show a decrease in the visible supplies of 1200 tons.

Lead—Demand has been somewhat better, absorbing the lots offered from Missouri and by dealers, which had been hanging over the market. The close is firm and higher at 4.17½@4.22½c., New York.

Some life was infused into the London market, due to cables from Australia that a strike had broken out in the mines of the Broken Hill Proprietary Company. This news started an advance, the market reaching £13 7s. 6d. for Spanish lead on Monday last, but since then an easier tendency prevails and the close is lower at £13 3s. 9d. for Spanish lead. £13 6s. 3d. for English lead.

Spelter—Demand on the part of speculators and consumers brought about considerable activity, under the influence of which a good business was transacted at advancing prices. The close is firm at 5.15@5.20c. New York, 5@5.05c. St. Louis.

Reports from Europe are also more encouraging and the close is cabled at £21 5s. for good ordinaries, £21 10s. for specials.

Gold, Silver and Platinum in 1908

Review of the Influences and the Commercial Conditions Which Governed the Production and Price of the Three Precious Metals

WORLD'S GOLD PRODUCTION $436,222,000

The gold mines of the world in 1908 not only kept up the great production of recent years, but increased it by a considerable amount. In the accompanying table is given the approximate production for the year, comparison being made with the ascertained figures for 1907. Some corrections will, of course, be required when the final returns are received; but the necessary estimates have been made on a conservative basis, and it is not believed that any important changes will have to be made in the total.

GOLD PRODUCTION OF THE WORLD.

(In Dollars.)

	1907.	1908.
United States	$90,435,700	$96,313,000
Transvaal	133,352,381	145,500,000
Australasia	75,819,349	74,296,000
Russia	26,578,253	27,500,000
Mexico	17,820,000	18,750,000
Canada	8,264,765	9,350,000
Rhodesia	11,266,845	13,288,000
British India	10,857,648	10,925,000
West Africa	5,627,970	5,800,000
China, Japan and Korea	10,403,378	10,500,000
Other countries	23,336,836	24,000,000
Total	$413,793,125	$436,222,000

The figures given in the table above for the United States are the preliminary statement of the director of the Mint. For nearly all the important producing countries—the Transvaal, Australia, Rhodesia, India and others—we have reports covering 11 months of the year, from which it is possible to estimate the December returns very closely. For Russia we are dependent, owing to the slowness of official action in that country, upon incomplete and partial returns, which indicate a considerable gain. Mexico, also, is estimated from partial returns.

The total increase in 1908, as compared with 1907, was $22,428,125, or 5.4 per cent. The total gold production for 10 years past has been as follows, showing continuous gains, except in the years of the Boer war:

1899	$311,505,497	1904	$349,088,293
1900	258,829,703	1905	378,411,754
1901	260,877,429	1906	405,060,969
1902	298,812,493	1907	413,793,125
1903	329,475,401	1908	436,222,000

The gains in 1908, in the order of their importance, were from the Transvaal, the United States, Canada, Russia, Rhodesia and Mexico. Australasia alone of the large producers showed a decrease.

Gold and Silver Production in the United States

By Frederick Hobart.

There was a marked contrast in 1908 between the course of gold production and that of silver in the United States, the chief causes of which are briefly explained in the following pages.

Gold Production

Gold production in 1908 exceeded that of 1907 by 6.5 per cent., and was the greatest ever reported in a single year, nothwithstanding decreases in some of the leading States. The increase over 1906, heretofore the year of greatest production, was $1,939,455, or 2.1 per cent. In the following table is given the production by States, as estimated by Frank A. Leach, director of the United States Mint, from the returns of the various branch mints and assay offices. These figures will approximate closely the final returns, though there may be a slight readjustment as among the different States. The figures give the value of the output in dollars:

GOLD PRODUCTION OF THE UNITED STATES.

(In Values.)

	1907.	1908.	Changes.
Alabama	$27,400	$43,686	I. $16,286
Alaska	18,489,400	20,930,784	I. 2,441,384
Arizona	2,664,000	2,345,308	D. 318,692
California	16,853,500	19,581,570	I. 2,728,070
Colorado	20,897,600	22,811,784	I. 1,914,184
Georgia	64,800	48,918	D. 15,882
Idaho	1,255,900	1,450,830	I. 194,930
Maine	...	198	I. 198
Michigan	...	20	I. 20
Minnesota	...	1,265	I. 1,265
Montana	3,472,600	3,322,551	D. 150,049
Nevada	15,411,000	12,090,218	D. 3,320,782
New Hampshire	...	2,306	I. 2,306
New Mexico	330,000	240,756	D. 89,244
North Carolina	78,700	85,314	I. 6,614
Oregon	1,122,200	1,119,528	D. 102,672
South Carolina	58,100	58,336	I. 236
South Dakota	4,138,200	7,690,294	I. 3,552,094
Tennessee	3,800	3,186	D. 614
Texas	1,000	545	D. 455
Utah	5,121,600	3,930,290	D. 1,191,310
Virginia	8,300	4,321	D. 3,979
Washington	262,300	222,189	D. 40,111
Wyoming	9,400	1,773	D. 7,627
Other States	...	19,936	I. 19,936
Total U. S.	$90,369,800	$96,005,906	I. $5,636,106
Porto Rico	1,200	642	D. 558
Philippines	64,700	306,708	I. 242,008
Total	$90,435,700	$96,313,256	I. $5,877,556

The lowest point touched in gold production, since the California discoveries began to have their effect, was $30,800,000 in 1884. For eight years after that time there were fluctuations from year to year, but no great increases until 1893, when the upward movement began which has culminated in the present large production. The total output of the United States for 16 years past has been reported as follows:

GOLD PRODUCTION FOR 16 YEARS.

1893	$35,955,000	1901	$78,666,700
1894	39,500,000	1902	80,000,000
1895	46,610,000	1903	73,591,700
1896	53,088,000	1904	80,723,200
1897	57,363,000	1905	88,180,700
1898	64,463,000	1906	94,373,800
1899	71,053,000	1907	90,435,700
1900	79,171,000	1908	96,313,300

The main factors in the growth of the production here shown have been the new discoveries in Alaska and Nevada; the exploitation of the Cripple Creek and other camps in Colorado; the improvements in metallurgy which have resulted in closer saving and the extended working of lower grade ores; and the improvements in handling material which have made possible the working on a large scale of low-grade placer ground, as in the dredge-worked fields of California. It is difficult to say which of these factors is the most important; all of them have contributed materially to the gain in the output of gold, which is now more than three times as great as it was 20 years ago.

If we examine the table of 1908 production we find that six States produced over $5,000,000 each in 1907 or 1908, and from these there came in the latter year 90.4 per cent. of the total production. These States, classed in their order as producers in 1908, were:

	1907.	1908.
Colorado	$20,897,600	$22,811,784
Alaska	18,489,400	20,930,784
California	16,853,500	19,581,570
Nevada	15,411,000	12,090,218
South Dakota	4,138,200	7,690,294
Utah	5,121,600	3,930,290
Total	$80,911,300	$87,034,940

Four other States—Montana, Arizona, Idaho and Oregon—produced over $1,000,000 each in 1908; no other State reached a total as high as $250,000. In all 98.9 per cent. of the gold production was from 10 States, or Territories, all of them in the Rocky Mountain region or on the Pacific Coast. The Southern States, our oldest gold producers, made a very small showing, notwithstanding efforts made to revive some of the old mines in Alabama and North Carolina. In our foreign possessions Porto Rico reports only a trifling output; that of the Philippines showed a large increase, though the total is still small. That it is increasing proves that attention paid to the mineral resources of the Islands is beginning to produce substantial results.

Silver Production

Silver production in the United States in 1908 was the smallest reported in nearly 20 years, and was less than that of 1907 by 8.3 per cent. in quantity. The decrease in values is much greater—25.8 per cent.—as the average market price of silver in New York, on which the commercial values are calculated, fell from 65.327 cents per ounce in 1907 to 52.864 cents in 1908. As usual, the production of silver was affected by that of lead and copper, in connection with which metals most of the silver is won. The production for two years, as estimated by the director of the mint, is shown in the following table in ounces of fine silver:

SILVER PRODUCTION IN THE UNITED STATES.

(Fine Ounces.)

	1907.	1908.	Changes.
Alaska	179,250	201,988	I. 22,738
Arizona	2,903,050	3,046,137	I. 143,087
California	1,590,000	1,823,588	I. 233,588
Colorado	11,495,500	10,161,318	D. 1,334,182
Idaho	7,888,350	6,289,585	D. 1,598,765
Michigan	331,350	232,184	D. 99,166
Missouri	25,300	25,000	D. 300
Montana	11,129,550	11,518,913	I. 389,363
Nevada	8,280,450	9,322,828	I. 1,042,378
New Mexico	599,550	372,950	D. 226,600
North Carolina	25,150	16,090	D. 9,060
Oregon	96,050	109,640	I. 13,590
South Dakota	106,600	197,996	I. 91,396
Tennessee	58,350	59,876	I. 1,326
Texas	305,300	461,715	I. 156,415
Utah	11,406,800	7,718,872	D. 3,687,928
Washington	83,950	68,175	D. 15,775
Other States	10,000	167,495	I. 157,495
Total U. S.	56,514,550	51,794,350	D. 4,720,200
Porto Rico	.....	3	I. 3
Philippines	150	3,700	I. 3,550
Total	56,514,700	51,798,053	D. 4,716,647
Commercial value	$36,919,358	$27,382,523	D. $9,536,835

Three of the important silver producers—Montana, Nevada and Arizona—show gains, only that of Nevada being large. These increases were due to the greater output of copper carrying some silver. On the other hand there were heavy decreases in three important States—Colorado, Idaho and Utah. Idaho and Colorado are the largest silver-lead producers; in Utah the loss resulted largely from the smelter troubles, to which reference was made under gold production.

As above noted, the silver output of 1908 was the smallest reported for 20 years, with the single exception of the year 1894. The production for 20 years past has been, in fine ounces:

SILVER PRODUCTION FOR 20 YEARS.

1889	50,000,773	1899	54,764,000
1890	54,516,300	1900	57,647,000
1891	58,330,000	1901	55,214,000
1892	64,900,000	1902	55,500,000
1893	60,000,000	1903	54,300,000
1894	49,500,000	1904	57,786,100
1895	55,727,000	1905	56,101,600
1896	58,835,000	1906	56,517,900
1897	53,860,000	1907	56,514,700
1898	54,438,000	1908	51,798,053

It is not possible to analyze the underlying causes directly affecting the variations in the production of silver.

The Commercial Movement of Gold and Silver

By Frederick Hobart

The great production of gold as shown in the preceding columns, still continued in 1908. Its movement exercises a most important influence upon the commerce of the world; but in its turn is directed and influenced by the currents of that commerce. That the production of gold was not only maintained, but increased, did not prevent the occurrence of a year of general depression; though it served in some degree to mitigate the effects of that depression. The supply of gold, however, is one of the complexity of causes which affect and direct the commerce of the world, any discussion of which is impossible here.

The movement of silver, while far less important than that of gold, still has its place in commerce of sufficient importance to be carefully recorded.

Commercial Movement of Gold

The additions made to the world's visible stock of gold during 1908 amount in round figures to about $340,000,000, or about 75 per cent. of the total production during the year. This is, in all probability, the largest proportion of the production which has ever taken form and become a part of the world's circulating medium. That it did not prevent a depression which extended, in a greater or less degree, to all the commercial nations of the world is a remarkable fact. It was not sufficient to make up for the great absorption of capital which had been going on for several years previously.

Gold Movement in the United States

The gold movement in the United States for 11 months ended Nov. 31 was as follows:

	1907.	1908.
Exports	$54,211,240	$73,857,749
Imports	98,949,557	45,105,993
Excess	Imp. $44,738,317	Exp. $28,751,756

The statement for the full year, 1907, showed a total of imports amounting to $88,182,385. The movement for December, so far as reported, indicates that for 1908 there was a total of about $36,000,000 excess of exports. The imports in 1907 were swelled by the large amounts borrowed from European bankers in November and December to tide over the panic period; in 1908, toward the latter part of the year, it became necessary to repay in gold a part of these advances which had not been met by shipments of merchandise or transfers of securities. So far as can be estimated, the debt is not yet fully settled.

Gold Movement in Great Britain

The movement of gold in Great Britain for 11 months ended Nov. 30 is reported as follows:

	1907.	1908.
Imports	£49,366,663	£41,539,849
Exports	45,986,743	45,197,929
Excess	Imp. £ 3,319,866	Exp. £ 3,658,080

Great Britain has, therefore, been placed in the very unusual position of showing an excess of gold exports. This was largely due to the extraordinary demands from France, which appears just now to be the universal creditor. A decrease in the export trade in many staple products also had its influence.

Gold Movement in France

The gold movement in France is reported uptodate for only 10 months of the year, the figures being as follows:

	1907.	1908.
Imports	Fr. 389,243,000	Fr. 789,825,000
Exports	94,004,000	18,347,000
Excess, imports	Fr. 295,239,000	Fr. 771,478,000

France has been steadily accumulating gold throughout the year, the policy of its leading bankers having been, apparently, to draw gold from every possible source in order to secure their reserves against all possible financial and political contingencies.

Bank Gold Holdings

The gold holdings of the great European banks in the closing weeks of 1907 and 1908 compare as follows, the amounts being reduced to dollars:

	1907.	1908.	Changes.
England	$ 165,383,645	$ 165,087,430	D. $ 296,215
France	538,787,750	689,929,615	I. 151,141,865
Germany	137,140,000	192,155,000	I. 55,015,000
Aust.-Hun.	228,795,000	244,860,000	I. 16,065,000
Russia	607,125,000	606,805,000	D. 320,000
Netherl'ds.	38,239,100	41,933,000	I. 3,693,900
Belgium	17,610,000	20,103,335	I. 2,493,335
Italy	193,320,000	187,000,000	D. 6,320,000
Spain	78,210,000	78,965,000	I. 755,000
Sweden	20,325,000	21,215,000	I. 890,000
Norway	8,255,000	8,200,000	D. 55,000
Switzerl'nd	13,735,000	23,495,000	I. 9,760,000
Total	$2,046,925,595	$2,279,748,380	I. $232,822,785

The specie held by the associated New York banks in the last week of 1907 was $181,503,100; in the last week of 1908 it was $272,248,200, showing a large increase. This surplus includes silver coin as well as gold. The banks have materially strengthened their reserves as compared to a year ago; but these specie holdings were diminished by some $35,000,000 during the month of December.

The United States Treasury held on Dec. 1 a total of $188,480,313 available gold coin and bullion; besides this it held $850,817,869 deposited to secure gold notes outstanding and the so-called circulation reserve of $150,000,000; making a total accumulation of $1,189,298,182 in gold—the largest quantity ever gathered in one place. The amount of gold in circulation in the United States—including gold reserves held by banks—is estimated by the Treasury Department at $610,060,000; but it is believed that this estimate is too high, and that insufficient deductions have been made for losses, destruction by fire and other accidents, gold sent

out of the country and not reported, and other causes.

Deducting the excess of exports from the production of the year, the increase of the gold supply of the United States in 1908 was approximately $67,560,000. From this is again to be deducted the quantity used in the arts and otherwise absorbed or lost. Assuming the same ratio as for the world's general supply, the gold monetized or made available for the uses of commerce and trade in 1908 was approximately $50,500,000, an amount not much more than one-fourth of that which this country absorbed in 1907. At the present time it appears probable that the same conditions will extend through at least the earlier part of the new year.

It is probable that, as usual in time of depression, the quantity of gold absorbed and used in the arts decreased considerably during the year, not only in the United States, but also in Europe. The definite determination of this quantity is impossible at all times, even when accounts are summed up over a series of years, and it has always been more or less a matter of conjecture.

Commercial Movement of Silver

The movement of silver, while almost as great in quantity as in the previous year, was represented by lower values, owing to the steady decrease in prices. The exports and imports of silver in the United States for the 11 months ended Nov. 30 were as follows in value:

SILVER MOVEMENT IN THE UNITED STATES.

	1907.	1908.	Changes.
Exports.....	$57,212,168	$47,111,382	D. $10,100,786
Imports.....	41,630,324	37,814,676	D. 3,875,648
Net import.	$15,521,844	$ 9,296,706	D. $ 6,225,138

At the average values of the year the net exports in 1907 were approximately 23,760,000 oz., and 17,580,000 oz. in 1908; the decrease in quantity being 6,174,000 oz., or 26 per cent., while the decrease in values was 40.1 per cent.

Only a small proportion of the total exports—about $4,500,000 in 1908—went directly to the East, being shipped from San Francisco to Hongkong. The balance went chiefly to Europe, the greater part of it to the central market in London.

Silver Movement in Great Britain

The silver movement in Great Britain for 11 months ended Nov. 30 was as follows, in values:

SILVER MOVEMENT IN GREAT BRITAIN.

	1907.	1908.	Changes.
Exports.. ...	£15,813,329	£11,804,119	D. £4,009,210
Imports.....	14,667,024	9,588,812	D. 5,078,212
Excess, exp.	£ 1,146,305	£ 2,215,307	D. £1,069,002

Here again the decrease in values was much greater than that in quantities, owing to the lower prices. A special statement of the exports to the Far East from Great Britain is as follows, complete to Dec. 17, or within two weeks of the end of the year:

SILVER EXPORTS FROM LONDON TO THE EAST.

	1907.	1908.	Changes.
India.....	£10,531,354	£8,412,390	D. £2,118,964
China.....	417,350	641,400	I. 224,050
Straits.....	691,150	164,885	D. 526,265
Total.....	£11,639,854	£9,218,675	D. £2,421,179

The decrease in values here shown was 20.8 per cent. Owing to the lower prices, however, the fall in quantities was small, the total value above representing approximately 92,538,000 oz. in 1907, and 90,668,000 oz. in 1908, a decrease of only 1,970,000 oz., or 2.1 per cent.

From this table it appears that India has taken at least the same quantity of silver as in 1907, but there has been a large decrease in other Eastern countries. The Straits are practically out of the market, and have been so since the currency changes made in that British dependency two years ago. China took some quantities early in the year, but since then has been a seller, not a buyer, disposing of the surplus metal taken two years ago, chiefly in India, but occasionally in London.

Price of Silver

The price of silver showed a steady decline, almost uninterrupted, during the year. The following table shows the monthly averages of the quotations in London and New York for two years:

AVERAGE PRICES OF SILVER.

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25 738
February.....	68.835	56.000	31.852	25 855
March	67.519	55.365	31.326	25 576
April.....	65.462	54.505	30.253	25 183
May.....	65.971	52.795	30.471	24 377
June	67.090	53.563	30.893	24 760
July	68.144	53.115	31.366	24 514
August	68.745	51.683	31.637	23 858
September	67.792	51.720	31.313	23 877
October	62.435	51.431	28.863	23 726
November.....	58.677	49.647	27.164	22 933
December.....	54.565	48.769	25.362	22.493
Year.....	65.327	52.864	30.188	24.402

New York, cents per fine ounce; London, pence per standard ounce.

The average yearly quotation of silver in New York for 10 years past has been as follows in cents per fine ounce:

1899.....	59.580	1904.....	57.221
1900.....	61 330	1905.....	60.352
1901.....	58.950	1906.....	66.791
1902.....	52 160	1907	65.327
1903.....	52.570	1908	52.864

The average for 1908 was lower than in seven out of the 10 years included in the table.

The fall in prices, which reached the lowest point since 1902, was due, apparently, in part only to the lower demand from the East. The increase in supplies from Canada and Australia was another cause. There were also minor contributing factors. The demand for silver for use in the arts has been small, in consequence of the general condition of business. The United States Mint was not a buyer from early in the year till late in December. European mints, except the French mint, took less than the usual quantities. While of less importance than the trade with the East, these factors have had their effect.

Another point to be considered was the existence for several months of an extensive bear operation in London, ably directed by some large Chinese and Indian houses. Any movement for an advance was checked by offers of silver on Chinese account, by statements of large shipments from China direct to India, and by reports of large accumulations of unsold metal in India. This bear movement, it is believed, is almost at an end.

United States Mint Purchases

Purchase of silver by the United States Mint, for purposes of subsidiary coinage, were much smaller in 1908 than in 1907, when 14,776,500 oz. were taken. In 1908, up to April 30, these purchases amounted to 4,978,300 oz. at prices varying from 58.067 down to 54.612c., the average price paid being 55.723c. From April the mint was out of the market until late in December, when it purchased 125,000 oz. at 49.118c. delivered. The total silver bought was only about one-third of that taken in the preceding year.

Platinum

The imports of platinum into the United States for the 11 months ended Nov. 30 were 68,712 oz. in 1907, and 38,857 oz. in 1908; a decrease of 29,855 oz. This indicates a large decline in demand, as was to be expected from the general depression of business. It must be noted that a large part of the platinum sold is not consumed in the ordinary sense of the word, but returns to dealers in the form of scrap, practically uninjured, and ready for use as new metal.

At the close of 1907 refined platinum was quoted in New York at $26 per oz.; during that year it had been as high as $38. During 1908 the price receded from $26 to about $22 in July. For two or three months the market was disturbed by offers of the metal at $18 and even as low as $17; the source of these offers, or at least of the supply of metal, being involved in some mystery. These offers gradually ceased, and in November and December of the year prices recovered. At the close of the year dealers quote $24@24.50 for refined platinum; $26@26.50 for hard, which contains some iridium; and $20@22 for good scrap.

The market for Russian platinum is controlled by a syndicate of Paris and London speculators, whose usual course is to depress prices, make long contracts with the Ural producers, and then exact from consumers all they will pay. This course is made possible by the limited quantity of the output, and the fact that there is no substitute for the metal known, in most of its uses.

The Copper Production of North America

The Production of the United States was 952,395,477 Pounds; of Mexico, 84,159,000 Pounds; of Canada, 53,494,202 Pounds

DECREASE IN REFINERY PRODUCTION

The production of copper in the United States in 1908 is given in Table I. These statistics are compiled in the same way as those for 1907, which for the first time stated the production upon the uniform basis of output of Michigan mines plus fine copper content of blister copper. The statistics for 1908 are computed from reports of all the producers, with a few insignificant exceptions, who have stated their actual production for the first 11 months with their own estimates for December. The reports having been received in most cases after the middle of the month and in some cases after the close of the year the estimates are probably close. However, some large smelters frequently make clean-ups at the end of the year that turn out larger or smaller than expected, and even in the possession of the complete data for computing copper production there are numerous items whereof the entry or rejection is necessarily a matter of opinion, wherefore the final report will doubtless show a difference of perhaps 1 per cent. from this preliminary report.

I. PRODUCTION OF COPPER.

Group.	1907.	1908.
Michigan mines	220,317,041	221,500,000
Smelters in Arizona and Texas	262,597,624	293,365,977
Smelters in Montana and Wyoming	229,362,164	258,102,000
Smelters in Utah and Nevada	90,100,052	81,051,799
Smelters on Pacific Coast (*a*)	21,936,026	40,698,720
Smelters in Mississippi Valley	24,062,550	24,019,355
Smelters on Atlantic Coast(*a*)	13,640,930	15,190,847
Smelters in Tennessee	14,784,379	14,750,000
Miscellaneous(*b*)	2,441,000	3,716,779
Totals	879,241,766	952,395,477

(*a*) These statistics do not measure the relative importance of these groups of smelters which produce much copper from foreign ore. (*b*) Includes exports of ore and matte and copper produced by lead desilverizers.

II. PRODUCTION OF COPPER BY STATES.

State.	1907.	1908.
Alaska	6,610,680	5,311,600
Arizona	256,866,761	288,885,644
California	34,398,823	37,529,007
Colorado	13,344,118	15,042,312
Idaho	11,471,101	9,125,797
Michigan	220,317,041	221,500,000
Montana	226,290,873	255,446,447
Nevada	1,462,450	11,362,638
New Mexico	8,652,873	5,737,505
Utah	68,333,115	75,298,906
Wyoming	2,919,137	2,551,468
South and East (*a*)	22,408,696	20,182,328
Other States(*b*)	6,166,098	4,421,825
Total	879,241,766	952,395,477

(*a*) Includes Vermont, New Hampshire, Pennsylvania, Virginia, North Carolina, Alabama and Tennessee. (*b*) Includes Washington, Oregon, South Dakota, Texas, and the production of the lead desilverizers and others which it is impossible to distribute according to place of origin.

III. CONSUMPTION OF COPPER.(*a*)

	1907.	1908.
Stock Jan. 1	9,000,000	120,000,000
Imports of refined	5,000,000	None
Production	1,152,747,890	1,105,000,000
Total supply	1,166,747,890	1,225,000,000
Exports	508,929,401	664,000,000
Remaining in U. S.	657,818,489	561,000,000
Stock Dec. 31	120,000,000	(*b*)
Delivered for consumption	537,818,489	(*b*)

(*a*) The figures for 1908 in this table are *estimates*, and are to be taken only as an attempt at a generalization. The stock of refined copper Jan. 1, 1908, is well established. As for the production, we take the American output of blister and Lake copper (952,000,000 lb.), plus the imports (212,000,000 lb.), plus 20,000,000 lb. for copper remelted from scrap and junk, the last being a guess based only upon the production in 1907. (It is well-known that much less of this material is reclaimed at low than at high prices.) From the total of 1,184,000,000 lb. it is necessary to deduct 10,000,000 for copper marketed as bluestone, and 9,000,000 lb. for ore and matte, included in the United States production, which was exported to Mexico and Canada and figures again in the imports from those countries. We make a further deduction of 60,000,000 lb. for blister copper included in the statistics of production and imports that could not have been turned out as refined before the end of 1908. This leaves 561,000,000 as available for consumption in the United States. The separation of this into consumption and stock is uncertain. There has been an idea in the trade that the domestic consumption has been smaller than in 1907, which has probably been the case, but there are no authoritative statistics upon this subject nor upon the amount of stock on hand. (*b*) No reliable data available.

The allocation of the production among the States and Territories can never be made with precision; that being so in the case of the final statistics, the distribution at this early date is necessarily less perfect. So far as possible we have made a distribution in Table II. The figures for Arizona, Michigan and Montana are probably close; those for California, Nevada and Utah will undergo more revision, California and Nevada probably to gain at the expense of Utah.

We made no attempt to collect statistics of the production of refined copper at this early date. The total is doubtless less than in 1907. At the beginning of 1908 the refineries were just feeling the curtailment begun at the mines 60 to 90 days earlier. At the end of 1908 they were not yet turning out the big output of Washoe, Cananea and Steptoe in November and December. Basing our estimates on such data, together with the production and importation of blister copper, we compute the production of refined and amount available for consumption in Table III.

Production of Copper in Mexico

On the basis of the net imports into the United States plus the Boleo production, the copper production of Mexico in 1907 was 126,710,000 lb. Figuring in the same way, the production in 1908 was 84,159,000 lb. Our reports from nine smelting works, producing blister from Mexican material, give 85,476,763. Boleo and Moctezuma increased their production, but not enough to offset the decrease from Cananea, which was idle during the major part of the year and Teziutlan, idle throughout the year. Operations are now in full swing again at Cananea, the new concentrator at Moctezuma is working, and the new smeltery at Teziutlan is to be blown in during February, 1909. Boleo was the largest producer in Mexico in 1908; Aguascalientes next, and Cananea third.

Production of Copper in Canada

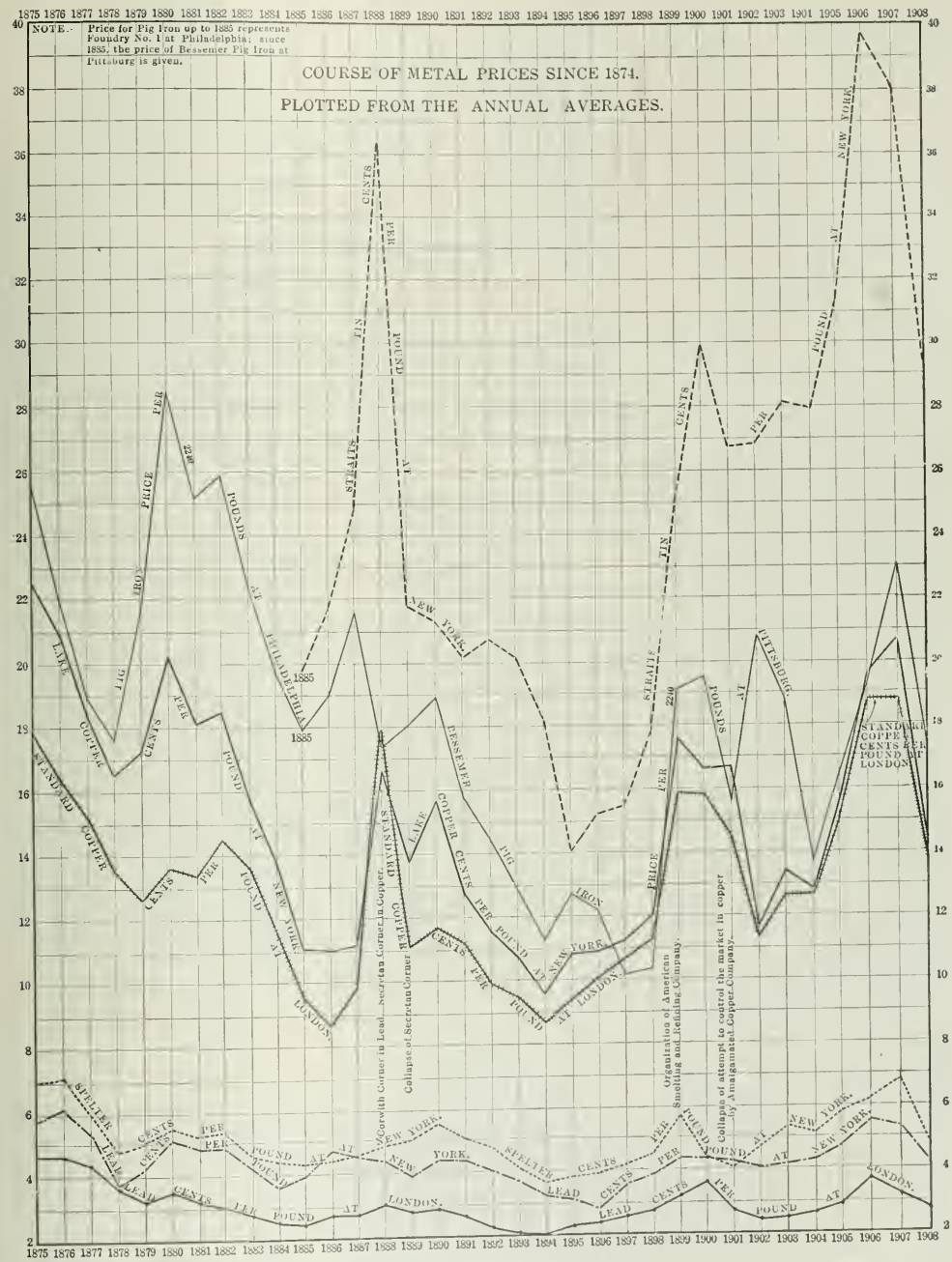
The copper production in the Dominion, computed from direct reports from all of the producers was 53,494,202 lb. in 1908, compared to 46,356,382 lb. in 1907. The production in 1908 by districts was approximately as follows:

Boundary	26,361,483
Rossland	5,538,207
Coast	1,849,473
Ontario and Quebec	19,612,243
Nova Scotia	122,000
Miscellaneous	10,796
Total	53,494,202

The above statistics are computed on the basis of blister copper reported. Several smelters producing matte in Canada reported matte shipments in excess of the blister reported by the concerns converting their product, the difference being explained, of course, by material in transit and accumulated in stock.

The Copper Market at New York

The severe financial depression which culminated in the fall of 1907 had a highly disturbing influence on all industries, but especially on those that are the principal users of copper. Money became exceedingly scarce, interest rates in consequence very high, and the uncertainty



as to the future did not tend to encourage large commitments on the part of the great financial institutions in this country. The railroads, our chief consumers, were particularly affected by such conditions, which in their case were further aggravated by hostile legislation in a great many States, directed toward a regulation of freight and passenger rates. Improvements under way were stopped and plans for further extensions abandoned.

All this, and similarly unfavorable conditions in other industries, naturally affected to a large extent the consumption

of copper, so that an accumulation of approximately 120,000,000 lb. of refined at the beginning of the year was the result. Production on all sides was curtailed.

Fortunately, much better conditions existed in Europe as far as consumption of copper was concerned, and exports from this side reached record-breaking proportions. These and a gradual improvement in consumption in this country disposed of a large part of the accumulated stocks and current production by early spring. By this time, money became more plentiful and rates of interest were once more on a normal level, so that home consumers, who had all along been most conservative and in buying had covered their immediate requirements only, began to show some interest in purchases for future delivery, something they had not done for almost a year. However, by the middle of the year there was again an accumulation of unsold stock.

Late in the summer, production was in full swing, and while the old camps had resumed normal operations, the new producers in Nevada and Utah also made themselves felt. In the Fall, when it became apparent that a Republican victory at the Presidential election was assured, buying of copper among consumers became general and requirements up to the end of the year were covered. These purchases and continued large exports to Europe took care of current production.

The outlook for copper is fairly favorable. The market is not burdened with an enormous stock, that in this country being no larger than at the beginning of the year, while that in Europe, although much larger than for some years past, is not any bigger than was considered the normal supply at a period when production of copper was only about one-half of what it is now. On the other hand, consumers have not anticipated their wants and will have to replenish their stocks of copper whenever new business is entertained by them.

The year 1908 opened with prices ruling at about 13¾ for Lake copper and 13½ for electrolytic. During January, there was an entire absence of demand on the part of domestic consumers. Europe, however, continued a large buyer and thus sustained prices, which at the end of the month had advanced to 13⅞c. for Lake and 13¾ for electrolytic.

In February it developed that for the time being European buyers were satisfied, and an effort was made by American holders to induce fresh purchases through a reduction in prices, which gradually established quotations at the end of the month on basis of 12⅞c. for Lake and 12⅝c. for electrolytic. These low prices had the desired effect, and the Chinese, who are always alert to any undue depression in the price of copper also became buyers to a moderate extent. The demand thus created, however, was not of long duration, and by the first part of March quotations stood at 12½c for Lake and 12¼c. for electrolytic. Domestic consumers at that time took hold of the market, so that a steady improvement set in and prices advanced at the end of the month to 13⅛c. for Lake and 13c. for electrolytic.

Prices remained on about this level during April, when fairly large quantities were purchased by home consumers for nearby delivery to take care of orders booked by them. Interest was also evinced in purchases for more distant delivery.

In May, fairly large quantities of copper were pressed on the market by Japanese holders, owing to a severe financial crisis then existing in the Far East, and tended to unsettle prices, which declined toward the middle of the month to 12¾c. for Lake and 12½c. for electrolytic. At the end of the month, some improvement was again noticeable, brought about by the more confident feeling shown in the stock exchanges of the world, and quotations were established at 12⅞c. for Lake and 12⅝c. for electrolytic.

In June, activity continued to a moderate degree, and prices practically remained unchanged. By this time a slow but gradual improvement had manifested itself in the more important copper-consuming industries. For instance, the wire industry, which during January had stood at 25 per cent. of the normal capacity, showed an increase in February to 33 per cent., March 40 per cent., April 50 per cent. and May-June 60 per cent.

This improvement made still further progress in July and both domestic and foreign consumers were buyers of large quantities of copper. In consequence of these transactions, prices advanced during August to 13⅞c. for Lake and 13⅝c. for electrolytic. A disturbing influence toward the second half of that month were offerings of copper held by speculators, which lots, however, were readily picked up by consumers at a discount from prices quoted by first hands.

After the great activity during the preceding two months, a reaction was to be expected, and occurred during September. First hands were, thanks to the large sales made, in a comfortable position, and did not press on the market. Sundry small lots of second-hand copper, however, were offered and made themselves disturbingly felt. Prices declined steadily, and at the end of September closed at 13½c. for Lake and 13¼c. for electrolytic.

The approaching elections had a restricting influence on buyers during the first half of October. The feeling as to the outcome of the elections became more hopeful during the second half of October and influenced by a cheerful tone on the stock exchange, which inspired confidence, buyers took hold of the market in earnest. Enormous quantities of copper were purchased during the last 10 days of October and immediately after the election of Mr. Taft, so that prices advanced by leaps and bounds and on November 10 reached a basis of 14¾c. for Lake and 14⅜c. for electrolytic. The activity of the market, however, received a check during the second half of November, when the demand subsided and when copper bought by speculators during the advance was realized upon. While necessarily under these conditions prices had to decline somewhat from the high level, many of the first hands showed no disposition to enter the market, having practically disposed of all the copper that they expected to have available up to the end of the year. The undertone, therefore, remained sound and prices steady at a level of 14¼@14½c. for Lake and 14@14¼c. for electrolytic. These conditions lasted nearly to the end of December, the holiday season always exercising a check upon business, but at the end the market started upward, the year closing with 14½c. for Lake and 14⅛c. for electrolytic.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January...	24.404	13.726	24.825	13.901	106.739	62 386
February..	24.869	12.905	25.236	13.098	107.356	58 786
March	25.065	12.704	25.660	12.876	106.594	58 761
April	24.224	12.743	25.260	12.928	98.625	58 331
May,.....	24.048	12.598	25.072	12.788	102.376	57 387
June.....	21.665	12.576	24.140	12.877	97.272	57 842
July.....	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.256	13.639	79.679	60 500
September	15.565	13.388	16.047	13.600	68.375	60 338
October	13.169	13.354	13.561	13.646	60.717	60 139
November.	13.391	14.130	13.870	14.386	61.226	63 417
December.	13.163	14.111	13.393	14.411	60.113	62.943
Year.....	20.004	13.208	20.661	13.424	87.007	59.902

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

Copper in Arizona

By James Douglas*

The financial gloom with which the past year opened did not acutely affect the large copper mines of Arizona, if we may judge by their activity. The Verde ran continuously and produced its normal output. In the south the Warren district increased rather than diminished its contribution, and the Clifton witnessed no falling off.

In Arizona's neighbor, Sonora, the Greene-Cananea Company, which shut down in October of 1907, resumed work

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in September of 1908, under the management of Dr. L. D. Ricketts. The concentrating plant, which had been built from designs by Doctor Ricketts during the previous administration, underwent no change. But the furnace and converting plants were completely rebuilt on the old site; the reverberatory was remodeled advantageously, in both its smelting and steam-generating qualities; the bedding and conveying devices, which had been planned by Arthur S. Dwight and the Robins company, were put into working order, and justified the economical results which were claimed for them. Notable saving in cost of smelting resulted, and all and more than was expected has been realized from the introduction of the caving and milling system in the mines. This great property has resumed work with every probability of attaining success, despite the enormous capital with which it is overburdened. C. F. Shelby has, in the JOURNAL, described with such candor and fullness of detail most of the improvements introduced in his smelting department so that outside testimony would be superfluous.

At Nacozari the old mill was put, perhaps only temporarily, out of commission, and the new mill of 2000 tons capacity is treating 1500 tons of Pilares ore a day. The concentrates are still shipped for metallurgical treatment to Douglas, and yield in copper about 2,000,000 lb. a month. The economies obtained at Cananea in the reverberatory smelting, with oil as fuel, of concentrates and flue dust, revived the discussion of the wisdom of the resumption of smelting at Nacozari. In addition to discarding the old concentrator, the gas plant and gas engines have been supplanted by a large power plant in which Curtis engines are used to operate the generators. The wood gas and gas engines were not rejected on account of dissatisfaction with cost, but the size of the new transmission plant required for moving the new mill, and supplying the necessary power to the mines would have demanded a cumbersome equipment of gas engines. Accurate estimates of cost of a horsepower under the two systems have not yet been made.

Bisbee and Douglas

At Bisbee preparations have almost been completed to hoist by a skip ore from every section of the mine through the new Sacramento shaft; then to load a train of cars by a belt and tripper and by this means to secure a uniform mixture. In the central power house, situated near the Sacramento shaft, power is derived from Curtis turbines, and is distributed for underground haulage by electric current and by compressed air to the engines of the old shafts, which will be used only for the hoisting of timber and of men.

At Douglas the Calumet & Arizona works were not only enlarged, but also rearranged to meet the increased demands made on them by the production of the Superior & Pittsburg mines. At the Copper Queen Douglas reduction works the shipment of about 300 tons of concentrates a day from Nacozari, necessitates a modification of both method and plant. Experiments are under way to determine whether sintering or reverberatory smelting will be used as a supplement to the blast-furnace practice.

Nothing of note occurred in the Clifton district, but the output of all the three smelting companies shows an increase.

Other Districts

In the Warren district the Copper Queen produced less than in 1907, and the joint mines of the Calumet & Arizona and Superior & Pittsburg much more than in 1907. The result of the mining in the Warren and Clifton districts will probably show an increase for 1908 over 1907 of approximately two and a half million pounds.

The Imperial company erected a second furnace and contemplates the building of a third. Saddle Mountain, Twin Butte, Helvetia and most of the smaller mines, have not resumed operations, or are working in a very languid way.

The Old Dominion furnaces exceeded their 1907 output by about 940,729 lb., and of the total output about 30,560,832 lb. came from the company's own mines. The development of the Miami mine and the success in floating that company gave a great impulse to both mining and smelting in that territory; but last year none of the companies except the Old Dominion was a large producer.

The closure of the smelter on the Agua Fria continues to impede general copper mining in Yavapai county.

During the year 1908 a new district loomed up as a possible large producer. As far back as the prosperous Tombstone days the Turquoise district, situated in the foothills of the Dragoons where they sink into the Sulphur Spring valley, attracted much attention on account of its silver mines. They were said to have been abandoned on account of the refractory character of the ore and the presence of copper. Nearby there has, of late, been opened in what is known as the Courtland district, by the Calumet & Arizona Company and by the Great Western Mining Company, a most promising bed of copper carbonate in a manganese gangue. The deposit is in limestone cut by intrusive rocks, and the geological conditions, as well as the actual developments promise well. The year, 1909, will determine whether another notable district will add to the already large production of the Territory. If so, it will maintain its supremacy for all of the running mines; unless overtaken by accidents or unfavorable general conditions, will maintain to the full their present output, and some, such as those of the Calumet & Arizona and Old Dominion companies, will probably show an increase. The low-grade mines of Gila county, notably the Miami, may contribute something to the year's total, but it will not be much, as the Miami mill will not be running till 1909 is nearly drawing to a close.

Production of the Year

Under the tax law passed by the legislature of Arizona in 1907, the gross product of the mines and mining claims is taxed, and, therefore, the tax statement gives besides the quantity, the actual gross value of the copper, gold and silver extracted from the minerals mined in the Territory. The law was pased in 1907, but was effective for taxes due for 1906. The returns are, therefore, available for 1906 and 1907.

The number of companies taxed in 1906 was 62, which was increased to 80 in 1907.

The total quantity and value assessed in 1906 was: Copper, 255,012,155 lb.; gold, 125,016 oz.; silver, 2,704,044 oz., with a total gross value of $53,891,781. In 1907 the figures were: Copper, 253,784,698 lb.; gold, 118,374 oz.; silver, 2,423,723 oz., with a total gross value of $54,788,674.

In both years the Copper Queen heads the list of gross value of product with $14,236,428 in 1906, and $13,699,107 in 1907. In 1906 and 1907 the United Verde comes next with $8,038,126 and $7,060,126. The Calumet & Arizona follows with $7,337,748 in 1906, and $6,226,664 in 1907. The Arizona Copper Company occupied the same position in both years with $4,973,400 in 1906 and $6,160,050 in 1907. In 1906 there are only three other companies, all copper companies, which produced more than $1,000,000, whereas in 1907 there were five.

The most equitable system of taxing mines is a question upon which there is great difference of opinion. As the rate is assumed to be adjusted to the total value of the property taxed, the total value of the product in metal or mineral of mines, above a given minimum, is perhaps open to less ambiguity than a valuation of product based on net returns, as is the system applied in Montana. The Butte mines in 1907 were taxed on the following net returns:

		Net Proceeds.
Anaconda	1-1*	$5,456,395
Anaconda	1-B	362,790
Butte & Boston	1-1	1,239,055
Butte & Boston	1-B	10,412
Boston & Montana	1-1	7,049,988
North Butte	1-1	3,271,214
Parrot Silver	1-1	14,300
Parrot Silver	1-B	127,431
Red Metal	1-1	1,432,761
Trenton	1-1	481,624
Original Consolidated	1-B	663,260
Monidah Trust	1-B	3,053
La France	1-W	151,013
Clark-Montana Realty	1-B	188
Total net proceeds		$20,263,482

Deductions may be drawn from the tables as to cost of production, but they will be of doubtful accuracy.

*1-1 means outside city limits, levy 18¼ mills; 1-B means inside city limits, levy 29 7/20 mills; 1-W means inside Walkerville city limits, levy 28¼ mills.

The Lake Superior Copper District

By C. L. C. Fichtel.*

The year 1908 in the Lake Superior copper district was noted for the vast amount of exploratory and development work done, practically all of the producing mines inaugurating this policy. The known lodes traversing the various properties were opened and great tracts of virgin ground were investigated. The producing mines throughout the district were operated consistently and production will be about the same as for 1907. Osceola will show a decided increase, Copper Range will be about the same (the increased production at the Champion and Baltic properties making up for any falling off in the Trimountain), and the Calumet & Hecla mines will, in all probability, show a slight decrease due to the conglomerate lode gradually diminishing with depth in its mineral yield, the rock now running about 40 lb. to the ton. The year was devoid of any labor troubles, or serious casualties and as a whole was very prosperous.

Keweenaw County.

The Keweenaw Copper Company became a producer. Its Medora shaft was sunk below the 13th level and the bottom levels were extended and showed a decided improvement at depth. The Phœnix mill, owned by this company, was overhauled and equipped with Woodbury jigs and at the close of the year was handling about 120 tons of rock daily. The Keweenaw Central railroad was completed during the summer months and regular freight and passenger service was maintained between Calumet and Mandan.

The Tamarack Company operated the old Cliff property throughout the year and openings were extended on several of the fissure veins running across the property. Rock shipment averaging about 80 tons weekly were shipped to this company's mill for treatment. During the last part of the year the shaft on the Avery tract was unwatered and cleaned out preparatory to sinking.

The Ojibway company made remarkable progress during the year, sinking both its shafts below 600 ft. and exposing the lode at the first and second levels of No. 2 shaft and the first level of No. 1 shaft. This was accomplished by crosscuts, the shafts being in the footwall side; the lode opened at No. 1 shaft was especially rich The surface equipment is complete and the railway now runs into the property.

Exploratory work was started on the Seneca tract and a shaft was sunk about 175 ft. The surface equipment was completed and is sufficient to carry the property through its development stages. The shaft is sunk in the footwall about 75 ft. behind the lode which will be reached by crosscuts. Considerable diamond drilling was done previous to shaft sinking.

The Gratiot property under the management of the Calumet & Hecla company was opened thoroughly. Both shafts were sunk deeper and drifts were extended; the showing is indicative of better results.

All five shafts of the Mohawk company were sunk deeper and drifts were extended from the various levels. At No. 5 shaft, the newest of the openings, the ground was especially good; this shaft was equipped during the year with its permanent hoisting plant. The stamp mill ran satisfactorily and treated an average of about 2000 tons of rock daily.

The Ahmeek company started sinking two new shafts to work the northern and central portions of the tract. These shafts will encounter the lode at about 1200 ft. Openings in the two producing shafts were extended and the ground opened to the south was especially good. At the fifth level of No. 2 shaft the south drift encountered a fissure of mohawkite. The company also purchased a mill site on the shores of Torch lake and began the erection of a modern four-head stamp mill which will be ready during the summer of 1909.

Both shafts of the Allouez company were sunk deeper and No. 2 shaft is approaching the lode and it is expected that it will be cut early in 1909. The lode has been opened from this shaft by a crosscut at the 6th level and a drift, connecting the two shafts, was holed through. No. 1 shaft maintained rock shipments to the mill averaging about 650 tons daily.

Houghton County.

A new hoisting equipment was installed at the Wolverine's northern shaft and at the stamp mill two heads were converted into steeple compound. Conditions underground are in fine shape and the property continues one of the most successful on the lake.

The Centennial company sank both its shafts deeper and the drifts north from No. 2 shaft entered the zone of the Wolverine mineralization and excellent rock was mined. At the stamp mill, owned jointly by the Centennial and Allouez companies a 3-head addition was built to the building and two heads were installed.

The Calumet & Hecla company did a vast amount of construction work during the year; the pumping station at Lake Superior was electrically equipped and consists of a 3,000,000-gal. multi-stage centrifugal pump, with its accessories. The station required the erection of a high-tension transmission line about 5 miles long. A series of pumps were installed underground at the north end of the property; a large addition was built to the foundry and a complete drill-sharpening plant was installed. At the stamp mill the twenty 510-h.p. boilers, comprising the new plant, went into commission and at the company's electric-power plant the third 2000-kw. generator was installed, bringing this plant up to about 11,000 h.p. The first section of the large regrinding mill was equipped and is ready to go into regular service; throughout the mills all railway trestles were remodeled and structural steel replaced all wooden construction; this was made necessary by the additional weight of trains used on the standard-gage equipment. All the shafts on the main, or conglomerate lode were operated but the copper content of the rock gradually decreased and the available working ground in some of the shafts is becoming exhausted. The Osceola amygdaloid formation was opened extensively. All 6 shafts were sunk deeper, new ground was opened and the upper drifts were extended. Nos. 13 and 16 shafts were equipped with two skip roads and No. 15 will soon be ready. The company operated one shaft on the Kearsarge lode (No. 21) and with the additional depth and openings especially good rock was exposed. Exploratory work was carried on by this company in Ontonagon county, on the White Pines and Nonesuch tracts.

At No. 1 shaft of the Tamarack company all rock hoisting was suspended and the shaft was equipped to handle all the water from the underground openings; all water-way connections were made with the working shaft and also with the Tamarack Jr. property. At No. 2 shaft arrangements were made to install the Kimberly skip system. The company has discontinued sinking its shafts vertically, and henceforth all additional depths will be obtained by subshafts sunk on the vein.

The Osceola company materially increased its production during the year; No. 6 shaft opened up especially good ground. This shaft was equipped with 6-ton skips and its hoisting facilities were strengthened. Both the North and South Kearsarge branches of this company are in fine shape. No. 4 shaft of the North Kearsarge, the newest of the openings, disclosed the lode by crosscuts from three different levels and found it well mineralized.

The LaSalle, a subsidiary company of the Calumet & Hecla company, was opened consistently. The Tecumseh shaft showed good copper rock, but the two shafts on the Caldwell tract gave indifferent results; sinking was suspended on

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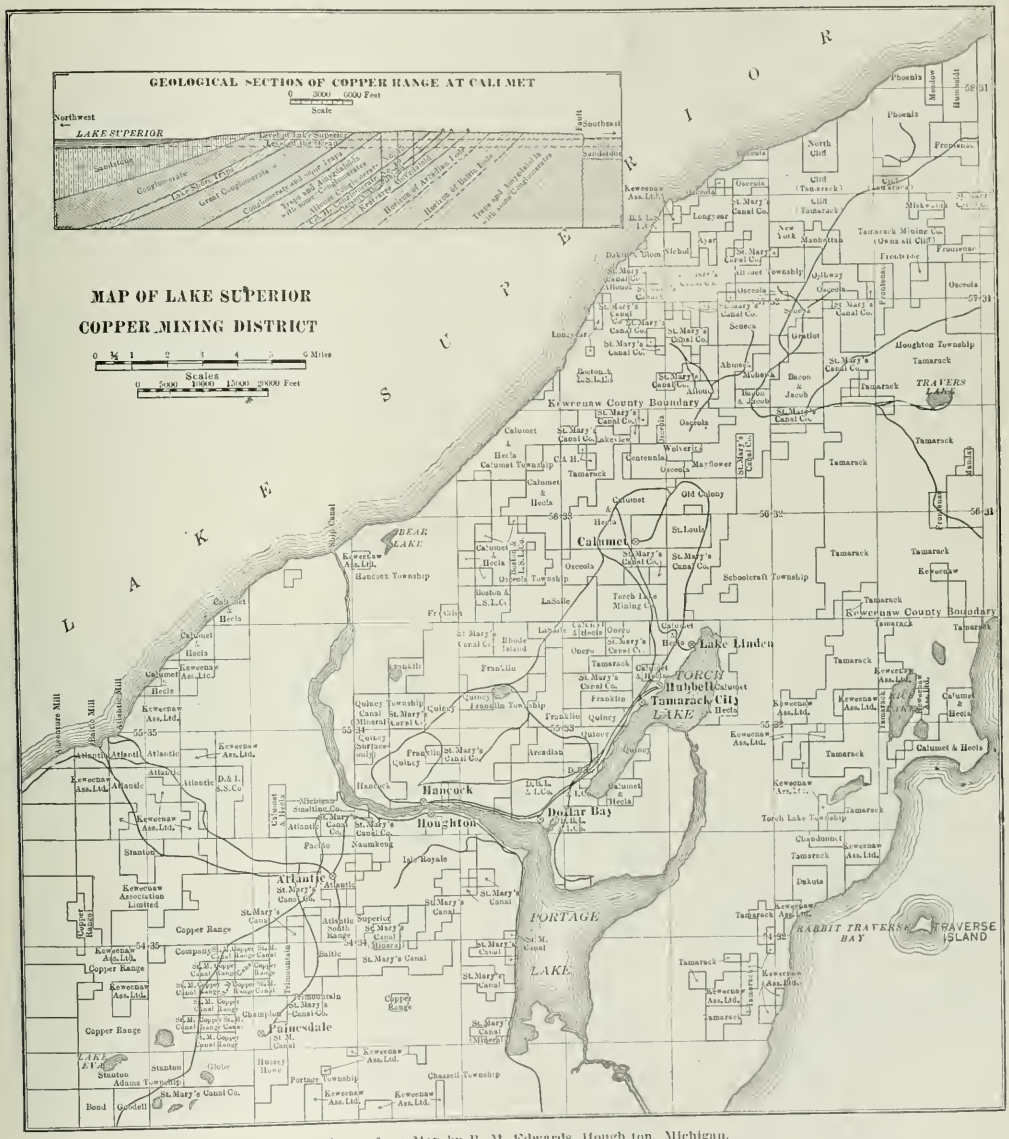
this tract and crosscutting was started to open more fully the surrounding territory. Operations at the Rhode Island property were centered in drifting on the Pewabic lode from the 10th level of its shaft.

some land belonging to the St. Mary's Mineral Land company. Under such conditions development will be centered upon the Pewabic lode as the main working body.

The Arcadian changed management

shaft known as the Pontiac, or No. 9, which is down 200 ft. in good copper rock; the shaft will develop the northern portion of the tract. A new steel shaft house was erected on the site of No. 2 shaft and is a model in all respects. At



Redrawn from Map by R. M. Edwards, Houghton, Michigan.

The Franklin company opened the Pewabic lode at depth by crosscuts extended from the conglomerate shaft and at the 23d level the lode was exposed highly mineralized. In all probability a consolidation will be effected between the Franklin and Rhode Island companies, including

during the year and its office was removed to Houghton, Mich. The company did not do any active work, being out of funds, but at a meeting to be held early in 1909 reorganization will be effected and work should be resumed.

The Quincy company started a new

the stamp mill the single-cylinder heads have been equipped with 24-in. single cylinders and excellent results are being obtained. This company will, if present plans materialize, take over a portion of the old Franklin workings.

The Hancock company sank its large

5-compartment shaft below the 15th level and from the 13th level started a crosscut to connect with No. 1 shaft; this shaft has reached its permanent bottom at the 14th level and all additional ground will be worked through No. 2 shaft. At No. 1 shaft the crosscuts opened the west lode and found it more uniform and of a better grade than the Hancock lode and this will be the main working lode hereafter.

The three southern shafts of the Isle Royale company, viz., Nos. 4, 5 and 6, were furnished with permanent equipment and will soon be in position to aid materially in production. This company is also developing the extension of the Baltic lode by a shaft sunk in section 11, which carries the lode.

No. 1 shaft of the Superior property was widened to accommodate two skip ways. This shaft has opened the lode by crosscuts for 10 levels; a fine grade of rock shows below the 5th level. Sinking was resumed at No. 2 shaft. The surface equipment was enlarged, additional hoisting and compressor facilities were added, and railway connections were made to the Atlantic mill, which is to treat its output temporarily. The company is on the verge of becoming a producer and has as fine prospects as any Lake Superior copper mine.

At the Atlantic mine all operations were centered at its section 16 tract, where the shaft was put down below the 18th level. The same shattered condition continued in the shaft with depth, but the extensions of the drifts, especially to the south encountered a more substantial formation. The rock was sorted the last few weeks of the year and as it accumulated was put through the mill. This shaft will be in shape, early in 1909 to maintain regular shipments.

The Champion and Baltic mines of the Copper Range Consolidated Company closed the year in fine shape; many improvements were made both at the mines and mills. The Trimountain is gradually approaching the other two in production; the ends of the property are revealing a good grade of rock and with depth a better showing is being made in the central portions of the mine. The shaft on the Globe tract, held under option by this company, cut the lode at a depth of about 1000 ft. and drifting was started but results were unsatisfactory; copper-bearing rock appeared from time to time, but it had no commercial value. This company is also diamond drilling on sections 7 and 8 to open the old Atlantic lode.

Ontonagon County

The Elm River company started a vertical shaft on the site of an old test pit and it is down well in the ledge; when sufficient depth has been reached it is planned to drive a crosscut east to cut the various formation supposed to traverse the tract.

The Wyandot began crosscutting from the bottom of its exploratory shaft 700 ft. from surface and encountered an amygdaloid formation carrying a small seam of copper; drifting to ascertain its condition was recently started.

The shafts of the Winona property were sunk deeper and the lode was cut at the various levels by crosscuts which revealed a satisfactory mineralization in all cases and improved with depth. The electrically operated hoisting plant went into commission and is doing regular service.

The King Phillip property, under the management of the St. Mary's Mineral Land Company, was systematically opened on the Winona lode. No. 1 shaft is below the 8th level and the lode, cut at this point by a crosscut, was encouraging. No 2 shaft is sinking close to the 2d level. A duplicate electric hoisting plant was installed at this property, and power is received from the Winona plant.

The wonderful showing, opened close to surface, at the Lake property has continued with depth. The shaft was put down to about 370 ft. without any change in the formation and drifts, extended from the 1st and 2d levels, are breasted in the same rich ground. An enlarged equipment was installed and a railway spur was laid to the shaft site.

The lands adjoining this property on the north and east aggregating about 1120 acres were taken over by the North Lake company and diamond drilling was started to open the Lake lode.

The Adventure company carried on extensive diamond-drill operations and cut an encouraging amygdaloid formation; additional drill-core data are being obtained, and when complete, shaft sinking probably will be started.

The Mass Consolidated Mining Company carried on extensive exploratory work throughout the year both by means of trenching and diamond drilling, but the nature of the results have not been announced.

The Michigan Copper Mining Company resumed the construction of its mill and "C" shaft again was put on the producing list and a much better showing was encountered on the Calico lode. This company also did a large amount of diamond drilling.

The Main lode of the Victoria property was disappointing and the company took up the search for a more consistent formation. A crosscut was started from the 22d level of its shaft and is just entering a copper-bearing formation; better results are being noted in the tunnel. Diamond drilling is being continued.

Antimony

The market for antimony in 1908 was quiet and without the sensational fluctuations in price that characterized the market in 1907. The chief factors which influenced low prices were heavy shipments of Chinese ore which readily cared for the demand and the restricted use of the metal by the railroads due to the financial depression. Throughout 1908 prices for Cookson's fluctuated between narrow limits; in January the average price was 9.344c. per lb. and in December it was 8.20c. per lb.

Hallett's brand was very scarce at the close of the year and Hungarian antimony was not prominent. Low prices affected these brands more than Cookson's.

But little antimony ore was mined in the United States in 1908 and the only smeltery in operation was that of Mathison & Co., at Chelsea, Staten Island. Low prices prevented the great majority of mines from extensive production and many were not operated at all during the year.

AVERAGE PRICES OF ANTIMONY.
(In cents per pound.)

	1907.			1908.		
	Cookson's.	Hallett's.	Ordinaries.	Cookson's.	Hallett's.	Ordinaries.
January	25.906	25.219	24.156	9.344	9.031	8.344
February	25.062	24.062	23.437	9.266	9.016	8.406
March	24.906	23.750	23.025	9.000	8.650	7.988
April	24.125	21.344	20.875	8.969	8.672	8.297
May	21.937	18.562	17.750	8.875	8.625	8.250
June	15.750	13.812	12.650	8.734	8.531	8.094
July	11.875	10.500	10.125	8.594	8.375	8.125
August	10.906	9.687	9.375	8.313	8.150	7.850
September	10.750	10.000	9.650	8.234	7.922	7.609
October	11.750	10.406	10.047	8.284	7.922	7.625
November	11.000	9.937	8.906	8.640	8.075	7.775
December	9.662	9.050	8.088	8.200	8.063	7.688
Year	16.969	15.527	14.840	8.704	8.419	8.004

During the first half of 1908 France, according to *Min. Journ.*, Oct. 5, 1908, produced 38,626 tons of acid bessemer ingots, 807,192 tons of basic bessemer ingots, 508,386 tons of open-hearth steel ingots, and 10,793 tons of crucible and electric steel. The total steel production was 1,364,979 tons, as compared with 1,318,530 tons in the corresponding half of 1907. The production of coal during the first half of 1908 comprised 18,116,143 tons of coal and 383,499 tons of lignite.

The output of copper ore in the United Kingdom in 1907 was 0792 long tons, against 7758 tons in 1906. In 1893 the production of ore and precipitate was about 210,000 tons, valued at more than £1,000,000.

The Production of Lead and Spelter in 1908

Statistics of Production and Price—Imports and Exports—A Review of Mining Conditions—The Markets—Production of Zinc Oxide

LEAD, 323,841; SPELTER, 207,735 TONS

The bulk of the domestic lead production comes from two districts, viz., southeast Missouri and the Cœur d'Alene, of Idaho. If we include Joplin, Mo., Park City, Utah, and Leadville, Colo., we account for nearly 80 per cent. of the production of the United States. The Missouri lead ore is non-argentiferous. Almost all the other lead ore is argentiferous and is treated by the silver-lead smelters. With them the lead is not only an object of recovery for its own sake, but also it plays the part of collector for the precious metals of ores containing no lead that are smelted along with the lead ore. This condition is of great economic importance in determining the price for lead. The cost of producing lead in southeast Missouri is now about 3c. per lb., delivered at St. Louis. In the Cœur d'Alene it is 2.5 to 3.5c., delivered at New York, when the silver by-product realizes 50c. per oz. These mines alone cannot supply domestic consumption under normal conditions. A considerably higher price is necessary to maintain the production of Park City, Leadville, and a hundred miscellaneous mines; and unless the smelters have their ore they cannot treat so much gold and silver ore as is offered. Consequently the price for lead affects not only the lead mines but also many mines that yield precious metals only.

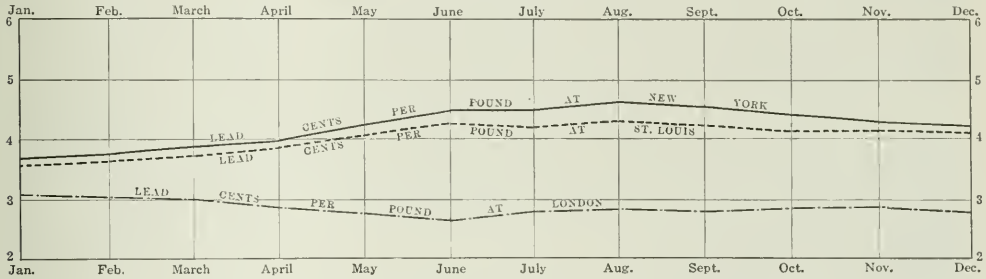
The year 1908 began with a large stock of unsold lead on hand and the price 3.55c., New York, which was only a trifle above the lowest of the panic period. During 1908 there were constant fluctuations with a generally upward trend until August, after which the market fell off a little, closing at about 4.20c. The stock on hand appears to have been reduced to ordinary and comfortable proportions, but at no time during the year was there any great life to this market. The average price for the year was 4.24c., which may be compared with 4.53c. as the average for the 10 years 1898-1907; this is a fair showing for 1908. However, lead is not a good criterion of commercial conditions in general. About 35 per cent. of the domestic consumption is for making white lead and oxides, the business in which was good in 1908. Labor being plentiful at reduced wages, many persons took advantage of this favorable opportunity to do necessary painting.

Mining continued in southeastern Missouri without any check to speak of throughout 1908. There was but little recession in the output of the Joplin district. Combining the production of these two districts, Missouri again holds the premier place among the lead-mining States. There is not yet in sight any limit to the productive capacity of the mines of southeast Missouri, except the ability to secure the necessary labor. The ore deposits are of immense extent, and great improvements in the methods of mining, milling and smelting have been, and are still being made.

Some of the mining companies of the Cœur d'Alene affected to be seriously hurt by the low price for lead at the beginning of the year, and curtailed their production. In some cases this action was doubtless justified, certain of the mines having been worked to such depths as to be no longer profitable. Indeed, the Tiger-Poorman mine, at Burke, of the Federal Mining and Smelting Company has been abandoned. On the other hand, certain companies, especially the Bunker Hill & Sullivan, can operate profitably at a lower price than was reached in 1908. This great company produced on a large scale throughout the year. All of the mines of the Cœur d'Alene were adversely affected by the declining price for silver, the cost of producing their lead being affected greatly by the amount realized for that by-product. Apex litigation was inaugurated in 1908 between the Federal Mining and Smelting Company, and the Bunker Hill & Sullivan company, and the Cœur d'Alene is now to be afflicted with that curse. Undoubtedly the expense of this litigation will materially increase the cost of production to both companies.

Elsewhere in the United States there were no important developments in lead mining in 1908. In general the Western smelters curtailed operations during the early part of the year, resuming later on. Among the refineries, that of the United States Smelting, Refining and Mining Company, at Grasselli, Ind., was the only one to be closed entirely. This was made necessary by the suspension of operations at the works of the United States Smelting Company, near Salt Lake City, because of the smoke injunction. That company developed a process for neutralizing the acid in the smoke, after which smelting was resumed.

The mines at Eureka, Nev., were idle during 1908. The old mines at Pioche, Nev., are being reopened, and there is talk about these becoming an important source of lead production.



COURSE OF LEAD PRICES DURING 1908. PLOTTED FROM THE MONTHLY AVERAGES

Production of Lead

The production of refined lead in the United States in 1908 is given in the accompanying table, the statistics of which are based on reports from all of the refiners stating their actual production for the first 11 months and their own estimates for December. Inasmuch as these

reports were for the most part made after the middle of December, the estimates are probably close, but in these preliminary statistics there is usually some uncertainty as to the separation of desilverized lead of domestic and foreign origin.

PRODUCTION OF REFINED LEAD.

(In Tons of 2000 Lb.)

Class.	1907.	1908.
1. Desilverized	213,383	182,401
2. Antimonial	9,614	12,491
3. Southeast Missouri	108,510	110,059
4. Southwest Missouri	17,833	17,890
5. Miscellaneous	790	1,000
Total domestic	350,130	323,841
Total foreign	76,016	80,293
Grand total	426,146	404,134

(1) Does not include the lead, chiefly of Missouri origin, which is desilverized by one smelter in Illinois and is here entered under Class 3. (2) The production of antimonial lead which used to be divided according to domestic and foreign, in 1907 and 1908, has been wholly entered under domestic. (3) Includes two smelters in Illinois, which use chiefly ore from southeastern Missouri. (4) Includes one smelter in Kansas, which uses ore chiefly from southwestern Missouri. (5) Includes small smelters in Wisconsin, Illinois and Iowa.

IMPORTS AND EXPORTS OF LEAD.

(For First 11 Months of the Year.)

(In Tons of 2000 Lb.)

	1907.	1908.
Imports:		
In ore and base bullion	62,973	97,092
Pigs, bars and old	9,164	2,753
Exports:		
In ore and base bullion	47,467	67,924

The Lead Market at New York in 1908

An upward movement, culminating in August, and a subsequent downward movement, which appears not to have exhausted itself at the close of the year, characterizes what has been an unusually erratic market. Under the impetus of an improvement in the general situation, heavy buying on the part of speculators took place in the first months of the year, reinforced by purchases on the part of consumers in anticipation of a better business. While the output in Missouri assumed normal proportions as early as January, production in the West continued heavily curtailed until the spring months, and this fact helped greatly in the distribution of the large stocks which had accumulated and the advance in the price which was almost uninterrupted until August.

The business of manufacturers was more or less of a dragging nature throughout the entire year, with the exception of the white-lead branch, where up to November the requirements were of very large volume. An equilibrium was reached in the middle of the year. At that time the resumption of Western mining operations on a normal scale made itself felt in the available quantity of marketable lead, but when the white-lead manufacturers ceased their purchases on a heavy scale, upon entering their dull season at the beginning of fall, the rate of offerings again overtook the requirements, and a rapid decline ensued. Prices at the close of the year again reached a level where they may be called cheap from a general point of view.

It is not unreasonable to assume that prices are now not very far from bottom, the expectation being general that those branches of the lead business which have been hitherto neglected, particularly lead-covered cables, sheets, pipes and miscellaneous products, will be greatly benefited by the increase in corporate activity and in the building trades, which for these particular purposes came too late to be felt in the fall, and now must wait until the winter has passed.

At the beginning of 1908 the market stood at 3.55@3.60c., New York, and a gradual and slow advance established prices at 3.70@3.75c. at the close of the month. This level was maintained well into March. The surplus which was left over from the previous year had been largely distributed by that time, and the market was depending upon the actual lead output which was restricted by the reduced activity in Western mining centers. A realization of this brought consumers and speculators into the market, and in consequence a sharp advance took place to 3.90@4c., New York. There was not much change from these figures until late in April. The spring season is always the busiest for the lead manufacturers, and the resulting influx of increased business brought them into the market for correspondingly larger quantities. Under the influence of this, prices reached 4.05@4.10c. toward the end of April.

The better outlook encouraged resumption of mining operations in the West on a normal scale, but the heavier production did not reach the market until several months later, and meanwhile the shortage of supplies facilitated the forward movement, a steady appreciation taking place throughout May and June, when sales on a large scale were effected at 4.47½@4.52½c. New York. The most urgent demand being satisfied, the market reacted in July to 4.40@4.45c. New York. There was a rally from this level during August, due to speculative influences, which caused an advance to 4.57½@4.62½c., New York, the highest point reached during 1908. This movement was short-lived. The weight of offerings became heavier during September, owing to the increased supplies turned out by the Western mines, which by that time had passed through the refining works.

The last three months of the year recorded, with one short interruption in November, a retrograde movement, which is still a factor at the end of the year, the close being steady at 4.15@4.20, New York.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.375
September	4.813	4.515	19.775	13.125
October	4.750	4.351	18.531	13.375
November	4.375	4.330	17.281	13.538
December	3.658	4.213	14.500	13.156
Year	5.325	4.200	19.034	13.439

New York, cents per pound. London, pounds sterling per long ton.

White Lead in 1908

There was an active demand for white lead during the early months of 1908, due in part to the necessities of paint grinders and other large consumers and distributors, who had allowed their stocks to run down under the depression of the latter part of the preceding year, to a point that gave them no surplus from which to meet the anticipated requirements of the spring business. The consumption of paints during the first half of the year was not all that had been hoped for; there was no general revival of the building industry, and the last quarter was distinctly disappointing because business was not greater than in the corresponding months of 1907, when the depression was at its worst. In spite of these facts, however, sales of white lead showed an increase over 1907, and this seems to have been an exceptional feature of the paint industry. The reason for this is chiefly the proportionately large demand for pure white lead or high-grade paints due to the educational work of the paint laws enacted in several States and the wide discussion that has attended their adoption.

Lead Carbonate

In spite of advancing prices for pig lead, consumers of the carbonate were given the benefit of the low-cost metal bought by corroders during the latter part of 1907, and there was no change in quotations from the list established in December, 1907, until the latter part of June, when an advance of ¼c. was made. This advance was maintained on lead in oil until Dec. 10, 1908, when there was a reduction of ¼c. and the year closed at 6½@6¾c., the prices ruling a year ago. This is the base price for lead in kegs of 100 lb. and upward, with an advance of ¼c. on 25- and 50-lb. kegs, and ½c. on 12½-lb. kegs. This differential is necessitated by the custom, adopted by all corroders during the year, of making all pack-

ages full net weight instead of including the weight of the wood in the invoiced weight as was the previous custom on sizes under 100 lb. Where the cost of the package bears so large a proportionate relation to the value of the contents it has to be charged for in some form, and as the newly enacted paint laws generally require that packages shall be branded at actual net weights, the added price is necessary. It is generally expected that in the near future a further innovation in the trade in paint in oil, will be the adoption of steel packages in place of wood, for all sizes from 100 lb. down. The high cost of cooperage makes this a change in the direction of economy for the corroder, and from the standpoint of the consumer the metal package has many advantages.

The last reduction in price applied to lead in oil only and was due chiefly to the wide margin that had existed all during the year, and especially during the fall months, between the price of dry lead and that of lead in oil. This margin has been sufficient to give paint grinders an exceptionally good profit, even though their dry lead has averaged them a little above last year.

As a matter of fact quotations on dry lead were largely nominal throughout the year, and the bulk of the sales were even below the nominally quoted price for carload lots. During the first half of 1908 the price generally quoted was 5⅝c. and this was fairly well adhered to as a price to grinders, although sales at 5½c. were by no means exceptional. The same nominal quotation prevailed during the last six months, but there were more sales at 5⅜c. than at the higher fraction, and the largest corroding interests entered into heavy contracts with grinders, and other large consumers during October at 5¼c. Since then, however, the business has been mainly at 5⅜c.

Lead Oxides

Lead oxides did not have as satisfactory a year as did the carbonate. While there was some improvement in demand as the year progressed, many of the large consumers of red lead were practically out of the market due to a lack of structural work, and in some other industries litharge was substituted for red lead because of an unusually wide difference in cost. Prices for both oxides, and especially litharge, were unsatisfactory to manufacturers, since some of the makers, who have recently become active in the market, have freely offered their product at narrower margins above the cost of metallic lead than had almost ever before prevailed. As a result published quotations were wholly nominal, and the bulk of the business in red lead was at 6¼ @ 6½c.; these figures, of course, represent the prices to large consumers, and in casks. Through the ordinary channels of distribution prices have ranged from 6½@7¼c. as to quantity and size of package, for both oxides.

The year closed with an evident expectation of a good spring business in all forms of high-class paints, but with marked conservatism on the part of large buyers as to present purchases based upon a lack of confidence in prices. The buyers of all lead products now watch closely the published quotations for pig lead and base their ideas of the value of the carbonate and oxides thereon; and while manufacturers do not always meet these ideas, they have a tendency, on a declining metal market, to keep the demand from this class of buyers down to their current running requirements.

Southeast Missouri Lead District

By H. A. Wheeler*

The output of the southeastern lead belt of Missouri closely approximated 104,000 tons in 1908, with an estimated value of $8,320,000 This is high-water mark as regards tonnage, for it exceeds the highest previous production, that of 1907, by about 6 per cent., but on account of the much lower metal prices, especially in the early part of the year, the production of 1908 is nearly 25 per cent. less in value.

In view of the discouraging condition of the market at the beginning of the year, this record is very satisfactory, and emphasizes the healthy, basic conditions prevailing in the district. It continues the record of continuous growth—a record that any old mining district might well envy—and while hitherto the output has increased at the rate of 10 per cent. or more annually, it should be borne in mind that the above growth of 6 per cent. is figured on the highest previous production.

The severe panic in the latter part of 1907 caused considerable curtailment in the output last winter, but it also enabled the rapidly rising wages to be lowered to a more reasonable basis. When the lead market unexpectedly showed such healthy improvement last spring, the larger producers resumed full-time work and continued to work full time up to the close of the year.

The increase in the output resulted from improvements largely made in 1907, as in 1908 no new work was attempted until the latter part of the year. No new orebodies were discovered; nor were any new companies floated in 1908. As the market maintained its improved condition, toward the end of 1908 it encouraged the starting of betterments that should increase production considerably in 1909, if the present bright outlook continues.

The output, as usual, was almost entirely derived from the five large producers in the Bonne Terre and Flat River camps in St. Francois county, especially as the depressed market was felt much more severely by the smaller producers in Madison, Washington, Jefferson and Franklin counties. But the decreased tonnage in these camps was not enough to affect materially the results of the district. The output of Madison county, which includes the Mine la Motte and Fredericktown camps, amounted only to about 4 per cent. of the total, while the production from the old shallow diggings of Washington, Jefferson and Franklin counties was less than 1 per cent. The unusually small output of the latter is not due to exhaustion, but rather to the sensitiveness of the mines in that area to a low market and to their slowness in recovering from the benumbing action of the severe panic of 1907, for, although the market rallied from an opening price of 3.4@3.5c. at St. Louis to 4.25@4.3c. later in the year, this failed to restore confidence among the small leasers who operate in the shallow diggings.

The searching for new orebodies with the diamond drill that was so conspicuous in 1906 and 1907 and which was so abruptly brought to a close by the panic has been taken up again on a large scale by only one of the large companies. Some diamond drilling was done by the other companies in 1908, but on a relatively small scale and mainly to define and extend the orebodies now being worked. The steady absorption by the large companies of mineral-bearing lands in the lead belt that had been in progress until the panic has not yet been renewed; but the few good tracts remaining are likely to soon be taken over as the times improve, for, with the steadily growing outputs and increased size of the mills, the present orebodies are being rapidly exhausted and foresight requires the accumulation of virgin properties to supply future ore reserves, especially while the prices are still so moderate. Prices that today look high at $100 to $300 per acre as compared with prices of $50 to $100 an acre that ruled scarcely 10 years ago will probably look extremely cheap 10 years from now.

An important innovation was introduced in this district in 1908 by the starting of an electric power plant in which gas engines supplied by producers are the prime-movers. Although the district, being only about 60 miles from the Illinois coalfields, enjoys probably the cheapest coal of any metal-mining district in the country, two 2400-h.p. plants were erected to still further reduce the fuel costs by utilizing the much greater economy of gas engines; these were installed to replace compound Corliss steam engines, equipped with condensers. But, since nearby bituminous coals can be laid down at the metal mines for $1.75 to $2.50 per ton, the margin for economy is not as attractive as usual. This will be especially so if higher grade coals have to be shipped in to obtain

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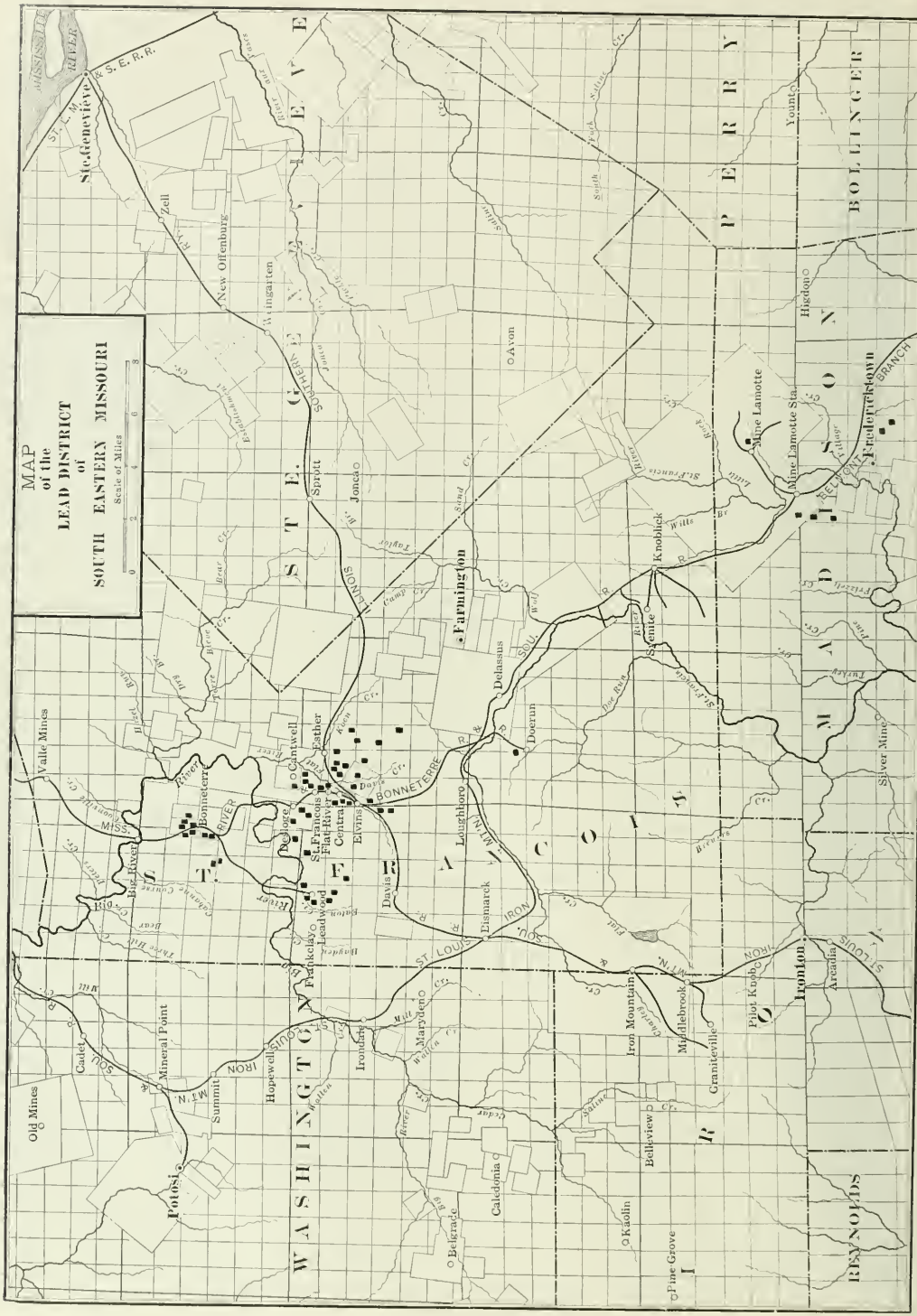

MAP
of the
LEAD DISTRICT
of
SOUTH EASTERN MISSOURI
Scale of Miles
0 2 4 6 8
MISSISSIPPI RIVER
ST. L. M. & S. E. R.R.
Ste. Genevieve
Zell
New Offenburg
Weingarten
Avon
Sprott
Jonca
Farmington
Knoblick
Mine Lamotte
Mine Lamotte Sta.
Fredericktown
Higdon
Yount
Delassus
Doerun
Cantwell
Esther
Bonneterre
Valle Mines
Desloge
St. Francois
Flat River
Central
Elvins
Leadwood
Davis
Bismarck
Loughboro
Silver Mine
Frankclay
Mineral Point
Cadet
Old Mines
Summit
Hopewell
Irondale
Marvden
Potosi
Belgrade
Caledonia
Kaolin
Pine Grove
Bellview
Iron Mountain
Middlebrook
Graniteville
Pilot Knob
Ironton
Arcadia
BONNETERRE R. & R.
ST. LOUIS IRON MT'N. & SOU. R.
ST. FRANCOIS
WASHINGTON
STE. GENEVIEVE
PERRY
BOLLINGER
MADISON
IRON
REYNOLDS

efficient work from the producers. Local experience in operating gas producers with western Illinois coals has shown that, as these coals are so high in sulphur and ash, in the past it has been more profitable to use the higher-grade and more expensive coal from Indiana or southern Illinois.

The St. Joseph Lead Company

This pioneer company in the operation of the modern disseminated mines still holds its well earned prestige of being the largest, most important and most profitable of the Missouri producers, in spite of being the oldest. It is still producing heavily from its No. 1 mine, which is now more than 40 years old, and its latest shaft, the No. 13, was recently sunk to open up an extension of its famous Bonne Terre orebody. While this company reduced its output 50 per cent. and entirely stopped extensive improvements in the latter part of 1907, the mines were reopened on full time early in 1908, and later in the year much of the new work was resumed. Betterments at its model town of Bonne Terre have been continued by adding to the new sewage system, and by the building of a large, attractive new store, now nearing completion. The second story of this building will be devoted to the use of the local Mine Club.

In October the gas-engine power plant of this company, at Bonne Terre, was completed and is now in successful operation. It consists of three 600-k.w. Westinghouse generators each directly driven by duplex, horizontal gas engines of the Snow type. The power plant is housed in a well lighted, fireproof, steel building that is equipped with a 10-ton traveling electric crane. At present the alternating current is distributed at 6600 volts to the nearby mines and mill, but later it is expected to enlarge the plant and send power to the more distant mines. The gas is furnished by two batteries of duplex producers of the Loomis-Pettibone downdraft type, which are housed in an adjoining steel building, with an intermediate large gas-holder.

The St. Joseph company is operating eight shafts. These supply the old or No. 1 mill at Bonne Terre, having a capacity of 1,500 tons, and the new or No. 2 mill at Owl Creek, having a capacity of 1200 tons. The concentrates are shipped 30 miles north to the company's smelter at Herculaneum, on the Mississippi river.

The Doe Run Lead Company

The Doe Run Lead Company has completed the installation of a gas-engine power plant at its No. 1 shaft at Flat River—a duplicate of the St. Joseph company's plant—and has resumed the construction of the concentrator at West Elvins, on which work was stopped by the panic. This mill will have a capacity of about 1500 tons and is expected to be in operation by July 1, 1909.

Like the St. Joseph company, the production was cut down 50 per cent. in the latter part of 1907, but work at full capacity was resumed in the early part of 1908. Four shafts are being operated, from which the ore is shipped ten miles south to the 1500-ton mill at Doe Run; the concentrates are then shipped to the St. Joseph company's smelter at Herculaneum.

The Federal Lead Company

The Federal Lead Company has entirely recovered from the partial shutdown in the latter part of 1907, and is today making the largest production in its history. Its new No. 2 mill at Central is being remodeled by taking out the 3-compartment Hartz jigs and replacing them with Hancock jigs. This is resulting in a marked saving in labor, power and water, besides materially increasing the capacity. When other improvements are completed it is expected that the No. 2 mill will have a capacity of 3500 to 4000 tons per day, making it by far the largest mill in the district as well as in the Mississippi valley. The company is operating its No. 1 mill, which has a capacity of about 1000 tons per day.

A new shaft, the No. 11, is being sunk on the south side of the No. 2 mill to tap the old Central orebody, and work is shortly to be started on Nos. 9 and 10 shafts; the sinking of both these was discontinued in the latter part of 1907. Six shafts are being operated at present, but before the close of 1909, nine will probably be supplying ore.

The National Lead Company

The National Lead Company kept steadily at work and made an excellent record for a busy, active year that has been far from unprofitable. Equipped as it is with one of the best and most compact plants in the district, it was probably the best money-maker during 1908, for it never curtailed its output, and its uptodate plant was under no expense for improvements. Four shafts supply the 1500-ton mill; these are only ¼ to 1½ miles distant from the mill.

The Desloge Lead Company maintained its usual output and did not attempt materially to curtail its production during the depression. The new No. 5 shaft has been completed; this shaft is not situated conveniently to the mill, being about four miles distant, but it promises to prove a valuable producer. The new orebody opened up by this shaft lies almost over the line in Washington county. The company's small plant of Flintshire or air furnaces has been operated on the Desloge brand of pig lead, but, as this plant is too small to smelt all the output, most of the concentrates have been shipped to the Illinois smelters. The company's 1000-ton mill is supplied from three shafts that are ½ to 4 miles distant from it.

The plant of the Mine La Motte company in Madison county has been equipped with a new 500-ton mill under the present Pittsburg management. The output was not pushed in 1908 owing to the low market, but instead the reserves were increased and the property developed. The lease of the old copper-mine tract that was sub-let by the Mine La Motte company to the Hudson Valley Mining Company has been transferred to the Eastern Lead Company which operated most of the year on a royalty basis.

The North American Lead Company at Fredericktown, in Madison county, continues to be operated as a copper property and the small amount of lead that it recovers in working the copper sulphides is merely a by-product that is shipped away to be smelted.

The Madison Lead and Land Company, which operates the old Catherine mine in Madison county, partially restricted its output during 1908 and ran only one of its two mills.

Spelter

The bulk of the production in the United States continues to be derived from the Joplin district. The fact that the resources of that district have been seriously diminished is of determining influence in the spelter industry. If it had not been for the appearance of the Rocky Mountain zinc ore, the rejuvenation of mining in Wisconsin, and the importation of Mexican ore during the last five years, there would undoubtedly have been a spelter famine. In spite of the new supplies it has been necessary to mine a very large quantity of ore at Joplin that yields only 2½ to 3 per cent. of concentrated mineral, which could be done only at an advance in price for the ore and consequently for spelter also. This condition is becoming more and more emphasized.

There is not now in sight any supply of cheap ore that might oust the Joplin district from its present position of premier zinc producing district. Consequently continuance of a high level of price for spelter must be expected, because it will be necessary to enable the Joplin sheet ground mines to continue to operate. The price might rise inordinately high under the demand for increasing consumption, but it will be restrained by supplies of ore from other districts. However, the other districts, except perhaps Wisconsin, will be unable to furnish cheap ore; because in spite of their advantage in a higher grade of crude ore, their cost of mining and milling per ton of crude ore is high (in most cases inevitably high), and their concentrated product is subject to high freight charges, owing to remoteness from the smelting centers. The experience of 1907-08 has shown that a price of less than 5c. for spelter tends to check production from these mines.

Yet it would be unjustified to say that

this condition will continue indefinitely, inasmuch as new zinc-producing districts may be discovered. None that can be pronounced as promising a substitute for Joplin is now in sight, but geologists consider that similar deposits may reasonably be expected along the skirts of the Ozark uplift, and the development of important mines at Miami, Okla., in 1908, lends color to this belief. Dr. Keyes, formerly State geologist of Missouri, has recently expressed the opinion that the name of "Joplin district" has become a fetish, upon which attention has been concentrated to the exclusion of other prospects that may develop into important zinc-producing centers. If this be so, and Dr. Keyes is not alone in the opinion, it is to be expected of course that sooner or later further zinc resources will be discovered in Missouri, Kansas and Oklahoma.

The spelter market was very unsatisfactory in 1908. It began with a greatly decreased production, a stock of 33,000 tons on hand, and the price 4⅜c., New York. Spelter is a good criterion of domestic business, inasmuch as practically the whole production is consumed in this country, while 80 per cent. of it is used by the galvanizers and the brass makers, wherefore spelter connects with both the steel and the copper manufacturing industries. During the first half of 1908 the demand for spelter was slack, but the smelters laid off so many furnaces that the small demand led to an advance in the price; however, by mid-year the latter was only ⅛c. above that of the beginning and the unsold stock had increased, estimates varying from 35,000 to 50,000 tons. The gradual improvement in the demand for consumption induced the smelters to fire more furnaces in the second half of the year, and the price averaged materially better, being a little over 5c. in November and December, but 1908 closed with a large unsold stock in the hands of the smelters, including what they were holding for speculators, the account of the latter being rather large. Applying to spelter the remarks that we have made respecting copper, the stock on hand at the end of 1908 does not loom large, being less than two months' consumption, but in this industry it is not common to have an unsold stock in first hands of more than 2 or 3 per cent. of the annual production.

The statistics given in a following table show a large decrease in the spelter production and also in the consumption as compared with 1907. The Joplin district does not show a corresponding decrease. Its production of ore in 1907 was 286,500 tons; for 1908 its output was about 256,000 tons. These figures correspond with about 143,000 and 128,000 tons of spelter respectively. Wisconsin made a small increase in 1908. It appears, therefore, that the Rocky mountain districts and the exporters of ore from Mexico suffered most. The year was one of the most disastrous on record for the smelters, whose competitive bidding for the necessary Joplin ore wiped out all margin for profit, of course to the advantage of the miners. This was a powerful factor in sustaining the Joplin production. Another factor was that many miners discharged by companies unable to work at a profit went to the old diggings and earned their living by old-fashioned hand work, thereby contributing to the increased total.

In spite of this mulcting of the smelters, the operators in the Joplin district found it hard to realize any profit and there was great complaint about the adverse conditions. The fact is, of course, that the old lens deposits, yielding 5 per cent. ore, have been to a large extent exhausted, during the last five years and a large part of the production has had to be derived from the "sheet ground," which yields only 2½ to 3 per cent. Prices for the concentrated product rose correspondingly and the producers were able to do finely up to the latter part of 1907. Yet, even under the adverse conditions of 1908, the Joplin district was immensely profitable, although not to the operators. The latter work generally upon leased land and pay the fee-owner a royalty upon what they produce. This royalty may have been reasonable when richer ore was mined, but under present conditions it is outrageous. Consequently the mining profit is going to the fee-owners. The operators command pity in their present situation, but they have made no serious or concerted attempt to secure a readjustment of the royalty question.

The works of Hegeler Bros. at Danville, Ill., were put in operation in 1908, but they had been completed in 1907. Otherwise there were no new constructions in 1908. Indeed, at least one plant begun in 1907 was abandoned. Few, if any, of the older smelters made additions to plant. Several small works remained idle throughout the year. Others were idle for longer or shorter periods. No one operated at full capacity.

There was a large increase in the zinc production of Australia in 1908, and the treatment of the mixed sulphide ores of Broken Hill now seems to have been successfully solved. The Zinc Corporation which experienced a great deal of difficulty during its experimental period finally succeeded in overcoming difficulties and during 1908 established itself upon a profitable basis. From now onward this company will probably make a large production. The Broken Hill zinc ore has become a highly important factor in the European market, where it has displaced a good deal of the ore formerly mined in Spain and other European countries. Although the Australian ore is not of the most desirable character for smelting, nevertheless it is advantageous to smelters to be able to contract for a long period for a large supply of ore of even character. Certain of the Broken Hill companies have sold their output for eight years ahead.

Toward the end of 1908 the convention among European zinc producers, under consideration all through the year, was consummated, but previous to the appearance of this article it has not been publicly announced. This convention appears to be the most severe and most scientific of any that has been organized in the zinc industry of Europe. Its fundamental idea is restriction of production to conform to the requirements for consumption at a certain price for spelter, which appears to be £20@23. If the unsold stock of spelter, to be reported monthly, exceeds a certain amount, there is to be a restriction of production according to schedule based on the excess of stock. Or if the price for spelter falls below £20 there is also to be a restriction of production. The regulation of production is to be in the hands of three commissioners. Bad faith on the part of any member of the convention, or failure to comply with the allotment, is to be punished by a fine. The members of the convention deposit with the commissions good securities as a guarantee for the collection of the fine. All of the zinc smelters of Europe, with two or three insignificant exceptions, have joined this convention. The convention has fortified itself against the entrance of new interests in the smelting business by associating with itself some of the largest banking interests of the Continent, including the Deutsche Bank, which on its part undertakes to refuse to assist in the financing new enterprises.

Production of Spelter

According to the accompanying table the production of spelter in the United States in 1908 decreased by about 33,000 tons. The statistics for 1908 are based on reports from all of the producers, who have given their actual production for the first 11 months of the year, together with their estimates for December. Inasmuch as the bulk of the reports were made subsequent to the middle of December, it is probable that the estimates for that month are very close.

A large number of the producers reported their unsold stock, as of Dec. 15, 1908, these reports including the amount held in storage for other parties. It appears from these statements that smelters who produced 147,870 tons of spelter had 20,112 tons in stock at their works. Estimating the stock of other smelters as being in the same proportion, the total stock of spelter in first hands in the United States, Dec. 15, 1908, was approximately 28,000 tons. On this basis, the de-

livery into consumption is computed in the second table.

PRODUCTION OF SPELTER.

(In Tons of 2,000 Lb.)

State.	1907.	1908.
Colorado	5,200	2,152
Illinois	56,103	50,202
Kansas	133,561	97,574
Missouri	11,594	10,068
Oklahoma	5,094	14,911
South and East	38,060	32,828
Total	249,612	207,735

DELIVERIES INTO CONSUMPTION.

(In Tons of 2,000 Lb.)

	1907.	1908.
Stock January 1	4,550	32,883
Production	249,612	207,735
Imports	1,778	900
Total supply	255,940	241,518
Exports	563	2,710
Stock, December 31	32,883	30,000
Deliveries	222,494	210,808

The Spelter Market in 1908

The large accumulations carried over from 1907 exerted an influence which was felt throughout 1908. At the opening of 1908, weak holders had been fairly well eliminated and the existing stocks were in a large measure concentrated in strong hands. Production was at low ebb. The consuming community began to emerge from the demoralization incident and subsequent to the panic. The purchases of spelter for legitimate requirements had been practically nil for some months. The tendency everywhere was to work up the stocks on hand to the lowest point possible, which policy was facilitated by minimum requirements.

Meanwhile the production has adjusted itself to this state of affairs. Unlike other base metals, the greater percentage of zinc ore is obtained from small properties, the operation of which can be stopped without serious sacrifice. The cost of idleness leaves a very small margin for losses incurred through sales of ore below cost, so that whenever spelter prices show a permanent decline, the production is automatically checked, depending upon the cost of producing in various mines. The proportion of the output which can be produced below 5c., St. Louis, as compared with the total requirements, is growing smaller in proportion to the growth of the total requirements, and this was clearly illustrated in the market developments during 1907 and 1908.

At the opening of 1908, the reduced output was just about sufficient to supply current requirements. When it was found that stocks were not increasing, speculative buying became an influence in the market and brought about an appreciation in the price, from 4.15c., St Louis in early January, to 4.40@4.45, St Louis at the end of that month. The movement made further progress in February, during which month there was an uninterrupted advance to 4.65@4.70c., St. Louis. Realization of speculative holdings caused a decline in March to about 4.50c., St. Louis, and around this level the market fluctuated within narrow limits until well into May.

During all these months the demand was never large enough to enable liquidation of the old stock. In consequence, some of the first-hand holders lost patience and in their efforts to force sales, depressed prices throughout June and July, bringing about a decline to 4.27½@4.30, St. Louis. They, however, accomplished their purpose by shifting a good portion of the stock to consumers, who wisely took advantage of this opportunity to replenish their empty yards at low prices.

The revival in general business during the fall months was reflected in the spelter market through increased business not only from galvanizers, but also from the brass manufacturers, who then, for the first time in over a year and a half, became buyers of anything like normal quantities. As a result, an advance started in August, which continued slowly but steadily throughout the remaining months of the year. The rise would doubtless have been more rapid if it were not that the remaining surplus is being gradually fed out with the current output. This, in itself, illustrates that the output is not adequate to meet current requirements, even though requirements of consumers have not yet attained normal proportions. A further increase in the consumption can only be satisfied at higher prices, without which a corresponding enlargement in the output of ore is not to be expected. The market closes firm at 4.97½@5c., St. Louis.

SPELTER

Month.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	5.732	4.513	6.582	4.363	27.126	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.565	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.544
May	6.441	4.608	6.291	4.458	25.563	19.905
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.663
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20.875
December	4.254	5.137	4.104	4.987	20.075	20.625
Year	5.962	4.726	5.812	4.578	23.771	20.163

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

In Western Australia there are 29 State stamp mills and 21 State cyanide plants. Prior to Jan. 1, 1908, 505,286 tons of gold ore was treated, and gold amounting to £2,036,156 was extracted in the stamp mills and £277,166 in the cyanide plants, while tin, valued at £52,915 was obtained from the 31,166 tons of tin ore treated in State batteries.

Zinc Oxide

The production of zinc oxide and zinc-lead pigment in 1908 was 65,100 tons, valued at $5,876,040, against 85,390 tons, valued at $7,731,100 in 1907.

Zinc and Lead in the Joplin District

By Jesse A. Zook*

At the beginning of 1908 conditions in the Joplin district were bad owing to the financial panic. This condition continued until toward the end of September. However, as soon as the mine owners and miners adjusted the wage scale an increasing production followed, and, although the margin of profit for the mines in the sheet-ore area was comparatively small, yet prices for zinc and lead concentrates were high enough for the richer properties to resume production. Shipments increased from 14,000 tons in January to 20,000 tons in February. The average per month continued at approximately this figure until October, when the output increased to 25,000 tons for the month.

The more rapid recovery of lead prices, from the extremely low point at the close of 1907, made it possible to resume mining operations at many lead-zinc mines, especially in the sheet-ore area, that could not have been operated but for the sharp demand for and strong prices of lead. Instead of representing the profit of the mine as had been frequently the case previous to the panic, lead had to bear a portion of the expense of operating the mine. Development opened up new orebodies in outlying camps and in the areas where the ore is easy to concentrate; these deposits helped to maintain the average production.

Developments in 1908

Much development work was done during 1908 along Springs river northwest from Carthage to Alba, and northeast from Alba. The richer of these newly found orebodies added materially to the output of this part of the district, for many of the older mines of Alba-Neck have been abandoned. New discoveries in the Spring City-Spurgeon mines in Newton county south of Joplin kept pace with the abandonment of worked-out mines. This area, aside from the channel deposits, produces principally silicate of zinc. The panic halted underground development around Sarcoxie and Reeds, southeast from Carthage, but a large amount of prospecting was done with drills.

South and southeast from Galena con-

*Statistician, Joplin, Missouri.

siderable drill prospecting was done in 1908, and some ore was found. Low ore prices had little effect on curtailing the work of drill prospecting, but it retarded development work all over the district. A few lens deposits were developed west and southwest of Joplin, but no effort was made to develop the disseminated deposits west of town, as that ore requires higher prices than those prevailing in 1908 to be profitably mined.

TABLE I. PRODUCTION OF ZINC AND LEAD ORE IN THE JOPLIN DISTRICT.

	Zinc Ore (Short Tons).				Lead Ore (Short Tons).			
	1908.	1907.	Increase.	Decrease.	1908.	1907.	Increase.	Decrease.
Oronogo	8,506	9,945		1,439	410	506		96
Webb City-Carterville	70,460	74,030		3,590	16,890	17,482		592
Prosperity	7,691	7,487	204		2,182	2,912		730
Duenweg	11,939	17,767		5,828	1,840	3,436		1,596
Totals	98,596	109,229	204	10,857	21,322	24,336		3,014
				10,853				3,014
Carl Junction	1,386	901	476		65	98		33
Zincite-Sherwood	2,064	2,912		848	83	339		256
Cave Springs	945	940	5		6	15		9
Joplin	51,727	56,344		4,617	6,278	7,108		830
Spurgeon-Spring City	6,863	6,635	228		1,479	1,509		30
Diamond		38		38				
Seneca	18		18		76		76	
Granby	10,599	11,413		814	831	1,345		514
Totals	73,602	79,183	727	6,317	8,818	10,414	76	1,672
				5,590				1,596
Alba-Neck	11,968	22,438		10,470	86	157		71
Carthage	3,893	2,227	1,666		3	4		1
Reeds	82	383		301				
Sarcoxie	2,123	1,349	774					
Wentworth	597	391	206					
Totals	18,663	26,788	2,646	10,771	89	161		72
				8,125				72
Stott City	159	817		658				
Aurora	8,406	12,302		3,896	204	337		133
Ash Grove	19		19		59	33	26	
Springfield		193		193		227		227
Totals	8,584	13,312	19	4,747	263	597	26	360
				4,728				334
Galena	16,576	26,542		9,996	2,807	3,393		586
Playter	220	398		178	36	17	19	
Badger	9,633	11,421		1,788	509	45	464	
Lawton		27		27				
Totals	26,429	38,388		11,989	3,352	3,455	483	586
				11,989				103
Quapaw-Baxter	3,149	2,320	829		44	640		596
Peoria	288	278	10					
Miami	5,870	60	5,810		1,254	16	1,238	
Totals	9,307	2,658	6,649		1,298	656	1,238	596
			6,649				642	
District	235,181	269,558		34,377	35,142	39,619		4,477

An Increased Production

Aside from a general resumption of operations in the sheet-ore area that may be looked for with higher metal prices, new production will come from the points where prospecting and development work during the last two years have indicated favorable ore deposits, as mentioned under the heading of developments in 1908. The Quapaw area, southwest of Baxter Springs, should show an increased output, as "wildcatting" has stopped and legitimate development work is being pushed. Miami will increase its output, and some of the recent drill discoveries in other parts of Oklahoma may become producing mines before the close of 1909.

The Increased Production in Oklahoma

The phenomenal increase of Oklahoma came almost wholly from the new camp of Miami where a wonderfully rich deposit of zinc and lead was discovered in 1907. This deposit lies in horizontal layers or sheets in a blanket form; the thick sheets of rich ore are found throughout an area 1½x3 miles, while thinner sheets of ore extend outward from the central body. The ore is coated with oil and asphaltum; without vanning from 3 to 7 per cent. of iron pass into the concentrates. On account of the presence of oil, concentration on tables is practicably impossible as the lighter ore particles are washed away with the oil-impregated water. The entire production of zinc for 1907 was 2500 tons, while at the end of 1908 this district produced a tenth of that amount in a single week. Although some of the leases at Miami are decreasing in output, a number of new mills are just preparing to produce, so it is believed that in 1909 the Miami camp will double or treble the tonnage produced in 1908. Miami is burdened with excessive royalty, the rate being universally 30 per cent. The land was leased in large tracts by the parties who discovered the ore while drilling for water, and they placed the royalty base at the maximum assessed in the older camps of the district. Toward the end of 1908 drill prospecting indicated the occurrence of ore in other parts of Ottawa county; at least three of these new areas look promising.

Automatic Shovels Underground at Joplin

Automatic shovels may be used extensively in the mines of the Joplin district during 1909. The American Zinc, Lead and Smelting Company took the initiative, installing one during 1908; another is ordered for early delivery in 1909. The use of these shovels is partly an experiment in the Joplin mines, and the shovels will need adaptation to the local conditions to be wholly successful. Upon the absolute necessity of some means of increasing the output of ore depends future profits of zinc-lead mining in this district. It is from no disposition to force a lower wage scale that power shovels are to be installed, it is simply a question of obtaining a larger output. The supply of American-born shovelers is about all utilized. Some operators favor hiring Italian laborers for this work, but the automatic shovel is now receiving first attention. If the shovel can be made to do the work, even at a slightly increased price per ton, and will increase the output sufficiently, its use will prove profitable. This problem of handling the ore underground will probably be solved in 1909.

A New Base-price for Zinc Ores

The enlarged production of zinc ore from Miami, carrying an average of 5 per cent. of iron, was the foundation of a new system of basing ore values. As prices advanced toward the close of 1908, and all grades of ore grew in demand, one of the smeltermen discovered that he could afford to buy this ore with no deduction for iron, and a price based on ore containing 40 per cent. zinc was made, with $1 per ton advance for each 1 per cent. of zinc above 40 per cent., and with no deduction for the iron in the ore. As high as $22.50 per ton was paid for ore containing 40 per cent. zinc. This was equivalent to $42.50 per ton on the 60-per cent. zinc basis, and as this ore carried 6 per cent. of iron without penalty it equalled a base-price of $48.50 per ton, while the best ore in the district was selling at $42.50 to $43 on a 60-per cent. basis.

This change in base-price opened the

eyes of producers to a fact which previously they had seemed scarcely to realize, that in taking off $1 per ton for each decrease of 1 per cent. in zinc, occasioned partly by the presence of iron, and in addition deducting a penalty of $1 per ton for each per cent. of iron in the ore they were being "double crossed." The smelting company making the innovation at Miami foresaw to what it might lead, and abandoned the new base within a few weeks, but other smelting companies continued to make this price until the close of 1908. This may eventually lead to a complete change in the base-price for zinc ores. At present the system of making zinc-ore prices is exceedingly crude.

Confusing Terms

The growing custom of speaking of the ore occurrence in various portions of the district as a sheet or blanket vein is creating a false impression. The sheet or blanket deposits from Oronogo southeast through Webb City, Carterville, Prosperity and Duenweg have no defined side walls, and, as the ore is found in horizontal layers between beds of chert, it is both a blanket and a sheet occurrence. In some of the Spring City mines the ore occurs in layers, but as the deposits have well defined vertical side walls they are not true sheet deposits, though the ore occurring in a channel form has been followed across country for distances as great as half a mile. The ore west of Joplin, discovered by drill during 1907, indicates a wide extent to the mineralized area, but the ore does not form a sheet deposit, for although very little prospecting was done in that part of the district during 1908, enough work was done to indicate that there are no layers of ore. The deposit is a highly disseminated orebody differing only from the disseminated lens deposits of Chitwood in being more regularly spread over a given area. Present developments point to this ore occurrence as a connecting link between the lens deposits, several of which are being mined in this new area, and the sheet deposits. These orebodies will probably be as expensive to mine as the thinnest sheets in the sheet-ore area.

Production By Camps and States

An accompanying table gives the production of the various camps for the first 11 months of 1908 compared with that of the same period in 1907. In table I the first section gives the production of the sheet-ore area from Oronogo southeast to Duenweg; the second section, all territory west and south of the Oronogo-Duenweg area to the State line; the third section, that of the sheet area to the east line of Jasper county; the fourth section, the Lawrence and Green County production; the fifth section, that of Cherokee county, Kansas; the sixth section, the production of Ottawa county, Oklahoma.

Table II is a summary of the larger table, giving the production of Missouri by counties and the total production of the district by States. An approximate reduction to spelter would give the following results: Missouri, 98,326 tons; Kansas, 9724 tons; Oklahoma, 3639 tons.

The Production for Fifteen Years

In only the two preceding years does the tonnage of lead shipped exceed the shipments during 1908, but in zinc tonnage the five previous years exceed 1908. The combined value of the lead- and zinc ore production during the four preceding years is greater than that of 1908.

Table III gives the zinc and lead shipments for the last 15 years and also the combined value of both ores. It shows the rise of the Joplin district from hand-jig camps to a district rapidly adopting every method for increasing the output of the mines and every known method of making the mill extraction greater. The four years previous to 1898 illustrate the old hand-jig district. In 1898, owing to the swift rise in metal prices, the mining and milling methods began to be modernized. Since then the advancement in methods of mining, hoisting, milling and even in the marketing of the ore has been wonderful.

High and Average Prices

Table IV, giving the high and average prices of zinc and of lead ore for the last 10 years shows the effect of the panic on ore prices. Zinc averaged $9.32 per ton and lead $14.20 per ton lower than in 1907, and the district lost over $5,000,000 in the value of its possible output. The average zinc and lead prices were lower than during the preceding four years.

TABLE II. PRODUCTION OF THE JOPLIN DISTRICT BY COUNTIES AND STATES.

	Zinc Ore (Short Tons).				Lead Ore (Short Tons).			
	1908.	1907.	Increase.	Decrease.	1908.	1907.	Increase.	Decrease
Jasper county	172,784	196,732		23,948	27,843	32,057		4,214
Newton county	18,077	18,477		400	2,386	2,854		468
Lawrence county	8,565	13,119		4,554	204	337		133
Green county	19	193		174	59	260		201
Missouri	199,445	228,512		29,076	30,492	35,508		5,016
Kansas	26,429	38,388		11,959	3,352	3,455		103
Oklahoma	9,307	2,658	6,649		1,298	656	642	
District	235,181	269,558		34,377	35,142	39,619		4,477

Note.—The output of Kansas is from Cherokee county, and of Oklahoma from Ottawa county.

TABLE III. ZINC AND LEAD PRODUCTION OF JOPLIN DISTRICT.

	Zinc Ore. Tons.	Lead Ore. Tons.	Total Value.
1908	257,071	38,822	$10,931,790
1907	286,538	42,065	15,419,827
1906	278,930	39,189	15,128,175
1905	252,435	31,679	13,302,800
1904	267,240	34,362	11,487,350
1903	234,773	28,656	9,471,395
1902	262,545	31,625	9,430,890
1901	258,306	35,177	7,971,651
1900	248,446	29,132	7,992,105
1899	255,088	23,888	10,715,307
1898	234,455	26,687	7,119,867
1897	177,976	30,105	4,726,302
1896	155,333	27,721	3,857,355
1895	144,487	31,294	3,775,929
1894	147,310	32,190	3,535,736
Totals	3,460,933	482,092	$134,866,479

TABLE IV. ORE PRICES IN JOPLIN DISTRICT.

	Zinc Ore.		Lead Ore.	
	High.	Aver.	High.	Aver.
1908	$47 00	$34.36	$66 00	$54 70
1907	53 50	43 68	88 50	68.90
1906	54 00	43 30	87 00	77 78
1905	60 00	44 88	80 00	62.12
1904	53 00	35 92	62 00	54.80
1903	42 00	33 72	60 50	54.12
1902	42 00	30 33	50 00	46 10
1901	34 00	24 21	47.50	45.99
1900	38 50	26 50	56 50	48 32
1899	55 00	36 61	55 00	51 34

Zinc Ore Prices During 1908

Zinc ore sold at $39 per ton the first week of 1908, an advance of $3 per ton over the closing price of 1907. In two weeks it jumped to $42.50 and the following week to $44 per ton. Beginning February at $42 it declined to $40, and $39, then rose to $40, $41, $40.50, $40, and stood at $39.50 for three weeks. The two last weeks of April and the first half of May it was $39, the last half of May $38, and throughout June it fluctuated between $36.50 and $37.75. During all of July and the first week of August the price was stationary at $38, advancing to $39, $39.50 and $40 at the end of August. September marked a range from $39.50 to $41. In October it declined again, opening at $40.50, dropping to $39.50 and then to $39. November opened at $40, going up to $41, $43 and to $45 at its close. The first week of December the high price was $46.50, the next week $47, and the third week $46.50.

Lead Ore Prices During 1908

Lead ore brought $45 per ton the first week of 1908, $5 higher than the closing week of 1907. It advanced to $47, and then to $50, at which price it stood for three weeks, then to $50.50, $52 and $52.50, closing February at $52. During the first two weeks of March it was $50 and the latter two weeks $52 per ton. In April it was $54 the first week and $55 the rest

of the month. In May the price advanced from $55.50, to $56, to $57, to $59, and finally to $60.50, and in June ti continued from $61.50 to $62.50, to $64, to $66. Then the decline in the price of pig lead began to decrease the lead-ore prices to $62 and $61, $60 for two weeks, then up a little again, $61, $63.50 two weeks, back to $61.50, and finally to $60 at the end of August. September opened at $59, declined first to $58, and then to $57, and closed at $55.50. In October the price was $54, $55, $54 and $56. It went up again to $58 for the first week and $60 for the second week of November, dropping back to $55 and $54 at the close. In December the price dropped to $53, then to $51 and during the third week to $50 per ton.

Zinc Mining in Wisconsin in 1908

By J. E. Kennedy

Mining in the Wisconsin district experienced a year of depression, as did all other lines of industry, in the year 1908. Compared with the results attained in 1907 there were few new properties opened up. Many concentrators were idle at all periods, yet it is a significant fact that the ore production of 1908 was, nevertheless, the largest this district has ever made. The total shipment of zinc ore reported to Dec. 26 (57,472 tons), exceeded the smelter figure for the entire year of 1907 by 4461 tons. The production of lead ore, though insignificant in amount, increased 100 per cent.; the total shipment reported to Dec. 26 (5393 tons) exceeded the total of last year by 2786 tons. The shipment of pyrites up to Dec. 26 (2536 tons) exceeded the total of 1907 by 2305 tons.

Prices of Zinc Ore

At the very beginning of the year zinc-ore prices started upward from the low-water mark reached in December, 1907. By the end of January the base price for 60-per cent. zinc had advanced to $40 per ton. Many companies which had shut down were induced to resume by this rally in prices, but before these were well under way again a reaction in the market set in, the downward trend continuing until June, when the base price had landed back to $32 per ton. In spite of low prices for 60-per cent. zinc, shipments steadily increased. The Mineral Point Zinc Company re-entered the competitive field for low-grade ores in April; the Platteville Separating Company began buying about the same time and the Joplin Separator Works, at Galena, was also active. The increased competition for low-grade blende advanced the price heretofore paid for this ore. The market improved during July, August and September and the monthly average shipment during the last six months increased 60 per cent. over the first half of the year. year.

Zinc Content

The metallic content of zinc shipped was considerably greater than in 1907. During the first three months of the year there was little or no demand for the lower grade ore. The Mineral Point Zinc Company was practically out of the open market from December, 1907, to April, 1908, and other buyers of low and intermediate grades were restricted to limited purchases during this time. Aside from an increased tonnage from roasting and magnetic separating plants, the electrostatic separator, at Platteville, has been turning out a product assaying between 55 and 60 per cent. metallic zinc.

Production by Camps

While there are 18 different camps and shipping points in the district, the bulk of the output has come from Platteville, Benton, Hazel Green, Highland, Cuba City, Linden, Rewey, Harker, Livingston, Galena and Mineral Point. It has been the older camps, and, with few exceptions, the older mines which have been producing the ore. Benton and Cuba City developed exceptionally rich bodies of sheet ground. The individual production of many mines was materially increased by better methods of operation; labor, moreover, was plentiful and more efficient.

New Developments

An important point was the completion and successful development of the electrostatic separator at Platteville, by the American Zinc and Lead Smelting Company, operating locally as the Platteville Separating Company. Blende concentrate assaying between 20 and 50 per cent. metallic zinc is bought in the open market. The accompanying pyrite is separated from the blende and recovered as a by-product, assaying between 42 and 48 per cent. sulphur, for the manufacture of sulphuric acid. In the development of the process the original Huff machines were largely changed and improved upon. A constancy of current has been developed which assures a permanent success for the process. During the last three months the plant has been averaging 70 tons per day; its ultimate capacity will only be limited by the average amount of raw ore available.

Nineteen properties were equipped with concentrators during the year; eight of these plants were begun in 1907 and five were second-hand mills. Two new roasting and magnetic separating plants were built. Foundations were laid for a Sutton, Steele & Steele dry-process mill, at Platteville, but construction was deferred until the spring of 1909. Twenty-five sinking plants were erected.

Investments

Comparatively little capital was invested in new enterprises. Shares of stock in undeveloped properties were unsalable. The event of the year was the consolidation of the Empire, Acme, Royal and Mitchell Hollow properties, at Platteville, into the Wisconsin Zinc Company, subsidiary to the American Zinc and Lead Smelting Company. The Picher Lead Company purchased the D. D. C. mine, at Rewey, to furnish raw concentrates to the Joplin Separator Works at Galena, a roasting and magnetic separating plant. The Mineral Point Zinc Company bought additional mineral lands at Highland and Benton. A few other sales of minor importance were made.

Prospect for 1909

The average weekly output of zinc ore during 1908 was 1000 tons. During November and December the production had increased to 1500 tons weekly. With an open market for all grades of ore and the base price for 60-per cent. zinc ore above $40 per ton, the mines already opened up will yield in 1909, 2000 tons weekly.

Tin

This metal is not produced in the United States, but we use 40 to 50 per cent. of the world's production, which is made chiefly by Malaya, the Dutch East Indies, and Bolivia. In 1907 the importation into the United States was 82,549,000 lb. In 1908 the statistics will probably show about 75,000,000 lb. The price suffered heavily. In June, 1907, the average was 42¼c., New York. The average for the year was 38.16c. The average for 1908 was about 29½c. January, 1908, showed the lowest monthly average, viz.: 27⅜c. The failure of tin to make more of a recovery appears to be due to continued large production. At the beginning of the year the prognostications in Malaya were for an extensive suspension of mining. Many of the corporations did indeed suspend, but as in the case of zinc mining at Joplin, the miners went back to old diggings and made a new production by primitive methods.

TIN SUPPLIES, 12 MONTHS ENDED NOV. 30.

(In Tons of 2240 Lb.)

	1907.	1908.
English production	4,700	4,400
Chinese exports	4,000	4,000
Straits to Europe and America	52,520	59,137
Straits to India and China	3,140	3,265
Australia to Europe and America	6,612	5,869
Australia, consumption	250	250
Banka and Billiton	13,493	13,765
Bolivia	15,500	16,280
Miscellaneous	250	250
Total	100,465	107,186

APPROXIMATE TIN DELIVERIES 12 MONTHS ENDED NOV. 30.

(In Tons of 2240 Lb.)

	1907.	1908.
United States	35,000	31,700
Great Britain	24,150	29,400
Other Europe	28,840	28,050
China and India	3,140	3,265
Other countries	4,500	4,250
Total	95,630	96,665

The Tin Market at New York in 1908

In sympathy with all other metals, the consumption of tin in this country suffered considerably during 1908. For this reason, the statistical position became more unfavorable from month to month, and at the end of the year visible supplies had increased to about 20,000 tons, as against about 13,000 tons in December, 1907.

The market for tin is influenced entirely by the operations of a few large concerns in London, and while 1908 did not witness the spectacular gyrations of 1907, it was nevertheless characterized by severe fluctuations up or down, accordingly as the bulls or bears had the upper hand. The domestic market is dependent upon the course which the metal takes on the London exchange, with such exceptions as are brought about by a scarcity or a corner in spot material, when premiums to a larger or smaller extent are exacted.

The market at the beginning of the year showed a firm undertone, and prices were quoted at about 26½@27c. for spot delivery. Spot material remained scarce throughout January and a premium of ½@¾c. per lb. was paid for the same.

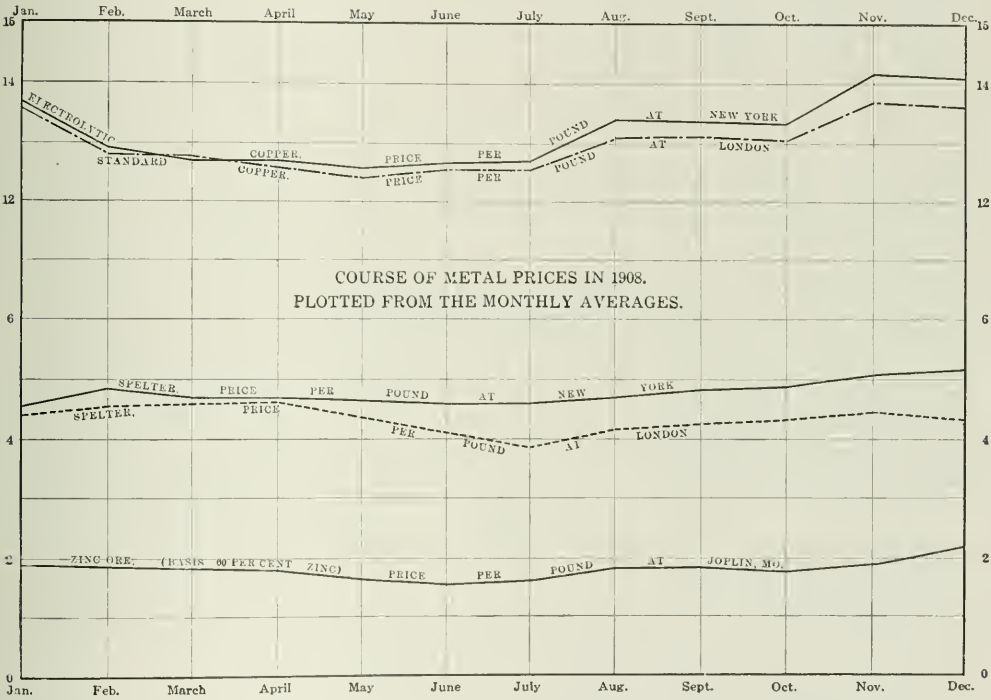
During the first half of February, under the lead of the London market, prices advanced to 29¼c., then declined to 28c., but rallied to 29c., and remained on about that level for the remainder of the month.

The announcement by the Dutch Government at the beginning of March of a reduction in the sale of Banka tin during 1907 led to excited speculation in the London market, where prices advanced considerably. Quotations at that time were established at 30½c. in the domestic market. March showed still further advances, and at the beginning of April quotations were about 31¼c. Until the middle of May, prices remained on this level, when a bear attack in the London market brought about a severe decline. At the end of May, spot tin was quoted at 28¼c. in this market.

In July the low point of the year was reached, and sales took place at 27¼c. The better feeling prevalent in the copper market toward the end of July and the beginning of August had a sympathetic effect on tin, and prices advanced to 31c. for spot material.

August and September witnessed again a gradual decline in prices brought about by an entire absence of interest among consumers. Quotations were 29½c. at the end of the latter month.

In October, tin remained fairly steady at around 29½c.; it advanced during the month of November to 30½c. per pound; but declined again in December, owing to its unfavorable statistical position which became public at the beginning of the month, to 29c., and closed at 29 cents.



TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.629	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.928	29.144
			Av. year	38.160	29.465

Prices are in cents per pound.

The Iron and Steel Industry in 1908

A Year of Deep Depression and Small Demand with Only Gradual Recovery. An Attempt to Revise Law of Supply and Demand

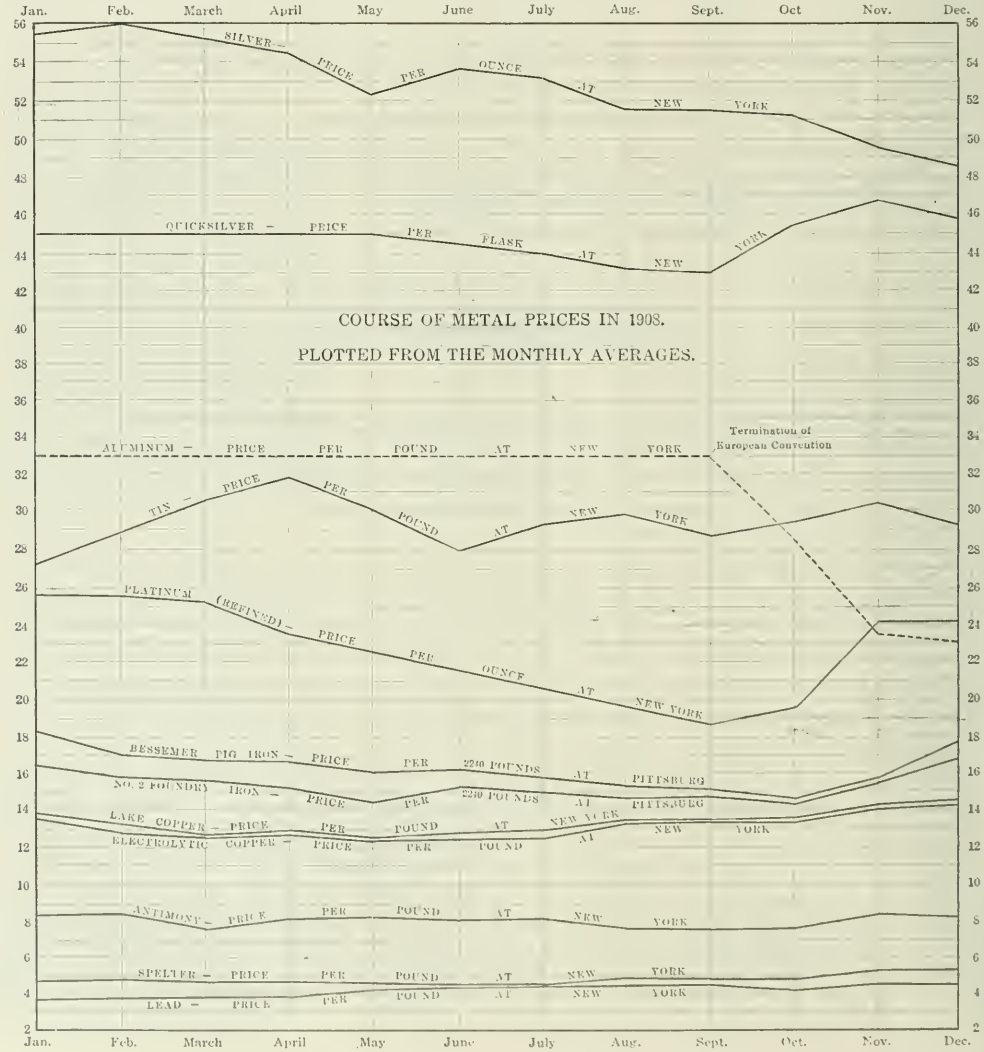
PIG IRON 15,828,000 TONS

The record of the iron and steel industry in 1908 is one of general and extreme depression followed by a slow and gradual recovery which promises well for the future, but is not yet so fully established as to warrant us in saying that a new prosperity is yet in sight. Another year will be needed, in all probability, to restore conditions fully and place the industry on a solid basis.

Iron and Steel Production

By Frederick Hobart

The short and sharp curtailment of the closing months of 1907 put the productive capacity of the United States on a basis lower than had been seen for at least eight years. The conditions were different from those of any previous period of depression. The dominating influence of the United States Steel Corporation had been exercised only in prosperous times, and it had now to face the reverses which had been brought about by a period of overtrading and too extended credits. The way in which this was done finds no precedent in former years. Through an adroit use of its influence in uniting with



it the larger independent producers the Steel Corporation succeeded in holding the trade to a policy of maintaining prices in the face of a lessened demand. This defiance of the law of supply and demand was maintained throughout the year, only some small reductions being made in a grudging way and at a time when they they were of the least effect. The result is apparent to those who study the operations of the year. Recovery, which has come slowly, might, it is believed by many, have been hastened by free concessions which would have encouraged the investment of capital in construction, by offering the advantages of cheaper material. It was in this way that recovery was started in former periods of depression with undoubted success.

A disturbing element came in during the latter part of the year in the form of the tariff-revision movement. To say nothing of the actual merits of the case, the conflicting testimony submitted at Washington confused the public mind. From present indications it is highly probable that reductions in duties will be made, and that iron and steel products will be picked out for such decreases. It is not probable that this will seriously injure producers or the trade; but the expectation of changes caused a halt for the time being.

The course of production in 1908, as compared with previous years, is shown below:

Iron Ore

The production and consumption of iron ore showed a very considerable decrease from the high level of 1907, as might have been expected. The cutting down of operations was sharp and sudden—more so, perhaps, than in any preceding period of depression, since a much larger proportion of the output is under a unified control than ever before. As in the previous year, Lake Superior ores furnished the raw material for 75 to 80 per cent. of the pig-iron production.

The estimated output of iron ore is as follows, in long tons, compared with the output of the preceding year:

	1907.	1908.	Changes.
Lake Superior...	42,245,070	25,927,000	D. 16,318,070
Southern states .	7,585,000	6,400,000	D. 1,185,000
Other states.....	3,125,000	1,875,000	D. 1,250,000
Total prod'tion	52,955,070	34,202,000	D. 18,753,070
Add imports.....	1,229,168	675,000	D. 554,168
Total supply..	54,184,238	34,877,000	D. 19,307,238
Deduct exports..	278,208	310,000	I. 31,792
Balance.....	53,906,030	34,567,000	D. 19,339,030

In the imports and exports the month of December is estimated.

In this statement no account is taken of stocks on hand, for the reason that it is impossible to obtain any exact figures concerning them. The stocks on Lake Erie docks at the close of navigation in 1908 showed an increase of 1,055,000 tons over the preceding year; but a considerable part of this is under contract and awaiting transportation. Stocks in furnace yards are believed to be smaller than they were a year ago. In 1907, owing to the sudden stoppage of many furnaces, there was a large accumulation of ore at furnace stockyards; this year the piling up of stock has been at the Lake docks instead. The larger stocks there may be regarded as a provision made against a possible increase in furnace activity before the opening of navigation next spring.

	1907.	1908.
Ore on docks, May 1	1,976,988	5,180,300
Receipts for the season	35,195,758	20,414,491
Total	37,172,746	25,894,791
Shipments to furnaces.	29,787,018	17,453,258
Stock on docks, Dec. 1.	7,385,728	8,441,533

The decrease in shipments to furnaces was 12,333,760 tons; and the increase in stocks on docks Dec. 1 was 1,055,805 tons. This is a sufficient reserve to provide for any probable contingency. The distribution of the stocks held Dec. 1 among the ports, and the receipts of those ports for two years were as follows:

Ports.	Receipts.		Stocks.	
	1907.	1908.	1907.	1908.
Toledo	1,314,140	680,553	518,645	590,925
Sandusky	83,043		44,546	36,079
Huron	971,430	213,377	415,730	458,158
Lorain	2,621,025	2,286,388	366,271	426,274
Cleveland	6,495,998	4,240,816	1,281,335	1,458,392
Fairport	2,437,649	1,518,961	523,981	835,821
Ashtabula	7,521,859	3,012,064	2,056,820	2,293,531
Conneaut	5,875,937	4,798,631	1,090,774	1,296,675
Erie	2,294,239	828,602	672,210	730,530
Buffalo	5,580,438	2,835,099	435,407	315,148
Total	35,195,758	20,414,491	7,385,728	8,441,533

Allowing for the probable increase in stocks the consumption of ore per ton of pig iron made in 1908 was approximately 1.98 tons, or a little higher than in previous years.

Lake Superior Ores—The statistics of Lake Superior shipments are so closely kept that it is possible to give definite figures, especially as water shipments close early in December. The only estimate required this year is of the rail shipments, part of which are made during the winter. The shipments of Lake ore, by ports, were as follows, for two years past, in long tons; with the rail shipments added for 1907, and an estimate of them of 1908:

Port.	1907.	1908.
Escanaba	5,761,988	3,351,502
Marquette....	3,013,826	1,487,487
Ashland.	3,437,672	2,313,670
Superior	7,440,386	3,564,030
Duluth.	13,415,977	8,808,168
Two Harbors.. .	8,188,906	5,702,237
Total water.. . . .	41,288,755	25,427,094
Rail.....	956,315	500,000
Total	42,245,070	25,927,094

The distribution by ranges in 1908 is not yet complete. Escanaba and Marquette are the shipping ports for the Marquette and the Menominee ranges, Ashland for the Gogebic. Two Harbors takes the ore from the Vermillion range and a part of the Mesabi; while the docks at Superior and Duluth are supplied entirely from the Mesabi range. The rail shipments come from all ranges; they go to Zenith furnace at Duluth, to the furnaces at Marquette, Gladstone, St. Ignace and other points in Michigan and Wisconsin.

The season shipments to furnaces from Lake Erie ports, to which about 80 per cent. of the Lake ore goes, and from which it is distributed were as follows:

The 20 per cent. of Lake ore which does not find its way to Lake Erie ports, goes chiefly to Chicago and vicinity for the furnaces of the Illinois Steel Company and others, and lately for the great new furnaces of the Indiana Steel Company at Gary.

Other Ore Production—The production in the Southern States is the most important after that of the Lake Superior region. It is, as a rule, closely regulated by the activity of the furnaces. The control of the mines by the iron-making companies and the proximity of the mines to the furnaces makes it unnecessary to accumulate stocks, as is done with the Lake ores, which have to be carried from 500 to 1000 miles by water, over routes which are closed by ice for five months of the year.

In the East, New York, Pennsylvania and New Jersey are the larger producers, in the order given. In all of them there was a considerable reduction in output. The same condition prevailed in the widely scattered iron-ore regions of the West.

General Conditions—The depression of the year did not stop preparations for an increase in the production of iron ore. Extensive operations are being carried on in stripping and preparing for mining on the lands of the United States Steel Corporation on the Mesabi range in Minnesota. In the Southern field all the large companies have made arrangements to extend their mining operations, and to improve them by the use of new machinery and appliances. In New York several new mines have been opened and some old mines reopened. The universal anticipation seems to be for a greater demand for ore, which must be met

A noticeable feature in all this new development work is the tendency to use lower grade ores. Even on the Lake ranges ores are taken into consideration which would formerly have been passed by. This is a significant feature.

The imports of iron ore during the year were chiefly from Cuba, and were used in the Maryland Steel Company's furnaces near Baltimore, and in others near the coast. The exports were chiefly to Canada.

Manganese Ore—The imports of manganese ores for the 11 months ended Nov. 30, the latest complete figures, were 188,526 long tons in 1907, and 170,662 tons in 1908; a decrease of 17,864 tons.

Limestone Flux—The production of limestone and dolomite for use as flux in iron blast furnaces in 1908 is estimated at 9,650,000 long tons, a reduction of more than 6,000,000 tons from the previous year. Dolomite is used chiefly at the Alabama furnaces, limestone being the usual flux elsewhere.

Pig Iron

The sharp contraction in pig-iron production which marked the close of 1907 continued well into 1908. There were, of course, many changes in the list of active furnaces, but only small increases in their aggregate capacity until well on toward the middle of the year. From that point an improvement began, which continued slowly but steadily, the second half of the year showing a substantial gain over the first.

For the first half of the year the American Iron and Steel Association has collected the full figures. Estimating the second half on the basis of the capacity of the active furnaces, we have the following production for the year. The comparative figures for 1907 are, of course, the corrected returns. The figures are in long tons:

	1907.	1908.	Changes.
First half	13,478,044	6,918,004	D.6,560,040
Second half	12,303,317	8,910,000	D.3,393,317
Total	25,781,361	15,828,004	D.9,953,357

The decrease in 1908 was, therefore, 38.6 per cent., the greatest proportional loss ever shown in one year.

Assuming that the division of the iron, according to the uses for which it was intended, was approximately the same in the second half of the year as in the first half, for which we have official figures, we find that the production of 1908 compares with that of the preceding year as follows, the figures being in long tons:

	1907.	1908.
Foundry and forge iron	6,397,777	4,203,000
Bessemer pig	13,231,620	7,754,000
Basic pig	5,375,219	3,380,000
Charcoal iron	437,397	299,000
Spiegel and ferro	339,348	192,000
Total	25,781,361	15,828,000

It is probable that this apportionment is not quite correct, as the increase in the second half of the year was somewhat greater in the steel-making irons—especially in basic pig—than in foundry and forge iron.

On June 30, the middle of the year, there were 168 furnaces in blast. On Dec. 1 the number had increased to 220, and was about 225 on Dec. 31. On June 30 there were 24 new furnaces under construction and 17 were being rebuilt. Only a few of the new furnaces were completed at the end of the year, but these included the first group of the great new furnaces at Gary.

The consumption of pig iron in the United States in 1908 was, approximately, as follows:

Production	15,828,000
Imports	89,000
Total supply	15,917,000
Exports	46,000
Approximate consumption	15,871,000

This shows an average yearly consumption of 406 lb. per capita. The imports and exports were both light.

The pig-iron production for 10 years has been as follows:

1899	13,620,700	1904	16,497,083
1900	13,789,242	1905	22,992,380
1901	15,878,354	1906	25,307,391
1902	17,821,307	1907	25,975,944
1903	18,009,259	1908	15,828,000

The production of 1908 was the smallest for eight years; it was rather less than half of our actual capacity for making iron.

Steel Production

No figures are available as to the production of steel for any part of the year, and only approximations can be made, based on the production of pig iron. It is estimated that the output of bessemer steel in 1909 was about 7,200,000 tons; of basic steel 7,100,000 tons; and of other steels 50,000; making a total of 14,350,000 tons, or a decrease of about 9,010,000 tons from the previous year.

No figures are available for the output of finished material, but the reduction was undoubtedly on parallel lines with the falling off in iron and steel. The greatest decrease was in rails and track material; the least in structural iron and steel.

Changes and Consolidations

No important changes are recorded during the year, and nothing so important as the transfer of the Tennessee Coal, Iron and Railroad Company in 1907 occurred. There was some exchange of properties among the subsidiaries of the Steel Corporation, but these did not change the general management. In December there was an important transfer of stocks of the Colorado Steel and Iron Company, which indicated that the Gould interests had parted with their control of that company. The new interest in the company is reputed to be either the United States Steel Corporation, or parties closely allied with it. These reports have not been confirmed, but are considered probable. Under present conditions it is not likely that the Steel Corporation would openly assume possession of this important Western concern. Its management on a friendly basis would, however, be a valuable asset.

Metallurgical Progress

Metallurgical changes during the year have been comparatively few. The great Gary plant of the Steel Corporation has begun work, two of its blast furnaces having been started in December. The most important feature of this plant is the use of blast-furnace gases for the production of power on a scale much larger than has heretofore been attempted. Progress was made in the use of the Gayley dry-air blast, and an extended course of experiments proved that its advantages when applied to the bessemer converter were quite as great as with the blast furnace.

Imports and Exports

The values of the imports and exports of iron and steel, including machinery, in the United States for the 11 months ended Nov. 30 are reported as follows:

	1907.	1908.	Changes.
Exports	$182,068,912	$138,881,661	D. $43,187,251
Imports	36,740,291	18,247,668	D. 18,492,623

The decreases were 23.7 per cent. in exports, and 50.3 per cent. in imports. The decrease in exports was in almost all branches, the structural steel and wire trades best maintaining their sales abroad. In imports the greatest decrease was in pig iron and in billets and other half-finished material, considerable quantities of which were brought in during the previous year under the stress of active demand.

At different times in the past we have heard a great deal of the possibilities of foreign trade in iron and steel products. This trade was to act as a balance wheel, maintaining production at an even level when the home demand was slack. Much was said of organizations promoted by the larger steel companies for the purpose of handling and extending sales abroad. In the present period of depression, however, these agencies did not work, apparently, as shown by the figures given above, exports having decreased to as great an extent as the home production.

The fact is that, in all the talk about foreign trade, no account was taken of the fact that under modern conditions a trade depression is not confined to one important country. It extends to others in greater or less degree, even spreading through the entire commercial world. When we have a large surplus to sell abroad, the demand there has fallen off, almost on parallel lines to our own. Other countries may be willing to buy our products at a low rate, but the purchasing and consuming capacity has been reduced. The balance-wheel theory failed entirely.

when it came to be tested, because there was little foreign demand to operate it, and low prices offered could not start the wheel.

In Great Britain, the chief exporting country, the foreign trade showed nearly the same course. The exports of iron and steel for the 11 months ended with November were 11 per cent. less in quantity this year than in 1907. While the decrease in domestic demand has been less marked than in the United States, foreign sales have shown even a greater decrease. Evidently the world was not a free buyer in 1908.

Germany alone among the important iron-making nations had a small increase—7 per cent.—in its exports. This was gained at the expense of producers by the large syndicates, which have sold abroad at such sacrifices that there have been strong remonstrances from a number of the constituent companies. Moreover, the gain in exports was chiefly in pig iron and in half-finished products. British, Belgian and French iron-masters took advantage of the syndicate policy to put in stocks of pig iron and steel billets at prices lower than their own cost of production. These crude products are finished in their own mills. Whether such sales of material are advantageous to German makers in an open question.

We do not decry the value of foreign trade, which may be a valuable asset of manufacturers when well established. It cannot, however, be established on short notice, nor can it be relied on any more than home trade in times of depression. And it may—as in the case of Germany—be acquired at a cost beyond its value.

Foreign Countries

European countries report a depression in the iron and steel trades parallel to our own, though not quite as great in amount. The British statements are unusually incomplete this year, but such as are available indicate a decrease of from 10 to 15 per cent. in iron and steel production. Exports for the year decreased considerably, as above noted.

In Germany pig-iron production for 11 months decreased nearly 10 per cent. and the market is reported extremely weak under the pressure of large unsold stocks. In part the overproduction thus indicated is said to be the result of the extended use of blast-furnace gases for power. Many furnaces have been kept in blast because the power was needed for other parts of the works, thus indicating one of the drawbacks of the system. The Steel Syndicate maintains its position so far, but the two important pig-iron syndicates have gone to pieces, with disastrous results to prices.

In other European countries production has declined, and everywhere the markets are in weak condition. As the European depression followed our own, so the recovery seems to be slower in coming.

The Iron and Steel Markets

The markets for iron and steel at the beginning of the year were in the condition of deep depression. The shock of the financial depression which began in October, 1907, was still too recent for recovery to begin, and it was not for some months that the trade was on its feet, so to speak; and not until nearly the end of the year was there a pronounced tendency to better conditions. Even at the present time recovery is progressing slowly. There is confidence in the future, as is shown by the preparations being made in many quarters to increase production; but this confidence has not yet reached the point of inducing active trade.

The most prominent feature of the year was the control over prices exercised by the large producers through the influence of the supervising committees instituted in December, 1907. These committees were active throughout the year, and their work was effective for the most part. The dominating influence was, of course, that of the Steel Corporation. The motives of this policy and its wisdom—or otherwise—are discussed elsewhere, and it is necessary here only to discuss its immediate effects.

The only really open markets for the greater part of the year were those for pig iron, for iron bars and for a few minor products. Pig iron was badly demoralized for a considerable part of the year, and its recovery was gradual and irregular. The business was limited, notwithstanding low prices; but this was due to the fact that so large a proportion of the pig iron made enters into the production of steel, the quotations for which were not materially lowered. Bar iron was an open market, owing to the large independent interests in that branch, and the lowering of prices on that product did stimulate orders and force a reduction in the quotation for steel bars to meet the competition.

The only changes in price made were some small ones in January, and a general "readjustment" in June, which involved reductions of 10 to 15 per cent. in the leading articles of finished steel. These did not have the effect of stimulating trade in any marked degree; and thereafter no material changes were made. It was pointed out by many consumers that there was a wider spread between quotations of pig iron and finished material than had often existed; but these representations had no effect.

The railroads were light customers throughout the year, and their purchases of rails were lighter than for a number of years. In part this was the result of inability to purchase, owing to decreased earnings and difficulties in finance; in part of the still unsettled dispute over specifications, and in part over the question of price. Toward the end of the year some good orders were placed for locomotives and other equipment, mainly for steel cars. Some good orders for bridge work also came forward. The rail question, however, is still far from a real settlement; and the rail mills enter 1909 with a lighter business on their books than has been the case for several years. In light rails for mining and industrial purposes, on which the price restrictions were removed, owing to the competition of the rerolling mills, there was a good business.

Recently the tariff discussion has had an effect on the markets, chiefly because it has strengthened the tendency to wait developments, and to defer contracting for future requirements until a more settled condition is reached. This question has also been considered elsewhere.

Details of the markets will be found in the following letters, which cover Pittsburg and Birmingham, the chief primary markets; Chicago, the leading distributing point for the Northwest; and the seaboard markets.

The Alabama Iron Market

By L. W. Friedman

Despite the general depression, which struck Alabama hard, continuing through the better part of the year 1908, the aggregate make of pig iron is only 300,000 tons less than in 1907. The depression came on the latter part of 1907, cutting the production down during the last three months to a considerable degree, but the total production for that year showed an increase over the previous year of about 11,822 tons.

The production of pig iron in Alabama for the year reaches a total of 1,405,000 tons, the last month's output a day or two behind official figures. When it is considered that the high-water mark by the month was not reached until November, 141,200 tons, with the first month of the year starting off with 86,000 tons, improving in February and March and then falling back in April to 94,800 tons, thence taking on improvement month by month, the total production can be looked upon with much satisfaction.

The number of furnaces in operation in Alabama varied. There was a good sized accumulation of iron through the first part of the year, but the production was held down and no effort was made to work to full capacity and that condition has not been reached as yet, though the recent depression appears to be a thing of the past.

Alabama iron producers suffered not alone from the general depression, which other districts also experienced, but also from a hard fight with union labor, the United Mine Workers of America in the district declaring a strike. This proved a battle to the finish and in its course there was a considerable falling off in coal and

coke production, causing the iron-masters to make contracts for this supply in other districts, all of which affected the iron production. While by all indications the iron make was maintained during the strike, it was with much difficulty and expense.

The quotations for pig iron in Alabama during the year 1908 ranged between $11 and $13 per ton, on No. 2 foundry basis. Recently the $13 rate became a fixture. On this score there is but little said. Some large-sized sales of iron were consummated during the low-price period, but care was taken by the producers in this section that this business should not interfere with general trade when the conditions improved. One instance is reported where a large bulk of iron was sold during the quiet period, but the stipulation was that the product would be held in yards at furnaces subject to delivery, but there was to be no delivery while the prices were down. When the iron went up, the speculation proved a good one and at the same time did not interfere with the general market.

Alabama witnessed considerable improvements in blast-iron furnaces during the year. But one concern fell by the wayside, the Southern Steel Company, while some of the progressive companies made deals whereby they took in other properties. The Birmingham Coal and Iron Company acquired the properties of the Tecumseh Iron Company (an ore-mining company), and completed and put in blast its new furnace at Vanderbilt, near Birmingham. The Tennessee Coal, Iron and Railroad Company made extensive improvements about blast furnaces and started work on big improvements in the steel plant. The Woodstock Iron Company put in shape one iron-maker and repaired another, besides putting in operation mining and other properties. The Sloss-Sheffield Steel and Iron Company practically rebuilt one furnace and has a force of men improving another. Other concerns made improvements despite the depression.

The raw-material supplies were given some attention and since the general quiet has been passing off the improvements have been worked on with vigor, so that the new year has started in with great expectations

The depression, the placing of improvements and other reasons, affected the steel production in Alabama. The big plant of the Tennessee Coal, Iron and Railroad Company at Ensley was the only institution of the kind in the State that worked through the year. With the exception of the last week in the year there was no interruption in this industry. The plant produced more than 38,000 tons of blooms in one month, and made 32,424 tons of rail. The average was kept up pretty well toward the latter part of the year. The aggregate production will show a falling off, as there was a cessation of operation at the big plant for some time. There was but little accumulation at the steel plant and to meet any kind of a demand it will be necessary to have a steady run.

The Chicago Iron Market

By E. Morrison

Except for two or three large transactions made at low points in the market, the history of the pig-iron market in Chicago for the year 1908 is a record of small buying for needs not more than three months away. The year began in depression. Prices fell gradually as it became apparent that no general revival of business was at hand. Sales of carload lots to 200 or 300 tons became the rule, and May saw iron decline from $18@18.25, the January price for Northern No. 2, to $17@17.50. Southern from $13@13.50 Birmingham ($17.35@17.85 Chicago), in January had dropped to $12 Birmingham, in the open local market. One large sale of about 50,000 tons was made in February at $11 Birmingham, and this transaction weakened the market greatly, the average melter concluding from it that general reduction in prices would follow.

The Spring depression lasted into June, when another sale of nearly as much tonnage was made of Southern at $11. There was a wave of buying for a brief time, and the market strengthened slightly. Southern was prevented from sagging below $11.50 in the open market and continued to rise slowly until December, when it brought $13@13.50 ($17.35@17.85 Chicago). Northern continued depressed, and in September, October and November sold at $16.50@17, or for less than Southern. This exception to the ordinary relations of the two kinds was largely due to the selling of considerable iron from Ohio furnaces throughout the months named at $16.50@17, meeting the needs of users of Northern to the disadvantage of local furnaces.

The high and low points in the market for 1908, compared with the high and low points of the preceding year, are shown in the accompanying table.

	1907.		1908.	
	High-est.	Low-est.	High-est.	Low-est.
Lake Superior charcoal	$28 00	$25 00	$24 00	$19 50
Northern No. 2 foundry	27.00	19 00	18 50	16 50
Southern No. 2 foundry	27 35	19 35	17 85	15.35
Bar iron	1 865c	1 75c	1 65c	1 50c
*Structural material	1 88c	1 865c	1 78c	1 88c

* Beams and channels, 3 in. to 15 in., and angles 3 in. to 6 in. by ¼ in. or heavier.

It was the hope of many in the iron business that the national election in November would bring a decided change in the condition of the market. Immediately preceding the election the market was very weak, but there was no decided change from the election or from any perceptible cause. Very slowly the trend upward became perceptible, however. The last half of the month of December saw a lull in business nearly always experienced in that month, but peculiarly disappointing because of the hopes raised by the gradual strengthening previously of the market.

There was little buying for more than three months ahead of needs at any time during the year and contract-making became restricted to the needs for the current year just before the election. The expansion into more general buying for the future in the last two months of the year rather than any increase in the immediate needs of buyers accounted for the general betterment of the market.

For iron and steel products the market was in general quiet, despite reductions in June from 1.65 to 1.50c. on iron bars and from 1.88 to 1.78c. on structural material. In summer the Western railroads began buying on a large scale in comparison with their purchases in the first half of the year, and they continued to make purchases throughout the last six months. Building projects became important, and the end of the year saw a large tonnage needed for bridge and building operations in sight.

The Pittsburg Iron and Steel Markets

By S. F. Luty.

Although the depression in the iron and steel trade which began in the last quarter of 1907 continued through 1908 the year was not as bad as the outlook at the opening indicated. This was due to cooperation on the part of the large producing interests. Meetings were held at intervals at which reports on conditions were received and plans for future action decided upon.

The strong position taken by the United States Steel Corporation at the outset in the matter of prices had a great deal to do with preventing a demoralization of the markets. When readjustments were made conditions only were considered, and at no time was the price of a commodity reduced for the purpose of enticing buyers into the market. Chairman E. H. Gary of the Steel Corporation contended that the cutting of prices in a dull period would not induce buying but instead would seriously disturb the situation.

Mill operations in January were unsatisfactory except in the tinplate and wire branches. At the opening of the month the American Sheet and Tin Plate Company had but 52 tin mills on the active list but before the close 154 mills were going The American Steel and Wire

Company operated its plants at an average of around 70 per cent. throughout the year, starting at over 60 per cent. and closing the year with nearly 90 per cent. of its capacity active. Since the latter part of the first quarter all the large concerns report a gradual increase in production, each month being a trifle better than the previous one.

New business during the year was chiefly for small tonnages, showing that consumers bought only for immediate requirements. Agricultural - implement makers who had placed contracts for the year ending June 30 took all the material ordered and were buyers of large tonnages through the year. The farmers had a profitable season and did not hesitate to place orders for new implements. They were also heavy buyers of fence wire.

Rail buying was disappointing. The tonnage placed all year did not amount to much more than 1,500,000 tons against about 3,600,000 tons in 1907 and almost 4,000,000 tons in 1906. Difference with the railmakers over specifications and also a lack of funds are assigned as reasons for failure to buy more liberally. Early in the year the Pennsylvania Railroad reserved 147,000 tons and on Feb. 6 announced that it had placed 55,000 tons. The railmakers, however, rejected this order on account of the specifications. This road got through the year with less than 10,000 tons of rails which were purchased from the Cambria Steel Company and used for experimental purposes. In December this road entered the market with an order for 135,000 tons for 1909 delivery. Other lines placed orders for smaller tonnages. The large systems are figuring on their requirements and are expected to enter orders early in 1909.

Late in the year railroads were large buyers of track material and bridge work, also rolling stock and other equipment. In November the Pennsylvania Railroad placed an order with the Westinghouse Electric and Manufacturing Company for the electrification of its system from New ark, N. J., to Jamaica, L. I., which will amount to $5,000,000. The Duluth & Iron Range Railroad, a Steel Corporation interest, in December ordered 800 ore cars which are being built by the Standard Steel Car Company, Pittsburg, at its Hammond works. They are of the Summers type and are for delivery in March and April. The 6400 wheels will be furnished by the Carnegie Steel Company which bought the Schoen Steel Wheel Company's works at McKees Rocks, Pittsburg, in July.

The Newburg & South Shore Railroad of the American Steel and Wire Company late in November placed an order with the Pressed Steel Car Company, Pittsburg, for 275 steel cars and the Birmingham Southern Railroad of the Tennessee Coal, Iron and Railroad Company, bought 160 steel cars. The Pittsburg & Lake Erie Railroad placed orders for 2000 cars, 1500 with the American Car and Foundry Company and 500 with the Standard Steel Car Company.

Structural steel contracts were confined to small tonnages chiefly, but there were a number of from 2000 to 3000 tons. The largest called for 13,500 tons for the Beaver bridge of the Pittsburg & Lake Erie Railroad and 12,000 for the new Oliver building in Pittsburg.

Work on the steel plant and blast furnaces being built at Aliquippa, a few miles below Pittsburg, on the Ohio river, by the Jones & Laughlin Steel Company which was stopped when the depression began late in 1907 was not resumed, but likely will be early in the new year. The new open-hearth steel department at the Ohio works, Youngstown, of the Carnegie Steel Company, was finished early in the year and put in operation. The Youngstown Sheet and Tube Company's two new blast furnaces were completed and put in blast in November. The Pittsburg Steel Company, the large independent wire interest, completed eight open-hearth furnaces at its plant at Monessen, about 40 miles from Pittsburg, in June and four were started in the following month. This company's contract with the Carnegie Steel Company for billets expired on June 30.

The year opened with a weak pig-iron market and most of the merchant furnaces in the Valleys were closed on account of dull conditions. The highest price of the year was in January and the lowest in October. As soon as the result of the national election was known producers advanced prices $1 and more a ton, and thereby checked what looked like a good buying movement. This did not deter producers from maintaining firm prices the rest of the year.

Average prices for all sales by months are shown in the accompanying table. The official average of bessemer iron in which only sales of 1000 tons or more are considered was as follows, Pittsburg delivery: January, $19; February, $17.90; March, $17.86; April, $17.49; May, $16.92½; June, $16.90; July, $16.73; August, $16.11; September, $15.90; October, $15.48; November, $16.74; December, $17.40.

The production of pig iron at furnaces in the Pittsburg district and the Valleys for the year has not been compiled.

Merchant furnace interests demanded a reduction in ore prices but at two meetings of ore producers, one on Jan. 29 and the other on Feb. 6 the appeal was ignored and old prices reaffirmed. The lake ore shipping season did not open until June 1 and a week later producers cut the price 50c. a ton, the season's new prices being as follows: Mesabi non-bessemer, $3.50; Old Range non-bessemer, $3.70; Mesabi bessemer, $4.25; Old Range bessemer, $4.50. These prices were guaranteed until May 1, 1909. The lake ore shipments for the short season of 1908 amounted to 25,430,544 tons.

When the Pittsburg Steel Company started four of its new open-hearth furnaces in July it bought 8000 tons of basic iron from the Midland furnace at a low price. Other small lots were purchased until Oct. 19 when it entered into a five-year contract with the Penn Iron and Coal Company, operating a furnace at Canal Dover, O., for 6000 tons a month, or a total of 360,000 tons. The price was on a sliding basis. The Standard Sanitary Manufacturing Company and the Westinghouse interests were large purchasers of pig-iron during the year.

The foundry pig-iron producers held several meetings early in the year for the purpose of devising means for preventing a decline in prices but all were unsuccessful. It was found to be impossible to maintain prices and late in April the pig-iron market was thrown wide open.

While the movement of the United States Steel Corporation and other large steel interests for the maintenance of prices was not an entire success it had the effect of preventing general demoralization.

The first readjustment of prices oc-

AVERAGE PRICE AT PITTSBURG, 1908.

Month.	Pig Iron.				Steel.					Nails.	
	Bessemer.	No. 2 Foundry.	Gray Forge.	Ferro-Mang.	Bessemer Billets.	Rails.	Black Sheets No. 28.	Tank Plate.	Steel Bars.	Wire Per Keg.	Cut Per Keg.
	$	$	$	$	$	$	c.	c.	c.	$	$
January	19 15	17.90	16.90	49.00	28.00	28.00	2.50	1.70	1.60	2.05	2.00
February	18 15	16.90	15.90	47.00	28.00	28.00	2.50	1.70	1.60	2.05	2.00
March	18 15	16.90	15.90	46.00	28.00	28.00	2.50	1.70	1.60	2.05	1.90
April	17.65	16.40	15.40	45.00	28.00	28.00	2.50	1.70	1.60	2.05	1.90
May	17.15	15.90	14.90	46.00	28.00	28.00	2.50	1.70	1.60	2.05	1.85
June	17.15	15.90	14.90	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
July	16.90	15.90	14.90	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
August	16.25	15.65	14.65	46.00	25.00	28.00	2.50	1.60	1.40	1.95	1.80
September	16.00	15.40	14.40	45.50	25.00	28.00	2.50	1.60	1.40	1.95	1.80
October	15.65	15.40	14.40	46.00	25.00	28.00	2.50	1.60	1.40	1.95	1.75
November	16.90	16.40	15.40	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
December	17.65	16.65	15.65	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
Year	17.23	16.28	15.28	46.38	26.25	28.00	2.50	1.64	1.48	1.99	1.83

curred on Jan. 6 when tinplate was cut from $3.90 to $3.70 a box; black sheets, $2 a ton from 2.60c. to 2.50c. for No. 28 gage; galvanized sheets, $4 a ton, from 3.75c. to 3.55c. for 28 gage; blue annealed sheets, 5c. per 100 lb., making new prices as follows: Nos. 10 and heavier, $1.80; Nos. 11 and 12, $1.85; Nos. 13 and 14, $1.90; painted corrugated roofing 10c. a square, from $1.85 to $1.75; galvanized corrugated roofing, 15c. a square, from $3.25 to $3.10. It was explained that these cuts were not made to induce buying, but were on account of the reduced cost of raw material.

A meeting of the principal bar-iron producers was held in Pittsburg on Jan. 7 at which prices for Pittsburg and Eastern shipment were reduced $1 a ton to 1.55c. Pittsburg, and for Western shipment $4 a ton to 1.40c. Pittsburg.

A practical reduction in the price of billets was made in March when the mills agreed to divide the freight of finishing mills located outside of Pittsburg when the rate was from $1 to $3 a ton.

At a meeting of steel interests held in New York on June 9 a readjustment of prices was decided upon. Billets were cut $3 a ton, from $28 to $25; sheet-bars and tinplate-bars, $2 a ton, from $29.50 to $27.50; structural material, a general cut of $2 a ton; shapes, from 1.70 to 1.60c.; plates, $2 a ton, from 1.70 to 1.60c.; wire products, 10c. per 100 lb.; wire nails, 10c. a keg, from $2.05 to $1.95; merchant-steel pipe, two points, or $4 a ton. Later wrought-iron pipe prices were reduced one point, or $2 a ton, by manufacturers who did not attend the steel meeting.

On June 1 the price of steel bars was cut $4 a ton, from 1.60c. which had been the price for two years, to 1.40c. On June 11 bar-iron prices were reduced to 1.40c. Pittsburg, and to 1.35c. for Western shipment.

The season's cotton-tie price was fixed in April at 85c. a bundle, the rate that ruled in 1905 and 1906, and a cut of 10c. a bundle from the 1907 price. Over 2,000,000 bundles, or 40,000 tons, were bought soon after the price was arranged.

On Jan. 22 the price of light rails was reduced $2 a ton but the new price was immediately shaded. Re-rolling mills cut the price of the large producers from $2 to $3 a ton all year.

The established prices on finished material were not strictly adhered to at all times. In the summer plates were cut about $2 a ton. Sheets also were shaded in some extremely dull periods and in September and October tinplate was shaded from 5 to 10c. a box. In the last two months of the year prices in all lines were firmly held.

Wage Adjustments

Although dull conditions prevailed throughout the year there were no particularly severe wage reductions. Outside of the mills governed by the annual wage scale of the Amalgamated Association of Iron, Steel and Tin Workers there was no concerted action in the matter of wages. In a few foundries and machine shops wages were readjusted and the reductions were accepted by the workmen without protest.

A largely attended meeting of merchant blast-furnace interests was held at Youngstown on Jan. 21 for the purpose of considering the advisability of reducing the wages of blast-furnace workers 20 per cent. After a thorough discussion it was decided to make no change as a cut might result in a further depression in pig-iron prices.

Bimonthly adjustments under the Amalgamated Association scale were as follows:

January—Bar iron average, 1.55c., a decline of 0.05c. compared with previous settlement, puddlers receiving $6.37½ a ton, a cut of 12½c. Sheets, average $2.40 same as previous settlement, workers continued to receive 2.6 per cent. above base. Tinplate, average, $3.70 a box and workers continued to receive 6 per cent. above the base.

March—Bar iron average, 1.45c., puddlers receive $6.12½, a cut of 25c. a ton. Sheets, average 2.30c., the base, and workers' pay 2.6 per cent. Tinplate, average $3.50 a box, and workers cut 4 per cent.

May—Bar iron average, 1.45c. No change, puddlers pay continuing at $6.12½ a ton. Sheets, average 2.30c. No change. Tinplate average, $3.40 a box, the base, and workers' pay cut 2 per cent.

July—Under new scale. Bar iron average, 1.35c. and puddlers' pay $5.37½ a ton, a cut of 75c. a ton. Sheets, at new base, a cut of about 2 per cent. Tinplate, at new base, a cut of about 5 per cent.

September—Bar iron average, 1.30c. and puddlers' pay cut to $5.25 a ton. Sheets and tinplate no change.

November—No change in the three branches.

The annual convention of the Amalgamated Association opened in Youngstown on May 5 and continued in session for two weeks. No changes were made in the wage scales. A conference was held at Cambridge Springs, Penn., June 1 with the Western Bar Iron Association. A stiff reduction was demanded, but workers refused and conference adjourned without a date. Amalgamated committee met officers of the Republic Iron and Steel Company on June 22 and could not agree on new scale. A conference was held on June 29 with the American Sheet and Tin Plate Company. The result was a complete readjustment of the advantageous scales enjoyed by the workers during the year. The base of the tinplate scale was advanced from $3.40 to $3.90 a box precluding any increase under the sliding arrangement, and the general scale was cut about 5 per cent. besides. In sheets the base was raised from 2.30 to 2.50c., and the general scale was reduced about 2 per cent.

The American company held a conference with representatives of the Tin Workers' International Protective Association and renewed the tin house scale for another year.

At a second conference with the Western Bar Iron Association held in Detroit on July 7 a settlement of the iron scale was reached. The new scale provided for reductions of 8 per cent. in the puddling branch and from 5 to 11 per cent. in the finishing departments. The Republic Iron and Steel Company accepted this scale later in the month when it was ready to start its idle union mills.

The Seaboard Iron Markets

The course of the trade on the seaboard and in Eastern territory is determined chiefly in New York and Philadelphia. New York is the distributing point for the State and New England, but Philadelphia is nearer the primary markets, and is directly connected with a large producing section in eastern Pennsylvania. The seaboard markets for the year followed the general course of the trade rather closely, and the variations were rather less than is usual in a year of depression.

The pig-iron market, which was practically the only open one, showed the greatest variations, as a consequence. For the greater part of the year foundrymen in Eastern territory bought on the hand-to-mouth plan, taking from time to time only such small lots as served their immediate needs. For these orders there was sharp competition among such furnaces as were kept in blast. It was a time when it was almost impossible to follow prices; cuts of 25 and 50c. were made from the nominal quotations, and these were kept quiet as far as possible. For several months there was considerable accumulation of unsold pig iron, and a natural disposition to try and work this off at almost any price was observed. About September a gradual stiffening began. The cast-iron pipe makers were taking a good deal of iron, and other foundries were increasing their requirements. Moreover, there was some rather active inquiry for basic pig, indicating some revival of business among Eastern steel makers. In October this business quieted down and the markets were dull until near the middle of November. Another revival set in, and by the beginning of December unsold iron accumulations were pretty well worked off. It was noticeable, however, that consumers continued the policy of buying for short deliveries only, and there was much reluctance about placing contracts for 1909. Very little business was done beyond the first quarter.

Through all the period of dullness Southern iron had the call in seaboard territory. Sales were larger, and the Southern furnaces kept in more active

operation than the Northern stacks during the entire year. At the close of the year the market shows more activity and greater firmness, the prices of $13@13.50 Birmingham for Southern No. 2 foundry, and about $17 seaboard for Northern No. 2 being fairly well established.

In finished material—with the exception of structural steel—the markets were dull throughout the year. Early in the year there was an expectation of lower prices, but these did not come, except in a very limited degree, and there was little change in the volume of business. As with pig iron, buyers took only what they required from time to time, and would not contract far ahead, except upon terms which sellers were unable to grant under the close restriction and supervision from which the markets suffered. Some revival set in in November, and there was some placing of contracts for the first quarter of 1909, but little beyond that time. There was also at this time an increase in demand for nails and other supplies used in small building, indicating a more hopeful condition as to that class of construction.

The structural market in the East showed some exceptions to the general rules. Owing to the withdrawal of money from the speculative markets, there was a large supply ready to invest in building projects, if conditions as to price should prove to be favorable. It was well understood that the Steel Corporation dominated the price situation, and its action was closely watched. The small and grudging reductions in structural prices made in June were a sharp disappointment. They were not enough to stimulate trade, but sufficient to induce hopes of further reductions. The immediate effect was to reduce the business that was ready to be offered.

A little later, however, structural trade began to revive, and more orders were placed. As the year went on the conditions improved, though nominally no further reductions in prices were made. The structural business in the larger cities of the East is done mainly with the large fabricating companies, which contract for the whole iron work of a building. Orders to the mills are sent by those companies. They began gradually to take orders and contracts for finished buildings at prices which, when closely analyzed, indicated a lower price for the steel than the nominal quotations. Though no acknowledgement of such reductions was made, there is no doubt that structural steel was supplied by many mills at cut prices. The exact extent of these cuts has been a secret guarded with unusual care, and it is impossible to give facts or figures. At any rate business improved, and during the later months of the year building and bridge contracts of large aggregate quantity were placed.

One feature of the year in the East was that there were not many failures or collapses in the trade, considering the general depression of the year. Labor conditions were fairly satisfactory. The close of the year was quiet and opinions as to the outlook for the new year differ widely.

Mine Accidents and the Geological Survey

Under the terms of its appropriation of $150,000 for the investigation of mine disasters, the Geological Survey has determined to establish rescue stations at or near the centers of mine accidents for the purpose of teaching miners how to use the most approved apparatus for mine rescue work. Government engineers will be assigned to the stations ready to go to the scene of any disaster, equipped with oxygen helmets. The stations will be supplied with air-tight rooms where gas can be generated, and coal-mining companies will be invited to send selected men to the stations for a sojourn. The men will then be trained in the use of the oxygen helmets. The Government does not plan to carry on general rescue work, but rather to assist mine owners in developing trained rescue crews at the mine, the rescue stations being erected in coöperation with the mine owners and State geological surveys.

The location of stations so far as determined on is as follows: At Urbana, Ill., in connection with the University of Illinois, for a district including, Illinois, Indiana, Michigan, Iowa, northern Missouri and western Kentucky; at Raton, New Mexico, for a district including New Mexico, Colorado, Wyoming, and Montana, with a second station possibly at Salt Lake City, Utah; at or near South McAlester, Oklahoma, for a district including Oklahoma, Arkansas, and southwestern Missouri; at an undetermined point (perhaps Knoxville, Tenn., Birmingham, Ala., or Lexington, Ky.) for a district including Alabama, Tennessee, Virginia, eastern Kentucky, Georgia, and southern West Virginia. George S Rice, mining engineer, will be given general charge of the mining inquiries at these stations and J. W. Paul, formerly State mine inspector of West Virginia will be assigned supervision of all the rest of the work.

A second function of the stations will be that of acting as headquarters for the engineers engaged in the study of the waste of coal in mining. Safety lamps of all designs will also be tested at these stations in order to ascertain their general safety and efficiency.

Officers of the Survey express the opinion that much progress in averting the evil results of mine disasters can be made through the use of the oxygen helmets which have recently been demonstrated in one or two important accidents with what are considered good results.

Garnet in New York

By D. H. Newland*

The abrasive garnet trade afforded no exception to the general course of business conditions during 1908. The Adirondack mines supplied, as heretofore, the greater part of the production of garnet for abrasive uses, but owing to the poor demand their output was reduced to less than one-half the total of the preceding year. The actual amount, as near as it can be estimated at this time, was about 2,000 short tons, compared with 5709 short tons in 1907. There was no corresponding decline in the prices obtained for the garnet, since the margin over the cost of mining is not large enough to admit any material reduction. Most of the output, also, was sold on contracts covering the annual requirements of the consumer.

No new companies have engaged in mining in the Adirondacks during the year. The North River Garnet Company, with mines and a mill on Thirteenth lake, has been the main producer. Since October, 1907, this company has been working a single shift only and suspended operations entirely for a period of three months last spring. On Gore mountain the mines of H. H. Barton & Son were run on a reduced scale. The Crehore mine near North River was inoperative throughout the year. A small output of massive garnet was reported from the new locality near Keeseville in the northern part of Essex county. This grade of garnet is mostly sold abroad.

A recent feature of the trade has been the introduction of foreign garnet which is finding a limited market in this country. It comes from Spain where it is said to occur in river sands, doubtless a product of the disintegration of crystalline rocks. The material can not displace the domestic product to any great extent as it is useful only for the finer sizes of abrasive papers. Garnet is a common ingredient of the sands found along the streams and lakes of the Adirondacks, but it seldom if ever forms deposits of any extent and is also always in finely comminuted condition.

The Cobar district in New South Wales is one of the most important sources of copper in Australia. The ore on smelting yields about 2.7 per cent. copper and 2.5 dwt. gold per ton.

The Luipaards Vlei mill (*South African Min. Journ.*, Sept. 12, 1908) crushed in August, 1908, an average of 9,677 tons per stamp per day. This is the record on the Rand.

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AVERAGE MONTHLY PRICES OF CHEMICALS, EARTHS, MINERALS, ETC., IN 1908.

(IN CARLOAD LOTS AT NEW YORK)

Material.	Unit.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Abrasives:														
Corundum	Lb.	$0 07	$0 07	$0 07	$0.07	$0 07	$0 07	$0 07	$0 07	$0 07	$0.17	$0 07	$0 07	$0 07
Emery, Turkish flour	Lb.	0 0175	0 0175	0 0175	0.0175	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175
Emery, Naxas flour	Lb.	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175	0 0175	0.0175	0 0175	0 0175	0 0175	0 0175	0 0175
Emery, Chester flour	Lb.	0 0150	0 0150	0.0150	0 0150	0 0150	0 0150	0 0150	0.0150	0 0150	0 0150	0 0150	0 0150	0 0150
Emery, Peekskill flour	Lb.	0 0125	0 0125	0 0125	0.0125	0 0125	0 0125	0 0125	0.0125	0 0125	0 0125	0 0125	0 0125	0 0125
Garnet	Sh. T.	30 00	30 00	30.00	30 00	30.00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00
Boric acid	Lb.	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07
Borax, sacks	Lb.	0 0425	0 0425	0 0425	0 0425	0.0425	0 0425	0 0425	0 0425	0 0425	0 0425	0 0425	0 0425	0 0425
Alum, lump	100 Lb.	1 75	1 75	1 75	1 75	1.75	1 75	1 75	1 75	1 75	1 75	1 75	1 75	1.75
Aluminum sulphate	100 Lb.	1 25	1 10	1.10	1 10	1 10	1 10	1 10	1.10	1.10	1 10	1.10	1 10	1 112
Ammonium sulphate	100 Lb.	3 075	3 075	3.075	3.075	3.075	3.075	3 075	3 075	3.075	3.075	3 075	3 075	3 075
Arsenic, white	Lb.	0 0475	0 05125	0 0500	0 0425	0.0356	0 03375	0 0350	0.0350	0.0325	0.03125	0 03125	0 03125	0 0381
Gilsonite	Sh. T.	35 00	35 00	35.00	35.00	35.00	35 00	33 00	32 00	32 00	32 00	32 00	32 00	33 58
Barytes, American ground	Sh. T.	17 50	17.50	17.50	17.50	17 50	17 50	17 50	17.50	15.75	15.75	15 75	15 75	17.06
Chrome ore	Lg. T.	17 50	17.50	17 50	17.50	17.50	17.50	17 50	17 50	17 50	17 50	17.50	17 50	17 50
Cobalt oxide	Lb.	2 50	2 50	1 45	1.45	1 45	1 45	1 45	1 45	1 45	1 40	1 40	1 40	1 61
Copperas, bulk	100 Lb.	0 55	0 55	0 55	0.55	0 55	0.55	0 55	0 55	0.55	0.55	0 55	0 55	0 55
Fluorspar, lump	Lg. T.	9 00	9 00	9 00	9.00	9.00	9 00	9 00	9 00	9 00	9.00	9 00	9 00	9.00
Fuller's earth	100 Lb.	0 800	0 80	0.80	0.80	0.80	0.80	0 80	0 80	0 70	0 80	0 80	0 80	0 80
Magnesite, Greece, crude	Lg. T.	9.00	9 00	9.00	9 00	9 00	9 00	9 00	9 00	9 00	9 00	9 00	9 00	9 00
Magnesite, calcined	Sh. T.	35 00	35 00	35 00	35 00	35 00	35 00	30.50	30.50	30.50	30 50	30.50	30.50	32 75
Nitrate of soda	100 Lb.	2 40	2 42	2 375	2 3125	2 275	2 25	2 2375	2.1875	2 1625	2 1175	2 15	2 175	2 255
Litharge	Lb.	0 0625	0 0625	0 0625	0 0625	0 0625	0 0625	0 0625	0 0625	0 0625	0 060	0 060	0 060	0 0617
Red lead	Lb.	0 065	0 065	0 065	0 065	0 065	0.066	0 066	0.066	0 065	0 065	0.065	0 065	0.0652
White lead	Lb.	0 0563	0 0563	0 0563	0.055	0.055	0 055	0 0563	0.0563	0 055	0 0538	0 0538	0 0538	0 0552
Zinc white	Lb.	0 0513	0 0513	0 0513	0 0513	0 0513	0 0513	0 0513	0 0513	0 0513	0.0513	0 0513	0 0513	0.0513
Phosphate Rock:														
*Florida hard rock	Lg. T.	10.25	10 25	10 25	10.25	10 25	9 50	9 25	10 00	10 00	10 00	10 00	10 00	10.00
Florida land pebble, 68 per cent.	Lg. T.	5 25	5 25	5 25	4.00	4 00	4.00	4 00	4 25	4 25	4 25	4 25	4 25	4 42
†Tennessee, 78 to 80 per cent.	Lg. T.	7 00	7 00	7 00	7.00	7 00	6.00	6 00	6 00	6 00	6 00	6 00	6 00	6 42
Tennessee, 75 per cent	Lg. T.	6 25	6.25	6 25	4.50	4 50	4 50	4.50	5.00	5.00	5 00	5 00	5 00	5.15
Tennessee, 68 to 72 per cent.	Lg. T.	5.25	5.25	5 25	4.00	4 00	4.00	4 00	4 00	4 00	4 00	4.00	4 00	4.31
‡South Carolina land rock	Lg. T.	6 75	6 75	6 75	6.75	6 75	6 75	6 75	6 75	6 75	6 75	6 75	6.75	6 75
South Carolina river pebble	Lg. T.	7 00	7 00	7 00	7.00	7 00	7.00	7 00	5 00	5 00	5 00	5 00	5 00	6 17
Potassium cyanide	Lb.	0 18	0 18	0.18	0 18	0.18	0.18	0 18	0 18	0 180	0.18	0 18	0.18	0.18
Kainite, bulk	Lg. T.	8 50	8 50	8 50	8 50	8 50	8 50	8 50	8.50	8 50	8 50	8 50	8 50	8.50
Pyrites:														
Dom., Non-arsenical furnace	Unit of S	0 1125	0 1125	0 1125	0 1125	0.1125	0.1125	0 1125	0 1125	0.1125	0.1125	0 1125	0 1125	0 1125
Dom., Non-arsenical fines	Unit of S	0 1025	0 1025	0 1025	0 1025	0.1025	0 1025	0 1025	0 1025	0 1025	0.1025	0 1025	0 1025	0 1025
Imp., Non-arsenical furnace	Unit of S	0 1325	0 1275	0 1275	0.1275	0 1275	0 1275	0 1275	0.1275	0 1275	0 1275	0 1250	0 1250	0 1271
Imp., Arsenical furnace	Unit of S	0 1250	0 1225	0 1225	0 1225	0 1225	0 1225	0 1225	0 1225	0 1225	0 1225	0 1200	0 1200	0 1221
Imp., Arsenical fines	Unit of S	0 0875	0 0875	0 0875	0 0875	0 0875	0 0875	0.0875	0 0875	0 0875	0 0875	0 0875	0 0875	0 0875
Imp., Non-arsenical fines	Unit of S	0 1075	0 1075	0 1075	0 1075	0 1075	0 1075	0.1075	0 1075	0 1075	0 1075	0 1075	0 1075	0 1075
Soda, caustic, 76%	100 Lb.	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1.800	1 800	1 800	1 800	1.800
Saltcake, bulk	100 Lb.	0 55	0 55	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 425
Sodium bromide	Lb.	0 16	0 16	0 16	0.16	0 16	0 16	0 16	0 16	0 15	0.135	0 135	0 135	0 153
Sodium cyanide	Lb.	0 18	0 18	0 18	0 18	0 18	0 18	0.18	0 18	0 18	0 18	0 18	0 18	0 18
Sodium sulphate	100 Lb.	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60	0 60
Sulphur	Lg. T.	22 00	22 00	22 00	22 00	22 00	22 00	22 00	22 00	22 00	22 00	22 50	22 50	22 08
Talc, dom	Sh. T.	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00	20 00
Zinc chloride, gran	Lb.	0 0475	0 04750	0 04750	0 0475	0 0475	0 0475	0 0475	0 0475	0 0475	0 0475	0 0475	0 0475	0 0475
Zinc dust	Lb.	0 0569	0 0569	0 0569	0 0569	0 0569	0 0525	0 050	0 050	0 0475	0 0475	0 0475	0 0475	0 0523
Zinc sulphate	Lb.	0 02375	0 0215	0 0215	0 0215	0.0215	0 0215	0 02125	0 02125	0 02125	0 02125	0 02125	0 02125	0 0216

* F.o.b. Florida or Georgia ports. † F.o.b. Mt. Pleasant. ‡ On vessel, Ashley river, S. C.

NOTE—These quotations were for ordinary wholesale lots in New York unless otherwise specified, and were generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers asked of consumers and not what producers realized in selling their outputs as matters of private contract.

Coal Mining in the United States in 1908

Reviews of Mining Conditions in Many Important Centers of Anthracite and Bituminous Production, with Forecasts of Future Production

TOTAL PRODUCTION, 418,968,000 TONS

The production of coal in 1908 showed less of a falling off when compared with the record totals of 1907, than was generally anticipated by those who were familiar with the apparent slackness in the industry during the year. The total output of coke, however, was rather less than expected.

From the best figures available at this early date, it appears that the coke production in 1908 was about 61 per cent. of the total output for the preceding year. The total coal production in 1908 was approximately 88 per cent. of the 1907 output.

The anthracite production showed a falling off of about 7 per cent., while the bituminous output was 14 per cent. less than in 1907. It is possible that a considerable quantity of the anthracite mined in the late months of 1908, has been stored as a provision in case of trouble on the expiration of the miners' agreement this coming spring.

The Coal and Coke Industries in 1908

By Floyd W. Parsons

The close of 1908 shows a slow, but perceptible improvement in all branches of the coal and coke industries. The Eastern operators were more severely affected by the slackness in business than the owners of coal mines in the South and West. Likewise, the coke industry felt the depression in business considerably more than did the production of coal. The production of coke in the Connellsville region, which district produces more than half of the total output of our country, showed a decrease in production of more than 10,000,000 tons, or about 50 per cent. of the 1907 output.

The enormous falling off in the production of coke was the natural result of the dullness in the iron and steel industries. Practically none of the coke operations in Pennsylvania and West Virginia has resumed on full time, although the outlook is more encouraging as the year draws to a close. In the Western States, the demand for coke was about equal to the output, during the latter half of the year. Both Alabama and Tennessee showed a slight falling off in coke manufacture during 1908; West Virginia produced about 70 per cent. as much coke in 1908 as was produced in the preceding year.

In the production of coal, some of the smaller States made a much better comparative showing than the more important fields. Michigan, New Mexico, Oklahoma, Washington and Utah had an output in 1908 equal, and in some cases exceeding the production of 1907. As was true in the coke industry, Pennsylvania also showed the greatest percentage decrease in coal production during the year. West Virginia suffered a greater falling off in production than did Illinois, so that the latter State will easily retain its place as the second largest producer in the Union. The production for that district formerly known as Indian Territory is now included under Oklahoma.

Car Supply and Labor Conditions

During the two years preceding 1908, the operators were much distressed over the lack of cars and the scarcity of labor. It is safe to say that no district suffered to any considerable extent from these causes during the past 12 months. There were no important labor troubles, excepting the Alabama strike, and but few wage reductions. The cause of organized labor made practically no headway in bringing new districts into the fold of the Union.

The year brought forth much discussion concerning the advisability of providing our miners with a higher education, so that a better understanding of the elementary problems attending coal mining, might result in bringing about a decrease in the number of mine accidents. These efforts to advance labor to a higher plane of intelligence have been undertaken along two lines: 1. Several of the larger companies have established night schools which provide instruction for all miners, free of charge. The expense incurred in carrying on this work is borne entirely by the mining company. 2. A general belief has arisen that all miners should be compelled to serve an apprenticeship before they are permitted to undertake important or responsible work. Along this same line, pressure is being exerted in several States with the idea of raising the standard of eligibility for mine foremen and fire-bosses.

Several important coal companies were organized during the year, but little new development was undertaken. It was expected that during 1908, the Hepburn law would become effective, and that as a result of the enforcement of this new legislation, many of the larger anthracite and bituminous companies would be obliged to reorganize and operate independently of the controlling railroad company. The test case against the anthracite coal companies was decided early in the year in favor of the railroads; the case was appealed to the Supreme Court and will probably be decided in 1909.

Mine Accidents

The question of coal-mine accidents, their cause and prevention, has been the all important subject of discussion during the past 12 months. The year has brought forth many new, if not startling ideas. In the expression of these opinions, our most prominent engineers have differed widely in their views. Several mine managers have made the assertion that we are sending too much air through our mine workings, and that before we adopted such elaborate systems of ventilation, explosions, especially those due to coal dust, were not so frequent. It has also been stated that the practice of sprinkling our mines in order to settle the dust and prevent dust explosions is in error; the opposition to this plan of introducing moisture into our mines, bases its opinion on the idea that excessive moisture in mine air causes roof falls, and thereby adds largely to our list of fatalities..

It is safe to say that the majority of mine managers do not agree with the foregoing statement, and that the introduction of a reasonable amount of moisture into mine air, as well as the practice of sprinkling the dust at the face of rooms and entries before shots are fired, is a precaution that insures greater safety to the miner working underground.

There is no question but that the great number of roof falls is a serious menace to the safe operation of coal mines; however, it is doubtful if we can safely reduce the volume of air at present being sent into our mines or increase the factor of safety by neglecting to sprinkle dusty working places. It is probable that in the future when such problems are better understood we will find that underground, as on the surface, rock disintegrates not so much from either dampness or from an atmosphere of unusual dryness, but rather from the frequent change to one or the other of these extreme conditions.

If we could keep the moisture in our mine air at a certain standard all the year round, we would then materially reduce the number of roof falls due to the disintegration of the top rock.

Coal Dust Explosions

The problem of eliminating coal dust as a factor in mine explosions has been the principal subject occupying the attention of coal engineers during the year. The first precaution to adopt is to remove as much of the dust as is practically possible. After this has been accomplished, there still remains an immense quantity of finely divided dust that must be taken care of. This powdered coal will not explode so readily or lend itself to a gas explosion so quickly when it is in a dampened state. Therefore, it seems that so far as present knowledge teaches, the only proper thing to do is to bring this dust to a condition of dampness, thus rendering it less dangerous in case of an explosion. Experiments by English engineers have shown that when rock dust is mixed with coal dust, the latter is rendered inexplosive. Whether this theory can be brought to a point where it will be a practical benefit, remains to be determined.

There are many other modern practices that are looked upon with disfavor by a few. Several important operators have recently declared themselves as opposed to mining machines, and they have stated openly that in solving our difficulties we must again return to pick mining. It is probable, however, that all of our advanced ideas that have been put to practical use have come to stay, and that those who claim to believe that our increased losses of life are due to high ventilating currents, sprinkling our mines, using mining machines, etc., have overlooked the fact that we now operate on a scale of magnitude with which former systems appear primitive. Our large mines are now many times the size of the important producers of a few years ago, and if anyone doubts that our advancement toward better methods has been slow, it is only necessary for him to investigate the working plan of any mine in any district as operated a decade ago, and then compare this map with the modern mine plans that exist in that same district today.

Comparing the present with the past in coal mining, there is not the slightest doubt but that this industry has advanced with equal, if not greater rapidity than other similar enterprises.

Blown-out Shots

The important coal-mining problem to be solved during the next year is that of shot-firing. An examination of the causes assigned for the various coal-mine explosions during the past decade has shown that in bituminous mines, which latter furnish us with the majority of our serious disasters, the great majority of explosions are due to blown-out shots. Although it is the practice of almost every coroner's jury to bring in a verdict, stating that the accident was due to a blown-out shot, which, of course, means that the miner was negligent and that the company is not to blame, it is nevertheless true that about 90 per cent. of our explosions, where dust has been a factor, are directly caused by such faulty shots.

The various powder manufacturers, and the Federal Government at its experiment station in Pittsburg, are rendering great service in providing us with a better knowledge of the correct kind of powder to use. There is one practice that must eventually be adopted at every coal mine, and that is to have all the shots fired by a special corps of shot-firers. Furthermore, all holes should be fired when the miners, with the exception of the shot-firers themselves, are out of the mine at the end of the day's work. There are no less than 100 important mines in our country today where the continual shooting in the various rooms makes the mine air so cloudy from smoke, dust and gas, that the mine surveyors, with their transits, cannot see a sufficient distance along the entries and up the chambers to enable them to put in their sights properly. Promiscuous shooting of this sort is dangerous and is sure to result in disaster.

When it is suggested to operators that they should have all shots fired by regularly appointed men who do this work after the miners have left the workings, the immediate reply is that the plan is impracticable because of the expense attached, and that there would surely be a falling off in production. Our mines are not institutions owned and operated by wealthy men for the cause of charity, and consequently it is useless to suggest that they adopt beautifully devised schemes that will make their mines safe, and at the same time cause them to show a financial loss at the end of the year. Competition in coal mining is as keen as it is in any other business, and legislators, theorists and students of reform, must remember that it is more desirable to close down a plant than to adopt measures which are sure to result in a loss. It is the common practice of reformers to devote their principal attention to reforming the other fellow's business methods instead of looking to the improvement of their own.

There are mines in this country, as well as in several European fields, where shot-firing, as before recommended, is carried on successfully, both from the point of safety and economy. I do not believe that conditions in any field in our country are such as to prohibit shot-firing by specially appointed men after the day's work has been done. It has been suggested that this practice is dangerous, especially if the miners charge their own holes, for when they do not fire the shots themselves, they are not so careful about loading and tamping the holes. This point is undoubtedly true to a small extent and cannot be entirely eliminated so long as we have to deal with the personal factor. It is better, however, if we must have explosions, that 8 or 10 men lose their lives than 10 or 20 times that number.

Mine Rules Must Be Enforced

We have examples each day where miners deliberately disobey all rules, and for the sake of personal gain, endanger not only their own, but the lives of fellow workmen. This can only be avoided by stricter supervision, and if necessary, by having a number of additional police underground. The Marianna mine, for instance, which was designed to be a model operation, was as dangerous as any poorly planned and badly managed property could be. The sole reason for this was due to the violation of rules by certain miners who carried black powder into the workings, and even went so far as to use cartridges filled with coal dust for tamping.

We must hold all miners responsible and see that they are severely punished for any infraction of prevailing rules. On the other hand, mine operators should be held responsible if they do not take every possible step to properly police their mines, and thus prevent such reckless violations. Coroner's inquests are laughable comedies, where no one but the dead are held responsible, and where the defendants suggest the questions put to themselves. No matter how many virtues we possess, we are sure to be more careful when we know that there is a possibility of responsibility and blame being laid at our door. In fairness to the honor we all claim to possess, and to those unfortunates who pay the heavy price, we must be willing to assume the burden of blame when it is ours.

The Chicago Coal Market in 1908

By E. Morrison

From the point of view of the dealer in steam coals, particularly those from the Illinois and Indiana fields, the year 1908 has been disappointing. The demand for such coals has been low throughout the year and although demand steadily bettered in the last three months of the year, it averaged probably 20 per cent. lower than in 1907. Prices of Western bituminous were low, but continued without any material reduction from the previous year, when keen competition brought them down to a low level. Domestic coals were low-priced and the lack of universal pros-

perity aided the western producers somewhat by bringing into demand low-priced bituminous as a substitute for anthracite and high-priced eastern bituminous.

The year opened with a weak market owing to mild weather and business depression. By February the demand for both bituminous and anthracite improved greatly and demurrage evils practically disappeared. In the first half of March, the demand became light again, although in the latter half the buying was heavy because of apprehension that a strike was impending in the bituminous-producing regions; the month of April, in which mining was generally suspended throughout the western fields, saw little demand for coal and no rise in prices. Consumers and retailers alike refused to lay in large stocks.

In May, after the arrival of new supplies from the fields where mining had been suspended, the trade quieted down to a steady and dull condition that lasted with hardly a break until November, when a condition of slow improvement began. Fine coals were more generally in demand throughout the summer than in any previous year. Contract making was not so large or so general as in the previous year, open market conditions being too favorable to the consumer.

For harvesting purposes, the demand in summer and autumn was large and this helped to hold up the level of prices. Fine coals began to weaken in September and dropped to a condition of enforced sales at low prices, to escape demurrage, by October. Lump strengthened gradually as the autumn months brought an increased demand for domestic supplies, but the slow market for lump continued without noticeable strength up to the end of the year, owing to lack of cold weather and the slowness of the revival of general business.

The range of average car prices of Illinois and Indiana coals, which formed about two-thirds of the total supply received in the Chicago market, was as follows:

PRICES OF WESTERN COALS (CHICAGO).

Mo.	Lump and Egg.	Run-of-Mine.	Screenings.
Jan...	$2.00@$2.75	$1.60@$1.90	$1.20@$1.60
Feb..	$1.90@$2.75	$1.60@$1.80	$1.20@$1.50
March	$1.80@$2.60	$1.60@$1.80	$1.30@$1.50
April.	$1.75@$2.30	$1.50@$1.75	$1.30@$1.60
May..	$1.75@$2.25	$1.65@$1.85	$1.30@$1.60
June..	$1.75@$2.25	$1.65@$1.75	$1.40@$1.60
July.	$1.75@$2.25	$1.50@$1.75	$1.40@$1.60
Aug..	$1.75@$2.25	$1.60@$1.70	$1.35@$1.50
Sept.	$1.75@$2.45	$1.55@$1.75	$1.25@$1.50
Oct...	$1.75@$2.25	$1.65@$1.75	$1.20@$1.50
Nov..	$1.75@$2.65	$1.65@$1.75	$1.00@$1.55
Dec..	$1.75@$2.65	$1.65@$1.75	$1.10@$1.65

The demand for anthracite was quiet throughout the year, car prices being the same as in the previous year—$6.50 for egg, stove and chestnut, and $6.25 for grate. As for several years previous, the graduated monthly discount system was in use between April 1 and Sept. 1, giving 50c. off on April sales, 40c. on May sales and thus down to 10c. off on August sales. Retailers and consumers bought lightly in the closing months of the year, mild weather chiefly accounting for their apathy.

Eastern bituminous coals suffered throughout the year from a tendency of steam users to seek low-priced coals, and throughout the summer and autumn from over-supply. High-grade smokeless coals sold fairly well as a result of persistent advertising; low-grade smokeless was moved with difficulty and was constantly sold at less than circular prices. Smokeless brought $3.05@3.30 for run-of-mine, and $3.85@$4.05 for lump. Hocking shipments were well restricted and though the demand was not heavy it was fairly uniform, the price ranging $2.95@3.15. Youghiogheny was very quiet and steady throughout the year at $3.15@3.25 for ¾ inch gas.

Many producers of bituminous coals learned greater caution about sending surplus products to the Chicago market, in 1908. The desirability of regulating the supply so as to prevent flood waves of shipments of one kind of coal or another has often been pointed out and was emphasized by the year's history. In default of such regulation, shippers found most uniform success in closely watching the market rather than in taking speculative chances.

Pittsburg District Coal in 1908

By S. F. Luty

Coal production in the Pittsburg district in 1908 did not come up to the prediction made late in the previous year by fully 20 per cent. With data for December and from some independent companies unavailable, it is estimated that the production in the Pittsburg district and including the Westmoreland field did not exceed 42,000,000 tons, a decline of about 10,000,000 tons compared with 1907, a record year, and equal to the output of 1905.

The Pittsburg Coal Company, the leading interest, in the first nine months produced 9,720,387 tons compared with 13,302,634 tons in a like period of the previous year. Its total for 1908 was nearly 13,000,000 tons as against a trifle over 15,000,000 tons in 1907.

The Monongahela River Consolidated Coal and Coke Company produced in round numbers 6,000,000 tons, or 1,500,000 tons less than the previous year and equal to the production of 1906. Of this tonnage 2,250,000 tons went to lower river ports, and 1,500,000 tons was shipped by rail. The rest of the tonnage was distributed among the manufacturing interests along the Monongahela, Allegheny and Ohio rivers and in the home market. Other river-coal interests produced about 2,250,000 tons, or about 750,000 tons less than the previous year.

River shipments were very good for the first five months of the year, but the rivers have not been navigable since the second day of June. What coal was not consumed in the home market, or shipped by rail, was still in the pools and harbor at the close of the year, and amounted to a round tonnage of 700,000 tons, or about 20,000,000 bu. When navigation was suspended in June there were enough empty coal boats and barges in the pools to keep the mines running for two months. Since that time operations were practically suspended, only rail shipments being made. About the middle of December the rains brought the rivers to a stage that permitted the return of empties and a partial resumption of the river-coal mines followed.

Lake Trade Was Disappointing

The lake-coal trade also was disappointing. In 1907 the Pittsburg Coal Company and other interests shipped 10,485,000 tons to the northwestern market, and in 1908 shipments fell off to around 8,000,000 tons. One reason was the late opening of lake transportation. In former years ore was sent down the lakes as soon as navigation was opened, but owing to conditions in the iron and steel trade no ore was shipped until June 1, and as coal is shipped on the return trip of these boats, none went out before the middle of June. Shipments to lake ports began at the usual time, but the docks at Cleveland soon became congested, and there was considerable delay.

Prices remained throughout the year on the basis of $1.15 for mine-run coal at the mine for both river and rail shipments. Producers figured that as the demand was not normal no advantage would be gained by cutting prices as it would not bring any more business. Some of the small producers, however, did shade the price, but not sufficiently to disturb conditions. Slack fluctuated, the highest point being 80c. and the lowest 40c. a ton at the mine.

A general suspension occurred on April 1 owing to the expiration of the two-year wage agreement on the mining rate with the United Mine Workers of America. The interstate agreement was dissolved when the joint convention, held at Indianapolis in January, failed to reach a settlement. The mine workers' organization demanded a renewal of the wage scale, which was on the basis of 90c. per ton for pick mining over a 1¼-in. screen. The two-year agreement expired on March 31, and the miners wanted an agreement for a period of one year. At a conference held in Toledo in April, a settlement was reached and a contract for two years was made.

No Scarcity of Railroad Cars

For the first time in many years there was no complaint of a scarcity of railroad cars. Idle cars could be seen at the mines at almost any time, and there was no delay in shipments. It is not likely that any of the annual reports of the different corporations will show serious losses, but all profits were greatly diminished and dividends were not paid by some large concerns.

At the annual meeting of the Pittsburg Coal Company, held in Jersey City in February, all officers were reëlected. The report showed that the gross earnings of the company for the year 1907 increased $434,859.95, or 8.21 per cent. Net earnings for the year 1907 showed an increase of $765,824.88, or 34.93 per cent.

The only serious accident of the year was the explosion at the Marianna mine of the Pittsburg-Buffalo Company on Nov. 28, when 154 lives were lost. It was caused by a blown-out shot which ignited gas and dust.

Following is the verdict of the coroner's jury at the inquest on the body of one of the victims:

"We, your jury, after hearing evidence of mining experts, inspectors, miners and operators, find that John J. Ivill came to his death from an explosion in the Marianna mine, West Bethlehem township, Washington county, Penn., Saturday, Nov. 28, 1908, and that said explosion was due to a blown-out shot in Blanche entry No. 3, which ignited the gas and dust, and that a secondary explosion occurred in the main dip entries almost simultaneously.

"We further find that no blame is attachable for said accident and we recommend that mine inspectors frame and submit to the incoming legislature a set of rules to be adopted into laws, namely:

"For the employment of experienced shot-firers to fire all shots; that all shooting be done between shifts, and that black powder and other highly inflammable explosives be excluded and the excessive use of brattice cloth be prohibited. That all charges of explosives be stemmed with clay; that safety lamps be used exclusively in gaseous mines; that an efficient water system be installed and the dust in all parts of mines be fairly wet.

"And further, owing to the fact that laws governing electricity in mines are very meager, that a more rigid set of laws be submitted for adoption."

Connellsville Coke in 1908

Coke production in the upper and lower Connellsville fields in 1908 was fully 5,000,000 tons less than the previous year. The output of the H. C. Frick Coke Company with December estimated was in round numbers 7,000,000 tons, and the independent interests produced about 6,000,000 tons. At times during the year less than 50 per cent. of the ovens were in blast.

A number of ovens were closed late in the previous year when the depression in the iron and steel trade began. In January conditions became worse, and thousands of men were thrown idle. Most of them were foreigners, who returned to their former homes where they remain awaiting a return of better times.

At the opening of the year furnace coke had dropped to $2 and foundry coke to $2.50. These prices did not continue long until there was a further decline, and sales of furnace coke during the year were made at from $1.60 to $1.75, and foundry at from $1.90 to $2 per ton. On account of the low prices, the H. C. Frick Coke Company made a reduction in wages effective Jan. 1. No change was made in some classes of labor, and the reductions in others ranged from 5 to 12 per cent. A readjustment was not a surprise, as coke prices had declined fully $1 a ton compared with the prices in the first quarter of 1907. On March 1 of that year the Frick company voluntarily advanced the wages of its workers from 8 to 12 per cent.

At the close of the year furnace coke for spot shipment was quoted at $1.85 and on contract at $2. Foundry coke late in December was quoted at from $2.25 to $2.40 for both spot shipment and on contract.

Alabama Coal Production for 1908

By L. W. Friedman

Statistics from the coal-mining industry in Alabama are always slow in being received at the office of the State Mine Inspector, J. M. Gray, and consequently the estimates are necessarily based on the figures submitted for the early months of the year. The production of coal in Alabama in 1908 will show a falling off of at least 2,000,000 tons in the aggregate as compared with the output of 1907, the estimate being that the production for the past year will total about 11,900,000 tons. The production in 1907 was 14,424,863 tons against 12,851,775 tons in 1906.

During the year 1908, in addition to the depressed conditions throughout the country, there was a big strike on in this State; the United Mine Workers of America carried on the struggle from July to September. The State was asked for troops and the militia was called out for more than a month. The sheriffs of Jefferson, Walker, Bibb and Shelby counties, in Alabama, were called on for protection and the necessity of deputies was shown and responded to. The laborers brought in to replace the union men had much trouble in remaining at work, and the production of coal, except at mines where convict labor was employed remained unsteady and unprofitable.

Summary of Coal Industry in Colorado During 1908

By John D. Jones*

The coal production of Colorado in 1908 was 9,773,683 tons; this was 1,191,957 tons less than the tonnage of 1907. The relapse in production is accounted for by the tightness of the money markets prevailing during the earlier part of the year, and which resulted in shutting down many fuel-requiring industries in adjoining States, and canceling the orders contracted in this State to supply the coal. The plants of many metalliferous mines in Colorado closed, or limited their producing forces, which in turn curtailed the freight traffic and considerably slackened the demand of the railroads for fuel.

In addition, the winters of 1907 and 1908 were exceptionally mild, and this, together with the above stated reasons, seriously affected the trade. In consequence numerous coal mines were obliged to suspend operations, and some did not resume business until late in the fall. There were but few mines working to their full capacities. At the present time nearly all the mines which ceased operations pending better markets have reopened and are forging ahead with renewed activity. The depression in the trade did not affect the wages of the miners, nor the price of coal.

The relation between operators and employees in general has been harmonious, and no labor troubles occurred to interfere in any noticeable way with the total production of coal.

The supply of railroad cars has been unusually regular, although at times there have been shortages, caused more through the inability of the companies to furnish motive power to haul the coal than to a lack of cars.

Attention Was Directed to Making the Mines Safer

What makes the year a memorable one is the fact that in spite of the poor demand for the commodity the operators turned their efforts in another direction. The low financial profits of the year did not discourage them, and they took this opportunity to place their mines on a safer and better working basis, both for the protection of the employees and the safeguarding of their property; it was also true that in many instances attention was directed toward developing larger producing capacities. In short, a general desire was manifested to place the mines on a safer and more sanitary basis, with the view of meeting increased demands of trade. A number of new mines were opened which are not yet producing, and

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which will, when completed, be equipped with modern and costly appliances.

From the fact that many of the industries which were shut down a year ago, have resumed operations and new ones have started up, there is every indication that the coal industry of this State is on the verge of a prosperous era, which will result in a material increase of tonnage in the years to come.

The following summary in which the December totals were estimated gives a fairly accurate digest of the industry during the past year:

SUMMARY OF THE COAL PRODUCTION OF COLORADO FOR 1908.

Number of producing mines	190
Number of new mines opened	8
Tons of lignite coal produced	1,991,234
Tons of semi-bituminous coal produced	818,272
Tons of bituminous coal produced	6,824,737
Tons of anthracite coal produced	69,440
Tons of unclassified coal produced, estimated	70,000
Total tonnage produced	9,773,683
Total tonnage of coke manufactured	854,662
Total number of coke ovens	2,811
Number of employees at the coke ovens	1,104
Number of employees in and about the mines	14,126

The Illinois Coal Industry in 1908

SPECIAL CORRESPONDENCE

The producion of coal in Illinois during 1908 showed but little change when compared with the output of the preceding year. Labor troubles which occurred in the central fields early in the year, caused the closing down of many mines. The demand was so slack, however, that it is probable the output would have been no greater had there been no enforced suspension of work. The depression in business caused many consumers to use the cheaper grades of bituminous coals in preference to the more expensive anthracite product.

According to the reports of the State mine inspector for the year ending June 30, 1908, there were 54 counties in Illinois producing coal. The number of mines and openings of all kinds that were being operated totaled 922, while 97 of these operations were new developments of the year. There were 108 mines closed down during the year which shows that the abandoned operations exceeded the new developments by 11. The latter half of 1907 which is included in the fiscal year ending June 30, 1908 was the period of greatest production. The total output for the year ending June 30, 1908 was 49,272,452 tons. Of this production, 47,809,730 tons were produced by 407 mines, while the remaining 1,462,723 tons were produced by 515 mines which latter were engaged in local trade only. The average value per ton for all grades of coal at the shipping mines was $1.02. The aggregate home value of the total product was $50,989,082. There were 105 mines in which machines were used, which compares with 101 machine mines in the preceding year. Of the total production, 15,210,423 tons were produced by mining machines. The total number of employees is estimated at 70,841, of which number, 64,424 work underground.

The average price paid per gross ton for hand-mining was 59.3c.; the average price paid per gross ton for machine mining was 46.7c. In blasting the coal the miners used 1,328,454 kegs of powder. In operating the mines throughout the year, the number of men killed by accidents totaled 175. These fatalities made 89 widows and left 217 fatherless children. For each life lost, 281,557 tons were mined. There were 2.5 deaths per 1000 employed; it is also estimated that there were 3.6 men killed for each million tons produced.

Indiana Coal Production in 1908

SPECIAL CORRESPONDENCE

Indiana continues to hold a place in the ranks of the six principal coal producing States; however, conditions of mining and coal trade during the past eleven months were not equal to the corresponding period of 1907. The total coal production in Indiana in 1907 was 13,985,713 tons, having a spot value of $15,114,300; this output was an increase of 1,893,153 tons over that of 1906. While the growth of the industry has been remarkable it is estimated that the production for 1908 will only be about 12,000,000 tons, or a decrease of nearly 2,000,000 tons as compared with 1907.

There are several important factors, which, in addition to the general financial and industrial depression during the present year, played an important part in the large decrease in the output. After the month of March, two months were required to adjust satisfactory working conditions, wages, etc., with the mine workers; the drought had some influence; there were a few strikes and labor troubles, but the principal, controlling feature was the lack of orders. Heretofore, Indiana has furnished a large amount of steam coal to manufacturers throughout the central States. This demand was curtailed nearly one-half. The Ohio river market, because of the low stage of water, was cut out, and this loss was perceptibly felt by the producers of southern Indiana. The usual demand for domestic coal from the Northwest was tardy and not up to volume, while the lake demand was by no means equal to previous seasons.

Considering all these conditions which contributed to the closing of a number of mines, the decrease in the estimated output is not greater than the decrease or depression in other business enterprises.

About 21,000 miners have been employed in the Indiana mines during the year. The average number of days worked were less than the previous year. The operators in many instances took occasion to improve their mines during the slack time and employed the idle miners to do the work In addition to putting the plants in good condition, several new mines were opened and a number of old and abandoned operations were repaired and worked in a limited way.

IRON ORE IS TO BE MINED

A start has been made in the iron ore mining and smelting business in this State. A smelter has been established and equipped at Linton, and ore is being mined in the Greene county field and shipped to Linton where crucial tests are being made relative to the quality and richness of the ore. It is understood that the Steel Corporation at Gary is back of the test. It is generally known that this latter company holds an option on a large acreage of the iron-ore land.

Coal has been found in several localities in the State heretofore unknown to contain workable seams. In each case the work of developing the new field is being pushed successfully.

The special session of the legislature amended the prevailing laws so as to make the use of a 3¼-in. bit permissible, instead of the 2½-in. bit prescribed by the law of 1907. The operators are not inclined to furnish the larger bit because of the increased danger, and this has precipitated serious trouble in the Clinton district.

There have been fewer accidents and explosions in the mines than last year and the fatalities from this source will not exceed six or eight lives.

Notwithstanding the decreased output, there is a decidedly optimistic feeling among the operators, who share in the belief that the future will restore the industry to its accustomed activity, and doubtless, during the next two years, the yearly production will surpass any previous totals.

Coal Mining in Iowa in 1908

BY JAMES H. LEES*

The coal-mining industry in Iowa has not been quite so active during the present year as it was in 1907. This has manifested itself in a reduction in the number of days the miners worked, and a consequent diminution in the coal output. This latter, however, has not amounted to a great deal as a comparison of figures will show. In 1907, according to data collected by the Iowa Geological Survey, the output amounted to 7,574,322 short tons. In 1908

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the production was about 7,050,000 short tons, the figures being based on the closest possible estimates.

There were a number of causes contributing to this decrease. One of these was the falling off in railroad business, which was especially noticeable in the early part of the year, notwithstanding the increased passenger traffic due to the 2c. fare. Another cause was the suspension of mining operations during April, pending the adoption of the working agreement by the operators and the miners. Still another reason has been the mild weather prevailing during most of the fall months. Even in December many of the mines have worked only four or five days a week, and this is true of railroad mines as well as of others.

Much Activity in New Development Work

Perhaps one of the most important factors has been the shutting down of numerous worked-out mines and the delay in opening others, together with the gradually decreasing output of some of the old mines. This factor is partially offset by increasing activity in prospecting and exploitation in certain counties in the central coalfields, notably Boone and Dallas. Here there has been more prospecting and development than for years past. This is due to the finding of several good seams of coal at greater depths than had been prospected before, depths varying from 170 to 270 ft. One firm has recently secured control of some 7200 acres of coal land in these two counties. Polk county, in the same general field, has also received an impetus through the opening of about 10 new mines; the larger size and superior equipment of these mines will result in increased output in the near future.

Another element which will aid in advancing the production in 1909 will be the more settled market conditions throughout the country and the stability and confidence engendered by the Des Moines agreement between the miners and the operators which will be in force until March 31, 1910. This will both enable the operator to reach out after new markets and longer contracts, and will insure better mutual consideration from both parties.

Accidents

In spite of the slight decrease in production, there has been some increase both in the number of mines operated and of the employees. Over 330 mines were in operation, giving employment to 17,312 men. During the fiscal year ending June 30, 1908, there were 38 fatal accidents, or 2.2 per 1000 employees, in addition to 100 serious, nonfatal accidents. This means the loss of one life for each 188,301 tons mined, and serious injury to an employee for each 71,544 tons raised. It must be said that these accidents are in a considerable measure due to the carelessness of the miners themselves, since the Iowa mining laws are broad, and are for the most part well lived up to by the operators. During the last half of 1908, fewer accidents have been reported than for some time previous.

The use of mining machines is not extensive in Iowa, and the same may be said of electric haulage, etc. Many mines are not large enough to use them profitably, and the broken nature of the deposits also tends to discourage the installation of expensive equipment except in the larger fields.

Taking all things into consideration in Iowa, the past year has yielded all that could be expected and the coming year holds out promise of improved conditions for the coal industry.

The Coal Industry in Michigan in 1908

There was much activity manifested in the operation of coal mines in Michigan during the year just passed. Thirty-five mines were operated, and the average number of employees was about 3200. The average daily earnings of each employee was $3.05, and the aggregate sum paid in wages totaled to nearly $1,200,000. The average cost of each ton of coal produced was approximately $1.60. The most reliable estimates place the coal production for Michigan in 1908 at about 2,000,000 tons.

Coal Mining in New Mexico in 1908

Special Correspondence

The coal-mining industry in New Mexico during 1908 did not prove as prosperous as anticipated, although the percentage of increase will fall but little short of the average of the past 10 years

There was every reason to expect a much greater increase of production, as the larger mines had recently been equipped with machinery of the most improved design and of far greater capacity than had heretofore been used in the Territory; extensive development work had been carried on for a year previous, in order to satisfy the great demand for coal, which, during the two previous years it was impossible to fully supply.

The demand for coke had also far exceeded the supply, and a considerable percentage of the coke for the metal-smelting plants of the Southwest and of Mexico, had been brought from Colorado, Pennsylvania, Australia and Germany.

To help in supplying this demand, 446 new underflue ovens were completed at Dawson, in the fall of 1907. Two hundred and ten new beehive ovens were built at Koehler, and 110 new beehive ovens had been recently added to the coking plant at Gardiner, New Mexico.

The general business depression of the fall of 1907 was felt most acutely by the copper mining and smelting companies of the Southwest, because of the greatly lessened demand for their product. Through the channel of the copper-producing companies, the coal mines and coke plants were similarly affected. Therefore, instead of any large gain in production, the percentage of increase fell slightly below the average. The fact that miners were plentiful to operate the mines and that transportation facilities were better, to some extent compensated for the lessened demand; but the capacities of the mines for production were not taxed to near their limit, nor indeed given a test of what might be accomplished.

The Price Per Ton Was Less Than in 1907

From January 1, 1908 to July 1, 1908, fully one-half of the coke ovens in the Territory were idle, and the mines were operated on half time; in one or two instances some of the mines temporarily suspended operations. About July 1, an increased demand for coke aided the demand for the product of the coal mines. However, an unusually warm fall and winter throughout the Southwest and Pacific coast lessened the demand for coal until November 15, after which date the inquiry for coal has been increasing. The demand for coke is at present keeping all of the 966 ovens in the Territory constantly in operation.

During the year just closed there was produced from the mines of New Mexico 2,725,000 tons of coal, of which 75,000 tons were used in operating the mines and for domestic purposes at the camps; 310,350 tons of coke were produced, requiring 558,630 tons of coal, or 1.8 tons of coal for each ton of coke produced. Approximately 2,091,370 tons of coal were shipped, the average value of which was $1.40 per ton, a fall in average price, by reason of the lessened demand and greater competition for orders, of about 45c. per ton from prices prevailing in 1907.

An average of 3200 men were employed underground in the mines, and 740 on top, or a total of 3940 men in the immediate operation of the mines; 120 boys were also employed, 72 of whom were underground and 48 on top.

Fully as many persons were employed on the outside in cutting and hauling timbers, operating coke ovens, electrical plants, saw mills and performing other duties incidental to the operation of the mines.

Twenty-one persons lost their lives in the coal mines of the Territory during the year; fourteen of these unfortunates were killed by falls of rock.

The percentage of fatalities is very high, 5.17 per cent., and it can only be remedied by more stringent laws against carelessness in timbering the mines, and by the enforcement of better discipline in the operation of the mines.

With a revival of business conditions throughout the country, coal mining in New Mexico will assume much greater proportions than heretofore, and will move forward with rapid strides.

West Virginia Coal Industry in 1908

SPECIAL CORRESPONDENCE

It is estimated that West Virginia produced 44,091,000 short tons of coal during the year 1908. The coke production was approximately 2,978,000 net tons. The number and seriousness of the accidents in West Virginia during the year showed a great falling off from the appalling figures of 1907. The year's record did not record any such disaster as the one that occurred at the Monongah mines in the 12 months preceding.

Every effort has been made by the State Department of Mines, as well as by the operators, to reduce the number of fatalities to a minimum. With the possible exception of Pennsylvania, it is probable that West Virginia felt the depression in the coal business, to a greater extent than any other State. There were no labor troubles of consequence, and the miners, as a rule, still remain in the ranks of unorganized labor.

Chief Mine Inspector Paul has severed his connection with the State to accept a position with the United States Geological Survey experimental station corps. John Laing, a mine superintendent of experience, has been appointed chief inspector to succeed Mr. Paul. At the close of the year, the outlook for the coal industry in West Virginia is much brighter, and it is expected that the output in 1909 will equal the record production of 1907.

The Coal Mining Industry of Washington in 1908

BY RAYMOND P. TARR*

During the past year more real advances have been made in coal-mining development in the State of Washington, than during any like period of its history. In the person of D. C. Botting, inspector of coal mines, the State possesses a painstaking, capable official who is popular with the laborer as well as the operator.

Both the Northwestern Improvement Company and the Pacific Coast Coal Company have signed a two-year agreement with the officials of District No. 10, United Mine Workers of America. This agreement is effective Sept. 1, 1908. Previously, the agreement has been for a one-year term.

The coal output has been less than that of 1906, but slightly greater than the production of 1907. Since 1906 the Northwestern Improvement Company has not been engaged in the domestic trade, and has mined solely for the supply of the Northern Pacific Railway Company. Owing to the working out of areas within the fields of the Pacific Coast Coal Company, the output of this latter corporation has fallen short.

At Coal Creek, the Pacific Coast Coal Company has driven a slope to obtain a vast amount of coal in this district lying below water level. The first level, 500 ft. down, has been driven for 4000 ft. in both directions. The slope mouth is 14 ft. in the clear, and is concreted for 40 ft. This company has started a new slope at Burnett, which will tap a body of coal to the extent of several million tons. Black Diamond, Wilkeson and Carbonado, have all done well and are progressing under good management. None of these operations have much to chronicle in the way of construction, however. Carbonado leads in development work. Some trouble over the labor question has kept Wilkeson in a state of unrest during the year.

NEW DEVELOPMENT WORK

During 1908 the Roslyn Fuel Company has gotten well under way in the development of its holdings on the north end of the Roslyn field. Their slope is fine in every particular and is still going down; three right and left gangways have already been turned off. The entire equipment of this mine is decidedly uptodate. The daily output is 400 tons, and this property is doing much to relieve the decidedly tight straits of the fuel market. The "Patrick and McKay" mine nearby, and the Summit Coal Company at the south end of the field are the other producers in this section.

The Mendota Coal and Coke Company has just completed building eight miles of railroad into the coalfield east of Centralia. The management here is proceeding slowly and everything that is being done is of a permanent and modern character. The Washington Union Coal Company has built a railroad into another portion of this field where the coal is decidedly more lignitic than that found in the former district.

The Northwestern Improvement Company has completed at Ravensdale its new cleaning plant with a 1500-ton daily output. Conditions after the flood and fire are again becoming normal, although the management has suffered two years of reverses at this mine. The company has instituted much new machinery at Roslyn, such as rotary car dumps, car hauls, boxcar loaders, etc. No. 7 mine, at Clealum, and No. 3, at Roslyn, have been opened. Both these operations have been equipped with new tipples. The Roslyn daily output has passed the 700-ton mark, which establishes a new record for the State. Shot-firers are employed at most of the Roslyn mines, and the battery system has been instituted; the whole field is well regulated and is worked according to set standards.

NUMEROUS PROMOTION SCHEMES

There are numerous promotion schemes, large and small, in various portions of the State, and these tend to discredit the true conditions and thereby do great harm. The most noteworthy of these ventures is in Whatcom county, where a so-called anthracite deposit exists. Here the measures are tremendously broken and the coal has even passed the fuel point. Every condition there is against economic mining.

Considerable Japanese, Welsh, Australian and British Columbia coal has been used during the past year. Most of the steamers and the California markets have long since been forced to obtain coal elsewhere.

Experimental work in briquetting has been done with the coals of the Northwestern Improvement Company, the Snoqualmie Coal and Coke Company, and the Seattle Electric Company. Results as yet have not been successful. As gas producers, all the lignite coals are promising; they possess a large amount of gas and are cheaply mined.

The following new companies will, in the future, be large producers of Washington Coals: Mendota Coal and Coke Company, president, F. H. Ketcham, Centralia; Roslyn Fuel Company, president, Walter Oakes, Lourman building, Seattle. The output for 1908 will be approximately 3,000,000 tons; the output for the five years previous is as follows:

1903	3,190,477 tons
1904	2,905,689 tons
1905	2,846,901 tons
1906	3,290,523 tons
1907	3,712,172 tons

Wyoming Coal Industry in 1908

The greatest trouble experienced by the Wyoming coal operators in 1907 was due to the scarcity of labor and the lack of railway cars. In 1908, these difficulties were largely eliminated; however, the industry was confronted with a lessened demand which resulted principally from the decrease in traffic on the larger transcontinental railways. The output in 1908 showed but little change from the production of 1907. The total output sold for about $10,370,000 at the mines. This was an average value of approximately $1.70 per ton.

*Mining engineer, Seattle, Washington.

The Eastern Coal Industry in 1908

By John H. Jones*

The year 1908 will show a production of coal in this country equal to about 85 per cent. of that of 1907, or approximately 400,000,000 tons, which is about equal to the tonnage produced in 1906. Had the increase in production not been so enormous during the past few years, this would have looked very large, and in fact is more than double that of 1897. During the recent depression the industrial centers suffered more than other localities, and the shipments to Pittsburg and the adjacent valleys were probably much more affected than any other section; the tonnage to these points showed a greater decrease than the domestic trade and what is known as the "Western" trade.

The conditions existing this year show the unfairness of freight rates from the Pittsburg district as against those from certain districts in West Virginia. Notwithstanding that this district, in 1908, will show only about 80 per cent. of its 1907 production, certain districts in West Virginia favored by cheap freight and mining rates, actually increased their production during the past year. If the Pittsburg district is to maintain its position in coal production, and to receive the proper returns upon the money invested in coal lands, the time is coming when a radical adjustment of the mining scale and freight rates must be made between certain districts in West Virginia, Illinois and other States, and the Pittsburg district. At the present time coal is being hauled three times the distance from parts of West Virginia and other districts at practically the same freight rate as from the Pittsburg region. This is an injustice and will have to be remedied.

Although certain companies in this district made low prices, the majority of them maintained a fair price throughout the season. By so doing, they lost considerable tonnage, but the wisdom of their position I think is emphasized by their ability to show a small profit instead of a deficit.

During 1909 it will be necessary for the Pennsylvania operators to secure higher prices for their coal on account of the increased cost of production, higher taxes and the greater cost which will be forced by new mining legislation which should and will be passed during the coming session of the Legislature.

Future Outlook is Encouraging

The prospects for the coming year look encouraging and I feel confident that during 1909 the tonnage mined will equal at least 90 per cent. of the amount of coal produced in 1907. Many new propositions have been floated and many railroads have financed their requirements for some time to come. I think we are on the verge of the greatest industrial expansion the country has ever seen, but in my judgment, this improvement will be gradual and before the boom strikes us with full force we will be well on into 1909. The business of 1909 will, in my opinion, be so much better than that of 1908 that we will all be well satisfied. To keep up to the natural increase of consumption, it will be necessary to build new railroads, new manufactories, develop new mines and increase the production and manufacture of all the necessities of life. This means plenty of work for our workmen, increased buying capacity and prosperity for all.

The production of coal in this district for 1908 will be about 40,000,000 tons, which is about twice as great as the output in 1897, which was the banner year up to that time. The production for 1909 will be about 50,000,000 tons.

The settlement of the mining scale by the miners and operators for the two years from April 1, 1908 to April 1, 1910, lent stability to the business during the past year, and I believe was a good thing for both miners and operators, as a great industrial strike would simply have retarded the return of prosperity.

The lake tonnage from all districts for the eight years ending 1908, was as follows:

THE LAKE TONNAGE FOR PAST 8 YEARS.

Year.	Pittsburg District.	Ohio District.	W. Va. District.	Total.
1901	3,795,706	1,954,825	787,572	6,538,103
1902	4,704,093	2,689,974	965,769	8,359,836
1903	6,092,047	2,458,265	1,539,435	10,089,747
1904	6,058,383	2,138,247	1,279,876	9,476,506
1905	7,443,883	2,062,692	2,109,262	11,615,837
1906	9,287,272	2,560,906	2,743,732	14,591,910
1907	10,549,995	4,074,296	3,420,941	18,037,232
1908	8,700,000	3,600,000	3,450,000	15,750,000

From the above figures it is evident that there was a decrease in the Pittsburg district of about 18 per cent., in the Ohio district of about 12 per cent., and a small increase in the West Virginia district, which shows that other districts favored by cheap mining and freight rates, are making great inroads into the markets which should really belong to the Pittsburg operators.

Every known method is being adopted by the majority of the operators of this country to provide for the safety and health of their employees. Mining experts from other countries have been called and consulted, and every appropriate suggestion carefully weighed with the opinions of the greatest mining experts of this country, before their introduction into the mines. During the past year many serious accidents have occurred in foreign countries as well as in this country, but I sincerely believe that with the benefits to be derived from our Testing Laboratory, and from the combined ideas of brain and skill, within the next two years, the Pittsburg district will show fewer lives lost per man employed than any other mining section in the world. At the present time, a less number of lives are lost per ton of coal produced, than formerly, as is shown by the accompanying tabulated statement.

In adopting new ideas, very often the welding of newer and stronger links makes the weaker ones in the chain more conspicuous, and what once appeared safe, now becomes actually dangerous. In years gone by, if there was an explosion in a coal mine, the air present was insufficient to render it serious; the gas would simply burn in suspension wherever it might be lighted, and do practically no damage. There have been and still are a number of unrecognized conditions in coal mines, but these conditions are rapidly being overcome.

I am satisfied that it is the earnest desire of every company in this country to do all possible for the health and safety of the men in their employ; moreover, all managers are glad to consider suggestions from a really intelligent source, as to the best methods of producing coal with the greatest safety to their employees.

A Tax Upon the Employers of Labor

During the past two years, I have recommended the placing of a tax upon the

LIVES LOST PER TON OF COAL PRODUCED.

	Production (net tons).	Employees.	Tons Produced Per Employee.	Lives Lost.	Lives Lost Per 1,000 Employees.	Lives Lost Per 1,000,000 Tons.	Days Worked.
Pennsylvania bituminous, 1903	103,713,982	151,745	683	402	2 65	3 84	216
Great Britain, bituminous, 1903	257,974,605	822,000	314	1072	1 30	4 15	264
Germany, bituminous, 1903	128,569,808	470,305	273	826	1 75	6.35	274
France, bituminous, 1900	34,123,901	158,580	215	224	1 41	6 56	296
Belgium, bituminous, 1902	25,217,835	134,889	187	144	1 06	5 71	289
Austria, bituminous, 1903	13,964,931	66,663	209	114	1 71	8 16	289

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pay rolls of the employers of labor, this tax to be administered by a Sate commission, one-third to be appointed by the Governor and two-thirds to be elected by the people, the duty of this commission would be to administer the fund so collected and to see in case of death that the widow is cared for and the children are well educated and reared in the proper manner, and in case of an accident, not involving death, to pay to the injured person a weekly indemnity equal to the average weekly wage earned by him during the three years preceding. In other words, place a tax on the employers of labor sufficient to prevent their employees, and the wives and children of their employees, suffering from want due to accidents over which they had no control; this would place the injured in position to receive in case of such accidents money which would be due them under this law and which would not be administered as a charitable contribution. The disasters during the past year in blast furnaces, coal mines, railroads, etc., are evidence that we need such a law as suggested and need it badly.

The mining laws of the State of Pennsylvania say to the operators employing miners: "You must employ certificated mine foremen, certificated fire bosses, and place them in absolute charge of your mines. You must furnish them with all the supplies necessary for the operation of these mines, and your superintendents (practically meaning the owners of the mines) must not interfere with these men in the discharge of their duties." These are wise precautions on the part of the State to protect the health and safety of employees in and about coal mines, but notwithstanding all these great precautions, a number of serious disasters have occurred. It is certainly a fact that these State officials (known as mine and fire bosses) would not go into the mines and spend their entire time there, and permit the miners to continue operations if they did not consider the workings absolutely safe.

During the past year, we have made great strides in the knowledge of mining, but the personnel of the men in charge and the personnel of the men employed are an important factor in the safe working of coal mines. It is an old saying that "familiarity breeds contempt," and the fact that a man has done something a hundred times without observing the necessary care, and escaped injury, breeds within him a contempt for the danger and sometimes creates a reckless disregard for his own safety as well as the safety of others. This is the most difficult factor to guard against.

It is absolutely impossible to prevent all accidents in the mines, but what we must do is to figure out the best methods of reducing to the lowest degree the possibility of accidents. When we take into consideration that about 85 per cent. of the accidents in mines are due to causes other than explosions of gas and dust, or blown-out shots, and that more than 50 per cent. of these accidents could be prevented by care on the part of the persons injured, it is easy to see what good a more rigid police regulation in the mines will mean in the future production of coal in this country.

The mine inspectors of our State are clothed with police power. They are all practical miners, who, by their natural ability, have risen from the miners' ranks, and by study of mining conditions, have fitted themselves for the positions they now hold. They are making a special study of the best methods to protect the men under their care, and I feel confident that with the coöperation of the miners and operators of this country, we will soon be able to show a much lower ratio of accidents to the number of men employed.

Coal and Coke Production in the United States

The following table has been compiled largely from data communicated by the several State mine inspectors, estimates having been made only where no such statistics were available, but in all cases upon the basis of good information:

PRODUCTION OF COAL IN THE UNITED STATES.

States.	1907. Short Tons.	1908. Short Tons.
Bituminous:		
Alabama	14,417,863	11,950,000
Arkansas	1,930,400	1,750,000
California and Alaska	45,300	55,000
Colorado	10,920,527	9,773,000
Georgia and North Carolina	365,300	275,000
Illinois	(c)51,317,146	48,000,000
Indiana	11,692,072	12,000,000
Iowa	(a) 7,568,424	7,050,000
Kansas	6,137,040	5,600,000
Kentucky	10,207,060	9,526,000
Maryland	5,529,663	5,000,000
Michigan	(b) 1,898,446	2,000,000
Missouri	4,350,000	3,900,000
Montana	1,810,000	1,800,000
New Mexico	(a) 2,302,062	2,725,000
North Dakota	268,300	250,000
Ohio	32,465,949	30,000,000
Oklahoma	3,450,000	3,250,000
Oregon	51,600	25,000
Pennsylvania	149,759,089	118,309,000
Tennessee	6,760,017	5,000,000
Texas	1,300,000	1,250,000
Utah	1,967,621	2,000,000
Virginia	4,570,341	4,000,000
Washington	3,743,824	3,000,000
West Virginia	47,295,965	44,091,000
Wyoming	6,218,859	6,100,000
Total bituminous	388,222,868	338,688,000
Anthracite:		
Colorado	45,113	30,000
New Mexico	17,000	10,000
Pennsylvania	86,279,719	80,240,000
Total anthracite	86,341,832	80,280,000
Grand total...	474,564,700	418,968,000

(a) For the fiscal year ending June 30.
(b) For the 12 months ending November 30, 1907.
(c) As reported by the U. S. Geological Survey.

PRODUCTION OF COKE IN THE UNITED STATES.

States.	1907. Short Tons.	1908. Short Tons.
Alabama	3,096,722	2,800,000
Colorado	1,097,051	854,000
Georgia and North Carolina	71,460	70,000
Illinois	372,697	270,000
Kentucky	77,055	60,000
Montana	31,400	30,000
New Mexico	203,437	260,000
Ohio	310,640	250,000
Oklahoma	57,600	50,000
Pennsylvania	23,516,309	11,287,000
Tennessee	495,200	250,000
Utah	324,692	290,000
Virginia	1,622,734	1,200,000
Washington	61,400	48,000
West Virginia	4,078,222	2,978,000
Other states (c)	1,650,000	2,000,000
Total	37,066,619	22,697,000

(c) Includes output of by-product coke for Massachusetts, Maryland, Minnesota, New York, Michigan, Wisconsin, New Jersey.

If the production of coal in 1908 had shown as large an increase as in 1907, the long predicted half-billion total would have been reached. To satisfy our fuel demands during the last 12 months, we have exhausted about 61 square miles of our available coal lands. If our production should remain stationary, at this total, in future years, it would require over 6000 years to exhaust our coal beds; if, however, the future production should increase at a rate equal to that shown in 1907, the available coal seams would last only about 200 years.

Mineral Output of Japan

The following table, taken from the *Yokohama Chamber of Commerce Journal*, shows the output of various minerals in Japan during the six months ending June, 1908, and the corresponding period of 1907:

	1908.	1907.
Gold.....	297,301 momme[1]	305,098
Silver	14,123,593 momme[1]	10,820,357
Copper ...	28,474,318 kin[1]	27,768,090
Iron.....	4,954,794 kwamme[1]	5,779,875
Coal.....	5,945,718 tons	5,793,936
Kerosene.	703,508 koku[1]	723,946
Sulphur.	19,992,554 kin	18,570,885

COPPER EXPORTS

The export of copper to foreign countries during the first half-year is stated to be 28,630,000 kin worth 10,700,000 yen.[1] The following table shows the quantity and value of export for the last three years:

	Quantity. Kin.	Value. Yen.
1905.....	34,040,000	16,040,000
1906.....	56,670,000	25,100,000
1907.....	53,450,000	29,260,000

The copper is chiefly exported to China, Hongkong, England, France, Germany, and America.

[1] 1 momme = 57.97 grains; 1 kwamme = 8.28 pounds; 1 kin = 601.04 grains; 1 koku = 39.68 gallons; 1 yen = 2s. 0.58d., or 49.95 cents.

The Petroleum Industry of the United States

Production of California, Texas, Louisiana, Lima, Illinois, Mid-continental and Appalachian Fields. Developments in Various Districts

PRODUCTION, 184,734,678 BARRELS

As shown in the accompanying table, the production of crude petroleum in the United States during 1908 showed a large increase over that of 1907.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES.

(In Barrels of 42 Gal.)

Field.	1907.	1908.
California	40,085,000	45,000,000
Colorado	400,000	(a) 1,250,000
Gulf { Texas	12,350,000	14,204,000
Gulf { Louisiana	4,620,000	5,896,000
Illinois	24,540,024	38,000,000
Lima { Indiana, Ohio	8,030,000	7,287,000
Mid-continental (c)	47,556,906	50,741,678
Kentucky-Tennessee	1,250,000	(a) 1,250,000
Appalachian (d)	25,500,000	21,904,000
Wyoming	13,000	(a) 13,000
Others	3,000	(a) 3,000
Total	164,347,930	184,734,678

(a) Estimated as the same as in 1907.
(c) Kansas and Oklahoma.
(d) Pennsylvania, New York, West Virginia and eastern Ohio.

California

When California was producing about 20,000,000 bbl. of petroleum per annum, and the prices at the wells were around 20c. per barrel., it was considered that there was an overproduction, owing to the fact that consumption did not keep pace with the gradually increasing yield. In fact at that time many productive wells were capped because the prices were unsatisfactory and a ready market was not found except for the product of the larger companies which had commercial or business facilities for disposing of their oil in a profitable manner. There was some uncertainty as to continuance of supply and difficulty in delivery at specified time. Probable consumers were afraid that they would be unable to obtain the necessary supplies regularly, and continued with their old systems. The railroad companies hesitated to put large amounts of money into oil cars when they knew that eventually pipe lines for oil transportation would be built, and the cars would become useless. The shortage of oil cars for this reason prevented developments which were contemplated in the various fields.

These conditions have changed. Pipe lines have been built not only from the valley fields to tidewater, but also from the various fields to the main lines, and even to productive individual wells. The demand has increased with the production, so that even with the more than doubled output and the trebled price all the oil which is produced is readily disposed of. In virtually all the large railroad manufacturing and power enterprises of the State, fuel oil has displaced coal in the boilers. As a steady supply of oil is assured, there is no hesitation in making contracts for steady supplies, with no fears of interruption or necessity of changing back to old systems of firing.

While there has been a great increase in the consumption of fuel oil, there is little increase shown in the output or consumption of by-products. The revival of the various manufacturing interests of the State since the great disaster in 1906 and the resultant increase in the business of the railroad companies form two of the most important factors in the increased demand for fuel oil. A few years ago 30 per cent. of the cars were laid up on the main railroad lines for lack of business, but now all are in use, requiring many more locomotives and causing a greater consumption of fuel oil. In the steamship business much larger quantities of fuel oil are now used than formerly, while the rapid multiplication of industrial enterprises and the demand throughout the State for power for various purposes has also increased the use of fuel oil.

California is now producing about 45,000,000 bbl. of oil a year, that being the estimated output for 1908. In 1907 the yield was 39,748,375 bbl. valued at $14,699,956, or about 37c. per bbl. In 1906 the average prices was 29c. per bbl. In 1908 the average price at the well to the producers was about 50c. per bbl., and at the end of the year it was perhaps higher than 60c. per bbl. All the old contracts have been "worked up" and the new ones being made vary from 50c. to 63c. per barrel.

As this is very encouraging to the oil men, every effort is being made to enlarge the output. In 1908 some of the companies nearly doubled the yield of the previous year; much prospecting is going on in undeveloped territory and new wells are being sunk in proved areas. Indeed had the daily yield of all the wells of the State continued throughout the year in the same proportion as it was in October and November, the total output for 1908 would have exceeded 50,000,000 bbl. The daily output was in those months about 140,000 bbl. The Kern River field heads the list in amount of daily production, followed in order by Coalinga, the Lompoc and Santa Maria, and the Los Angeles-Salt Lake fields. In the Kern River field there are 1090 producing wells which average 35 bbl. a day per well. In Coalinga there are 385 wells yielding an average of 80 bbl. a day per well. In the Santa Maria field the wells are averaging a daily product of 200 bbl. a day per well. In other fields the flow from the producing wells varies from 20 to 70 bbl. per day.

In 1907 there were 2630 wells which were producing but the figures for 1908 are not yet available. When the entire number of productive wells in a field is considered, the average daily production per well is not nearly as high as many persons imagine. Some will run high and others low, but, when the sum total is added, the aggregate may become quite large. For example, in 1907 the Kern River field had 840 productive wells, which averaged a daily yield of 40 bbl. a well. The average of a smaller number of wells in the McKittrick field was 102 bbl. per day and in the Midway, the average was 87 bbl. while it was only 47 bbl. in the Sunset field. At Coalinga 247 wells averaged 99 bbl. a day per well. At Santa Maria and Lompoc combined the average per well was 291 bbl. per day, there being 80 wells in the field. At Santa Paula and Newhall the average was 4 bbl., and in the Salt Lake field of Los Angeles 80 bbl. per diem.

Development During 1908

The increase in consumption of California fuel oil in 1908 is general and is from 20 to 25 per cent. over the amount in 1907, both for industrial and railroad uses, and the output is expected to keep pace with this. In one field alone—the Kern River—there was in 1908 an increase of 25 per cent. in the number of productive wells compared with the number in 1907 and, while the increase is not so large in other fields, yet there is an apparent increase in all, with the possible exception, perhaps, of the Santa Maria field which has not quite "held its own." In that field a large amount of water is being pumped with the oil, and it has not been found possible thus far to shut this water off.

A great deal of "wildcat" drilling is going on in most of the fields, especially between Coalinga and Sunset, but there are possibilities of opening up a great production in that region. In the Mid-

way field in Kern county somewhat lighter oils are obtained in the wells at some distance from the area where the outcrops are. In the Monterey County region where much prospecting has been done lately there is as yet no production to note. The drilling in that vicinity is hard and slow for there is much granite drift to pass through.

The pipe line 280 miles long, from the Kern river field to Port Costa, at tidewater, was completed in 1908. It is an 8-in. rifled pipe line owned equally by the Associated Oil Company and the Southern Pacific Railroad. Between Bakersfield and Port Costa there are 12 pumping stations, for both water and oil, on this line. The "rifling" of the pipe gives it a much greater carrying capacity with heavy fuel oil, than an ordinary smooth-bore pipe has. This is the second pipe line from Kern county to tidewater.

The Associated Oil Company intends building another pipe line from Sunset on through the Midway, the McKittrick, and the Devil's Den fields to Coalinga. The fields in Santa Barbara county have their pipe lines to the ocean, and there is one from Fresno county to Monterey bay.

The average California oil is quite heavy, with an asphalt base, and lighter oils for local purposes are greatly in demand. Many rigs are at work prospecting for low-specific-gravity oils in what are considered likely regions. This light oil is needed for refining purposes.

The Japanese are large consumers of California fuel oils and have extensive contracts, mainly with companies owning wells in the Santa Maria field. It is understood that they would take 10,000,000 bbl. yearly if that quantity could be guaranteed for delivery at satisfactory prices. They have some fear, however, that the amount desired could not be supplied regularly at stated periods. There is at present in California a party of Japanese oil experts looking over the different fields, and investigating their ability to supply the Japanese demand. There is some talk of these Japanese buying out entirely certain productive fields or companies.

The owners of productive wells in California are quite independent, for they have an assured market and get good prices for their oil. In the valley fields when a good productive well is struck they can, without much difficulty, get someone to build a branch pipe line to it., They are not dependent on a refining company, for their fuel oil does not have to be handled by others to become a marketable product, as is the case with illuminating oils. They get the ground, dig the well, and get out the oil in the same way relatively that the farmer gets his crop. As soon as the oil is pumped it is salable, and there are plenty of people ready to take it, or make future contracts for it. Moreover, there are a number of California capitalists ready and willing to invest in oil and oil lands, to develop territory, to build pipe lines, etc. Under these circumstances no one company can control the various fields and fix prices. For these reasons the owners of oil wells are becoming particularly independent, and self-reliant.

The Output of the Leading Companies.

The various oilfields are gradually being enlarged as new wells are sunk and developments progress. All have now good transportation facilities to tidewater, and large refineries are numerous. A great amount of prospecting is being done in new sections which promise good results, and much money is thus being expended in finding new oil-yielding areas. Meantime, in the older fields more extensive operations are being carried on, and deeper explorations are being conducted

The California Stock and Oil Exchange of San Francisco, in its monthly statement of dividends paid by active listed California oil companies for the month ending Nov. 30, 1908, gives the following:

Total dividends paid to date: Alma, $136,800; Amalgamated Oil, $800,000; Apollo $4,000; Associated Oil, $1,522,300; Brookshire, $322,500; Caribou, $377,720; Chicago Crude, $15,000; Claremont, $197,000; Coalinga Pacific, $30,000; Columbia, $154,886; Esperanza, $20,650; Euclid, $68,000; Four, $186,000; Globe, $51,000; Hanford, $80,000; Home, $442,000; Homestake, $60,250; Illinois Crude, $48,000; Imperial, $1,040,000; Junction, $2,500; Kern River, $92,000; Linda Vista, $26,870; Lucile, $8011; Monte Cristo, $265,000; Nevada County, $40,000; Peerless, $741,000; Piedmont, $11,317; Pinal, $594,841; Pittsburg, $124,800; Reed Crude, $1,107,000; Rich Ranch, $69,000; Royalty, $200; S. F. & McKittrick, $75,000; Sauer Dough, $329,175; Sovereign $65,000; Sterling, $247,000; Superior, $30,000; S. W. & B., $15,080; Thirty Three, $640,000; Union, $4,420,961; United Petroleum, $1,532,052; Wabash, $72,000; West Shore, $225,000; Western Union, $484,951; total dividends paid to date, $17,393,772; total dividends paid by the above companies for November, 1908, $358,220.

The total dividends paid up to date by some California companies not listed on the Exchange to date, as copied from other official records are: California Oil Fields, Ltd., $1,750,000; Central, $483,926; Continental, $15,000; Fullerton, $142,000; Olig Land Company, $13,000; Olig Oil Company, $35,000; Olinda Land Company, $40,000; Perseus Oil Company, $13,564; total, $2,756,490; grand total, $20,150,262

Illinois

By H. Foster Bain*

The oilfields of Illinois produced in 1908 a little less than 40,000,000 bbl. of petroleum. The returns for the year are not complete, but, estimating the December production as equal to that of November and that the tank-car shipments were very little more than in 1907, a total of 38,000,000 bbl. may be given as the approximate figure for 1908. The detailed pipe-line runs and miscellaneous receipts of the Ohio Oil Company for the first 11 months of 1908 are given in an accompanying table.

RECEIPTS OF THE OHIO OIL COMPANY, 1908.

	Pipe Line Runs, Bbl.	Other Receipts, Bbl.	Total, Bbl.
January	2,497,914	98,433	2,596,347
February	2,464,914	228,004	2,674,918
March	2,594,911	191,963	2,788,874
April	3,089,417	439,709	3,529,126
May	3,084,815	1,015,263	4,100,078
June	2,965,786	947,741	2,913,527
July	2,579,977	301,090	2,881,067
August	2,690,631	1,059,941	3,750,572
September	2,555,871	744,125	3,299,996
October	2,582,561	395,815	2,978,376
November	2,356,385	318,352	2,674,737

The bulk of the miscellaneous receipts consists of oil purchased in tanks when leases were transferred. No additional lines have been laid into the field though the Pure Oil Company is now laying a line to connect with the Tidewater line. The Indian Refining Company, the Sun Oil Company, the Cornplanter Oil Company, and the Robinson Oil Refining Company continue to ship in tank cars. As in past years production, except for a short time in May and June, ran ahead of the capacity of the pipe lines. For most of the season approximately 60 per cent. of the oil offered was taken. The price remained fixed at 68c. per bbl. for all oil above 30 deg. B, and 60c. per bbl. for that below 30 deg. B. The great bulk of the oil was marketed at the higher rate. On Dec. 1 the gross stock of the Ohio Oil Company amounted to 24,930,030 barrels.

Development During 1908

The principal development work of the year was in Crawford, Lawrence and Clark counties, the largest wells being found in the deepest sands. Within the year Coles county, after repeated failures, became a producer. Drilling was active in the early summer, but the severe drought crippled operations in the fall.

On Jan. 1, 1908, it was estimated that 0772 wells had been put down. Of these 1260 were dry holes In the first 11 months of 1908, 3290 wells were drilled, with 513 dry holes and 72,353 bbl. of new production. The record by months, taken as heretofore from the

*Director, State Geological Survey, Urbana, Ill.

Oil City Derrick, is given in an accompanying table.

WELLS DRILLED IN ILLINOIS DURING 1908.

	Average Initial Production.	Wells Completed.	New Production.	Dry Holes.
	Bbl.		Bbl.	
January	24½	303	6144	55
February	24½	157	3329	22
March	27½	187	4133	37
April	26	197	4285	33
May	29	264	6628	35
June	29½	390	9876	54
July	23	474	9475	65
August	23	417	8322	55
September	26½	344	7848	49
October	26½	290	6091	51
November	29½	273	6242	51

The drilling record for 1908 in southeastern Illinois, summarized by counties, is given in an accompanying table.

WELLS DRILLED DURING 1908 IN DIFFERENT COUNTIES, ILLINOIS.

County.	Wells Completed.	New Production, Bbl.	Dry Holes.
Crawford	2024	40,326	289
Lawrence	601	19,405	63
Clark	321	5,996	66
Coles	7	91	2
Edgar	3	15	1
Miscellaneous	27	10	25

Outside the old oil district "wildcatting" continued active throughout the year. The principal result was the bringing in of enough wells to start production at Sparta in Randolph county. Here the Sparta Oil and Gas Company made up of St. Louis people, has a group of wells a short distance east of the old gasfield. The oil comes from the Chester formation. After finding several 5- and 10-bbl. wells, one was shot which is said to have come in at 135 bbl. a day. The oil is shipped in tank cars and through field lines; approximately 50 bbl. a day are going out. Numerous other wells are being drilled in the vicinity.

Importance of the Centralia Find

On Nov. 1 a well was brought in at Centralia in Marion county. Oil had been found here seeping into a coal mine along a fault plane. The well was drilled a short distance east of the mine; at about 600 ft. a good sand was found in the coal measures. After shooting, the well settled down to an 18-bbl. pumper. Numerous other tests are now being drilled in the vicinity. The significant points in this find are that Centralia is well toward the center of the great structural basin of southern Illinois and that the sand is of approximately the age of the Casey sand in which oil was first found in Clark county. This geological horizon is widespread, but as yet it has not been found productive in many places.

Small amounts of oil and gas continue to be found at various points along the western edge of the basin, but so far without any important commercial result. The year as a whole has been quietly prosperous, and the outlook for 1909 is excellent. In 1908 there was no especial change in the situation as regards the production of natural gas.

Texas and Louisiana

Special Correspondence

Nothing but the expected happened in the gulf, coastal and north Texas fields during 1908. Field operations declined, and while two new gusher fields were threatened, fortunately (most persons think) they did not materialize.

The Anse Le Butte district, which in 1907 seemed to promise a large output, simmered down, after the expenditure of a large sum in development, to the original discovery well and a few others in the immediate vicinity. Markham and Goose creek discoveries sent declining crude-oil prices to the lowest point of the year, only to prove a false alarm. Caddo slowly increased its output and prevented the coastal field from showing a decline in production.

Old districts were in some cases extended in area, and held up their production better than expected, so that the yearly output was satisfactory, in spite of the fact that Jennings during November reached its lowest output for many months.

While prices declined very much they were a fair reflex of conditions and above the normal when compared with mid-continent fields.

Output

The 1907 production in Texas was 12,322,696 bbl., of which 11,410,078 bbl. was derived from the coastal region. The Louisiana production for 1907 was 5,000,221 bbl. and the total coastal field output, 16,410,299 bbl. The 1908 estimates for Texas, as nearly as can be stated at the present time, are 11,904,000 bbl., of which about 10,010,400 bbl. is credited to the coastal field. The Louisiana output is placed at 5,896,000 bbl., making the total for the coastal field 17,000,000 bbl. The figures are only approximate, for the north Texas and the December output of the coastal fields are not definitely known.

The figures given above indicate a decrease of 418,000 bbl. in Texas, half of which is attributed to coastal fields, while Louisiana shows an apparent increase of 895,500 bbl., occasioned by the added output of Caddo and Anse Le Butte.

The selling price of crude varied greatly and was so much lower than in 1907 that the total value declined from $14,000,000 in 1907 to about $10,500,000 in 1908. Wildcat drilling was generally confined to local owners of land and State corporations, for oil operators who make a regular business of exploiting prospective oil territory were engaged in the mid-continent field, where the percentage of dry holes proved less than in Texas.

According to the *Oil Investors' Journal*, the number of completed wells in the coastal field in the 11 months to Dec. 1 was 748, of which 559 were oil producers, 21 gas wells and 168 dry holes. The record for a similar period in 1907 was 681 producing oil wells, 21 gas wells, and 213 dry holes.

In north Texas to Dec. 1, 1908, 65 wells had been completed, of which 20 were dry. The 1908 figures do not include those wildcat wells outside of the Markham and Goose creek fields, and the gas wells were mainly in the Caddo field though Humble and Henrietta contributed a few.

Jennings was again the largest producer, having an output of approximately 4,960,000 bbl. The production of the other leading pools was as follows: Humble, 4,011,000; Spindletop, 1,814,000; Sour Lake, 1,791,000; Saratoga, 1,774,000; Batson, 1,543,000; Caddo, 615,400; Anse Le Butte, 280,000 bbl. Other small producing pools were Markham, Goose Creek, Mission, and Welch. In north Texas Powell was the largest producer, followed by Corsicana and Henrietta.

Commercial Conditions

The crude market opened weak in 1908 and the use of weathered crude from Oklahoma and northern Texas further depressed prices early in the year, so that the posted credit-balance prices (which may be taken as the base price paid consumers) ranged from 67 to 75c. The quotations compared favorably with those of 29 to 41c. per bbl. paid in Oklahoma, when the quality of the crude is considered, although it must be borne in mind that for fuel purposes (practically the sole use of coastal crude) an oil of 18 to 20 deg. B. is better than that of 30 to 32 deg. B.

The undoubted effect of high crude-oil prices in 1907 was shown in the 500,000-ton increase in the coal output of Texas for that year where previous years had shown a decline.

Quotations declined in March, April, and May, until the highest price posted was 60c., and in June the Gulf and Texas companies suspended quotations while the Sun Company prices ranged from 38 to 42c., a decline of more than 100 per cent. Stocks were increasing, demand was poor, and there was general uneasiness regarding the capacity of the new pools at Markham and Goose creek.

Buying by cotton compressors, sugar plants, and by the railways, combined

with the failure of the new pools and the operations of the Oil Producers Marketing Company raised the posted prices gradually to 55 to 57c. in October. Since then the market has remained weak. There is no valid reason for any advance in the near future unless production declines greatly, when local conditions may warrant higher prices.

If the proposed Prairie Oil and Gas Company pipe line from Oklahoma to New Orleans is constructed, a market now exclusively supplied by coastal crude will be divided and consumption further reduced. The preliminary survey of 520 miles for this line has been made, and all the interested Oklahoma municipalities have consented to the crossing of their highways. Under existing and probable future conditions coastal producers will be fortunate if the average price for 1909 equals that for 1908, which was about 60c. per bbl., compared with 84c. in 1907.

These prices do not apply to the Caddo field, the oil from which is not taken by the Southern pipe lines, but has been shipped by tank cars and for which recent prices have ranged from 35 to 38c. per bbl.

It became known during the year that the amount of crude carried as stored oil was much too large. The quantity deducted for evaporation, seepage and field consumption during the last few years was much too small, most of the discrepancy being occasioned by the extended use of crude in operating the large air compressors in the Jennings pool.

Careful investigation by the *Oil Investors' Journal* placed crude stocks on Oct. 1 at 3,130,000 bbl., and the amount of stocks on Dec. 31, was approximately 3,200,000 barrels.

Legislative and Judicial Proceedings

The suits instituted by the State against the Standard Oil Company, Security Oil Company, Union Tank Line Company, and other alleged affiliated corporations resulted in a receiver taking charge of the Union Tank Line Company cars, which were promptly leased to one of the railways. The Security Oil Company succeeded in obtaining relief from the vexatious conditions of the injunction proceedings, and its large refinery near Beaumont was put in operation again in January. The suits which are for ouster and for penalties amounting to many millions with the customary collateral garnishee proceedings drag along subject to the usual legal quibbles and delays.

The protests against the burdensome Kennedy gross tax laws continued, but most operators paid the tax, only one or two, including the Southwestern Oil Company of Houston, are testing the constitutionality of the act.

Louisiana Districts

Production in Louisiana was confined entirely to fields located prior to 1908, although wildcats were drilled in Rapides, Webster, Terrebonne, Winn, Saint Landry, and Calcasieu parishes during the year. The Welch pool remains small and practically no effort was made to develop it.

The Jennings pool was extended about a half mile westerly, the most important development since the Latrille 40-acre extension in 1907. Many of the new wells had an initial flowing output of 3000 to 5000 bbl. daily. After a brief period compressed air was used on them giving a much larger ortput than they would have yielded under the pump. The pool is not only the largest producer in Texas or Louisiana, but also leads in average production per well.

More than 50 new wells were drilled in 1908, but the last months of the year show a rapid decline in field operation and production. The maximum output of Jennings was 557,000 bbl. in March and the minimum, 320,000 bbl. in November.

The Anse Le Butte pool proved a disappointment, despite active work and a very large expenditure of money. Salt water is the greatest detriment encountered, and the few producing wells are confined to those in the vicinity of the original well drilled by the Lake Oil Company. The average daily output does not exceed 1000 bbl., and the production for 1908 was about 280,000 barrels.

Caddo field operations were gradually extended during the year, and this pool will certainly be the most active one in Louisiana during 1909; 50 wells were completed up to Dec. 1, 1908, and the total output is estimated at 615,000 bbl. The proved field now extends over an area of many square miles and both the United States and State Geological Surveys are investigating its resources and geology. Conditions are radically different from those of the large gusher fields of the coast (which are of small area) and will be more slowly developed. While the gas wells are of large capacity the oil wells are small producers when compared with those of Spindletop, Saratoga, or Humble. Drilling is expensive in addition to being slow and hazardous on account of the enormous gas pressure usually found in the overlying strata at 820 to 940 ft. Most of the producing oil wells are in the 2200 to 2275-ft. sand, although there are several in a sand at 1580 ft. The gravity of the oil varies from 24 to 39 deg. B., and the initial production runs from 100 to 400 bbl. per well.

The output in January, 1908, was only 8000 and gradually increased to 90,000 bbl. in December.

Texas Districts

Humble and Spindletop were the only pools showing an increased output as compared with 1907. Humble's large production was caused by active development in the northern extension of the proved field. Completed wells to Dec. 1, aggregated 234, a number three times as large as in any other Texas field. The average initial capacity of the wells was also greater than in any pool outside of Jennings.

Spindletop production increased slightly, and field work was more extensive than at Batson or Saratoga. The only feature at Sour Lake was the expandng of the proved area 450 ft. easterly, while at Saratoga drilling into the deeper sand at 1490 ft. prevented a more serious decline than would otherwise have occurred.

The small pools at Mission, Liberty, Dayton, and Piedras Pintas were only notable for inactivity and their output was confined to a few wells of limited capacity.

In Clay county, northern Texas, some excitement was caused by the bringing in of a few oil wells of larger flow than usual. Gas wells of great volume were also located and are being utilized by the Navarro Refining Company to supply the cities of Henrietta and Wichita Falls, with a probable extension of the pipe line to Dallas and Fort Worth.

None of the wildcat wells scattered through Texas created anything more than local interest other than those located at Markman and Goose Creek. The first-named field is in Matagorda county, 6½ miles northwest of Markham, a station on the Victoria division of the Southern Pacific Railway. The topography of the district is similar to that of other coastal fields. Gas seepage induced the Hardy Oil Company to drill a well which was brought in early in June at a depth of 1370 ft. The pay sand resembles that at Jennings, the gravity of the crude is 22 deg. B., and the initial capacity of the well was about 80 bbl. per hour. The Rio Bravo Oil Company (Southern Pacific Railway) promptly laid a pipe line to the railway and contracted for the output at 50c. per bbl. Another well of smaller capacity was soon brought in, but subsequent field operations by the Guffey Company and others extended over a wide area failed to find any extension of the pool. Production soon fell off and in consequence of the failure to "make good" the field is practically idle at the present time, although there is a bare possibility of its developing into a fair producer. The output to date has been about 60,000 barrels.

Goose Creek, the other discovery which

gave promise of being another gusher field, was located about the same time as Markham. The territory lies in Harris county, 25 miles east of Houston at an altitude of 30 ft. above the level of Galveston bay, and only a mile distant from the barge channel. The discovery well was the third test hole drilled by Armstrong, Peden & Co., the second well having yielded a small amount of oil which was utilized for fuel. Well No. 3 was finished at 1600 ft. (much deeper than usual in similar formations along the coast) and yielded about 700 bbl. daily, of 18 deg. B. gravity crude. The Producers' Oil Company acquired the producing property and drilled about ten wells to determine the area of the field. All these holes proved dry except one or two in the immediate vicinity of well No. 3. Several wells are now going down, but most operators have formed an unfavorable opinion regarding their success, although their opinion may be fallacious. The Texas Company has laid a pipe line to the barge channel, so that water shipments can be made, but the output so far is merely nominal.

Future Production

It is unlikely that the Texas-Louisiana production will decline materially in 1909, for while the old fields are failing they are still capable of development and will be actively worked. Caddo will surely increase its output and make up largely for the deficiency in other fields. There is also the possibility that Markham and Goose Creek will develop into farily good fields, although it must be admitted that operators are pessimistic.

It is to be hoped that no very large pools will be discovered in the near future, for the present supply fully equals consumption in local markets and a new gusher field would cause a fall in crude prices demoralizing to producers in the old pools.

Oil and Gas in the Mid-continental Field

By Erasmus Haworth*

During the year 1908 no remarkable developments were made anywhere in the Mid-continental field, either in oil production or gas production. Drilling was greatly diminished compared with either of the previous two years. Nevertheless, many rigs were in operation almost constantly and in the aggregate a great many new wells (something more than 1600) were brought in. In Oklahoma drilling was confined principally to a search for oil, and, therefore, gas developments in the main were incidental, while in Kansas more than half of the drilling was done expressly in a search for gas.

Oil.

Drilling was continued practically in every district in Oklahoma, particularly in the Glenn pool area and the Alluwe shallow pool area. The Glenn pool remained the largest producer, aggregating 50,000 bbl. daily throughout the year. The Alluwe area was greatly extended northward and its total production materially increased. Production in the vicinity of Dewey, and generally throughout the Osage, declined. Scarcely a well was drilled for oil in Kansas, and the production in this State was greatly reduced. Numerous wells are standing idle which would produce in the aggregate large amounts of oil were prices better, but with the ruling low prices they would not pay to operate.

(Standard) again was the principal purchaser of oil, although not so emphatically so as previously. The company's total runs aggregated 33,181,951 bbl., the December runs being estimated, which gives a daily average of 90,661 bbl. Of this amount 25,273,941.54 bbl. were delivered to the refineries, the remainder going to storage. At the end of the year the Prairie Oil and Gas Company, therefore, had a total storage of 38,971,913 barrels.

The largest independent purchasers of oil were the Gulf Oil and Pipe Line Company and the Texas Oil Company, each of which purchased more than 5,000,000 bbl. The independent refineries are on the increase and this year consumed perceptibly more oil than the same class of refineries did in 1907. A number of other firms shipped large quantities of oil by rail from different points in Oklahoma.

CRUDE OIL BOUGHT BY PRAIRIE OIL AND GAS COMPANY DURING 1908.

Month.	Total Runs, Bbl.	Daily Average, Bbl.	Deliveries, Bbl.	Stored, Bbl.
January	2,914,843	94,027	2,332,098	582,745
February	2,773,592	95,641	2,005,285	768,308
March	2,985,697	96,313	1,994,992	990,705
April	2,979,844	99,328	1,941,284	1,038,561
May	2,487,426	80,240	1,987,441	499,985
June	2,395,326	79,844	2,162,765	232,561
July	2,950,757	95,186	2,326,524	624,233
August	2,858,651	92,215	2,353,609	505,042
September	2,674,264	89,142	2,405,831	268,433
October	2,773,996	89,484	2,297,333	476,333
November	2,620,725	87,358	2,310,282	310,443
December	2,766,829	89,248	2,192,497	574,333
Total	33,181,951		25,273,942	6,871,681

OIL PRODUCTION, MID-CONTINENTAL FIELD, DURING 1908.

Prairie Oil and Gas Company	33,181,951 bbl.
Texas Oil Company	5,298,545
Gulf Oil and Pipe Line Company	5,654,182
Independent refineries	3,107,000
Fuel Oil, crude	1,750,000
Independent shippers	1,750,000
Totals for year	50,741,678

Prices.

No change whatever occurred in the prices of crude oil throughout the year; oil of 32 deg. B or lighter brought 41c. regularly. During the year oil prices in Indiana, Ohio, West Virginia, and Pennsylvania had slight fluctuations, the highest price paid in Pennsylvania reaching $1.78; Lima, Ohio and Indiana oils, around $1; Kentucky oils, $1; Corsicana, Texas, light oils, 70c.; heavy oils, 48c.; Illinois regular, 68c.; and under 30 deg gravity, 60c. Why such a great discrimination is made by the large purchasers of oil in the Mid-continental field is known only to the purchasers themselves. Probably the public would all guess in the same direction, i.e., that the low price is maintained simply because it is in the power of the purchasers to maintain it It was hoped by the producers that when the independent pipe lines were put in operation, prices would be advanced, but no apparent change resulted.

Production.

The Prairie Oil and Gas Company

the more important shipments being made by W. G. Barnes, Haywood Oil Company, Quaker Oil Company, W. H. Milliken, Laurel Oil Company, Benson Oil Company, Kansas-Oklahoma Oil Company, Superior Oil Company and a few others shipping smaller amounts.

To all of these sums must be added the amount of crude oil used for fuel, which was fully as great as in any previous year. In the following estimates no account was taken of the amount of oil stored by the producers. It is probable that the total storage in the field at the end of 1907 was as great if not greater than at the close of 1908. The figures included in the following tables, therefore, are for the actual deliveries to purchasers. These tables summarize the entire statistics for the year. It should be noted that there is a slight discrepancy in the figures given out by the Prairie Oil and Gas Company, the amount put in storage plus the deliveries not being quite equal to the total runs. The error evidently was an unintentional one, but suf-

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ficient data were not at hand to make the slight corrections desirable.

Refineries.

Of the refineries using oil from the Mid-continental field those of the Standard at Neodesha, Kan., and at Sugar Creek, near Kansas City, are much the greater. They consumed the principal part of the 25,000,000 bbl. delivered by the Prairie Oil and Gas Company, the remainder going to the large refineries at Whiting, Ind. At the present time 25 different independent refineries are in existence, 17 in Kansas and eight in Oklahoma, all of which are in operation excepting four; two of these are closed down temporarily and the other two not quite completed.

These 25 refineries have an aggregate annual capacity of more than 3,500,000 bbl. consumption, and are located as follows:

Oklahoma: Big Heart, one; Chelsea, one; Muskogee, one; Oklahoma City, one; Okmulgee, one; Sapulpa, one; Tulsa, two (one closed down).

Kansas: Atchison, one (closed down); Caney, one; Chanute, four; Cherryvale, one; Coffeyville, three (two not yet completed); Erie, one; Humboldt, one; Longton, one; Moran, one; Niotaze, one; Paola, one; Petrolia, one.

The refinery at Paola changed hands late in 1907, at which time it was reported that it was bought by the Standard Oil Company. Since then this report has been denied, and at present the public is uninformed as to where the ownership lies. These independent refineries consumed a little more than 3,000,000 bbl. of oil during 1908.

Fuel Oil.

A large amount of fuel oil is used in the great-plains area of western Kansas, Oklahoma and Texas, and eastern Colorado and New Mexico, a large proportion of which is drawn from the Mid-continenal field. Some of it is taken directly from the wells, the remainder being supplied by the refineries after the lighter oils have been removed.

The plains area in general consumes but little fuel; yet in the aggregate it amounts to 4,000,000 to 5,000,000 bbl. annually. It is used by almost every flouring mill, ice plant, electric light plant, and other plants generating steam throughout the entire territory of the plains area where coal is high priced, it having been found that oil is cheaper than coal, especially on account of the lower labor cost involved in its use. Such a large consumer even as the portland cement plant at Yocemento, Ellis county, Kan., finds it advantageous to use oil for fuel.

Gas

But little change occurred in the gas situation in the Mid-continental field during the year. At the present time the consumption in Kansas is exceedingly large, while that in Oklahoma is but little more than a year ago.

In Kansas the Kansas Natural Gas Company is the largest consumer. The principal addition to its pipe lines during the year 1908 was in a greater extension of the service in Kansas City, Mo. At the close of 1907 less than half of Kansas City was supplied with natural gas, but before the winter season had passed the greater part of the city was reached with the supply pipes. Pipe-laying was continued during the summer so that at the present time practically all of Kansas City and its suburbs are supplied with natural gas from the Kansas fields. Here is a city which, including Kansas City, Kan., and all suburbs, has a population of nearly 400,000 using natural gas for domestic purposes. Nearly all of the smaller factories use it, while some of the larger factories employ the gas during the summer season.

The supply pipe lines were also considerably extended in the Joplin zinc mining district, thus reaching hundreds of consumers which were not supplied with gas during the year 1907. The Kansas Natural Gas Company's pipe lines extend east from the gasfields as far as Joplin, Mo., and supply gas to every town and village along the line, including Parsons, Oswego, Cherokee, Pittsburg, Baxter Springs, Galena, Joplin, Webster City, Carterville, Carthage and many other places. The company's pipe line also extends north from the gas fields to Lawrence and Topeka, to Leavenworth, Atchison, St. Joseph, Mo., and Kansas City. During the year 1907, according to official statements of this company, the income from sale of gas was a little more than $3,000,000. For the year 1908 it will aggregate about $4,000,000.

The Supply

A great deal of complaint was made last winter at Kansas City about the insufficiency of the supply of gas. Similar complaints were made from St. Joseph and Topeka, but to a much less degree. The gas company answered such complaints with the statement that large pumps, which would guarantee an abundant supply in the gasfield were in process of being installed; during the latter part of the winter and throughout the summer of 1908 a large pumping plant was installed at Scipio, a few miles north of Garnett, Kan., and another large one in the heart of the Montgomery County gasfields, five or six miles south of Independence.

The months of November and December, 1908, were so mild that no opportunity offered for testing the adequacy of these pumps. It is hoped, however, that they will prove sufficient to supply all the gas that may be needed in the near future.

The second largest consumer of gas in the Mid-continental field is the Wichita Gas Company, which has laid a pipe line from the Montgomery county field westward to Winfield, Arkansas City, Wichita, Hutchinson and other towns in south central Kansas. This company has holdings in Oklahoma but obtained the main part of its gas from the Montgomery County fields, picking up a very considerable amount from various wells in Chautauqua and Cowley counties. In addition to supplying practically every residence and business house in the various towns and cities reached by its line, the company also supplies the smaller manufacturers and to a considerable extent the salt plants at Hutchinson and Sterling, where large quantities of evaporated salt are produced.

The zinc smelters and portland cement plants come next in quantity of consumption, particularly the cement plants. The year 1908 was not a very prosperous year for zinc smelters, many of the plants being idle a considerable portion of the time, which reduced the consumption of natural gas. This reduction was offset in a way by new smelting plants built at Bartlesville and Coffeyville. Most of the cement plants, however, were in operation practically all the time, especially throughout the first half of the year, and consumed more gas than the cement industry consumed in 1907.

Three new plants were added to the list of consumers, one at Fredonia, Kan., which started late in 1907; one at Dewey, Okla., which began operations in the spring of 1908; and one at Chanute, Kan., which began during the latter part of the summer of 1908. With these additions it is evident that the total gas consumed by cement plants was fully equal and probably greater than that in 1907. The glass plants, brick plants and other factories have remained about as they were and their consumption of gas is, therefore, practically the same as in 1907.

Rates.

The rate at which natural gas is sold is almost uniformly 25c. per 1000 cu.ft. for domestic consumption, with a penalty attached if payment is not made by the 10th of each month. This is the price throughout practically the entire extent of the Kansas Natural Gas Company's pipe line service. In a few places a rate of 30c. is made. The Wichita Gas Company likewise charges 25c. in most places, but in the western part of its territory the rate is 30c. Each pipe line makes a great reduction for factories, the rate of 10c. per thousand being most common.

One or the other of these companies has bought out the local company in almost every town and village in the gas region, so that at the present time citizens of Topeka, Lawrence, Leavenworth, etc. obtain gas as readily and at the same rates as do the little villages in the heart of the field.

Oklahoma

In Oklahoma conditions are different The rulings of the secretary of the interior on leased Indian land and the enforcement of the new law in the State prohibiting the piping of gas out of the State, thus far has prevented any considerable amount of gas being taken outside Oklahoma. Rumors are current that in at least one instance the law is evaded, and that a secret pipe line crosses the State boundary, but such rumors lack public confirmation.

One of the results of the enforcement of the State law and the rulings of the secretary of the interior is that no strong company has yet laid extensive pipe lines anywhere in the State for the purpose of supplying gas to the market. Each town in a measure, therefore, has its own pipe line, and obtains its supply from nearby pools. Very recently the Henry Oil and Gas Company arranged to build a 12-in. pipe line from the Hogshooter district into Bartlesville, a distance of from 12 to 15 miles. This has become desirable on account of the rapid growth of Bartlesville, particularly in the manufacturing plants established. Likewise, Tulsa is preparing to increase its gas supply by laying a large pipe line from the strong gas wells in the vicinity of Collinsville, a distance of about 20 miles.

Rates paid by consumers of gas in Oklahoma differ greatly in different places, not only for factory purposes, but for domestic purposes as well. A number of the communities are supplied by the old fashioned flat rates at from 5 to 10c. a gas jet per month for lighting purposes, and from $1 to $2.50 on stoves per month for heating purposes. Elsewhere, but not very commonly, meter rates are established.

For manufacturing purposes gas is still offered at very low rates at a number of different places. Bartlesville, for example, immediately upon completion of arrangements to bring gas from the Hogshooter district, published far and wide that it would supply factories using large quantities of gas at the rate of 2½c. per 1000 cu.ft. for a number of years with an increase to 3c. later, which price was to rule throughout the life of the gasfields. Such offers are made in good faith and are used by different cities as inducements to draw factories.

Gas Development in Kansas and Oklahoma

Little attempt was made to obtain gas in Oklahoma during the year, such wells as were obtained being incidental to oil developments. The only important exception to this statement lies with the Kansas Natural Company which did some drilling in Oklahoma expressly to develop gas The result is that no new gasfield appeared, but here and there throughout the entire district frequently while drilling for oil good gas wells were obtained In this way the supply was increased faster than the consumption; so that at the end of 1908 the portion of the Mid-continental field lying in Oklahoma is capable of producing a larger supply of gas than ever before.

In Kansas matters are different. Practically in every place where there was much hope for obtaining gas, drilling was prosecuted with zeal. The new field to the southwest of Chanute has been pretty well circumscribed on three sides, and a large amount of gas was obtained by various private individuals and small companies. The Kansas Natural Company also was alert and got hold of some exceedingly valuable holdings.

To the northeast of Chanute, and farther north by way of Humboldt toward Iola many wells were drilled, the great majority of which were successful, some of them developing from 10,000,000 to 15,000,000 cu. ft. per well. In the vicinity of Altoona also some excellent gas wells were obtained by the Altoona Portland Cement Company and private individuals. It is claimed by the cement company that it has one well with a capacity of 20,000,000 cu. ft. per day. Its territory virtually, however, is a southern extension of the pool southwest of Chanute already mentioned.

Farther north, in the vicinity of Colony, a small field of shallow gas was opened up with eight or nine wells ranging from 750,000 to 1,500,000 each. This, by the way, is an interesting locality, particularly on account of its non-productiveness. Colony is situated on the very summit of the most pronounced anticlinal ridge in the entire Kansas gasfield, and yet every deep well drilled in that vicinity has been a failure. The shallow field just mentioned lies east of town from two to three miles, and forms a narrow band trending a little northeast and southwest. The wells here are from 500 to 600 ft. deep, while the horizon supplying gas at Iola and elsewhere so abundantly in the State would be found at from 900 to 1000 feet.

The small gasfield developed more than a year ago in the vicinity of Rantoul near Ottawa is about the same as it was then, and in many respects is about like the Colony pool just mentioned Here also may be named the Bonner Springs, and the Fudora pool, each of which furnishes a small amount of gas, but neither of which thus far has been able to supply large quantities. The development during the past year lends but little encouragement to hope for great production from any of those light fields.

Farther west in the vicinity of Elmdale, Chase county, a small gasfield was developed more than a year ago, which remains about the same as it was when first developed. To the south and southwest from this place a number of small wells were found, particularly in the vicinity of Augusta and Arkansas City. It is to be hoped that future prospecting may increase the supply. Likewise, a little northeast of Elmdale in the same range 12 or 14 miles southwest of Council Grove light wells were found, but none of any particular promise for a strong gasfield.

The Appalachian Oilfield

By Harold C. George*

The total production of petroleum in the Appalachian or the high-grade oilfields has been steadily declining for years. In 1908 there was a further decrease in the production, for the total production of petroleum in the Appalachian field for 1908 was 24,240,000 bbl., as compared with 25,500,000 bbl. in 1907, 27,345,000 bbl. in 1906 and 28,324,324 bbl. in 1905.

In addition to the natural decrease in production in the Allegheny field of New York State and practically all of the oilfields of Pennsylvania developments and operations have been retarded for several months by the drought and the resulting lack of water. Large numbers of pumping wells have stood idle for the past three or four months and consequently where such conditions existed no new wells were drilled.

It is only by the successful drilling operations in southeastern Ohio and West Virginia that the decrease in petroleum production in the Appalachian field has been gradual and slight rather than rapid and great.

West Virginia is the only district in the Appalachian field that holds out any great possibilities of increasing the supply of high-grade petroleum, for in the southwestern part of that State there is a large unprospected area. This region is now attracting the attention of prospectors. In both Jackson and Lincoln counties some prospecting was done during 1908, but as yet no large wells have been drilled. In Lincoln county nine wells were completed during April and May. These wells averaged 40 bbl. a day. In November twelve wells were completed which averaged 35 bbl. a day. Brooke county continues to lead all other districts in "gushers." The Follansbee pool in Brooke county and the

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Holidays Cove pool in Hancock county attracted much attention during 1908, but it is generally believed that these fields are now on the decline. This section of the State had remained unprospected and undeveloped for years, but finally, after much drilling, oil was discovered in that section of West Virginia which lies across the Ohio river from Steubenville, Ohio. Hancock county has long been noted for its large oil pools, but it is only recently that Brooke county has become a factor in the petroleum production of West Virginia. In Roane county operations continue most active and with profitable results. The best wells are found in the "Big Injun" sand.

In Kentucky and West Virginia weather conditions during October and November were very favorable for construction work in those sections of these States which are almost inaccessible in bad weather. Operators seized this opportunity to move in a large amount of material preparatory to drilling operations this winter.

The operations in southeastern Ohio have attracted some attention owing to the development of the Mingo pool, but like the Follansbee pool across the Ohio river in Brooke county, West Virginia, of which this pool is a part, the Mingo field also is on a decline.

All recent additions to the areas producing oil of Pennsylvania grade have been too small to have more than a temporary effect in checking the waning production. There was no change in the price of the high-grade petroleum during 1908. The price during 1908 staid at $1.78 per barrel throughout the year; in 1907 the average price was $1.74 per barrel. The accompanying table gives statistics regarding the production of oil wells drilled in the Appalachian field during 1907 and 1908.

PRODUCTION OF WELLS DRILLED IN THE APPALACHIAN OILFIELD DURING 1907 AND 1908.

Field.	Number of Wells Drilled.		Daily Production in Barrels.		Daily Production per Well Drilled in Barrels.		Per Cent. of Dryholes.	
	1907.	1908.	1907.	1908.	1907.	1908.	1907.	1908.
Allegheny, New York	575	493	1,114	880	1 9	1 8	16 0	13 1
Pennsylvania	3,611	3,748	12,176	9,532	3 3	2 5	21 0	19 0
West Virginia	1,320	1,329	21,300	27,304	16 1	20 6	38 0	32 5
Southeastern Ohio	1,335	1,344	6,793	13,798	5 9	10 3	39 5	39 3
Kentucky and Tennessee	212	205	2,006	2,519	9 4	12 3	32 0	33 6
Total	7,053	7,119	43,389	54,033	6 1	7 6	27 0	25 0

In hydraulic sluicing operations in Victoria, Australia, according to D. B. Sellars, in the report for 1907 of the Secretary for Mines, the only improvement during the year was the introduction at the Creswick Black Lead and the Portugese Flat hydraulic mines of high-lift centrifugal pumps coupled in series so as to give the pressure necessary for hydraulicking the gravel.

The Adirondack Graphite Industry

By D. H. Newland*

The Adirondack mines contributed the usual quota of crystalline graphite in 1908. For several years the production has averaged about 3,000,000 lb. annually, nearly all from the American mine at Graphite, Warren county. The success obtained in the operation of this mine by the Joseph Dixon Crucible Company has furnished an incentive to a great deal of exploration along the eastern border of the Adirondacks, which has demonstrated the widespread occurrence of the Pre-Cambrian graphite quartzites in that section, though workable deposits seem to be sufficiently uncommon. Besides the actual content in graphite, the size of the flake and freedom from other scaly minerals like mica are factors of prime importance in determining the value of a deposit.

The Crown Point Graphite Company and the Glens Falls Graphite Company were active during a part of 1908. The former company opened a deposit near Eagle lake, about 10 miles from Crown Point, Essex county, where it has erected a new mill with a capacity of 75 tons of rock a day. The crude graphite from this mill is refined and finished at a second mill situated at Crown Point Center. The mines and mills of the Glens Falls Graphite Company are near Conklingville, 8 miles west of Hadley, Saratoga county.

Some development work has been done during the year on a graphite-bearing quartzite just north of Saratoga Springs.

*Assistant State Geologist, Albany, N. Y.

The Lima Oilfield

By Harold C. George*

The oilfield of northwestern Ohio and northeastern Indiana known as the Lima oilfield has shown a falling off in petroleum production The total production in 1908 was 7,287,000 bbl., as compared with 8,030,000 bbl. in 1907.

A large number of wells were abandoned in this field in 1908 and the production was maintained only by the increased activity in operation due to the higher market price prevailing in 1908 than in 1907. The average price paid for North Lima was $1.03 per barrel as compared with $0.93½ in 1907, and for South Lima $0.98, as compared with 0.88½ in 1907.

There was a much smaller percentage of dry holes drilled in northwestern Ohio in 1908 than in 1007, as shown in the accompanying table, which gives the production of only those wells that were drilled during the year referred to.

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WELLS DRILLED IN THE LIMA OILFIELD IN 1907 AND 1908.

	Number of Wells Drilled.		Daily Production in Barrels.		Daily Production per Well Drilled in Barrels.		Per Cent. of Dry Holes.	
	1907.	1908.	1907.	1908.	1907.	1908.	1907.	1908.
Northwest Ohio	930	837	8,100	9,252	8 7	11 0	15	9
Northeast Indiana	682	413	5,673	3,405	8 3	8 2	20	19
Total	1,612	1,250	13,773	12,657	8 5	10 1	17	13.5

Cadmium

This metal continues to be produced in the United States by but one concern, viz., the Grasselli Chemical Company, of Cleveland, Ohio. The production in 1908 was about 10,000 lb. At the beginning of the year the price was $1.25 per lb Later it was reduced to 75c. At the end it was 80c. These prices are for round lots. The production in Upper Silesia in the first half of 1008 was 35,000 lb., against 36,500 in the corresponding period of 1007.

Wolframite in India

Wolframite was discovered in 1908 at Agargâon, seven miles southeast of Maunda, which is 20 miles east of Nágpur on the main road from Nágpur to Raipur. The ore is found in quartz veins intercalated in mica schist. The grade of the ore is good and the deposits are believed to be commercially workable. The discovery was made by J. Kellerschon, of Nágpur, agent in India for the Carnegie Steel Company.

Mining in the United States During 1908

History of the Year in Various Camps of California, Colorado, Nevada, Montana, Utah, South Dakota, New Mexico and Other States

REVIEWS OF PROGRESS

The mining industry in the United States in 1908 was more or less under a cloud, as appears from the following reviews, although in the second half of the year, and particularly in the last quarter there was an improvement in sentiment. Yet after all, 1908 was not a very bad year. The production of copper and gold increased, while the outputs of the other metals were not very much smaller than in 1907, except in the cases of iron and a few of the minor metals. The average prices for the year do not compare unfavorably with the averages for the last 10 years. Why, then, was there so much complaint? Chiefly because the abnormal prices of 1906-7 stimulated the operation of many mines which ought not to have been opened.

Alaska

Members of the U. S. Geological Survey who have recently returned from Alaska report no great advance in the mining industry in the southeastern part of the Territory, although at some of the mines in the Juneau district—the Treadwell group, the Perseverance, and the Eagle River mines—substantial progress was made and extensive mining and water-power projects were undertaken, which promise well for 1909. The following article is compiled from recent reports by the U. S. Geological Survey.

Juneau District

At the Treadwell mine developments have been pushed on the 1450-ft. level, which is to be used as a base for deeper explorations, and to this level the Seven Hundred Foot and Mexican mine shafts will be extended. At the Ready Bullion mine explorations are being made on the 1500-ft. level. The stamp mills were in continuous operation throughout the year, and the gold production will be about the same as in 1907. The use of oil as a substitute for coal for all purposes at these mines has reduced the fuel expense considerably, and additional water power has been provided by the building of dams on Ready Bullion and Fish creeks. Work on a project to obtain power from Turner lake, on the east side of Taku inlet, 18 miles from Treadwell, is being advanced. This project will necessitate the transmission of power across Taku inlet, a distance of 2½ miles.

At the Perseverance mine the lode deposit is now opened at the tunnel level for 1500 ft. in length and 60 to 100 ft. in width. The 100-stamp mill was in operation from June until November. Mining operations were in progress at the Alaska-Juneau mine from the last of June until the middle of October, and the 30-stamp mill was in continuous operation during that period. At the Eagle River mine developments were advanced, and the quartz veins which are displaced by faults, causing much difficulty in their exploration, have been discovered further in the mountain on the various tunnel levels. The 20-stamp mill on the property was supplied with ore obtained principally from the upper tunnel levels. Encouraging results are reported from the Yankee Basin prospects and from other properties within the Juneau gold belt, and also from the De Groff and Mills properties to the north of Sitka.

Ketchikan District

The copper mines in the Ketchikan district suffered a considerable setback early in 1908 because of the decrease in the price for that metal, and except at the Jumbo mine operations were suspended during the winter. The Mount Andrew and Rush & Brown mines were idle throughout 1908; at the Mamie and Stevenson mines activities were renewed in August, and a relatively large amount of ore was mined, which was treated at the Hadley smelter. Explorations at these mines are to be advanced during the winter months, though the smelter suspended operations in November and no ore will be shipped. The largest production and most extensive developments during 1908 were made at the Jumbo mine, near Sulzer. The operations on this property were confined to the sulphide deposits at the head of Jumbo Basin, and only small developments took place on the copper-bearing magnetite deposits on the north side of that basin. The Niblick mine was operated from Apr. 15 to Oct. 30, during which period the shaft was sunk to a depth of 360 ft. and developments were extended on the 300-ft. level, where two orebodies were opened. Raises were made in these orebodies to connect with the 225-ft. level, and most of the ore thus developed was mined. At the It mine, on Kasaan Peninsula, mining operations were begun by the It Mining Company early in the spring, and a body of high-grade copper ore was developed. A tramway one mile long was built to tide water, a wharf was erected, and ore shipments were begun in the first part of October.

The copper production of southeastern Alaska for 1908 will be less than that for 1907, but the average content of copper per ton of ore mined will be somewhat greater.

At the Calder Bay marble quarry near Shakan and at the gypsum mine on Chichagof Island work was in progress throughout 1908, and a large production is reported from each locality.

Yukon Valley

Three new localities for placer gold in the lower central part of the Yukon valley, brought to the public notice within the last two years, are of particular interest because they show that the gold-bearing formations of the valley are of much wider extent than has generally been supposed.

Innoko District

Since the discovery of placer gold, in 1906, on some of the headwater tributaries of Innoko river, that part of Alaska has received more attention from prospectors looking for new fields than any other district in the Yukon valley. The Innoko, the lowest noteworthy tributary of the Yukon entering from the left, is about 500 miles long and has been the principal route to and from the diggings on its headwaters. During 1906 small sternwheel steamboats ran up the river to Dichkakat, about 250 miles from Anvik, on the Yukon. From Dichkakat it is 190 miles farther by the river to Ophir, the principal settlement at the diggings, and this distance is traveled in poling boats that will hold about one ton of freight. The most serious drawback to prospecting in the Innoko country is the difficulty and cost of getting supplies to a central distributing point convenient to the creeks on which pay gravel has been discovered. So far most of the provisions have been shipped into the district from Fairbanks, and by the time the freight is delivered at the town of Ophir the transportation cost has reached $500 a ton.

The Innoko country has been staked in a wholesale manner, about 1200 locations being on record. Of this number only about 25 claims were worked during the summer of 1908; practically all of these were on Ganes, Little and Ophir creeks.

About 150 persons are now wintering in the Innoko district.

Gold Hill District.

The name Gold Hill is applied to an area in the central Yukon valley, about 25 miles below the mouth of Tanana river, that lies along the north side of the Yukon and extends westward from the western slopes of the valley of Tozitna river to the higher mountains north of the United States telegraph station called Birches. Roughly, the district embraces an area extending 30 miles east and west and 20 miles north and south, covering about 600 square miles. Most of this area consists of mountains that form a divide extending east and west about midway between the main courses of the Yukon and the head-waters of the Melozitna. This divide separates the region into two areas that are drained to the north and south by creeks of moderate length and volume.

The principal southward-flowing creeks, named from east to west as they join the Yukon, are Grant, Illinois, and Mason and their tributaries; those flowing northward into the Melozitna, named in the same order, are Moran, Eureka, Hudson, Langford, and Tiffany creeks and their tributaries. It is in the gravel deposits of these creeks that the placer gold is found. Practically all the alluvial ground on these streams has been located for placer mining. The locators are mostly association groups that enable a few men actually present on the ground presumably provided with powers of attorney from a number of absent persons, to tie up completely many thousands of acres of alluvial deposits bearing placer gold. The result of this practice is that many intending workers are unable to acquire ground rights and the healthy growth of the placer-mining industry is being retarded in a discouraging manner.

Open-cut ground-sluicing operations have been begun at several localities in the Gold Hill area, but owing to the scarcity of water, due to the unusual dryness of the summer of 1908, there has been thus far very little production of gold.

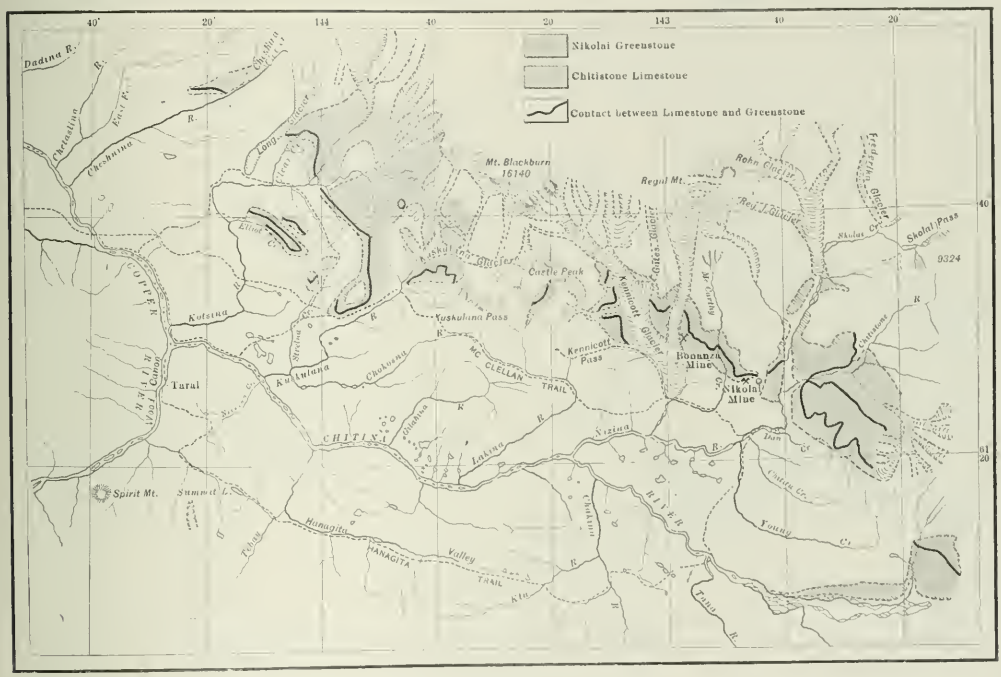
Ruby Creek District

The area known as the Ruby Creek district—from the name of the small stream on which gold was first discovered in the area—lies on the south bank of the Yukon, directly south and opposite the mouth of Melozitna river, about 175 miles below Tanana, or 110 miles above Nulato. For a distance of 10 miles along the south bank of the Yukon the Ruby Creek country presents rolling hills from 400 to 500 ft. high that overlook the river with bluffs 200 to 300 ft. high. This district received considerable attention from prospectors in the winter of 1907-8. Large tracts were located as placer-mining ground on Ruby, Melozi, Big, Main, Boston, Bonanza, Beaver and Dome creeks and their tributaries. A number of holes were sunk to bed rock during the winter, and propects of gold are reported to have been found at several places. Discovery claim, on Ruby Creek, was the only property actively worked in July, 1908.

Tin Deposits

Stream tin was discovered in the York region of Seward Peninsula during the fall of 1900 as a heavy and objectionable constituent which accumulated in the sluice boxes of the placer-gold prospectors. A. H. Brooks, of the U. S. Geological Survey, who was engaged in a hasty reconnaissance of the region, brought some of this material back to Washington, where it was identified as cassiterite.

Developments in this region have been sufficient to demonstrate, at least, that the granite-limestone contacts are not favorable places to hunt for commercial bodies of cassiterite ore. Quartz porphyry dikes, locally known as lodes, or even as quartz veins, have been prospected to some extent, owing to the fact that the original discovery of lode tin in Alaska was made on a mineralized or altered dike of this



SOUTHERN COPPER AREA OF ALASKA
(From map of U. S. Geological Survey)

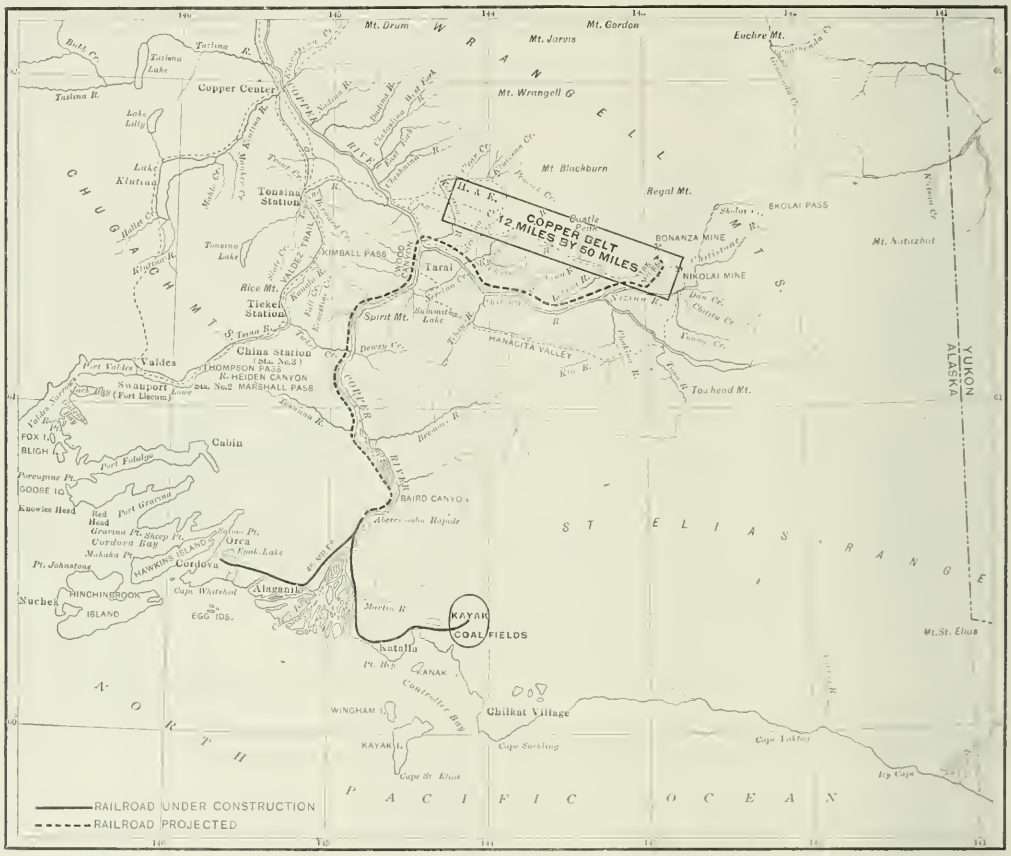
character. The value of any such dike depends on the number of cassiterite stringers which it contains and the closeness with which they are spaced. Of itself a quartz porphyry dike has no value. The unwelcome fact should be speedily realized that few of these dikes hold out any inducements whatever as prospective tin producers.

Most of the developments throughout the region are still in the prospecting stage, and many of the open cuts have not uncovered solid bed rock. No tonnage of tin-bearing rock, except at one place on Lost river, has yet been blocked out. Small holes in the ground, which give no clue to either dip, strike, or persistence of the ore rock, are held at enormous figures. The great need of the country is less desultory prospecting. The slate area deserves more careful examination, as it is possible that valuable quartz veins may exist within its confines. The distribution of stream tin in Anikovik river and its tributaries proves that the stanniferous mineralization is not limited to the region at the head of Buck creek, but is more widely spread throughout the slate belt. It is probable that a great granite mass, of which the stocks at Brooks mountain, Tin creek and Cape mountain are protruding bosses, underlies the entire York region.

Copper River Region

Active prospecting was carried on in 1908 on the head of Nabesna river, on Cross creek (or Copper creek, as it is now called), and on White river. The White River prospects are situated in two areas—one at the head of the river, in the vicinity of Skolai glacier, the other near the international boundary line, partly, it is supposed, in Yukon Territory. Prospecting in the region northeast of the Wrangell mountains is restricted almost wholly to the search for copper. The best known copper prospects on Nabesna river are near the foot of Nabesna glacier, in the vicinity of Orange Hill, but development work is not yet sufficiently advanced to give an idea of their extent.

The copper minerals on Copper creek are found in lavas and consist chiefly of chalcopyrite and chalcocite, but include also cuprite and native copper. The copper deposits of White river consist of copper sulphides and native copper in lava flows. Native copper is found in greatest amount near the boundary line. This region gives some promise to the prospector for gold-lode deposits, and development work on a vein of argentiferous galena associated with sphalerite has been begun.



MAP OF MOUNT WRANGELL DISTRICT, ALASKA, SHOWING POSITION OF THE COPPER BELT AND ROUTE OF THE PROPOSED RAILROAD
(Based on map of U. S. Geological Survey)

Prospecting in Chitina valley was discouraged during 1908 by the low price of copper and the consequent difficulty of obtaining financial backing, but some effective development work was done. At the Bonanza mine the season was spent in erecting a sawmill, ore bunkers, buildings for various purposes, and an aërial tram from the mine to the camp.

Development work was done on the ex

tension of the Bonanza in the upper part of McCarthy creek valley by the owners of the Mother Lode claim and by the Houghton Alaska Exploration Company The largest operations in the remainder of the field were those of the Alaska Consolidated Copper Company on Nugget creek, the Hubbard Elliott Copper Mines Development Company on Elliott creek, and the Great Northern Development and Alaska Kotsina Copper companies on Kotsina river.

Placer mining was active on Dan and Chititu creeks during the summer. The two hydraulic plants on Chititu creek continued operations in 1908 but experienced some difficulty in procuring labor, a difficulty encountered at the Bonanza mine also.

Probably the most important work affecting the future of the Copper River region is the construction of the railroad from Cordova to the interior. During 1908 more than 50 miles of track were laid, bringing the road to the bridge over Copper river between Childs glacier and the lake in front of Miles glacier. This road will establish communication with steamboats on the river above Abercrombie rapids and it will be possible to carry freight from the coast at Cordova to Copper Center on Copper river or to the mouth of Lakina or Nizina river on the Chitina. Construction work is also being pushed on a short piece of road connecting the Bonanza mine with Chitina river, and its completion will make it possible to carry supplies to the mine or to ship ore to the coast before the whole of the railroad up the river is completed. A branch line to the Bering river coalfields is also under way.

Arizona

By William P. Blake*

The cloud of industrial depression which hung over the country for the greater part of the year 1908 was not without a serious depressing effect upon the mining enterprises of the Southwest. With the exception of the well established copper, gold and silver mines, the mining prospects generally were closed down. But with the brightening skies of November and December there was renewed activity giving promise of prosperity for the year 1909.

Gold

Gold, the second in value of Arizona's mineral productions, was officially reported as amounting to $2,617,312 in value in 1907 and is believed to have equaled, but not to have exceeded that figure for 1908.

One mine, at least, was added to the list of producers, the Mohawk, in the Old Hat district, Pinal county, near Schultz. It ranked high as a producer for several years, but until 1907 remained closed down for a decade or more. Under the management of William Roberts, it has been reopened. The shaft was sunk from the 300- to the 500-ft. level. Drifting on the contact between granite and an eruptive rock opened up new bodies of oxidized free-milling ore. The mill of 30 stamps was started in September, and has since been satisfactorily producing gold bullion. The tailings do not run high enough to justify cyaniding. Water is not expected until a depth of 725 ft. is reached, this being about the level at which it stands in the neighboring mine, known as the Mammoth, which is idle. Like the Mammoth ore, there is a notable amount of wulfenite in it, but not exceeding 1.4 per cent., insufficient to pay for the extraction by concentration as was adopted with the tailings at the Mammoth mill on the San Pedro.

In the extreme southwest of the territory the Fortuna has ceased to be a notable producer. In the Quijotoa region, the Weldon Gold and Copper Company, under the management of Director Fitch, continued operations through the year. About 300 ft. of driving and sinking was added and rich gold and silver ore was opened up. The capacity of the mill was increased by new stamps and a cyaniding plant. The copper-bearing part of the property was reached by a shaft penetrating the ore 300 ft. below the outcrop of gossan. Shipments of oxidized ores averaged from 22 to 30 per cent. of copper. A second shaft 1000 ft. west reached a depth of 330 ft. on the footwall with the expectation of striking a body of sulphide ore.

The mines of the Congress and other gold properties of the Piedmont region of the Bradshaw mountains continued in operation. The Octave mill was started late in the year and resumed its additions to the bullion product of the territory.

Near Prescott, Yavapai county, the Bullwhacker gold-quartz mine has been worked since January, 1907. The quartz carrying coarse gold of high grade in 1908 was worked at the Oriental mill, Poland.

The Arizona Copper-Gold Mines property was worked up to Sept. 20, opening up reserves of ore ready for the crushing machinery to be added early in 1909 In northern Pinal county development work on the gold-bearing veins in the Saddle Mountain mining district, south of the Gila river, was resumed in the latter part of the year, particularly upon the mines of the Ash Creek Company. There are now 600 ft. of workings, with the shaft 100 ft. below the main tunnel level. The vein may be said to be double, being formed on both sides of an intrusive porphyritic dike A crosscut shows the south side vein to be 20 in. wide, assaying from 5 to 20 per cent. copper and from $20 to $70 in value for gold. The north vein is about 4 ft. wide and assays 4 per cent. copper.

There are several groups of similar veins all traversing andesitic rock, giving by their weathering and erosion placers of considerable value. The Ash Creek Company's ground gives access to these veins by a tunnel at a low level. A concentrating mill is needed, and projected at the river, by which rich auriferous concentrates could be taken from the mines of the district.

In the Bunker Hill district, east of Mammoth, prospecting by the Calumet & Arizona company of Bisbee, during the year, was so satisfactory that there are now three different companies and nearly 100 men at work there. The district within which there are good evidences of copper and gold ore is described as about five miles wide and 12 miles long. Machinery is on the way for the erection of a 200-ton concentrator. In Mohave county there are many producing gold properties from which no reports have been received.

Near Kingman the Gold Roads is operated by Porcy & Bailey, and the Blue Ridge by men from Pasadena, California.

The Gold Crown group, also near Kingman, in the Union Pass section, is reported to have developed promising orebodies, so also the Tyro groups.

At Cerbat, the Golden Gem reached in its shaft a depth of 500 ft. and cut a body of high-grade gold ore according to a late report.

In northern Yuma county the Signal mine, 20 miles north of Bouse, was opened by a shaft to a depth of 300 ft. and a large body of low-grade auriferous copper ore was reached by a crosscut on the 200-ft. level.

At Salome, Yuma county, north of the Harqua Hala mountains, the closing of the year witnessed increasing activity, and the development of the Ullimatum copper flat and the Cahralla properties in the limestone belt of Tank Pass.

At the Harqua Hala the efforts to work the fillings of the old stopes ceased and attention is now given to unwatering and sinking for new orebodies below the old works. This mine is said to have produced upward of $7,000,000 in value above the 300-ft. level. The reopening of the old Vulture mine is reported.

Silver

The production of this metal, third in value of Arizona's minerals, may be estimated at 2,000,000 oz. fine for 1908, or somewhat less than the figures given officially for the production in 1907 (2,511,897 oz.). The Territory was formerly celebrated as the source of many ponderous masses of nearly pure silver

*Territorial geologist, Tucson, Ariz.

from the gravelly placer deposits near Globe.

During the year 1908 the Old Stonewall Jackson mine, supposed to be the source of much of the placer silver, was reopened and at the depth of 280 ft. a rich vein of silver is reported to have been found. There were also efforts looking toward a resuscitation of the Silver King mine in Pinal county, but active work has not resulted.

Most of the silver production is derived from the smelting of argentiferous lead ore and from the silver-bearing gray-copper ores.

Argentiferous Lead

The silver-lead mines of Santa Cruz county remained practically as at the close of the year 1907. The Hardshell and the Flux mines near Patagonia, Santa Cruz county, noted for their large bodies of argentiferous lead ore and carbonates suitable for smelting operations, which were under bond in 1907-1908, are still under bond. The deepest workings on the Hardshell are 500 ft., by an incline shaft. It is claimed that there are fully 100,000 tons of ore that will assay 10 per cent. lead and 10 oz. silver per ton. In crosscutting from the 500-ft. station to the ledge a large flow of water was encountered which stopped further mining operations for a time. The deepest shaft on the Flux was carried down to the 260-ft. level, opening up, by estimate of owners, 50,000 tons of ore assaying 12 per cent. lead and 6 to 8 oz. silver to the ton. The World's Fair mine is closed, and was for most of the year 1908.

During the year operations at the Salero mines were confined to the extension eastward of the lower drift on the Eureka Mabel, and westward on the same lode, and to surface surveys for patenting the Eureka and other claims beyond. Work was delayed somewhat by the uncertainty of ownership entailed by the claimants of the Baca Grant Float No. 4 and the consideration of the claims by the department of the interior. The full investigation having shown conclusively that a large part of the region covered by this Baca location was well and publicly known by publications to be mineral land prior to the location, the claim, after repeated hearings, was dismissed, and it no longer blocks mining or farming locations.

The "Constitution" or Darwin lode at Happy Camp, on the south side of Salero mountain, was under exploration during the year by sinking a vertical two-compartment shaft, which, at the close of the year, reached a depth of 300 ft. It is proposed to crosscut to the ledge at the 500- or 600-ft. level, to intersect the supposed prolongation of the shoot, or chimney, of high-grade silver-copper ore mined out above the 150-ft. level.

The Alta mine opened on a lode of argentiferous gray-copper and galena ore, similar to that of the Eureka, remained closed during the year, the transportation facilities not being favorable to the shipment of the ores to smelters.

The Tia Juana group of claims on the great quartz ledge carrying iron pyrites, chalcoyprite, galena, tetrahedrite and blende, which crosses the diorite ridges at the head of Josephine cañon, in Santa Rita mountains, was surveyed and patented, and will be worked when railway communication is established along the Santa Cruz valley, by which the ores and concentrates may find an outlet. The Mowry silver-lead mine, south of Patagonia, was not actively worked during 1908. The smelter remained closed down, but some exploratory drifts were run in the mine.

The Vekal silver-lead mines, 35 miles southwest of Casa Grande station, on the Southern Pacific railway, which were large producers of silver-lead ore in the years from 1885 to 1904, were reopened and the concentrating mill of 10 stamps with Wilfley tables is in operation. One shipment of a carload of concentrates was made. A double-compartment shaft was sunk to the depth of 380 ft. so as to reach and open up new orebodies at lower levels. The old workings, said to measure more than five miles in total length, are found to contain a large amount of low-grade ore suitable for profitable concentration. The Commonwealth, also known as the Pearce mine, in Cochise county, continued in successful operation under lease to Swatling & Smith. There were 34,763 tons of ore taken from the mine, crushed dry and cyanided direct. These ores were passed through a Blake crusher and four sets of Chalmers-Williams rolls, one set 15x36 in., two sets 15x30 in., and one set, finishing rolls, 10x30 in. Two additional sets were recently added to increase the capacity and to crush through 10-mesh instead of 8-mesh screens. With this plant the capacity is 150 tons in two shifts of eight hours each. By pan-amalgamation 28,912 tons of medium grade ore were treated. This was crushed by stamps. For a part of the year 30 stamps were used, but 10 stamps were dismantled in June to install more rolls, and since then only 20 stamps were used, averaging two tons to the stamp. The tailings from the pan-amalgamation process (11,040 tons) were treated by cyanide. The figures of production and treatment pertain to the months of 1908 up to November 1.

The lessees state that in 1908 they have mined and milled more ore than at any time during the life of their lease, which dates back to May, 1905. They expect to treat 200 tons daily during 1909; 150 tons of this will not average more than 5½ oz. silver and 80c. to $1 in gold.

The mines of the Tombstone camp were continuously operated by the Tombstone Consolidated Mining Company, and more ore has been extracted and shipped from lower levels than ever before. Water at the rate of 5000 gal. per minute is pumped from the 1000-ft. level.

New Railway Facilities

The construction of the Arizona & California railway across northern Yuma county from a point between Congress and Wickenburg westward to and beyond Parker on the Colorado, gave access to the rich mineral region hitherto remote and neglected. It passes by the Harqua Hala mountains, toward Quartzite, then winds northwest by the town of Bouse toward the Bill Williams Fork region and gives an outlet to the mines of the Santa Maria mining district and about Parker on the Colorado river. The early completion of this road drew renewed attention to the mining districts along its route, and active prospecting in 1908 resulted in the addition of many promising properties, bearing copper, gold and silver.

Colorado

By George E. Collins*

Mining in Colorado during 1908 was on the whole in a distinctively depressed condition. The low prices for all the commercial metals resulted in a considerable lessening of output. With the exception of Cripple Creek and Telluride, both of which are essentially gold-producing camps, every district throughout the State was materially affected not only by the low metal prices, but also by the fact that the financial conditions in the Eastern States necessitated the postponement of new outlay both for equipment and for prospecting. The tonnage of ore received at the various plants of the American Smelting and Refining Company, which may be taken as a fair index of the condition of the mining industry, outside of that from purely gold-producing mines, was about 550,000 tons as compared with 796,000 tons in 1907, a decrease of approximately 30 per cent. Owing to the lower prices received for the product, the falling-off in value was still more serious

Gold and Silver

Cripple Creek District

A reduction in the costs of treatment at the custom chlorination plants was in force during the greater part of the year and resulted in an increased tonnage. This increase, however, was mainly in shipments of very low-grade material, so that the total output was of

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less value than has been generally supposed. The minimum price for freight and treatment was $3.50 per ton; this rate enabled the shipment of great quantities of dump material. So far, however, as can be learned at the time of writing, the shipments of ore of the better grades were decidedly smaller than during 1907, and the value of the output correspondingly reduced.

The principal producing properties were the Portland, Elkton, Golden Cycle, Strong, and Cresson; an important output was maintained by leasers working in the El Paso. Of the outside leases, the most profitable and productive was probably that on the Lucky Gus Mine; the Dante leases hardly came up to what was expected.

The drainage tunnel has made good progress, the face being now in about 4500 ft. from the portal. The footage reported during the last few months of the year has been particularly gratifying. The new mill of Stratton's Independence was completed early in the year, but owing to a variety of causes, principally financial, it has not yet been in steady operation. It is understood that these difficulties have now been straightened out so the mill should add largely to the production next year. The future of Cripple Creek depends largely on the cheap treatment of the low-grade ores. Discoveries of high-grade orebodies seem to be fewer in number each year, and it is improbable that the existing rate of production can be maintained much longer from ore of the present grade; still, the completion of the drainage tunnel and the introduction of cheaper milling methods may result in maintaining Cripple Creek as the chief gold-producing district of Colorado for many years to come

San Juan Country

The Ouray district was comparatively inactive, with the exception of the great Camp Bird mine, which maintained a large production throughout the year. It is, however, generally understood that the orebodies in that mine are approaching exhaustion. At Telluride the Tom Boy, the Smuggler-Union and the Liberty Bell maintained the same output as for some years past, but the Smuggler-Union was considerably affected by the low price of silver. At Silverton, the Gold King was shut down for several months, on account of a disastrous fire. The Silver Lake was compelled to curtail its production on account of the low values of lead, silver and copper and at present the mine is being worked only by lessees.

Central Districts

Leadville and Aspen were both seriously affected by the drop in silver. Until the drop in silver, however, the Crescentia and Reindeer shipped largely. A considerable production of gold-bearing material was made from the territory contiguous to the Ibex properties. The Dinero tunnel was completed to the vein during the fall, and development work is now in progress. At Aspen the production, as to quantity, was not much less than in 1907. The Della S. and Durant shipped a large tonnage; in the latter case low-grade lead-silver ore, that was mined by lessees. The Percy LaSalle was shut down, but the Smuggler mill ran continuously throughout the year. At Creede also the tonnage handled was about the same as in 1907, but here again the low prices of metals must have seriously curtailed the profit margin.

Northern Counties

From Gilpin county the output was perhaps a little better than in 1907, but as a whole the district has been in a depressed condition. The opening-up of important orebodies in the Bobtail vein on the lowest level promises an increased production in 1909, while the resumption of work in the Newhouse tunnel is certain to lead to a revival in the district around Nevadaville. The Georgetown district was hard hit, on account of the low metal prices. Although the high-grade silver ores cannot fairly be described as approaching exhaustion, it is unfortunately true that the discoveries made of late years have been of small extent. The amount of development work done, however, is altogether inadequate, and is likely to remain so unless capital is invested from outside. An important orebody, the value in which is largely gold, has been opened up in the Capital tunnel, and a mill has been built at the entrance of the tunnel to handle this ore. At Idaho Springs, the Stanley and Lamartine mines have been producing very little ore. The Gem and Little Mattie mines, both operated on the leasing system, have been probably the largest contributors to the output. The Sun and Moon mine, on the boundary line between Gilpin and Clear Creek counties, has been opened up with a raise, from the level of the Newhouse tunnel, that connects with the lowest workings from surface. Several levels from this raise have been commenced in ore, and probably in 1909 this mine will be the largest producer in the district. The resumption of work in the heading of the Newhouse tunnel, which took place on Dec. 16, is likely to prove of great permanent importance to this district.

The well known Alice orebody, at the head of Fall river, is again being tested; the result of several careful mill-runs indicates that it is susceptible of profitable working on a large scale. There is very little of importance to report with reference to developments in Boulder and Summit counties. The large dredging operations planned for the Breckenridge district have been delayed, as a result of the financial stringency in the East.

Lead and Zinc

Leadville

The operations of the Western Mining Company at the Coronado and Penrose mines were suspended in December, 1907, as a result of the fall in metal prices, and the pumps were taken out. Work was, however, continued for several months thereafter by lessees, who continued shipping until the water drove them out. The Moyer and Tucson mines of the Iron-Silver Company have remained idle throughout the year. The Yak-Tunnel properties have, however, maintained a large output.

Minor Districts

At Creede the output, as to quantity, has been fairly well maintained, but the fall in value has been seriously felt. In the San Juan, as indeed everywhere throughout Colorado, the mines producing lead and zinc depend mainly for their profit on the gold and silver in the ore, since the lead and zinc are in the nature of by-products, though often very important ones. The partial suspension of the Silver Lake mine has been already referred to; the Iowa mine, also near Silverton was disabled by a snow-slide during the winter, but has been reopened by a leasing company. On the whole, outside of Leadville, the output of these metals has been affected less than might have been expected; but, should a recovery in the value of silver be long delayed, it is probable that 1909 will witness a further falling off.

Copper

The production of copper in Colorado is not of equal importance with that of the metals previously mentioned. It is, however, notable that the quantity, if not the value of the copper produced, has increased. This is due partly to shipments from the Leadville district, and partly to several discoveries in the San Juan; notably at the San Antonio mine in the Red Mountain district, and at the Frank Hough mine near the dividing line between Hinsdale and Ouray counties.

Rarer Metals

Tungsten

The demand for tungsten was very much lessened during 1908, largely because of depression in the steel industry, and the price was correspondingly reduced. For this reason the industry in Boulder county was inactive, and the value of the output for the year was probably less than $100,000. Lately the demand seems to have revived somewhat, and mining and milling are being more ac-

tively carried on. An unusually snowy winter, however, will tend to retard production, even if the demand should be good. Nothing has been done toward the development of the sporadic occurrences of tungsten ore in the San Juan and other districts throughout the State.

Vanadium and Uranium

The milling plant of the Vanadium Alloys Company at Newmire, near Telluride, was operated continuously during 1908. A new McDougall furnace is being installed, and the output will be largely increased.

The discovery of a body of pitchblende ore in the Belcher mine on Quartz hill in Gilpin county is reported. This mineral occurs in quite a number of veins including the Wood, Kirk and German, but the occurrence is pockety, as isolated lenses in gold-bearing fissure veins.

Montana

By H. K. Welch*

Difficulties between the miners and operators about the wage scale, and the resulting strikes occurring during the last six months, had their effect upon the coal production of the State for the year 1908. At Roundup, in Yellowstone county, the Chicago, Milwaukee & St. Paul Railroad during the year developed some mines which will eventually become large producers. The Washoe Copper Company's mines at Bear Creek, Carbon county, were brought to a producing state and thoroughly modernized, although of late they have not produced to their full capacity, which is about 700 tons daily. At Red Lodge, in Carbon county, the Northwestern Improvement Company mines held first place in the State in the amount of production. Almost the entire output was used by the Northern Pacific Railway Company. At Chimney Rock some new properties of Evans & Anderson were opened up; they give every indication of becoming large producers. The mines of the Great Northern Railroad at Sand Coulee, in Cascade county, were in almost constant operation throughout the year.

Copper

Copper is easily the first mineral in importance in the State, and Butte is the leading copper camp. While the low price of the metal, and severe floods interfering with transportation, tended to lessen the output, still little decrease will be shown from the output of 1907. In the Butte district the effects of the financial panic of 1907 kept the mines closed for the first two months of 1908, and they had barely got under way when the floods and the consequent damaging of the Boston & Montana smeltery at Great Falls caused a very material curtailment of the production from the Boston & Montana mines in and around Butte. The Anaconda company, with its High Ore, Never Sweat, Anaconda, Mountain Consolidated, St. Lawrence, Bell, Diamond, Buffalo, J. I. C., Modoc and Belmont mines, with the exception of the first two months of the year, worked almost continuously. The Anaconda and St. Lawrence mines were hampered to a certain extent because of the fires smouldering in the old stopes. The High Ore, with its depth of 2800 ft., is now the deepest mine in the camp. As a result of the deepening of the Belmont shaft so as to connect it with the lower levels of the Anaconda, nearly 400 ft. haul will be saved in hoisting the ore of the latter mine. The Butte Coalition Company accomplished a great deal during the year. At its Tramway mine a new gallows frame and hoisting engine were installed and new machine shops, carpenter shops, and office buildings were erected. Through the workings of the Tramway an enormous amount of development work was done in Minnie Healy ground on the 1400-, 1500- and 1600-ft. levels. Several connections were also made with the Rarus mine.

The Cora mine of the Coalition Company is worked through the Anaconda company's Diamond mine. As a whole the mines of the company are in much better shape than ever before, both for the production of a larger quantity of ore and for more economical mining. The Boston & Montana company operated during the year the Mountain View, Leonard, Pennsylvania, and East and West Colusa mines. At the West Colusa work was somewhat retarded by the fire which has been present in the mine for more than a year. At the Leonard a new shaft was sunk and the daily output of the mine for the last few months of the year was greater than ever before.

The Butte & Boston company operated almost continuously the Silver Bow, Berkeley, and East and West Greyrock mines. The Parrot company worked the Parrot and Little Mina mines. While the showing of the Parrot mine for the year was rather poor, in the Little Mina several bodies of good ore were opened up. The Trenton Mining Company, operating the Gagnon mine, was able to obtain better ore than at any time within the last few years.

The Original Consolidated Mining Company, in which W. A. Clark is the controlling factor, was able to work throughout the year unaffected by floods or the financial panic. The Original and West Stewart mines are the principal producers of this company, and the ore is treated in the Butte Reduction works, owned by the same men. The ore in these mines has improved with greater depth. W. A. Clark also operated the Elm Orlu and Poser mines, which are situated in the North Butte district. The North Butte company during the year sank its shaft from the 1800- to the 2200-ft. level. On the 2000- and 2200-ft. levels crosscuts were driven to the veins, and they were found to be fully as good if not better than those on the 1600- and 1800-ft. levels. The mine averaged in production about 1400 to 1500 tons daily during the year, with about 900 men employed.

At the mine of the Pittsmont company, formerly the Pittsburg & Montana company, the processes under experiment for treatment of ores proved to be a costly failure and were discarded by the new management, with Oscar Rohn in charge. Under Mr. Rohn's management the smeltery was overhauled, a new 250-ton concentrator was built and the property was put on a paying basis.

The La France Copper Company operated the Lexington mine and did considerable work on the 800-, 1000- and 1400-ft. levels. Good bodies of copper ore were opened up and with further development the property may become a large producer.

The Davis-Daly company underwent a complete reorganization after the financial panic, but continued to operate all but a very short period of the time. At the Colorado shaft, where the work was carried on more extensively than elsewhere, the shaft was sunk from the 1000- to the 1500-ft. level. The property has a favorable location and has good chances to develop into a producer of merit.

The Butte & Superior company confined its operations to the Black Rock mine in the northern section of the Butte camp. The shaft was sunk from the 800- to the 1350-ft. level. The last place at which a crosscut was run to the vein was on the 1000-ft. level, which was found to contain a small percentage of copper.

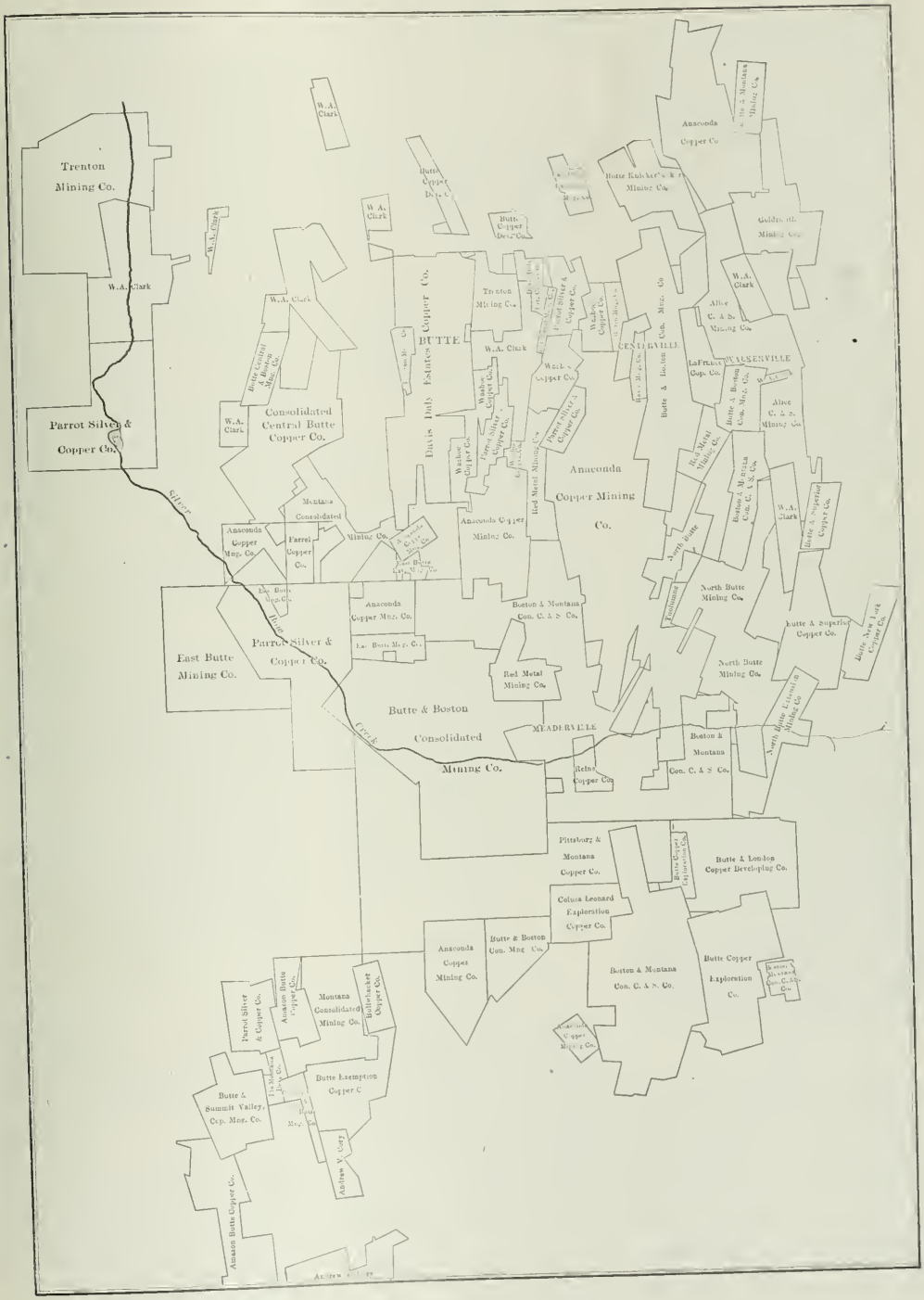
The Tuolumne Company succeeded in developing a body of commercial ore and made large strides toward becoming a regular producer. The shaft was deepened about 400 ft. during the year and is now 1200 ft. deep. The latter part of the year work was begun installing an entire new surface plant.

At the mine of the Raven company development work progressed steadily under the direction of John Berkin. The shaft was sunk an additional 400 ft. during the year and is down about 1250 ft.

The Butte & Balaklala company continued development work on the claims in Meaderville without interruption and sank the shaft from the 500-ft. to the 1150-ft. mark. Four veins were cut on the 1000-ft. level, all showing commercial ore.

The Butte-Milwaukee company resumed operations late last summer; the principal work was confined to the 300-ft. level.

*Butte, Mont.


Trenton Mining Co.
W.A. Clark
Parrot Silver & Copper Co.
Silver
Consolidated Central Butte Copper Co.
Montana Consolidated
Anaconda Copper Mng. Co.
Parrel Copper Co.
East Butte Mining Co.
Parrot Silver & Copper Co.
Butte & Boston Consolidated Mining Co.
Creek
Davis Daly Estate Co.
BUTTE
Anaconda Copper Mining Co.
Anaconda Copper Mining Co.
Red Metal Mining Co.
Boston & Montana Con. C. & S. Co.
MEADERVILLE
Reine Copper Co.
Anaconda Copper Mining Co.
Butte & Boston Con. Mng. Co.
Pittsburg & Montana Copper Co.
Butte & London Copper Developing Co.
Colusa Leonard Exploration Copper Co.
Boston & Montana Con. C. & S. Co.
Butte Copper Exploration Co.
Anaconda Copper Mining Co.
Butte & Boston Consolidated Mining Co.
Butte & Summit Valley Cop. Min. Co.
Butte Exemption Copper C
Anaconda Butte Copper Co.
Montana Consolidated Mining Co.
Butte & Superior Copper Co.
North Butte Mining Co.
Butte & Balaklava Copper Co.
Anaconda Copper Co.
Butte & Montana Con. C. & S. Co.
Butte & Duluth Mining Co.
Butte & Boston Con. Min. Co.
Butte & Ludlow Mining Co.
Butte & Boston Consolidated Mining Co.
Butte & Boston Consolidated Mining Co.
Butte & Boston Consolidated

The Butte & London company worked but a few months in the year; when it ceased operations the shaft was down 1100 ft., and operations had cut several veins of commercial size and well mineralized. The company ran out of funds before it had an opportunity thoroughly to explore the property.

The Lewisohns sank shafts on the Granite Mountain and Flat Iron claims in the North Butte district, but discontinued the work a few months ago. Both shafts were more than 500 ft. in depth when sinking was discontinued.

In the Butte camp about 10,000 men were employed steadily and more than 10,000 tons of ore were mined and shipped daily in 1908. Of this amount the Amalgamated mines contributed about 12,500 tons; the North Butte 1450; Clark properties 1100; Coalition 1100; Pittsmont 350; and others 300 tons. The copper production for the year averaged 29,000,000 lb. per month, and for the district during the entire year the production was about 270,000,000 pounds.

In the Corbin district in Jefferson county the Boston & Corbin company's property reached a depth of 500 ft., and several bodies of commercial ore were opened up. Other properties upon which work was done are the Black Jack, Corbin-Wicks, Corbin Consolidated and Alta. The Montana Consolidated company's property near Basin was operated steadily. The formation in the Corbin district generally is very similar to that of Butte, the granite being coarse-grained and micaceous. The veins also resemble the Butte veins, with the exception that the sulphides are found nearer the surface.

At the property of the Monitor Mining Company in Missoula county, H. F. Samuels was in charge of the property and a rich mine was opened up. Several shipments of ore were made. The principal mineral in the ore is chalcopyrite. In Meagher county the Copperopolis mine, owned by the Daly estate, was worked by leasers all year and several shipments of high-grade ore were made. The shaft is down 500 ft. The Silver Fissure Mining Company carried on operations on a small scale during the year at the property near Polaris in Beaverhead county.

Zinc

The principal zinc district in Montana lies in and around Butte. In fact, the La France Copper Company's Lexington mine produced a large quantity of zinc during the year. A mill was erected on the property for the separation of the zinc product, but it did not prove to be an unqualified success and has been closed for some time. On the upper levels of the Elm Orlu and Butte & Superior properties immense bodies of zinc were discovered in a search for copper. The Comet mine, near Basin, in Jefferson county, produced considerable zinc and much experimenting was carried on all year for the separation of this product.

Gold and Silver

From a mining standpoint in Montana, gold is secondary to copper. There are, however, several districts which operated continuously for gold during the year. In the Garnet district in Granite county the Mitchell & Mussighroad properties made several rich shipments. The Anderson & Magone properties in the same district were turned over to a new corporation, the Anderson & Magone Mining Company, which will carry on operations. In the Cable district, in Deer Lodge county, the Cable Consolidated Company operated practically all year with a small force of men. The operations were confined principally to development work.

At the Southern Cross mine operations were continued throughout the year and consisted principally of development work. A new mill was erected on the property. The Gold Coin mill and mine also ran for the last few months. At the properties of the Milwaukee Gold Extraction Company the work was uninterrupted. In the Radersburg district in Broadwater county the Keating mine made steady shipments to both the Pittsmont and to the Washoe smelter.

In the Granite district in Granite county the Granite Bi-Metallic Company operated its properties in a small way under the management of John R. Lucas and several shipments were made to the East Helena smeltery. In the Ruby district in Madison county, a new gold dredge was built, making three in all, and operations were carried on all year. In Silver Bow county the British-Butte company finished the construction of a Risdon gold dredge, but the machinery has not as yet been put in operation.

New Mexico

By Reinold V. Smith*

Activity in the mineral industry of New Mexico during 1908 fell short of that of former years, but the Territory was by no means alone in this respect. The principal mineral product was coal, and the demoralized metal markets did not affect this branch of the industry seriously. In fact the conditions are in many ways better than ever before. Many business changes were brought about, but the development of the great dormant mineral resources did not stop with the shipments of ores.

Three new gold camps attracted wide attention, and one of them, Sylvanite, is destined to become a mineral section of great merit and importance. One other, Hachita, has been periodically discovered, under different names, since the advent of man to this southern section of the country; and since the placer gold there found is in what would be considered rich gravel in California, it is likely soon to be "discovered" by men who are able to unravel the problem of recovering gold from gravel worth from 13c. to a dollar and more per yard, but where water is hard to get. Much gold has in the past come from this section, but conditions have been so unfavorable that prospectors have sought other fields of opportunity where the washing of the gravel seemed to present fewer difficulties.

In Sylvanite the parent stock of much of this placer gold has undoubtedly been discovered. Though as yet the precious metal from Sylvanite has not been shipped in sufficient quantities to attract attention by reason of its money value, nevertheless the ores appear to be of a permanent character, of good grade, and of wide distribution. At the close of the year shipments were made regularly by wagon from several of the claims.

All of the producers of coal continued production throughout the year, and improved their plants more or less to meet an expected demand for the future. The agitation of new railroad enterprises brought to light many resources unknown to the general public. One railroad, the New Mexico Central, commenced grading and laying track. The feeling is abroad in the mining world that the market conditions which prevailed last year will speedily improve during this present year, and all are preparing for an active season of production during 1909.

During the year, coal, iron, gold, natural cement, copper, lead, silver, zinc, turquoise, meerschaum and vanadium were mined and shipped. Marble, and building stone of various qualities, were produced as usual for domestic use, and a little for transport. Systematic search for oil was carried on at several points, and salt was gathered on a small scale.

Coal

Prof. A. K. Adams, of the department of geology in the New Mexico School of Mines says regarding coal in the Territory: "The vast coalfields of New Mexico, about ten million acres, have scarcely been scratched, although the annual production is more than 2,500,000 tons."

Each of the coalfields has from two to six seams of workable coal, and in many cases the coal mined is more than 5 ft. thick, practically all of it being Cretaceous. Most of the coal (two-thirds of that now mined) comes from the northern part of the territory, near Raton, and it is in this region that most systematic and scientific mining operations are carried on. This coalfield is the southern extension of

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the Trinidad field of Colorado and its coal produces excellent coke.

The greatest producer was the Phelps Dodge company of Arizona, which operates coal mines and coke ovens at Dawson. The Hagan coalfield, just north of Albuquerque was developed during the year, and plans are well under way for a branch railway to connect this district with the Santa Fe railroad, and thus to make the coal more marketable. The Cerrillos district produced the only anthracite in the Territory; one seam of coal there is anthracized by a sheet of andesite near it. There were no special developments in this field, mining continuing as usual. At Carthage a short branch connects the Allaire mine with the railroad. The Western coalfields near Gallup were in active production all the year furnishing domestic and steam coal.

Surveys were made for a new railroad in the western part of the Territory; this will furnish transportation to the mines near Silver City, Cooney, and Mogollon, and also the large coalfields south and north of Gallup. If this line is completed it will open up a large area that has great mineral wealth but is as yet little known.

The Bernal mine at Carthage had a dust explosion early in January which killed 12 men, that being the only serious accident in the Territory this year.

Iron

Next to coal in importance stands copper, so far as present value is concerned. Potentially, however, the worth of iron is greater to the Territory. Up to the present time the Colorado Fuel and Iron Company has alone profited by the vast deposits of excellent iron that exist in the Territory. The properties of this company are situated in the Fierro district and at Hanover, about nine miles east from Silver City, in the southwestern part of the Territory, whence the ores are shipped over the line of the Atchison, Topeka & Santa Fé railway to Pueblo, Colo., for reduction.

At the beginning of the year the mines worked a full force of about 240 men and shipped about 500 tons a day. During the year production was reduced, but at the close of the year it was again increased, shipments being about 200 tons a day. The total product for the year was 94,000 tons.

Besides the deposits at Fierro many others of wide extent are known; for instance, those at the north end of the Sierra Oscura, in the eastern part of Socorro county, where the outcrop is traceable for a distance of 10 miles along one of the dikes, the protruding masses of ore being in places 60 ft. thick and exposed for 300 ft. and more. The deposits of Lincoln county, almost as large, lie a little farther to the east. This ore is of very good grade, the percentage of iron running up to 66.4 per cent., the sulphur down to 0.07 per cent., and the phosphorus down to 0.09 per cent. on what is known as the Jones' iron in the Oscuras. Other samples from these same fields show practically no phosphorus, only traces of sulphur, and no titanium.

Copper

Although the production of copper during 1908 fell short of that for 1907, due entirely to the drop in the price of metal, nevertheless copper has become a decidedly important factor in the mineral industry of the Territory. Many millions of dollars' worth of development work was done in the Territory in the last two years, and the total reserves of copper thus opened up have become enormous. The most extensive development was in the southwestern and central western parts of the Territory, especially in the Burro mountains, the Organ mountains, the Mogollons and the Magdalenas. But in many other localities also development was carried on in a systematic manner. Rotary and churn drills were used in several localities, especially in the Grant county properties, and have been instrumental in developing the large deposits of the Burro mountains and elsewhere.

Geographically the copper ores are widely distributed over the Territory, commercial bodies of ore being found in 16 counties out of the total of 24. Geologically the ores have been divided by Dr. Fayette A. Jones into those from deposits in the pre-Cambrian; those from the later Tertiary series; and those of the Permo-Carboniferous and Jura-Triasic formations. Nearly all of the active producing localities are in formations belonging to post-Cretaceous time, and the ores come from porphyritic masses with disseminated copper minerals; from carbonate and oxide replacements in limestone; and from fissure and contact veins containing both primary sulphides and oxidized ores according to locality. Some of these deposits have long been known, as those at Santa Rita, which are the oldest worked copper deposits in the United States, the native copper being shipped to the City of Mexico more than 100 years ago, and mined almost continuously since. These deposits are still among the largest producers. The copper ores always carry some gold and silver, and in some of the camps, as at Pinos Altos, lead and zinc accompany them also. The ores of Grant county generally, and especially those of the Santa Ritas and Burro mountains are very pure and carry only small amounts of silver and gold, while at other localities a little farther to the north and to the east, as, for instance, the ores in the Cooney district of the Mogollon mountains, carry much silver and gold, and are always uniformly high in these metals.

The production of the Territory as a whole amounted to just about 4,900,000 lb. of copper during 1908 as near as figures at present obtainable indicate. This tonnage came principally from the camps of Grant and Socorro counties with smaller amounts from Santa Fé, Dona Ana, Luna and Sierra counties. Among the largest producers and heaviest operators in the Southwest may be mentioned the new Savannah Copper Company, which has taken over and consolidated the properties of the Comanche Copper Company with its smelter at Silver City and its railroad to the mines, and the Copper Gulf properties; the Chemung Copper Company operating with a large force of men at Tyron; the Burro Mountain Copper Company at Leopold where the big concentrator is kept busy on 3 to 4 per cent. ores; and the Azure Mining Company, all of Grant county.

The copper ores in the Tertiary, known as the "Red Beds" occur in many places, and have again during 1908 been the subject of investigation on the part of several companies. Their form is usually carbonate and oxide, but frequently metallic, and their tenor in copper is near 2 per cent., and in places rises higher, coming nearer to 3 per cent. The problem of their reduction seems near solution at the present time.

Gold

The unsettled condition of the copper market had its effect in the search for gold and the attention was given to the old and well known silver mines, many of which have been reopened and equipped with new or renovated mills. Gold comes from both lodes and placers. The placer production remained about the same as formerly in the northern counties. The new placers recently discovered at Hachita have not had time thus far to add materially to the production. Operations at Hachita were rather extensive, so far as prospecting was concerned, but the regular development has proceeded with caution. Dry washing was tried in this section on several pneumatic machines. It has also been tried on some of the older placer ground in Santa Fé county, but so far with no marked success.

The shipment of telluride ores from Sylvanite will, no doubt, add materially to the production of gold during 1909, but shippers had barely commenced to send out their ores regularly before the end of the year, so little additional supply can be credited to that section for 1908. The great source of the gold is the gold-quartz ore of Socorro county, and the gold-copper ores of Grant and Socorro counties. The Last Chance mine in the Mogollons, the largest individual producer of the precious metals in the Territory increased its output almost 50 per cent. during the year. The Rosedale mill, one of the best known cyanide mills in the Territory, was remodeled and enlarged and is working at full capacity again. The gold ores of the Mogollon mountains were extensively developed, and several powerful companies were organized for the purpose of exploiting that section.

Six mills are now being put into commission in the Territory, three of them being cyanide mills.

A large part of the gold produced is from the copper-gold ores and since these were cut down on account of the copper, the production fell short of that for 1907, notwithstanding the fact that the production of gold ores increased. The total production has been estimated at 10,600 oz. fine, or $219,100.

Owing to preparations now under way in the southwestern and central western parts of the Territory together with those of the counties in the north central part, the production of gold should be more than doubled this year, even though no more than the normal amount of copper-gold is produced from Grant county during 1909. A large amount of exploration and development work is conducted in the Mogollons, Hillsboro, Jicarillo, Lordsburg, and Central districts, in the Organ mountains, and in the Sangre de Cristo mountains and Colfax and Taos counties, to develop gold properties. Most of the producing sections are in post-Cretaceous formations, the same as copper, but several prospects which show promise of becoming extensive producers are in the pre-Cambrian, as, for instance, those in the Sandias, but in this formation the ore seems to be of lower grade, averaging, perhaps, $3 to $4 gold per ton.

Silver

The silver production which is estimated at 332,000 oz. fine, showed a reduction from the previous year. The silver ores are found associated with the other ores, principally lead and gold, but also frequently with copper in rather large proportion. The curtailment in the production of silver was brought about by the low production of copper and lead. In several important instances, however, systematic investigation of properties for silver alone were undertaken during the year, and encouraging results were obtained. The localities most influential in the production of silver were the Mogollons, the Organs, Pinos Altos, Steeplerock, and the camps of the Central district, though smaller shipments went to make up the amount stated. Among the important undertakings based largely upon the silver content of the ores should be mentioned the Boston Cerrillos Mines Company, an incorporation now commencing extensive improvements on the old Cash Entry mine near Cerrillos. The Last Chance mine in the Mogollons, is by far the largest producer of silver.

Lead

Donna Ana, Sierra, and Luna counties were the most active in the production of lead, which amounted to about 1350 tons of metal including that from the Magdalenas. Development work was carried on even where shipments were suspended. The largest individual producer was the Stephenson Bennett Consolidated Mining Company, operating upon lead-silver ores at Organ in Donna Ana county. The company is producing ore at the rate of 300 tons per day. Shipments went regularly forward from the mines in the upper Magdalenas, all carbonate ore derived from development work. The Ocean Wave mill at Hermosa was built during the year.

Zinc

The mines at Magdalena, in Socorro county continued to ship zinc carbonates, though the camps in the southern portions of the Territory were mostly closed down except for development work which was pushed with vigor in a few places. In Magdalena the leasers in the Kelly mine shipped 5300 tons in seven months, sending out a car a day at the close of the year. The Kelly has been equipped with a 100-ton concentrator using the Sanders flotation process to separate the zinc sulphides. In the Graphic systematic development work was conducted continuously, with a force of from 20 to 40 men, still further blocking out the already enormous bodies of ore exposed within the ground.

Even a cursory review of the mineral industry of New Mexico should not fail to mention the turquoise found and produced in three principal places in the Territory. The most famous locality is that of the Burro mountains. The mines at Cerrillos were reopened, and in the southwestern part of the Territory a new find commenced to market turquoise.

Natural cement, known as the "white sands," is proving a most noteworthy addition to the list of mineral products. Meerschaum is now regularly produced in Grant county, and has been found of excellent quality in three places in that county.

Texas

By Walter E. Koch* and J. K. Prather†

There will not be much metal mining in Texas until the legislature passes fair and equitable laws, and gives the miner an even chance as in other States. The sooner this is done, the better for Texas mining. There is some silver mining at Shafter, Presidio county, where about 300,000 oz. of silver are obtained annually from an oxidized limestone-replacement deposit; these ores also contain some lead, but it is not recovered.

From time to time miners come to El Paso with copper ores from the Gaudalupe mountains and the Sierra Blanca range to the east of El Paso. Some veins have been traced and several shafts have been sunk on copper deposits in that part of the State. In northern Texas copper has been found in the Permian beds.

The tin prospects on the eastern slope of Mount Franklin, about 10 miles north of El Paso, have been further developed with very gratifying results, and it is quite probable that a concentrating mill and a smelter will soon be erected. The granite masses in places have been found to be impregnated with cassiterite, which varies in color from very pale to very dark crystals. This fact doubtless has caused it to be overlooked or mistaken for other minerals, and careful and constant assaying is required since the use of a microscope with a 100-diameter object-glass is necessary to detect the various forms in which the cassiterite occurs.

Cinnabar is mined at Terlingua, in Brewster county, about 12 miles from the Rio Grande river, and about 100 miles from Marfa station. The ore is found in veins and pockets in the Cretaceous limestone, and is mined chiefly by open cuts; it is smelted in wood-fired furnaces, and the quicksilver shipped to the railroad in flasks. There are several companies owning mines in this district, but only one is reported to be producing now. Brown-hematite ore occurs in 19 counties, and in Llano county there is a deposit of magnetic and specular ore.

At Baringer Hill in Llano county the Nernst Lamp Company still continues to mine a few hundred pounds of the rare minerals, allanite, cryolite, fergusonite, gadolinite, polycrase, etc.

Coal is mined in Webb, Maverick, Houston, Shelby, Wood, Hopkins, Wise, Parker and Erath counties. Lignite is mined in Milam and Robertson counties. Some of the companies are: the Rio Grande Coal and Irrigation Company, at Minera, Webb county; the Cannel Coal Company, at Darwin, Webb county; the Carr Wood and Coal Company, near Lytle, Medina county; the Maverick County Coal Company, near Eagle Pass, Maverick county; the Bertetti Coal Company, near Lytle, Medina county; the Rio Bravo Coal Company, near Eagle Pass, Maverick county; the Glenn-Belto Coal Company, Bishop, Bastrop county; the Worley mine, Rockdale, Milam county; the Black Diamond Coal Company, Rockdale, Milam county, the Lignite Eggette and Coal Company, Rockdale, Milam county; the Central Texas Mining, Manufacturing and Land Company, near Calvert, Robertson county; the Houston County Coal and Manufacturing Company, at Crockett, Houston county; the Timpson Coal Company, near Timpson, Shelby county; the North Texas Coal Company, near Alba, Wood county; the Como Coal Company, near Como, Hopkins county; the Wise County Coal Company, near Bridgeport, Wise county; the Bridgeport Coal Company, near Bridge

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port, Wise county; the Texas Coal and Fuel Company, Rock Creek, Parker county; the J. S. Young mine, Keller, Parker county; the Texas & Pacific Coal Company, Thurber, Erath county; the Strawn Coal Mining Company, near Strawn, Palo Pinto county, and the Smith-Lee mine, near Cisco, Eastland county.

The lignite beds in Texas are Eocene in age and extend over a belt 200 miles long. The Cretaceous coals are found in the Eagle Pass coalfields which extend into Mexico, and for 8 miles north of Eagle Pass. The Carboniferous coals are found in a small area in El Paso county and in a much larger area in north-central Texas, stretching from a few miles south of the Colorado river in Concho, McCulloch, and San Saba counties in a north easterly direction to the Red river.

Asphalt is found in the vicinity of St Joe, Montague county, and at Muenster, Cooke county in a sandstone near the Cretaceous-Carboniferous contact. In Anderson county the asphalt occurs in the Tertiary (marine Eocene) sediments. In Uvalde county the asphalt has been developed to some extent by the Uvalde Asphalt Company. The asphalt occurs both in a bituminous limestone and in a bituminous sandstone.

Sulphur and salt have been found in El Paso county, but these deposits have not been developed as yet. Gypsum is found in northern Texas and also west of the Pecos river. Fire clay occurs associated with the coal and lignite; there are also many useful clay deposits in many widely separated parts of Texas. Heinrich Ries has published a report on the Texas clays.

Wyoming

By Henry C. Beeler*

As were all her sister States whose mines are developing, Wyoming was hard hit by the business depression of 1907, and some of her mines were almost put out of business for the time being. Since the election, however, many of these were reopened, and are at least doing their annual work and making preparations for an active campaign in 1909.

Copper

Copper is the principal mineral in Wyoming, being noted in all the State camps either as the main ore or the carrier of other metals. Production was low owing to almost impossible transportation conditions, which are gradually being overcome as the old and new railroads are extended throughout the State. The only smelter in the State is at Encampment, where the Penn-Wyoming Copper Company controls the Ferris-Haggarty and Doane-Rambler mines. The company built 44 miles of railroad from Walcott on the Union Pacific Railroad to Encampment, and ran the greater part of the year. It is now doing development work only in its two mines for a larger record during 1909. Several new strikes were made in the Encampment district, that of the West Virginia-Wyoming Company, in Battle Basin, being the most notable, as it proves the further extent of the contact ores of the region and shows the way for others.

After about six years of expensive experimenting, the Rambler Mining Company, controlling the Great Rambler mine, in the Medicine Bow range in Albany county, succeeded in separating the platinum and palladium which occurs in commercial quantity in the copper ores; during the fall of 1908 the company had a force of men reopening up the property. The building of the Laramie, Hahns Peak & Pacific Railroad from Laramie to the North Park coalfields brings transportation within a few miles of this and the adjacent mines on Lake and Douglas creeks, as well as the Shawnee and properties on French creek and the Snowy range where heavy copper indications are being quietly developed and proved.

The Williams-Luman Mine at Depass, on Copper mountain in Fremont county, is opening up the largest body of copper ore yet discovered in Wyoming. Little is heard about it as no stock is sold and none is for sale. About 2000 ft. of development work showed a huge orebody, 80 ft. wide, the length not being proved. At 485 ft. depth, copper oxides and metallic copper were noted, as at the surface and the accompanying gold-bearing streak of about 6 or 7 ft. is much in evidence. A gas-producer plant to use lignite was installed for additional power.

The Boysen power dam in the Big Horn cañon at the west end of Copper mountain is relied upon for power for the whole adjacent mining territory, as well as for the nearby towns. As all the difficult work of installation is practically completed, the plant should be in operation by the spring of 1909.

Copper prospecting proceeded over a greater territory than ever before, and more genuine development work on better showings is the result of this systematic work. It is more generally recognized that copper is the main mineral to be found in Wyoming and the low grade of the ores, conditions of occurrence and method of development are better understood, with marked improvement in results.

Gold

Almost all the work on gold properties this year was development and preparation. The Miners Delight mine in Fremont county shut down owing to expense of fuel. The Popo-Agie oil and Power Company is installing a plant to supply electric power to this and the other mines of the South Pass gold district, using the oil of the Lander fields as fuel, with the plant located at the old Murphy wells.

At Centennial, Albany county, Copper mountain, the Wind River ranges, South Pass and Atlantic, in Fremont county, all reports showed activity in the gold properties but production during the year was low.

Active placers were reported from the Little Big Horn, Sheridan county, Willow Rock and Twin Creeks, in Fremont county, Green and Snake rivers in Uinta county, Snake river in Carbon county, Sundance in Crook county and Douglas and Lake creeks in Albany county. The American Gold Placer Mining Company installed a steam shovel, prepared its pits and worked up to the last workable day of the season but operations were frozen up before a cleanup was complete. Preliminary tests were satisfactory.

Coal

Coal showed the largest production, as usual, but not much increase as compared with 1907, owing to a quiet strike which tied up the mines a part of the year. New mines are opening in the newer sections of the State, and those opened in 1907 are showing a uniformly larger tonnage than was anticipated last year. The lignites of Wyoming are in great demand for local fuel and in adjacent States as the new gas producers utilizing these fuels have made their use possible in plants where formerly they were useless.

Iron

Production proceeded steadily in the Colorado Fuel and Iron Company mines at Sunrise, Laramie county, the total for 1908 exceeding that of 1907. Additional prospecting in this vicinity showed a greater area than this deposit was supposed to cover, and the presence of iron operators from eastern fields, bidding for lands, indicates that other mines and properties again have a chance of being opened up. The Bradley Peak and Rawlins deposits, in Carbon county, were also under inspection but nothing definite was given out for publication. Prospecting for iron is also going on in other sections of the State and samples submitted indicate that other commercial iron areas will be opened. A shipment of chrome iron was made from Converse county.

Asbestos

Asbestos will be an important item in the mineral reports of Wyoming for years to come. Commercial chrysotile

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asbestos was practically developed in 1908 by the North American Asbestos Company on Casper mountain, Natrona county. A mill will be erected in the spring of 1909 and commercial production will begin. There is no doubt as to the quantity and quality of the product; the fiber shows up to 4 in. in length, 2 in. is not uncommon, and fiber an inch long is common. Practical tests amply demonstrated the spinning and workable qualities of the fiber, though at first only the rougher grades will be regularly produced. The asbestos occurs in serpentine in granite and schist, showing up to 200 ft. wide. Solid asbestos rock was shown in the main workings, 20 ft. wide and the full width not cut at that time. A similar asbestos appears at Smith creek and Deer creek near Casper mountain, and part of this is under development by the same company.

Sulphur

The Wyoming Sulphur Company opened up a large deposit of sulphur at Thermopolis, Fremont county, and erected a plant to treat the ore and make commercial sulphur. This is a hot-springs deposit, similar to the Cody and Sunlight deposits in the same county, but more extensive and accessible. The ground was proved by drilling and tests before the works were planned.

Oil and Gas

More drilling was done in 1908 than for a long time in the different oil fields of the State. In the Salt Creek field in Natrona county, one gusher was struck, and the rigs were moved to another location where drilling is now going on. The Popo-Agie Oil and Power Company is drilling near the Murphy wells for oil, for fuel for the new power plant. A pipe line is contemplated from the wells to Hudson, the nearest railroad point, and additional rigs will be put into commission as soon as they can be advantageously placed.

A gas gusher burned for a year near Basin, Big Horn county, but was finally capped. Additional wells were drilled in the vicinity to furnish local consumers and further to test the fields. At Byron and Garland, in the same county, oil and gas were struck; drilling still goes on.

The Uinta county fields are more active than for several years with indications that production is to be permitted, and these high-class oils to be put on the market. High freight charges have hitherto kept the production down and stopped production.

All things considered, Wyoming held its own during 1908, and while location work and patenting of mineral, oil and coal lands all were seriously hindered and the miners were put to much unnecessary expense and trouble by the over-zealous agents of the National Forest and Land departments, whose various reserves and "withdrawn" areas cover most of the State, general prospecting was active and productive of good results.

Vermont and New Hampshire

By George A. Packard.*

Very little copper ore was mined in Vermont in 1908. The Eureka mine at Corinth was closed during the entire year, and little work was done on the nearby property which has been partially developed by the Corinth Copper Company.

At South Strafford the Vermont Copper Company continued equipping its mine. Power development has been seriously delayed by winter and spring freshets, which twice carried away the dam on the White river when in a partially completed stage. This power plant, which is located at Sharon, is now ready for operation. The station is built for 750 h. p., but the equipment so far installed includes water-wheels and generators for only 500 h.p. This is transmitted at 6600 volts, 3-phase, and the motors, locomotives, hoists and pumps, have been tested and found satisfactory. The flues and stack are completed, and the furnace will be blown in early in 1909. It is expected that between 300 and 400 tons of ore per day will be treated at the start. Plans for a sulphuric-acid plant are being prepared, and surveys for a railroad to connect with the Boston & Maine system are completed.

The old Milan, N. H., mine, from which pyrite and a little copper ore were shipped "in the '80's," has been reopened, and several carloads shipped are said to have run 5 per cent. copper, and as high as 50 per cent. silica.

South Dakota

By John V. N. Dorr†

The mining industry in South Dakota has been fairly prosperous in 1908. No new properties were developed but the principal mines were in steady operation. As the production is mainly gold, the drop in the price of silver and other metals has made no difference, and the principal difficulties to be met have been the gradual decrease in value of the ore mined at many of the old properties, together with the somewhat increased cost of labor due to the adoption of the 8-hour day.

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†Metallurgical engineer, Pluma, S. D.

The use of electric power has been extended, so that the only steam power in use in the northern Black Hills is at the Homestake properties; indeed there also electric power is now in use at the three stamp-mills, the slime plant and the re-grinding plant. Both the Consolidated Power and Light Company, with a steam-electric plant, and the Black Hills Traction Company, with a hydro-electric plant, are loaded to their capacity, and are planning to increase their output. It is probable that in the summer of 1909 a hydro-electric plant generating from 5000 to 7000 h.p. will be built on Spearfish creek. The saving made by the use of electric power has been a material factor in maintaining the present production.

The Homestake Company

The Homestake company has operated all its stamps continuously during the year and has made a production, as given by the State mine inspector's report, of $6,000,000, which is considerably larger than that of any previous year. The company increased the November dividend from 50c. to 75c. per share, the largest amount ever paid, but in December it was returned to the former figure. Among the improvements made in 1908 have been the constructing of a large reservoir, the rebuilding of the foundry and the equipment of it with all modern improvements, and the installation of a re-grinding plant to handle the coarsest sands from the batteries, the reground pulp passing over plates before going to the cyanide mills. The equipment consists of six grinding pans and a 5x14-ft. tube mill. The operation of the plant should give some interesting data as to the comparative efficiency of the two mills for regrinding under conditions obtaining here. The plant has proved very successful.

Silicious Ore Mines

The Mogul, the Golden Reward, the Imperial, the Lundberg, Dorr & Wilson, the Reliance and the Wasp No. 2 properties have operated their mills steadily during the year.

The Imperial company reached lower quartzite in the Dakota shaft during the summer and has drifted several hundred feet in the quartzite and found some ore. If the further prospecting of the lower quartzite should disclose orebodies as strong and rich as those found in the shale above, it will mean a much longer life to the district.

The Mogul company, operating its remodeled mill at Pluma, has averaged over 320 tons per day and reached a maximum of 388 tons in October.

The Golden Reward company, which installed a Chamberlain press for handling its slimes early in the year, has recently

let a contract for a Moore-filter installation and expects to increase the tonnage handled greatly.

The American Eagle Mining Company started a 200-ton mill during the summer, but found the mine developments were not adequate to operate this at full capacity and so closed down awaiting further development.

In the Garden City district the North Homestake Company operated its 40-stamp mill steadily during the year, and the Minnesota Mines Company, with a mill equipped with slow-speed Chilean mills, has commenced operations.

Galena District and Other Districts

The Gilt Edge-Maid company, working a very large body of low-grade porphyry and crushing dry to 3/16-in. size, has run regularly, milling about 200 tons daily. This company is believed to have established a record for the Black Hills for low cost of mining and milling, for the cost is reported to be approximately $1 a ton.

The Golden Crest company, also mining in porphyry near the Gilt Edge-Maid, is building a 200-ton mill to crush with stamps, regrind with tube mill and treat the whole product by the Moore process. This is the first company in the Black Hills to erect an all-sliming mill As the ore is very soft, the cost of complete slime treatment should not exceed that of a sand-and-slime treatment, and the recovery will undoubtedly be higher.

The Branch Mint company started its 120-stamp mill, but found, as so often happens, that it had gone ahead without sufficient mine development, so the mill was shut down after a short run. The property is now leased to an operating company which is running part of the mill on an old dump, while the mine is being developed.

Considerable work has been done in the southern Black Hills during the year, and the Standly company, at Rochford, has been running its mill while doing development work that has extended the limits of its orebody. It promises to become one of the big mines of the Hills.

Metallurgy

The problem of the successful treatment of the "blue" ores of the district, which as they are worth only $5 to $7 per ton, are too low in grade to stand shipment to outside smelters, has received considerable attention. Renewed efforts have been made to obtain a better extraction by the use of other chemicals with cyanide. Some very promising results have been obtained, but nothing has reached a commercial basis. Roasting will give a good extraction on much of this ore, but not on all, and it is considered too costly for the grade of the ore.

The Black Hills will shortly be the place *par excellence* for the inspection of slime processes, for with the mills now building, there will be in operation four Moore plants, one Merrill sluice filter-press plant, one closed-type filter-press plant, two decantation plants, one Burt press, one Chamberlain press and a Butters plant.

In closing it may be of interest to note the influence of Black Hills practice on slime treatment. The Merrill sluicing press was first operated at the Homestake mill and the first successful installation using a submerged filter plan (a Moore plant) has been in continuous operation at the Lundberg, Dorr & Wilson mill since February, 1904.

Utah

Special Correspondence

At the beginning of 1908 the outlook for the mining industry in the State was not bright. As in other States, the financial depression had a far-reaching effect. However, the ore market at Salt Lake was glutted all through the year owing to the closing down of the United States, Highland Boy and Bingham smelters. The smoke question was the chief cause of the closing of these smelters, although there were other contributory factors, among which might be mentioned the fact that the Bingham Consolidated practically reached the end of its ore supply.

Among the matters which attracted attention was the attitude of the Utah Consolidated in connection with its contract with the American Smelting and Refining Company for the treatment of ore. The present contract expires in March, 1910. The Utah Consolidated, before renewing its contract, began looking into the advisability of building a smelter of its own. The cost of transporting ore from Bingham to Garfield, under an old contract with the Denver & Rio Grande railroad is 40c. per ton; other companies pay only 25c. per ton. The Utah Consolidated secured options and smoke easements on 30,000 acres of land in Pine cañon, Tooele county. By building a smelter here the ore could be transported by aërial tramway, thus saving most of the amount at present paid for freight to Garfield. The American Smelting and Refining Company was opposed to the erection of another smelter, fear of a competitor being among its chief objections. There was a great deal of activity displayed on both sides; some difficulties were encountered from the fact that there were a few influential stockholders of the Utah Consolidated who were also interested in the American Smelting and Refining Company. However, before the date of expiration, Sept. 30, the Utah Consolidated had exercised its options and had completed plans for its smelter.

Toward the end of 1908 it was announced that the Utah Consolidated had let a contract for the erection of a smelter, to be completed by April, 1910. According to the latest plans this smeltery is to be one of the constituent plants of the newly organized International Smelting and Refining Company.

Bingham

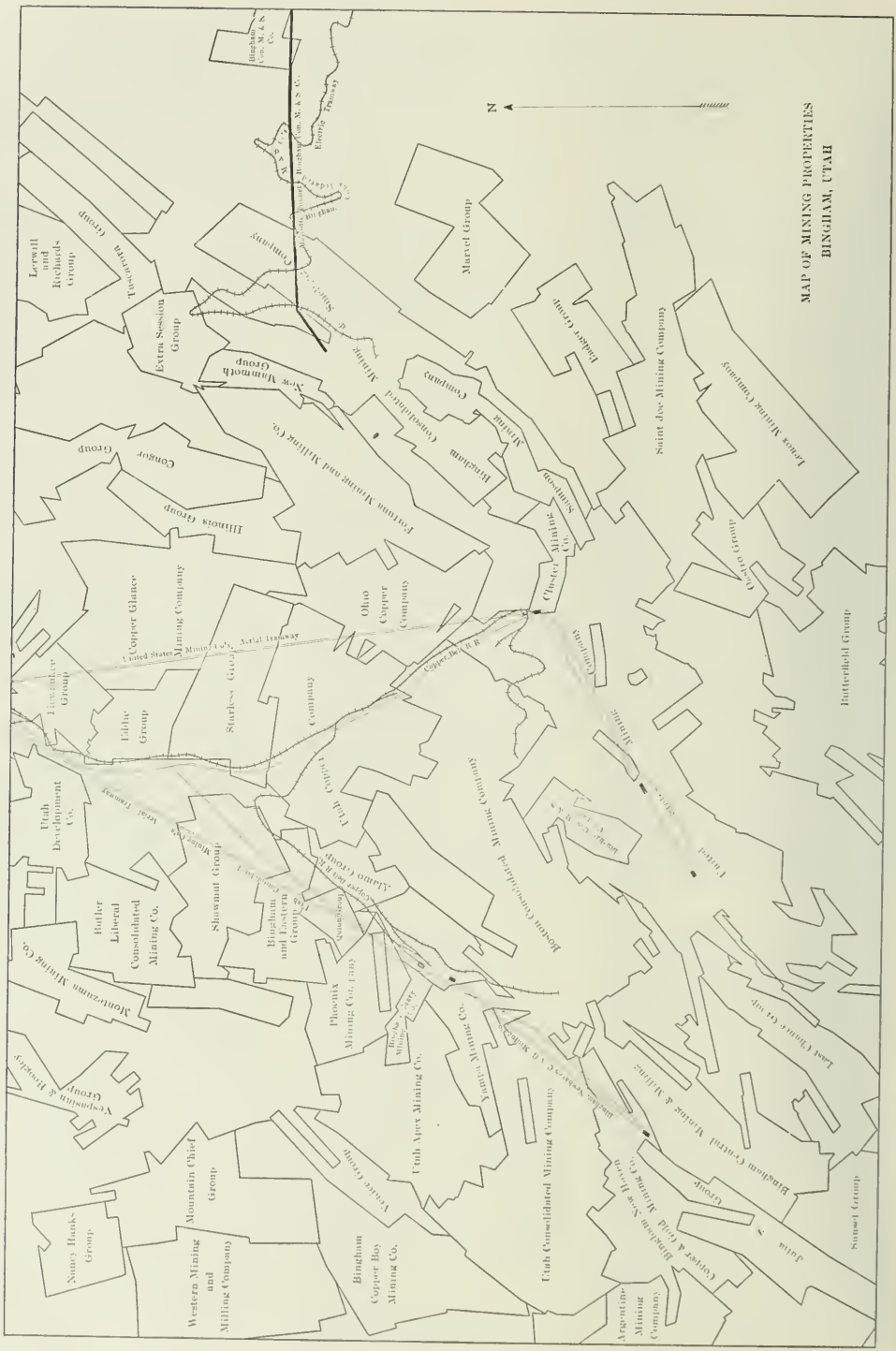
The Utah Copper Company completed its Garfield mill in 1908 and operated at nearly full capacity. This company owns 200 acres of mineral ground in the central part of Bingham. The area developed to date includes about 72 acres. The thickness of the orebody has not yet been determined, but the work to date shows an average depth of 310 ft. The ore averages about 2 per cent. copper, 0.15 oz. silver and 0.015 oz. gold per ton. To the depth of present development, the ground promises an average yield of 1,000,000 tons of ore per acre. Below the depth included in this estimate is a zone of lower-grade ore which averages 1.5 per cent. copper; this, as indicated by diamond drills, contains 40,000,000 tons of ore.

The company is mining from 6000 to 7000 tons of ore per day, about 80 per cent. of which is secured from open cuts. At the mine the company operates 20 locomotives, 125 dump cars of 6 yd. capacity, and six steam shovels. There are about 10 miles of standard-gage railway laid with 65-lb. rails. The compressor plant has a capacity of 500 h.p. All repair work for locomotives and machinery is handled in a fully equipped machine shop.

The Porphyry mine of the Boston Consolidated covers about 156 acres, adjoining the Utah Copper on the south. A large proportion of this area is underlaid with mineralized monzonite, similar to the ore of the Utah Copper, but containing about 1.5 per cent. copper. The equipment for stripping and milling this ore is capable of handling 15,000 tons per day. During 1908 the company put additional units into operation in the mill, and expects to be running at full capacity early in 1909.

The operations of the Boston Consolidated have not been as successful as was anticipated because the ore mined was not so high in grade as had been hoped. The high content of pyrite caused the grade of the concentrates to fall below what had been expected. This led to further prosecution of underground mining in order to get below the zone of oxidation in the quickest manner. However, there is no question as to the successful outcome of the operation.

The property of the Ohio Copper Company adjoins that of the Utah Copper on the east and the Boston Consolidated on the north, and covers an area of 120 acres. There are estimated to be 13,500,000 tons of ore above the present transportation tunnel. The copper content of the ore is


MAP OF MINING PROPERTIES
BINGHAM, UTAH
N
Bingham Con. M. & S. Co.
Electric Tramway
Marvel Group
Badger Group
Saint Joe Mining Company
Lenox Mining Company
Lerwill and Richards Group
Tuscarora Group
Extra Session Group
New Mammoth Group
Fortuna Mining and Milling Co.
Bingham Consolidated Mining Company
Sampson Mining Company
Congor Group
Illinois Group
Cluster Mining Co.
Oasis Group
Butterfield Group
Copper Glance Mining Company
Ohio Copper Company
United States Mining Co's Aerial Tramway
Copper Belt R R
Starless Group
Eddie Group
Utah Development Co.
Butler Liberal Consolidated Mining Co.
Montezuma Mining Co.
Vespasian & Hoogley Group
Showmut Group
Bingham and Eastern Group
Phoenix Mining Company
Utah Apex Mining Co.
Yampa Mining Co.
Boston Consolidated Mining Company
Bingham Central Mining & Milling
Last Chance Group
Sunset Group
Mountain Chief Group
Nancy Hanks Group
Western Mining and Milling Company
Bingham Copper Boy Mining Co.
Utah Consolidated Mining Company
Argentine Mining Company
Copper & Gold Mining Co.

between 1.6 and 1.75 per cent., in addition to which it carries about 10c. in gold and 3c. in silver per ton. The company did little actual work in 1908, owing to Heinze's difficulties.

The Garfield plant continued to experience metallurgical difficulties, one of which pertains to the handling of the very fine concentrate produced by the Utah Copper Company and the Boston Consolidated. The inability of the smelter to handle all the tonnage offered has led to a large accumulation of unsmelted ore in the district.

The Yampa mine is an important producer of sulphide ore. The ore is practically self-fluxing, requiring only the addition of a small quantity of limestone. During 1908 there were installed at the smelter in Bingham cañon, two converter stands with six converter shells of 84x136 in. diameter. Toward the end of the year the mine was working an output of from 700 to 800 tons of ore per day. The smelter treats the tonnage of the mine and about 200 tons per day of custom ore.

Park City

The unfavorable prices of lead and silver during 1908 had a depressing effect on the Park City district. The chief activity in 1908 was in development work, and several promising orebodies were uncovered. This was especially true of the properties in Thaynes cañon, near Brighton. In that section the Copper Apex, Keystone, Uintah Treasure Hill, New York, Wabash and Silver King Consolidated displayed activity.

Tintic

The Tintic district still holds the distinction of having more dividend-paying mines than any other district in the State. Early in 1908 the mines of the district suffered much by the closing down of the Salt Lake smelters. Relief was furnished through an amicable agreement between the farmers and the lead smelters.

An outlet for the ore of several mines was furnished with the blowing in of the smelter of the Tintic Smelting Company, at Tintic, on July 24. This smelter, which is controlled by Jesse Knight and associates, has a capacity of 350 tons of ore per day. In October, operations ceased temporarily, lack of electrical power supply being given as the cause. It was also hinted that there were some metallurgical difficulties. Three lead furnaces were in operation as the close of the year. One copper furnace is nearly ready to start up, and another lead furnace is under construction.

In October, a syndicate, headed by Jesse Knight, obtained a controlling interest in the Opex group, and organized the Opex Consolidated Mines Company.

Mercur

The Mercur gold district felt the financial depression to a less extent than did the other mining districts of the State. Little of exceptional note transpired during 1908. The Boston Sunshine Gold Mining Company reconstructed the mill of the old Sunshine mine and is adding much new equipment preparatory to cyaniding the refractory clayey ores of this once famous mine.

The dividends paid to date by the Consolidated Mercur Gold Mines Company, and the old De Lamar and Mercur companies, totals $3,385,312.

Idaho

By Robert N. Bell*

The mining industry of Idaho during 1908 has experienced a rather dull year. A large tonnage of ore was mined and treated, but owing to the low metal prices that prevailed throughout 1908 profits, as compared with previous years, were seriously curtailed. Such development work as was in progress during 1907 was stopped at the approach of the money panic, and a great deal of this work has not been resumed. This reduced the number of men employed in 1908 about the mines and mills of the State fully 20 per cent. as compared with 1907.

Shoshone County

In the Cœur d'Alene district, two of the principal producers, the Hecla and Morning mines were closed down for the first six months of the year owing to lack of market for their ores; the Last Chance mine was also idle for two months of the year. These properties threw out of employment 1000 men; they resumed full operation in June, and have since been employing the normal force of men and making the usual production of ore. The Hercules, Standard-Mammoth, Bunker Hill & Sullivan, and Snowstorm mines were operated continuously. At present the producing mines of this district are employing about 2000 men, while the smaller producers and development enterprises of the district provide employment for approximately 1000 more.

The notable event of 1908 in the Cœur d'Alene district was the completion of the Idaho-Northern railway up the north fork of the Cœur d'Alene river from Enaville, on the Oregon Railway and Navigation Company's road, to Murray on Pritchard creek. This will give railroad transportation to the well mineralized section of the Cœur d'Alenes, known as the north side, and is likely to result in an important increase in mineral traffic during 1909, for on the north side there are a number of very promising deposits of silver, lead, gold and tungsten.

The construction of the Chicago, Milwaukee & St. Paul railroad down the St. Joe river and extending through the south border of the district is approaching completion. This road will prove a great aid in the development of the numerous rich copper, gold and lead-silver prospects in that part of the district and will greatly enlarge the productive area of the Cœur d'Alene district.

At Burke, the old Tiger Poorman mine, owned by the Federal company, after being developed to a depth of 2200 ft. through a vertical shaft was closed permanently. Its famous pumping station has been dismantled, and the mine has been allowed to fill with water. On the bottom level, the oreshoot had contracted in length and width so that it was no longer profitable to work. However, the mine still contains a big, strong root of an oreshoot, and it is a pity that a winze has not been sunk in the orebody to a depth of 400 ft. or 500 ft. in order to see if the shoot did not enlarge as has been the case at great depth in other oreshoots in this district.

At Mullan, the development of the new oreshoot discovered at a depth of 800 ft. in the Star mine has disclosed another large source of high-grade concentrating lead-silver ore. This is a new oreshoot on the Morning fissure which traverses the full length of this property. The shoot is 500 ft. long and from 5 to 15 ft. wide; the ore is of about the normal grade characteristic of the silver-lead ore in this part of the district. Extensive plans for further development at great depth are being made, and this property will probably become in time a large producer.

In addition to the Star, other promising ore discoveries are the Alice mine at Ruddy gulch, the Cooney mine at Burke, the Ambergris mine at the head of Nine Mile creek, the Bear Top at Murray, and the Caledonia mine near Wardner and on the foot-wall side of the Wardner lode. At present all these properties can ship high-grade crude ore from bodies of considerable size. There are also a number of other promising properties that are being operated, and, as the old mines gradually drop out, their place will doubtless be taken by new properties that will maintain the present output of the district.

The principal producers, including the Bunker Hill & Sullivan, Last Chance, Hercules, Hecla, Standard Mammoth, Morning, Gold Hunter and Snowstorm mines, are all in splendid physical condition and producing their normal tonnage. In 1908 the total yield of these mines was approximately 1,250,000 tons.

In spite of their great depth, the big lead-silver mines continue to maintain a comparatively high-grade ore; in fact, the average yield of the ore is probably a little higher now than at any period in the history of the district. The bulk of the ore is, of course, concentrating ore and averages about 8 per cent. lead and 5 oz. silver per ton for the whole district.

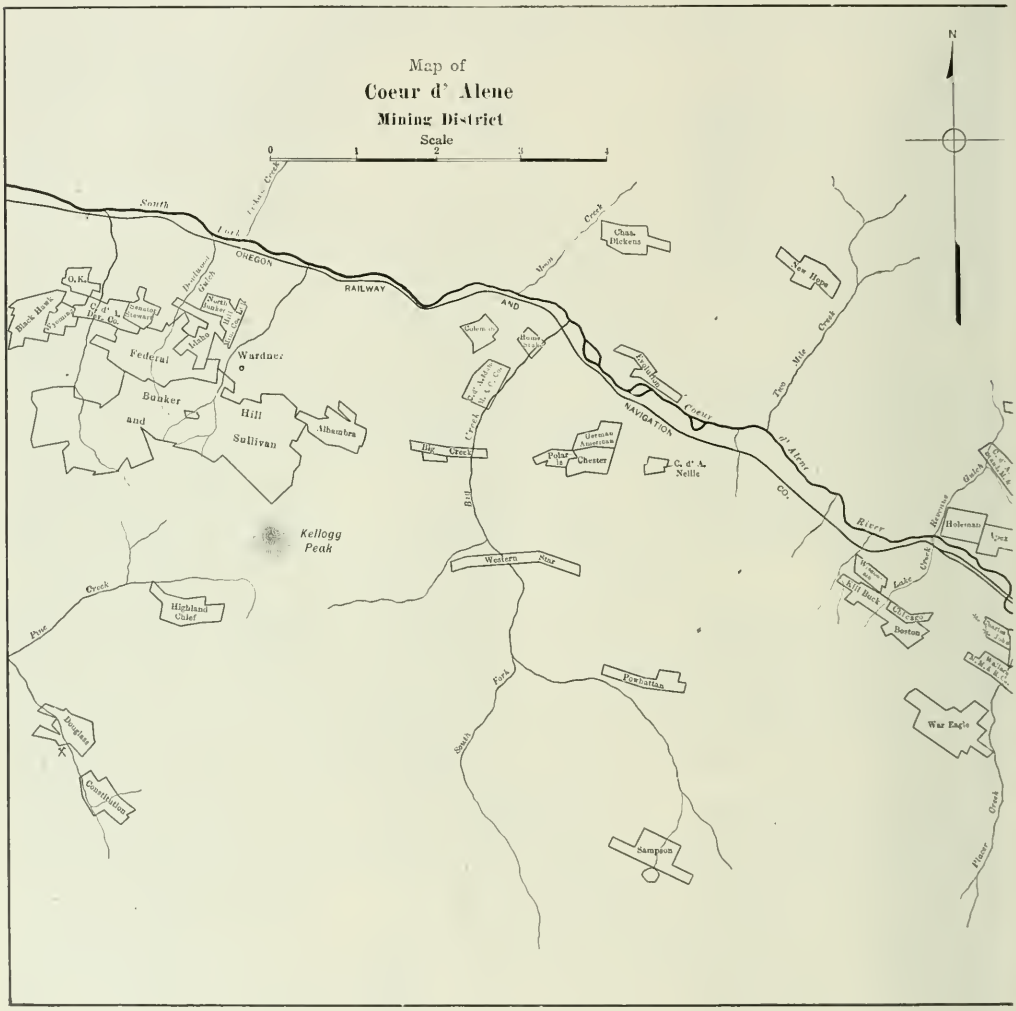
*State Mine Inspector, Boise, Idaho.

The operators are seriously concerned over the proposed cut in the tariff on lead ores. Any reduction would have a large effect on the profits of the Cœur d'Alene companies, and would probably be the cause of a retrenchment in the wage scale, for while the silver in the ore is a large item in reducing the cost of producing the lead, the mines are getting very deep, and consequently becoming more expensive to operate than formerly.

The principal producers are nearly all in bonanza at this time, but they have involved large outlays in preliminary development and plant equipment. Several years were required to develop these mines for nearly all the veins in the district were poor at the surface, and some of the mines had a hard struggle for existence until a depth of several hundred feet was reached. The profits figured against the total expenditures on the mines do not show more than a reasonable margin, and at several of the largest producers much of this margin would be wiped out by the removal of the present tariff rate.

An important economy has been introduced at all the big mines by adding a picking plant near the portal of the main adit. The ore is roughly sorted into shipping ore, concentrating ore, and clean waste, the shipping ore being sent direct to the smelter, and the waste returned to the mine for filling. This sorting has materially increasd the extraction in the mills by reducing sliming losses which formerly were large owing to the crushing of much waste rock with the ore. Owing to this sorting the crude-mineral shipments of the district in 1908 became much larger than in 1907.

The Snowstorm copper mine produces nothing but shipping ore. Its lower levels developed in a magnificent manner during 1908, and the mine made the largest output in its history, shipping a total of 100,000 tons of ore, containing slightly over 90 lb., or 4½ per cent. copper and 6.14 oz. silver per ton. The mine is paying dividends at the rate of $45,000 per month and has ore resources for several years ahead that will yield this rate of profit if present copper prices are maintained.



MAP OF COEUR D'ALENE MINING DISTRICT

Wood River District

Several of the mining districts of Idaho have experienced a very slack year in production; this is especially true of the Wood River district. In the Wood River field an unusually light output has been made owing to the lack of market and low metal prices, but nevertheless 1908 has been a year of great preparation, as five new mills were building in the district. Two of these, the Idaho Consolidated mill at Bellevue and the Crœsus mill, having a capacity of 100 tons per day and three miles west of Hailey, were completed. Developments on the bottom levels of the Crœsus mine, the deepest in the Wood River district, are magnificent. This argues favorably for the further development at depth on other fissure veins in this field. During 1908 the Idaho Consolidated property was equipped with a hydro-electric power plant of ample capacity.

At the Independence mine, near Ketchum, a new mill having a capacity of 100 tons per day is being installed; the machinery is all on the ground. An electric transmission line was constructed from Hailey to this property; over this the power to run the mill will be transmitted from the Cramer electric plant. The Independence has a reserve of high-grade ore estimated at 60,000 tons, and upon the completion of its mill in 1909 it should become an important producer.

A 100-ton mill is also being built at the Lucky Boy mine on Warm Springs creek, and at the Muldoon mine in the Muldoon district another 100-ton mill is being erected. The future of this field is bright, and promises a largely increased yield of rich ore in 1909.

Custer County.

In Custer county the White Knob mine, owing to lack of market for its ores, was idle during the greater part of 1908.

At Loon creek, the Lost Packer company successfully operated its 100-ton smelter for 90 days during the summer, and produced some high-grade gold- and silver-bearing copper matte.

The Golden Sunbeam mine in the Yankee Fork district operated its 50-ton mill throughout the year and made a large output of gold bullion. This property has developed in a magnificent manner, and promises to continue a steady producer for a long time in the future.

MAP OF COEUR D'ALENE MINING DISTRICT

Lemhi County

In Lemhi county the ore shipments from the lead-silver district were very light, due to low metal prices and the long wagon haul to the railroad. Several important discoveries were made during 1908, and a new independent smelting plant to treat the medium-grade ores of this district is in process of construction at Spring mountain. This should greatly encourage ore development in this part of Idaho.

At Indian creek the Ulysses mine resumed operation during 1908, and is again making an important yield of gold bullion.

The coal mines at Salmon City were developed during the year with a small force of men, and made a remarkable improvement; the local market was supplied by them with a desirable fuel, and unsuspected deposits that promise a big tonnage in the future were developed.

Silver City District

In Owyhee county the Silver City district is giving employment to a force of about 600 men. The old Delamar mine greatly increased its ore reserves and enlarged its milling capacity 50 per cent. during 1908. The Trade Dollar Consolidated mine is employing its normal force of men, but its operation has been somewhat interrupted during 1908 through tying the Boise Interurban railway onto its electric-power plant.

Considerable activity in mining development is shown in the district around Silver City that should result in important ore disclosures in 1909. The most successful new enterprise near Silver City is the Potosi mine, which has been developed to a depth of 300 ft. by three levels and is showing considerable reserves of rich ore. This property was equipped with a 20-ton mill, which began successful operation at the close of the year. The mine promises soon to develop into a good dividend payer.

The extension of the Northwestern railroad down Snake river will shortly be completed to a point 58 miles below Huntington. This brings the west slope of the Seven Devils range in close touch with railway transportation, and is already proving a great stimulus to the development of the rich copper deposits in that district.

Atlanta District

The Pettit mine in the Atlanta district of Elmore county was purchased from the original owners by the Bagdad-Chase Gold Mining Company, of Rochester, New York, for $125,000. This property is equipped with a 20-stamp mill, which was profitably operated throughout 1908; 20 more stamps are being added, so that the mill will treat 150 tons a day. The Pettit mine is responding to development and is showing up a large tonnage of good milling ore.

The new mill of the Atlanta Mines company was tried out during the year, and found unsuited to the successful treatment of the extensive ore reserves of this property; the mill will require considerable remodelling in order to treat successfully this ore.

The ores of this district, on account of their mixed silver minerals, need very close treatment in order to obtain a good extraction, but the orebodies are large.

Elk City District

The Elk City district, in Idaho county, has enjoyed a prosperous year and has given employment to a good many men.

The Buster mine in that district has been developed to a depth of 400 ft. on a 10-ft. fissure vein, containing ore that averages from $10 to $20 per ton. This mine is equipped with a 10-stamp mill and cyanide plant, that has been successfully operated throughout 1908, making a large production of gold.

In the Elk City district are many promising fissure veins, so that further work is likely to develop other producers. The district also contains some large deposits of low-grade gold ore that are likely to become mines of the Treadwell type, with proper development and equipment. It is also noted for extensive old-channel, placer deposits; some of the placers are quite favorable for dredging.

Coal

In the Fremont County coalfields, the Brown Bear mine was developed to a depth of 200 ft. during 1908. The coal is found to be of even better quality and of greater value than in the shallow levels above. This district is producing considerable high-grade bituminous coal and is supplying the local farmers; with railway transportation, the district would probably be capable of supplying the demands of the State for high-grade fuel.

Phosphate Rock

Idaho produced 5700 tons of high-grade phosphate rock during 1908. This came from the property of the San Francisco Chemical Company at Montpelier, Bear Lake county. Recent development of the phosphate deposits of this district tends strongly to confirm the opinion that this field will prove the richest and most important source of phosphate rock ever discovered in the United States.

Statistics

The total metal output of Idaho for 1908 based on the gross contents of the mineral shipped, is approximately: Lead, 208,196,159 lb.; silver, 7,636,271 oz.; gold, 65,175 oz.; copper, 10,080,506 lb.; zinc, 200,000 lb. The dividends distributed during 1908 by metal-mining companies operating in Idaho will approximate a total of three million dollars.

Nevada

By William H. Shockley*

The Nevada output for 1907 was 711,339 oz. of gold, value $14,707,658; and 7,767,510 oz. of silver, value $5,074,281; a total value of $19,778,938. I estimate the production for 1908 at $20,000,000, viz., $15,500,000 gold, and $4,500,000 silver. This is lower than was anticipated, the shortage being due in part to the fall in the price of silver from 55c. per oz. in January to 47.5c. in December, 1908, and in part to the fact that the Goldfield Consolidated husbanded its ore. This company produced about $700,000 in 1908 and should make a large production in 1909 with its new 100-stamp mill. In November the Goldfield mines stopped publishing their output, so their product for the last two months of the year must be guessed at.

Dividends

I have learned of the following dividends paid by Nevada mines in 1908:

Goldfield:	
Engineer's Lease	$555,000
Florence Annex	50,000
Forence Mining Co.	420,000
Little Florence Lease	750,000
Mohawk-Jumbo	200,000
Red Top Consolidated	20,000
Rogers Syndicate Lease	215,000
Comstock:	
Ophir Mining Co.	32,400
Round Mountain:	
Round Mountain Mining Co.	64,000
Tonopah:	
Tonopah Mining Co.	500,000
Total	$2,806,400

Other dividends have probably been paid about which I have no information.

Labor Troubles and Labor

At the end of 1907 a bitter strike was in progress in Goldfield and nothing but the presence of Federal troops prevented mob rule. In January, 1908, under the protection of these troops, non-union miners began work in Goldfield. The strike was called off on April 3, and Goldfield is now an open and peaceful camp. The establishment of a State police at a special session of the legislature in January preserved the peace of the State. This action of the legislature was approved by the voters at the election of Nov. 3, 1908, and this vote makes it certain that future strikes will be conducted peaceably. Though wages have been reduced to the Tonopah scale—$4 per diem for miners—in a number of the camps there were no strikes during 1908.

The riches of Goldfield and Tonopah have drawn white men from all over the world. This mixing of races is well shown by the nationality of the miners in

*Mining engineer, Palo Alto, Cal.

the Tonopah mine: 56 German; 50 Slavonian; 25 Finnish; 20 Swedish; 150 English, Irish, American, Australian (one New Zealander).

"Highgrading," though not so prominent a business as in former years, is still carried on. Two men were killed while stealing ore in the Mohawk mine. Very bold were the "highgraders" at Manhattan when they started up an idle hoist in the dead of night and stole 26 sacks of rich ore. Even the silver ores of Tonopah have been "highgraded," four men being arrested for stealing ore from the MacNamara mine in October.

The State of Nevada should appoint mine inspectors. This is especially needed in some of the Tonopah mines, where there is a reckless disregard of ventilation. An unusual rescue of entombed men was that at the Alpha shaft of the Giroux mine at Ely; three men confined by a cave on Dec. 4, 1907, were extricated on Jan. 18, 1908, being fed and cheered meanwhile through a 6-in. water pipe.

In the fall of 1908 both Hazen and Rawhide were destroyed by fire.

Financial

Early in 1908 money became easier and on Jan. 11 the smelters resumed cash payments for ore purchased. Two banks with small capital failed during 1908 in Rawhide, and in December the Round Mountain Bank, capital $25,000, closed its doors. The receiver of the State Bank and Trust Company has paid a dividend of 5 per cent. to the depositors and *hopes* to pay more.

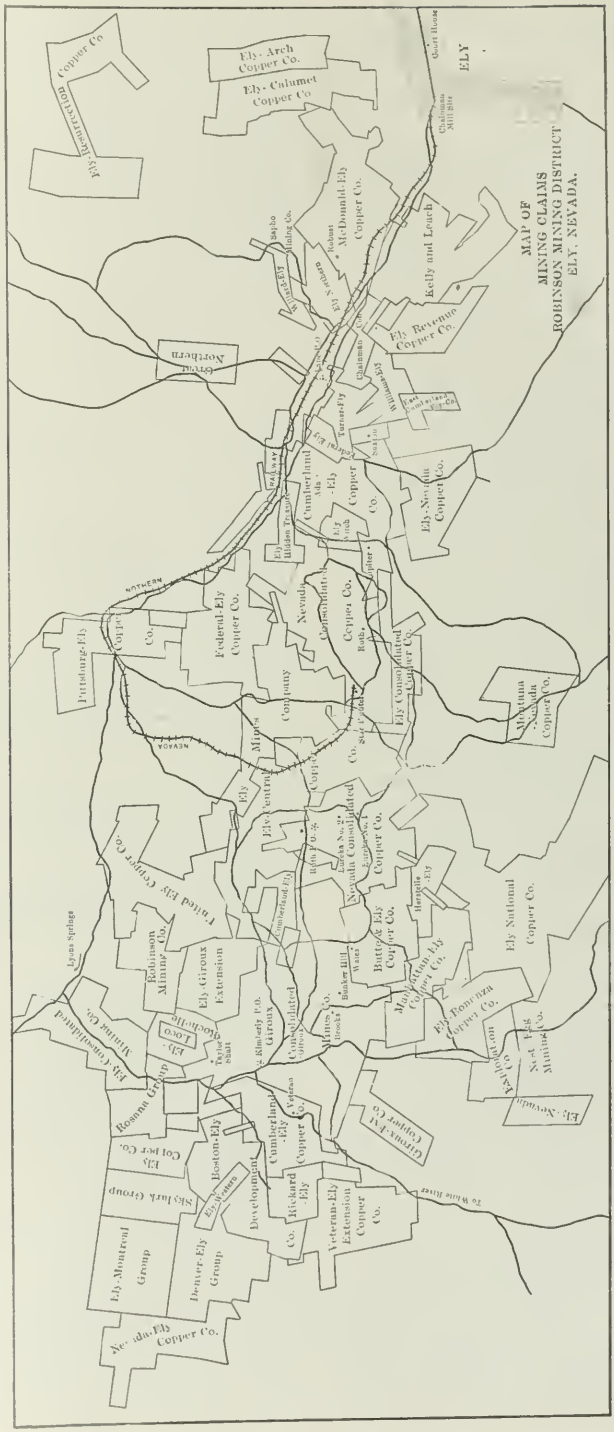
Railways

The Western Pacific is steadily constructing its line and in a year should have trains running across Nevada into San Francisco. The Bullfrog & Goldfield road was sold to the Tonopah & Tidewater in the spring. Many new railroads are projected, but no work was done on them in 1908. A branch line to the copper mines at Yerington is likely to be the first one built. Important freight reductions have been made by the Clark road in order to attract ores to the Jerome smelter.

Metallurgy

The tendency in all the Nevada gold and silver mills is toward fine grinding. The new mill of the Goldfield Consolidated will employ this process; a novelty in this mill is the treatment of the concentrates by sulphuric acid followed by cyaniding. The Greenawalt chlorination process is used in the mill of the Goldfield Chlorination Milling Company.

In southern Nevada, demands for electric power have steadily increased; 30,000 h.p. are now being developed at Bishop Creek, 113 miles west of Goldfield.



Dry washers of two kinds were tried at Manhattan and Round Mountain, but proved failures; it is stated that the ground was too moist.

Air-hammer drills, especially good in raises, are now extensively used and give great satisfaction.

Shattered rock, which cementing failed to solidify, defeated an attempt to prospect below the Red Plume shaft of the Tonopah Mining Company with a calyx drill.

Hydraulic mining is carried on at Round Mountain. At Rabbit Hole, near Lovelocks, high-pressure pumps are to be used for hydraulicking.

Copper

In the past a small amount of copper has been produced from the ores of Nevada, 1,462,450 lb. in 1907. But 1908 marks the beginning of a big increase, and in 1909 Nevada will be an important factor in the copper market, for the Ely mines will produce a large amount of copper. The Steptoe concentrator, three units of which are already completed, is now handling 4000 tons of ore daily, and its smelter is turning out 3,000,000 lb. of copper monthly.

The mines at Yerington, Lyon county, have developed a large tonnage of copper ore. The most important company, the Nevada Douglas, owns a mile along a vein which shows ore up to 100 ft. wide. The Bluestone Mining Company reports 3,000,000 tons of 3-per cent. ore developed; and the Mason Valley Mining Company is showing its faith by building the town of Mason 3.5 miles south of Yerington. This company has 50 ft. of ore running from 3 to 10 per cent. of copper. At Ubehebe, Mina, and Luning nothing specially good has shown up. At Lodi, Nye county, a 100-ton smelter will start early in 1909.

Gold and Silver

Esmeralda county is still Nevada's chief producer. Its yield was increased in 1908 by the 100-stamp mill of the Pittsburg Silver Peak Mining Company at Blair; this mill produced $750,000 during the 10 months it ran, and should turn out more than $900,000 in 1909. Goldfield's output was $7,500,000 from 75,000 tons of ore. In 1909 Goldfield's product should be even larger, since the 100-stamp mill of the Goldfield Consolidated is expected to treat 600 tons daily and ship $6,000,000 in the year. With the completion of this mill Goldfield has a daily milling capacity of over 1000 tons.

A well traveled road does not seem a promising place for prospecting, but several roadside mines have been found in Nevada during the last few years. The croppings of the first mine found at Manhattan had been worn by wagon wheels for more than 40 years. In 1908 the Lucky Boy mine near Hawthorne, and the Great Western south of Goldfield, both found close to old wagon roads, have come into prominence through their rich ores. The Great Western is shipping its silver ore to the Belmont mill at Millers. A number of mines have been found near it; one of these, the Nevada Empress, has built a 35-ton Hathaway mill.

The Rawhide boom was faint early in 1908. A new rush began later, but was interrupted by the burning of the business portion of the town on September 4. More than 50 hoists are working in Rawhide, and it will doubtless prove a good low-grade camp.

In 1908 the Tonopah mines, in Nye county, produced about $2,000,000 in gold and $4,000,000 in silver. These mines have been seriously hampered by the fall in the price of silver and with a further fall many of them will be obliged to close; with silver selling for less than 50c. per oz., the Tonopah Mining Company is probably the only one that can make a substantial profit. The 100-stamp mill of the Tonopah Mining Company, at Millers, and the 40-stamp mill of the Montana Tonopah, at Tonopah, are both working ore for $3.50 per ton. The Montana, however, is the better mill and has proved that fine grinding is superior to separate treatment of sands and slimes for the Tonopah ores.

Round Mountain has five small mills and one of the few hydraulic mines of Nevada. This is a prosperous camp. The Round Mountain Mining Company paid two dividends during 1908, and reported a profit of $55,000 from working 14,000 tons of ore for the six months ending June 30, 1908.

In spite of its facilities for milling 160 tons of ore daily—present charges $5 per ton—Manhattan made very little profit from its mines in 1908.

The town of Helena, 40 miles east of Tonopah, was started in November, 1908, on the strength of the Clifford mines, from which Goldfield option holders are shipping $300 ore.

The Berlin mines, formerly owned by J. Phelps Stokes, of New York, have been recently bought by Goldfield operators.

The mines in the southern part of Nye county have proved disappointing. The Montgomery-Shoshone, heralded as the wonder of the world in 1906, is comparatively a failure; 17,798 tons of ore worked from January to June, 1908, yielding $412,231, gave but little profit.

A disgraceful fiasco marked the career of the Gold Bar Mining Company, which did not find out that its ore was too low grade to work until after building a 20-stamp mill. This mill is now shut down and the property will doubtlessly be sold to satisfy the creditors of the company. Though the Homestake King Mining Company, a neighbor of the Gold Bar, is running its 25-stamp mill at present, it does not seem prosperous.

The Bonnie Clare mill is closed. The Johnnie mill shut down in August, but is to start again soon. Judging by the complicated litigation over the stock of the Keane Wonder Mining Company, it ought to be a good property. Its 20-stamp mill is now running profitably. The Campbell-Smith custom mill near Beatty will start in February. The Skidoo mill is giving $20,000 monthly.

The mines of Wonder, in Churchill county, shipped a little ore in 1908. The Nevada Hills mine at Fairview was not very prosperous during 1908; its ore was cut off by a fault.

Gold Circle, in Elko county, is improving and is to have a 40-ton mill.

In Humboldt county the new camp of Jessup was prominently mentioned by the newspapers. In the same county the old Hendra mine at Dun Glen was resuscitated by E. S. Chafey, after whom the new town of Chafey is named. He found a body of good ore from which he was able to pay $30,000 for the mine by his ore shipments. These shipments stopped in November, and it is said that the mine is not looking so well. Seven Troughs, present population 1000, is likely to last for some years; for, though the fabulous riches reported a year ago have not materialized, much good ore has been developed. Twenty hoists are now running in this district, and the Mazuma Hills and the Kindergarten have each built a 10-stamp mill.

Rosebud, from which much was expected, has proved a "dead one."

Lincoln county is one of the large producers. The Bamberger De Lamar ran steadily in 1908, crushing 130,000 tons of $4.75 ore. There is much activity in Searchlight; here the Quartette has just finished a 150-ton cyanide plant.

The famous Comstock mines in Storey county have had much newspaper notoriety lately. Pennsylvania capitalists have obtained control of some of these mines. Whether the stockholders will receive larger profits, or the mill men secure most of the product, as in former years, remains to be seen.

Silver-Lead

Non-argentiferous lead and zinc ores are mined in the Good Springs district in Lincoln county, but the bulk of the lead comes from the silver-lead ores. These ores are mined all over the State, but most of them come from the Richmond-Eureka mines in Eureka county. This county produced $400,000 in 1908, largely from silver-lead ores. At Ward, in White Pine county, the Nevada-United is shipping 20 carloads monthly of ore containing 40 per cent. lead and 6 oz. of silver per ton. In Pioche, Lincoln county, the Nevada-Utah Mining Company is reopening the famous Raymond & Ely, and the Meadow Valley mines. This camp should make a good showing in 1909.

Zinc ore is found in quantity within 35

miles of Lovelocks. The chief producers of zinc are the Potosi and the Monte Cristo mines in the Good Springs district, Lincoln county.

Minor Minerals

Alum.—It is proposed to work the alum deposits of Esmeralda county.

Antimony.—A small amount of antimony ore was mined. More should be extracted in 1909, since the Chase-Andrew's Company, of New York, is building a 100-ton concentrator near Lovelocks. Antimony has been mined in former years, by the Antimony King Mining Company near Austin, and also at Battle Mountain. A 12-in. vein of stibnite was found on the 120-ft. level of the Mazuma Hills mine at Seven Troughs.

Barytes.—The deposit near Silver Peak has been studied with a view of building a mill to work it.

Borax.—This is produced in small amount by Chinese lessees near Columbus, Esmeralda county.

Coal.—William Groezinger, the rediscoverer of the coal beds near Tonopah (these beds were first noticed in the '60s), died in November. Many old Nevadans will recognize him under the name of "Jackass Billy." He made a small fortune by giving options on his coal mines.

Gems.—A small amount of turquoise was cut from the deposits of Lincoln and Esmeralda counties. Original Bullfrog ore is used for jewelry, as is the handsome azurite and malachite mixture found at Yerington.

Gypsum.—The Arden Plaster Company has a 150-ton mill, costing $150,000, 10 miles south of Las Vegas.

Mercury.—In former years a few flasks of mercury were distilled from the ores of Mill City, Humboldt county. For some months past Davis & Workman have made 300 to 400 lb. of mercury daily from cinnabar found at Ione, Nye county.

Mica.—A mine of this mineral has been bought, in Lincoln county, by the American Mica Company.

Molybdenum.—Occurs in many mines as wulfenite, and is found in a wide quartz vein in Lida valley, Esmeralda county, as molybdenite.

Nickel.—The American Nickel Company was to start work on its mines near Boyer, Churchill county, in November.

Petroleum.—Prospecting wells are being driven near Buckskin in Lyon county; and near Silver Peak, and south of Rhyolite in Esmeralda county, but no oil has been produced. A Government expert has reported unfavorably as to the prospects.

Platinum.—Is found in a vein in the Bunkerville district in Lincoln county, where the ore contains 3.5 per cent. copper, 2.5 per cent. nickel, and 0.25 to 0.33 oz. of platinum.

Salt.—Is made in several counties.

Sulphur.—A few loads of sulphur were taken from a large deposit a few miles south of Goldfield.

Tungsten.—A shipment from Lovelocks netted $120 per ton. Several veins have been worked near Round Mountain.

Aërolite.—Easy and profitable mining was the extraction of a 4500-lb. aërolite from its sandy bed in the Quinn cañon country east of Tonopah. This is thought to be the meteor that illuminated this section of Nevada and a portion of California when it fell in 1894. I understand that an offer of $6000 has been refused for this mass of nickeliferous iron.

California

Special Correspondence

California was credited by the division of mining and mineral resources of the United States Geological Survey with a mineral production valued at $56,679,436 in 1907. About 40 substances are enumerated, the most important being gold, valued at $16,853,500; petroleum, $14,699,956; copper, $6,730,320; stone, $3,134,429; clay products, $5,740,537; asphalt, $1,213,957; borax, $1,121,520; and silver, $1,049,400. Other substances of lesser total value were cement, chrome, coal, glass sand, gypsum, lead, lime, magnesite, manganese, mineral waters, natural gas, ocher, platinum, precious stones, pyrite, quicksilver, salt, slate, zinc, asbestos, infusorial earth, talc, soapstone, and a few other minor substances.

Up to the end of 1907 the value of the gold output has always exceeded that of any other single substance in California; but in 1908 the value of petroleum passed that of gold insofar as the present available statistics show. The developments in the oilfields of the State exceeded in 1908 those in the goldfields. While the unit value of gold naturally remained the same, the value of the oil produced greatly increased. The estimated average value of oil in 1907 was 37c., and in 1908 it was 48c. per bbl. of 42 gal. The gain in production of oil for 1908 was about 20 per cent., whereas the gain in value was a little over 25 per cent.

There were no specially important developments in the gold-mining industry of the State in 1908. Numerous changes were made in ownership of mines; some new ones were opened and some old ones abandoned. The reopening of long-abandoned properties continued in the principal counties. Many of the old mines of the State were given up years ago because, under the circumstances then existing, they did not pay; but under modern conditions they can be made profitable when sufficient capital is invested for proper development and suitable machinery.

In general California did better in 1908 than in 1907 because there were no general labor strikes and no floods, although the dryness in the fall affected the yield to some extent.

In the central and northern portion of the State there were no developments of note aside from a few instances. In the southern portion new railroads brought new sections into notice and gave prospectors a chance to enter regions heretofore neglected, especially in Inyo and San Bernardino counties, where numerous discoveries were made and many new mines were opened.

In the desert regions of California, particularly those bordering on the State of Nevada there was more or less activity due to the fact that, of late, transportation facilities have been provided; prospects, hitherto worthless, have since become of some value because ores can now be shipped to reduction works. For these reasons more or less prospecting was done and both old and new claims were developed to a producing stage.

In the Mother Lode section of the State and in other older portions there were few changes. Development work continued as usual. In Siskiyon and Trinity counties of northwestern California, there was much activity in gravel mining and some new quartz enterprises were begun. In Shasta county some new smelting enterprises started in 1908 so that the copper industry should show an increased output for the year. That county is the center of the copper-mining industry.

The increased output of gold for California for 1908 is expected to come mainly from the gold-dredging industry. About 10 or 12 new dredges were installed during the year; most of these are of the largest size and have double the capacity of the old-fashioned dredge. Most of them were installed in the main dredging fields on the Feather, Yuba, or American rivers, but a number were operated in localities where but a few hundred acres of available dredging ground are known to exist. Some mergers of prominent companies took place in the dredging industry.

It is expected that when the statistics of the gold-mining industry for 1908 are completed California will show an increase of $1,000,000 to $2,000,000 over the production of 1907. The mines were handicapped in the fall of 1908 by a dry season, and several properties were shut down for a short period. But the deficiency due to this cause will be made up by the increased output of the dredges.

The most notable feature in 1908 was the increased output and value of petroleum. It is expected that the statistics of 1908 will show that the oil yield is valued at about $23,000,000. The Midway oil district came to the front and Coalinga displaced Kern River as the most important field. The McKittrick district increased its yield by 2400 bbl. and the Sunset district by 1000 bbl. per day. The first

three months of the year showed little increase, but the last three months gave a very large yield. With an average price for the year of 48c. per bbl. the price went up to 63c., and is expected to reach $1 per bbl. The great demand is for a light oil, as heavy oils are abundant.

The dividends of oil companies listed on the California Stock and Oil Exchange in 1908 amounted to only $574,556, but the total paid by them to date is $18,008,882.

Although all the oil companies paid $574,556 in 1908, one gold mine, the North Star, of Nevada county, paid out $375,000. With increased prices and output, the oil companies should be more profitable.

The production of mineral substances other than gold and oil will show little change in 1908. The structural materials of the State are coming into greater demand each year, but most of the substances will show little advance in value in 1908. The high freight rates for the heavier materials restricts production inasmuch as the consumption is largely confined to the Pacific coast, and it is impossible profitably to ship them East.

The cost of producing copper at the Burraga mine in the Bathurst mining district, New South Wales, Australia, in 1907, according to *Mineral Resources,* Bulletin No. 6, issued by Department of Mines, New South Wales, was as follows: Mining, including transportation to the mill, 11s. 4.9d.; concentrating, including transfer to calciner, 5s. 2.8d.; calcining concentrates and picked ore, 1s. 4.8d.; smelting calcined concentrates and stall-roasted ore to matte, 3s. 8.5d.; roasting matte at Burraga, 1s. 1.5d.; roasting blister copper and matte at Eskbank and refining same, 1s. 8.4d.; total, £1 4s. 6.9d. per ton of ore. The ore yielded 2.36 per cent. copper; 58,159 tons were treated during the year. The high cost of mining is due mainly to the fact that the stopes dip only 25 deg. The orebody is from 10 to 40 ft. wide.

The zinc mines at Broken Hill, Rhodesia, shipped about 16,000 tons of zinc ore to Europe in spite of the high freight charges, which amounted to $30 per ton to the seaboard, but then exhausted the high-grade zinc carbonate ore and were left with a mixture of lead carbonate and zinc carbonate and silicate, assaying about 25 per cent. lead and 25 per cent. zinc, which cannot be economically separated by any known process. There are large deposits of the ore, occurring in a limestone formation, which are nearly pure mineral, containing only a little lime as gangue, but incapable of separation into marketable products. The ore is non-argentiferous.

The United Kingdom produced 10,194 long tons of iron pyrites in 1907 as compared with 11,140 tons in 1906. Of this amount 7394 tons came from England, 2516 tons from Ireland and 284 tons from Wales.

DIVIDENDS PAID BY MINING AND METALLURGICAL COMPANIES.

American Companies.	Location.	Paid in 1908.	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Alaska Mexican	Alas.	$324,000	$1.80	$2,040,381
Alaska Treadwell	Alas.	600,000	3.00	10,235,000
Alaska United	Alas.	117,130	0.65	423,420
Am. Sm. & Ref., com	U. S.	2,500,000	5.00	15,000,000
Am. Sm. & Ref., pfd	U. S.	3,500,000	7.00	28,875,000
Am. Smelters, pf. A	U. S.	1,020,000	6.00	3,455,000
Am. Smelters, pf. B	U. S.	1,500,000	5.00	5,250,000
Anaconda	Mont.	2,400,000	2.00	43,050,000
Arizona	Ariz.	1,167,584	0.39	6,182,361
Boston & Montana	Mont.	1,800,000	12.00	52,500,000
Bunker Hill & Sull	Ida.	855,000	2.85	10,671,000
Calumet & Ariz.	Ariz.	800,000	4.00	10,300,000
Calumet & Hecla	Mich.	2,000,000	20.00	107,850,000
Camp Bird	Colo.	984,000	1.20	5,313,600
Copper Range Con.	Mich.	1,536,740	4.00	7,299,515
Doe Run	Mo.	241,186	3.00	1,765,005
Elkton, Con.	Colo.	150,000	0.06	2,191,961
Federal Sm., com	Ida.	180,000	3.00	2,615,750
Federal Sm., pfd	Ida.	840,000	7.00	4,121,250
Florence	Nev.	420,000	0.40	420,000
Francis-Mohawk	Nev.	45,500	0.05	546,000
Hecla	Ida.	70,000	0.07	1,660,000
Homestake	S. Dak.	1,419,600	6.50	23,718,240
Intern'l Nickel, pfd.	N. Y.	534,756	6.00	1,604,268
Jamison	Cal.	31,200	0.08	331,500
Kendall	Mont.	30,000	0.06	1,275,000
Mammoth	Utah	40,000	0.10	2,220,000
Mary McKinney	Colo.	39,227	0.03	841,093
Mohawk	Mich.	250,000	2.50	1,650,000
New Idria	Cal.	110,000	1.10	1,050,000
North Butte	Mont.	1,200,000	3.00	6,400,000
North Star	Cal.	375,000	1.50	1,911,988
Old Dominion	Ariz.	146,623	0.50	720,710
Old Dominion M. & S.	Ariz.	162,000	1.00	364,500
Osceola	Mich.	192,300	2.00	7,227,950
Portland	Colo.	360,000	0.12	8,107,080
Quincy	Mich.	495,000	4.50	18,450,000
St. Joseph	Mo.	600,000	0.60	6,158,357
Snowstorm	Ida.	150,000	0.10	600,000
Standard Con.	Cal.	356,788	0.20	5,194,130
Tennessee	Tenn.	500,000	2.50	2,056,250
Tomboy	Colo.	396,000	1.32	2,016,000
Tonopah of Nev.	Nev.	500,000	0.50	4,000,000
Uncle Sam	Utah	95,000	0.19	295,000
United States, com	Utah	701,866	2.00	1,622,632
United States, pfd.	Utah	1,700,458	3.50	4,456,263
Utah Con	Utah	600,000	2.00	7,200,000
Utah Copper	Utah	735,000	1.00	735,000
Vindicator	Colo.	225,000	0.15	1,935,000
Wolverine	Mich.	600,000	10.00	5,100,000
Totals		$35,597,147		$438,859,204

Foreign Companies.	Location.	Paid in 1908.	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Buffalo Mines	Ont.	$108,000	$0.12	$ 243,000
Coniagas	Ont.	480,000	0.60	840,000
Crown Reserve	Ont.	70,000	0.04	70,000
Dos Estrellas	Mex.	675,000	2.25	3,480,000
El Oro	Mex.	777,600	0.72	4,980,600
Esperanza	Mex.	1,806,350	3.97	9,222,400
Granby Con	B. C.	540,000	4.00	3,508,630
Guanajuato Dev., pfd	Mex.	30,000	3.00	30,000
Guggenheim Expl	Mex.	1,050,000	10.00	4,747,500
Kerr Lake	Ont.	360,000	0.60	850,000
La Rose	Ont.	171,505	0.15	171,505
Le Roi No. 2	B. C.	115,200	0.96	831,600
McKinley-Darragh	Ont.	280,000	0.14	280,000
Mex. Mill. and Trans., pfd	Mex.	35,450	3.00	35,450
Mines Co. of Am	Mex.	480,000	0.24	3,385,000
N. Y. Hond. Ros	C. A.	270,000	1.80	2,317,000
Nipissing	Ont.	720,000	0.60	2,040,000
Peregrina, pfd	Mex.	70,000	7.00	189,856
Pinguico, pfd	Mex.	120,000	6.00	240,000
Securities Corp., pfd	Mex.	14,000	7.00	42,699
Silver Queen	Ont.	225,000	0.15	345,000
Temiskaming	Ont.	225,000	0.09	225,000
Trethewey	Ont.	141,817		217,463
Totals		$8,764,922		$38,300,503

Industrial Companies.	Location.	Paid in 1908.	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Am. Ag. Chem., pfd	U. S.	$1,089,180	$6.00	$9,547,342
Cambria Steel	Penn.	675,000	0.75	8,775,000
Consolidation Coal	Md.	666,250	6.50	10,082,900
Empire S. & I.	N. J.	150,000	6.00	895,533
Gen. Chem., com	U. S.	296,412	4.00	2,148,987
Gen. Chem., pfd	U. S.	600,000	6.00	6,105,000
Lehigh Coal & Nav	Penn.	1,529,040	4.00	*15,014,890
Maryland Coal, pfd	Md.	122,525	6.50	‡2,013,997
New River Coal, pfd	W. Va.	225,702	6.00	451,405
Penn Steel, pfd	Penn.	1,155,000	7.00	8,662,500
Pocahontas C. C., com	W. Va.	271,200	6.00	†406,800
Pocahontas C. C., pfd	W. Va.	168,000	6.00	168,000
Sloss-Sheff., com	Ala.	425,000	4.25	1,883,000
Sloss-Sheff., pfd	Ala.	469,000	7.00	4,103,750
Standard Oil	U. S.	38,800,000	40.00	629,522,905
United Metals Selling	U. S.	1,125,000	22.50	5,625,000
U. S. Steel Corp., com	U. S.	10,166,050	4.00	78,765,032
U. S. Steel Corp., pfd	U. S.	25,219,677	7.00	218,875,574
Va. Car. Chem., pfd	U. S.	1,440,000	8.00	13,980,869
Totals		$92,693,036		$1,017,128,184

*Since 1894. †Since 1907. ‡Since 1890.

Review of Mining in Foreign Countries

The Year's Developments in the Mineral Industries of the Transvaal, Peru, Chile, Colombia, Mexico, Ontario and Australia

DETAILS OF GOLD PRODUCTION

The mining industries of Canada and Mexico suffered from the same adverse conditions which affected the United States in 1908. Mexico had troubles of its own arising from the declining value of silver, so many mines in that Republic being dependent upon their silver output alone. However, Mexico is rapidly attaining a high rank as a gold producer, through the further application of the cyanide process. On this account the gold production of Mexico probably increased in 1908, and inasmuch as the gold ores yield a large amount of silver, the Mexican production of the latter metal may not show any great decline. The production of gold in South Africa was the largest on record. An increased production of gold is also to be expected from Russia.

Australasia

By F. S. Mance*

The record of the mineral industry in Australasia during the year 1908, insofar as regards the extent to which operations were affected by the fall in the prices of the industrial metals, varies little from that of other countries. The general condition of affairs thus brought about was, however, further accentuated by a persistent decline in the gold yield. The result of the year's work, especially when compared with the buoyant returns of the preceding years, consequently makes an unfavorable showing, but a closer analysis of the position makes it appear that the magnitude and extent of the operations conducted under such disadvantageous circumstances afford good grounds for satisfaction, and tend to emphasize the possibilities which, under favorable conditions, are yet likely to eventuate from the development of the mineral resources of this country.

Gold

The gold production of Australia has for some years past shown a steady decrease, and although the falling off during the year 1908 was not so pronounced as in previous years, still the forecast indicates that a decline of about 65,000 oz fine may be looked for, or a decrease of 1.8 per cent. on the production for the year 1907.

The following comparative statement shows the yield for the last two years, the figures for 1908 being estimated on the basis of the production for the first ten months of that year:

	Yield 1907. Oz. Fine.	Yield 1908. Oz. Fine.
Western Australia	1,697,554	1,662,500
Victoria	695,576	684,400
Queensland	465,882	463,500
New South Wales	247,363	230,000
Tasmania	65,355	62,500
South Australia and Northern Territory	10,651	9,000
Commonwealth	3,182,381	3,111,900
New Zealand	477,312	482,500
Australasia	3,659,693	3,594,400
Value	$75,645,854	$74,296,248
Decrease		$1,349,606

The position will be more clearly gaged when it is stated that the estimated production for 1908 represents a decrease of 15 per cent. on that for the year 1903, the decline from this latter year having been constant.

The State of Western Australia contributed 53 per cent. of the production of the commonwealth during the year 1908, and the indications are such as to favor the opinion that the output has reached a normal level, and that there is not likely to be a further continuation of the decline which has characterized the yield for some years past. Some of the outside fields certainly give evidence of partial exhaustion, but as against this the developments at the deep levels in the mines at Kalgoorlie, and the systematic manner in which operations are proceeding, strongly support the view to which expression has just been given. The dividends paid by mining companies in this state during the first ten months of the year totaled $6,121,000.

The industry in Victoria cannot be viewed with equal complacency, and the gold yield for 1908 promises to be the lowest for the past 15 years. The falling off is principally due to the closing down of one after another of the deep alluvial mines, owing to the exhaustion of the deposits. The efforts made to prove the extension of these leads have involved the expenditure of very considerable sums during recent years, but so far without any measure of success. The lower grade of the ore which is being won as depth is attained on the Ballarat and Bendigo fields, the increased cost of working, and the consequent lessening of the margin between profit and loss, are all adverse factors. As illustrating the depth to which operations have extended, it may be mentioned that the Victoria quartz mine at Bendigo has opened up a reef 4 ft. wide at a depth of 4504 ft. from the surface.

In the state of Queensland the depression of the preceding year has not in any way lifted. The government has endeavored to stimulate operations by voting a substantial sum for the purpose of carrying out deeper sinking and prospecting, and has also undertaken the construction of railways to connect the outlying mines. However, the success which has attended the operations of the Mount Morgan company, and which is referred to later on under the heading of "Copper," is a particularly pleasing feature of an otherwise disappointing year.

In New South Wales there were no developments of significance during the year, and the yield was mainly contributed by the established mines on the Cobar and Wyalong fields, and by the dredging plants. Here, as in the other eastern states, the waning productiveness of the gold mines and the absence of any developments which are likely to arrest the decadence, are matters for much concern when the future of the industry comes to be regarded.

The production of the states of Tasmania and South Australia was unfavorably influenced by the lessened output of those metals with which the gold in small quantity is found associated.

The yield of the Dominion of New Zealand, as disclosed by the returns for the first ten months of the year, gives every indication of showing a substantial gain. This is due to the increased output by the mines in the Ohinemuri district, which include the famous Waihi mine. This mine has been creating fresh records with each succeeding crushing, and the results have given a gratifying impetus to operations on the Thames field. The dredges at Otago and the West Coast, which have been important contributors in the past, furnished a lessened output during the year under review.

Silver-Lead

The serious fall in the prices of these metals resulted in a complete dislocation of the affairs of the companies on the Broken Hill field. Events show that the sharp decline which took place early in the year was not anticipated, and the companies were thus unable to adjust

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their internal economies in time to lessen the severity of the effects of the falling market. The companies were further handicapped by the fact that the agreement made with the miners when lead was at a top price, allowing a 12½-per cent. increase in wages, did not terminate until the end of the year, while the new customs' tariff had added considerably to the cost of supplies. The results are reflected in the report of the Broken Hill Proprietary Company for the half-year ending May, as, although the production was considerably greater, the profit for this term amounted to only $110,919, as against $1,501,119 for the same period in 1907, and for the first time in the company's history the declaration of the quarterly dividend had to be deferred. Several of the mines closed down, others worked fewer shifts, while development work was almost wholly discontinued, so that the number of men employed at the end of September was 6000, which shows a decrease of 50 per cent. compared with the same date in 1907. The position of affairs on the field at the time when this article was written was very unsettled, as the miners were making a determined stand against any lowering of wages, and had made a demand for the reduction of the hours of labor to 44 a week.

The output of metals was fairly well maintained, and for the financial year ending May the Broken Hill Proprietary Company raised 592,362 tons of ore and produced 74,575 tons lead, 5,315,314 oz. silver, and 1,955 oz. gold. The difficulties which some of the companies experienced in respect to the high returning charges on their concentrates sold to foreign buyers seem likely to be settled at an early date, as the Broken Hill South and the North Broken Hill companies secured an option of purchase over the Australian Smelting Company's Works at Port Kembla (N. S. W.).

The effect of the fall in the prices of the metals on the silver-lead mines of New South Wales, generally, is more fully disclosed by the returns of the exports from this state for the first nine months of the year, as the value of the silver-lead concentrates, etc., despatched totaled $9,320,844, or $4,158,152 less than for the same period in 1907.

In Tasmania the output from the mines at Zeehan and elsewhere was greatly restricted owing to the closing down in April of the Tasmanian Smelting Company on account of financial difficulties. The government purposes to come to the financial assistance of the company with a loan of £20,000, and it is expected that, if this be done, supplies of ore can be obtained which will enable a fair margin of profit to be realized under present conditions.

In Queensland a satisfactory increase is recorded both in the quantity and value of the silver-lead production, the output for the nine months of this year being 730,465 oz. silver and 4712 tons lead. This yield was furnished mainly by the Chillagoe Mining Company, the chief supplies of ore being drawn from the Mungana Company's Girofla and Lady Jane mines.

Zinc

Under this heading it is pleasing to be able to record that the year witnessed satisfactory progress in respect to the operations of the several companies on the Broken Hill field. The Proprietary company's experimental spelter furnace proved so successful in actual work that the erection of nine additional furnaces was put in hand, to be completed and in operation by January, 1910. It is estimated that these furnaces will be capable of producing 8000 tons of spelter per annum, and that there is sufficient raw material on hand at present to keep them supplied for 38 years. The zinc concentrating plant of this company is at present producing at the rate of 76,000 tons of concentrates per annum averaging about 45 per cent. zinc.

The Zinc Corporation, Ltd., formed to treat the enormous heaps of accumulated tailings on the Broken Hill field, after many reverses and set-backs, also appears to have now brought operations to a successful issue. The Elmore plant, which was adopted, is stated to be doing all that was claimed for it, and high recoveries of both zinc and lead are reported. The company is at present working on a good dump of tailings purchased from the Block 10 company. The average quantity of tailings now treated monthly approximates 16,000 tons, yielding 5840 tons zinc concentrates and 410 tons lead concentrates, the assay values being: zinc concentrates, 46.5 per cent. zinc, 16.5 oz. silver, 7.4 per cent. lead; lead concentrates, 56 per cent. lead, 38.5 oz. silver, and 17 per cent. zinc. It will be interesting to see if this extraction can be maintained when the heaps of inferior tailings come to be handled.

The Potter process in use at the Sulphide Corporation's mine is stated to be securing an extraction of 90 per cent., and about 1200 tons of tailings per day are treated, the product assaying 40 per cent. zinc. A difficulty is experienced in finding a market for the concentrates, and the plant was not worked full time at the close of the year.

The output of the De Bavay Company was almost doubled without any addition to the plant, the working costs were materially reduced, and a high rate of extraction was secured.

The other processes seem also to have made forward strides, but it is noticeable that those engaged in the chemical treatment of the tailings show an exceptionally high recovery when compared with mill plants, while even in mechanical details a great many advantages are apparent.

Copper

The commonwealth statistician reports that the value of the copper exported from Australia during the first nine months of 1908 totaled only $7,806,000, as compared with $13,720,000 for the same period in 1907. In the face of these figures the results secured by the Mount Lyell Company, Tasmania, as set out in the accompanying table, make a pleasing showing.

PRODUCTION OF MOUNT LYELL COMPANY.

Year Ending September.	Ore Treated, Tons.	Metal Produced.			Dividends Paid
		Copper, Tons.	Gold, Oz.	Silver, Oz.	
1905	412,273	8,203	24,290	739,691	$730,500
1906	394,752	9,009	23,088	703,945	1,314,900
1907	406,397	7,886	19,449	700,087	1,972,350
1908	401,983	8,641	19,532	681,262	1,095,750
	1,615,405	33,739	86,359	2,824,985	$5,113,500

The 850-ft. level in the North Mount Lyell mine is now one of the principal sources of the ore supply. The development work undertaken at the 1000-ft. level gave particularly satisfactory results, the orebody being proved to be of considerable size, and to maintain fully its value. The accession to the ore reserves during the last half-year in this mine amounted to 169,000 tons, or 103,000 tons in excess of the output. The Mount Lyell open cut, as hitherto, supplied the pyrites for smelting purposes, and for acid making. It will be noted that the ore treated during 1908 was of a higher grade than during the preceding term, and is consequently responsible for the increased production of metals. As further evidence of the healthy position of this company it may be mentioned that the cost of producing blister copper during the last half-year was only $3.4 per ton of ore treated.

In South Australia, the Wallaroo & Moonta Smelting Company found it necessary considerably to modify the program of operations, and as a result it is anticipated that the production of copper from the company's mines during 1908 will reach only some 5300 tons, or 1700 tons less than for the previous year. Purchased ores are estimated to have furnished an additional 300 tons as against 1720 tons in 1907. The cost of produc-

ing fine copper per ton was considerably lowered, and is approximately as follows: Mining, $189; smelting, $66; shipping, $261, and other charges, $6; total, $522. The ore dealt with during the year is estimated at 165,000 tons. Development work was undertaken on a scale fully commensurate with the extent of ore raising, and the area of new ground opened up by the exploratory work, as a whole, showed no variation in its average value. The increasing depth of the workings necessarily tends to an advance in costs, but taken all in all the prospects must be regarded, under similar conditions, as decidedly favorable to a maintenance of the results of the present year.

In the state of New South Wales several of the mines which have been important producers in the past were closed down either wholly or in part during the year, and the value of the copper exported during the first nine months of the year amounted to $2,131,000, or $1,365,000 less than for the same term in the preceding year. The Great Cobar, Ltd., maintained its position as the largest producer in this state, and during the year the company completed the extensive additions to its plant, which have been in progress for some time, and carried out a large amount of development work. The lode at the 1000-ft. level has been found to improve in width, while its value exhibits no alteration. In these circumstances the returns for the year may be expected to show a well augmented production, and a higher extraction combined with economies in working costs Of the other smaller mines, that owned by the Grafton Copper Company at Cangai probably yielded the most satisfactory results.

While the state of Queensland naturally experienced a great reaction after the copper boom, still the attention which it was the means of directing to the important deposits of this state was productive of good results and proof of this is afforded by the output for the first nine months of 1908, which was 10,508 tons of copper, as against 9,462 tons for the same months in the previous year. The Mount Morgan mine quickly gained the pride of place as the chief contributor of this state. The following statement of the production of gold and copper shows the strides made during the course of the last three financial years:

OPERATIONS OF THE MOUNT MORGAN MINE.

Year Ending May.	Gold, Oz.	Copper, Tons.
1906	117,197	483
1907	145,138	4,087
1908	153,091	5,561

The oxidized ore in the surface levels is rapidly becoming exhausted, but the supply of mundic ore from the intermediate levels is well maintained, while development work underground has revealed the existence of larger quantities of auriferous copper ore than previously estimated by diamond drilling, the average value of that so far mined being 3.30 per cent. copper and 8.62 dwt. gold per ton. The present reduction plant is capable of dealing with 216,000 tons of this ore per annum. In the latter months of the year several extensive falls of earth occurred at the 750-ft. and 850-ft. levels, and which, unhappily, were responsible for the death of 12 men. Operations were retarded on this account, and a special board was appointed by the government to advise as to the method of conducting future operations, the present system of "pigsties" being shown to be unsafe.

At the O. K. mine the stopes in the various levels opened out well, and the ore reserves were considerably augmented. Toward the close of the year this mine contributed an output of about 140 tons of blister copper per mouth. The Chillagoe Mining Company maintained a satisfactory output, the chief supplies of copper ore being drawn from Ruddygore and Redcap. Important contributions were also furnished by the mines at Mount Perry, and those on the Cloncurry field.

The works of the Electrolytic Refining and Smelting Company at Port Kembla were completed and got into working order in the month of December. This company has contracts with the Mount Morgan and other mining companies for the supplies of matte, and Australia is now in a position to enter the lists as a large supplier of electrolytic copper.

Tin

Under this heading there are few developments of note to record. The industry received a set-back owing to the lower prices ruling, the extent of which is apparent when it is said that the value of the exports from the commonwealth during the first nine months of 1908 was $3,091,000, as against $4,428,000 for the same period in the previous year.

The Mount Bischoff Company, Tasmania, continued operations uninterruptedly, the several fresh bodies of high-grade ore opened up having proved of material benefit at a period which was regarded as a critical one in the company's history. The usual dividends were accordingly regularly declared, and the sum distributed to shareholders by this company now totals $10,400,000.

The mines in the Derby district, including the Briseis and New Brothers Home, in the circumstances, experienced a fairly satisfactory year, and contributed about 1500 tons of tin oxide; the future prospects, however, indicate a reduction in the output The production of tin ore from the state of Tasmania for the first three-quarters of this year is valued at $1,514,000, as compared with $1,920,000 in 1907.

In New South Wales the alluvial deposits in the Tingha and Emmaville districts continue to be systematically worked, the operations of the dredges, although somewhat hampered by an insufficient rainfall, proving fairly satisfactory. Several small, but rich, lodes were also worked. The exports of tin from this state during the nine months, however, reached only a value of $1,225,000, or $1,050,000 below that for the same term in 1907.

In Queensland the output was much on the same scale as in the preceding year, the production to the end of September reaching 3914 tons, or within 51 tons of the output for the first nine months of 1907. The value, however, shows a drop of over $600,000. The Walsh & Tinaroo field is still the chief center of operations, but the general results do not come up to those of last year, owing to the fact that two of the large producing mines, the Smith's Creek and Stannary Hills, suspended operations pending reconstruction of the companies. The position was somewhat relieved by the opening up of rich ore in the Vulcan mine, and the lode in this mine has now been proved to a depth of 1400 ft. The Great Northern Freehold mine at Herberton is also contributing improved returns, while the dredging industry at Stanthorpe has made good headway.

Of the tin fields in the Northern Territory little was heard during the year. Operations at the Pilbarra and Greenbushes fields in Western Australia were also unfavorably influenced by market conditions.

Other Metals

Mining for tungsten was adversely affected by the fluctuation in market values. The government geologist of Queensland estimated that the wolfram-bearing country of the Walsh & Tinaroo, and the Hodgkinson fields, extends over an area of 3500 square miles. Operations there were proceeding on an increasing and promising scale, as shown by the fact that during the first three-quarters of 1907 the quantity of wolfram produced by this state totaled 505 tons, but during the corresponding term this year the production, owing to the closing down of the mines, fell to 225 tons.

In New South Wales the mines at Torrington also suspended work for several months during the year.

Iron smelting now appears to have been established on a permanent basis at Lithgow (N. S. W.), the iron and steel produced being in every way satisfactory. The Federal Government, with the object of encouraging the industry, passed a bill through the House of Representatives granting a bonus of $2.88 per ton on all

pig iron made from Australian ore, also on puddled bar iron and steel made from Australian pig iron. The total sum set apart for the purpose is $730,500, and the annual bounty is limited to $146,100.

Coal

The labor troubles which seriously threatened this branch of the industry in New South Wales in the early part of the year were happily averted, and the output promises to be one of the largest in the history of the state, that is if the figures of the export trade may be taken as a guide. These show that the coal exported during the nine months of the year reached a total of 4,686,553 tons and was valued at $11,304,975, showing an increase of 461,000 tons and $1,865,658 in value compared with the same months in 1907. The coal trade generally was exceedingly brisk during the first half of the year, after which there was a noticeable slackening off. The coke trade, while feeling the effects of the depression in metalliferous mining, was, on the whole, satisfactory.

South America

By John Power Hutchins*

The year 1908 was not a prosperous one for South America. Countries like Peru, Bolivia and Chile, which produce copper, silver, lead and other metals felt the hard times particularly and production suffered. The gold-producing countries were not affected. Columbia, Brazil and the Guianas about maintained their production. Ecuador is a gold producer but of inconsiderable importance.

Peru will show a larger copper production, for the Cerro de Pasco smelter operated continuously and produced about 30,000,000 lb. of copper. Silver mining suffered greatly and many of the mines are shut down. Gold mining, both placer and lode, was actively conducted in southern Peru. The extensive coal deposits are being investigated with good results and there is a likelihood of extensive developments. The coal is bituminous and coking. The coal deposits of Chile are nearly exhausted, while no coal has yet been developed in Bolivia. Peruvian coal is, therefore, in greater demand than formerly.

The Chilean copper mines generally continued operation but no new enterprises were started because of the low price of the metal, and the low exchange. Considerable interest has been taken in concentrating low-grade copper ores.

Bolivia still suffers from high cost of transportation.

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Gold

The total gold productions of some of the countries of South America in historic times is remarkable. Colombia is credited with $895,000,000; Brazil, $720,000,000; Bolivia, $199,000,000; Peru, $119,000,000; Chile, $33,000,000. This makes a grand total of nearly $2,000,000,000. These figures suggest possibilities for further development and exploitation with modern methods particularly in placer mining. In South America, as in all partially developed regions, the more important mines are the placers, and nearly all the past and most of the present production is from alluvial deposits. Many of these placers are essentially one-man enterprises, but there are others which could be worked on a large scale by dredger or hydraulicking.

Gold mining in Colombia has an interesting history. Its deposits were worked by the Spaniards with slave labor soon after the discovery of America, and in 1905, with $895,000,000, it still ranked fourth in total gold production of the world, only the United States, Australasia, Russia and Siberia outranking it. Compare the area of Colombia with those of the three regions that outrank it; then remember that most of the gold produced by Colombia came from a comparatively small part of the total area.

A very large territory in South America lies awaiting prospecting and development. There are several reasons why this area has not as yet been investigated. All of the tropical parts of the continent have at low altitudes a climate with a pernicious effect upon the health of the white man of temperate zones. His efficiency is lowered soon after arrival and usually he cannot stay in the interior for a year without a trip to the coast or the sea, or a visit to higher altitudes to recover from malaria and anaemia. Nor does a residence of several years in the tropics with vacations to healthful climate, give much, if any, immunity from malaria. A person hardened in that way may be ill less frequently than the newcomer in the tropics only because he knows how to take care of himself. Those parts of South America which lie at elevations more than 3000 ft. or in the temperate zone have no difficulty with malaria.

Lode mining is carried on in Peru, Colombia, Ecuador, British Guiana, Brazil, Venezuela, Chile, Uruguay, Argentine and Bolivia.

Colombia has a few profitable gold-lode mines. The most important of these are the Frontino and Bolivia near Remedios in the department of Antioquia. An intensive investigation of lodes has been carried on in southwestern Colombia for several years by Americans. Several promising properties are under development in this region near the boundary line of Ecuador. Difficult transportation has been and will continue to be a serious obstacle.

Lode mining is carried on in Ecuador only in the Zaruma district, where the application of the cyanide process has made it possible to do profitable mining. A small amount of placer gold is produced on the headwaters of the Amazon river in Ecuador.

This is an extremely inaccessible region and will probably remain undeveloped for many years.

Other Minerals

The nitrate deposits of Peru, Chile and Bolivia were worked as usual.

The extensive asphalt deposits of Venezuela are not worked, although the product is of high grade. There are several good reasons for this lack of activity. The limited demand is easily supplied from the more accessible though less pure deposits at La Brea on the coast of Trinidad, and the government of Venezuela has hitherto been far from stable.

Mexico

By H. A. Horsfall*

Mining in Mexico during 1908 showed very erratic conditions. The first of the year opened with extreme depression, owing primarily to the financial panic in October of the preceding year; in the early months of the year a considerable recovery was noticed in the prevailing conditions, which was succeeded by successive periods of advance. Toward the latter part of the year, however, depressed conditions were reported and they still prevail.

The reduced prices of the various metals was the chief and primary cause of the continued depression. Copper and lead prices, however, materially advanced since the middle of the year, but silver, of which Mexico is the largest producer, continued to recede in price during the whole of the year, until at the present market price very few mines are able to show a working profit. Other matters tending to aid in the depression were the agitation of material changes in the mining laws, increased railroad freight rates on coal, ores and iron and steel products.

These conditions continue operative at the conclusion of the year, except the uncertainty in regard to the mining law. A number of large deals, which had been pending for some time were lately reported as consummated; others owing to the prevailing money conditions have been held up indefinitely. On the whole a considerable advance as compared with the preceding year was accomplished.

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Gold and Silver

The gold output continued to increase at a rapid rate, notably in the districts of Guanajuato, El Oro and Dolores, as reported in previous years. The increase is partly due to the discovery of new mines, but principally to the increased use and continued improvement of the cyanide process for treating gold and silver ores. A large number of new mills using this process were put into commission during the year. Notwithstanding the general adverse conditions prevailing, the quantity of silver produced will show a material increase over previous years, new producers having come to the front and the old ones having increased their output. In prospecting greater attention was given to gold properties and many promising prospects were located.

Copper

The complete cessation of operations at the Cananea mines at the close of the previous year was followed by the complete reconstruction of the smelting plant, and partial resumption of production, since July. The Boleo company operating in Lower California will probably lead in the amount of copper produced during the twelve months, followed by the mines at Cananea.

The starting of the 2000-ton concentrating plant at Nacozari, several new copper smelters in various parts of the country, and additions to the capacity of the older plants, will in all probability, give an increase in production in 1909.

Lead

Notable additions to the amount of lead-silver ores produced were reported, particularly in the districts of Mapimi in the state of Durango, and Santa Eulalia in the state of Chihuahua. This is to be discounted, however, by the decreased production from the silver-lead mines of the Sierra Mojada district; late reports from this district indicate that many of the mines have resumed shipments. On the whole the production of lead will be about the same as in previous years.

Tin

A number of tin properties in the state of Aguascalientes are reported to have been purchased by Americans and are being developed. Deposits of tin ore were discovered in the state of Coahuila, near the Rio Grande river opposite Boquillo, Texas. The owners are said to contemplate extensive developments.

Mercury

A number of properties producing quicksilver were in operation during 1908, high prices being the cause. Extensive deposits are known to exist in several states; many of them were formerly worked.

Iron and Steel

Very little progress in the utilization of Mexico's resources in the manufacture of iron and steel was reported. The Monterey Iron and Steel Company has, however, been able to start up its steel plant on a large order for rails for the Mexican National railroad. The plant at the city of Durango, it is rumored, will start up again in a very short time. The manufacture of iron and steel showed very little advance in consequence of the continued shortage in the necessary fuel requirements. The recent opening of a branch of the Mexican Central railroad, from Guadalajara to the gulf coast, will in all probability, lead to increased activity in this branch of mining, for new discoveries of coal and iron ore are reported from that section.

Coal and Oil

Coal mines in the state of Coahuila continued to produce their normal output. Reports of discoveries in other states were received, from time to time, but as yet the production has been on a limited scale. Prospecting for oil in the state of Vera Cruz was very active during the past year. The firm of S. Pearson & Son placed in operation the new refinery capable of producing 6000 bbl., per day. Prospecting in Chihuahua by the Hearst syndicate has been stopped temporarily.

Other Minerals

Other mineral products of importance produced in Mexico are: antimony, sulphur, asphalt, salt, building stone, onyx of Puebla, and precious stones, of which the most important are opals and turquoise. Late reports from the statistical department of the Mexican government give the amount of Mexican and foreign capital invested in the mines and industries of that country as follows: Mexican capital, 475,509,468 pesos; American, $336,991,000; English, £52,169,717; German, 109,817,500 marks; French, 83,757,500 francs; Austro-Hungarian, 1,000,000 florins; Spanish, 12,334,300 pesetas, and Italian, 300,000 liras.

Railroad Building

The increase of new railroad mileage, during the year was confined principally to the states of Sonora and Sinaloa. In Sonora the branch from Nogales, Ariz., to Cananea was completed and placed in operation on Dec. 15. On July 28, 354 kilometers from Navajo, Sonora, south to Culiacan, Sinaloa, was placed in operation. At the present time the rails have been laid to Mazatlan on the coast and 51 kilometers from Culiacan south to the Lorenzo river will be open for traffic Jan. 15, 1909.

In the state of Jalisco the Mexican Central completed and opened for traffic its branch from Guadalajara to Colima, and is building in the state of Durango, from its present terminus at Rosario, south to Inde. The Parral & Durango railroad is making additions in the state of Chihuahua and has let a contract for an extension southward from its present terminus into the mountains of Durango. Other small additions were made during the year. The Southern Pacific is building northward from Guadalajara toward the coast and recently put in operation 34 kilometers from Orendain station on the Mexican Central to Tequila, Jalisco.

Chihuahua

This state ranks among the first in the number of new enterprises started during the year under review. Some of the old producers ceased operations, but new ones have arisen to replace them. The principal production, as in former years, came from the districts of Parral and Santa Eulalia. The Lluvia de Oro in the southwestern part of the state is closed down during the reconstruction of the milling plant; it produced some gold during the year. The Dolores mines continued to increase their gold production. The Rio Plata Mining Company operating at Santa Barbara in the southwestern part of the state showed a large increase of production. The Cienega gold mine, a short distance south of Morris in the district of Rayon is said to have taken out with arrastres $12,000 in gold in a period of nine days. This mine has been worked for only a year. A number of promising gold prospects were recently located in the extreme southwest part of the state.

The Republica mine was a steady producer. The mines at Candamena are producing 20,000 oz. of silver per month. The Palmilla mine is again listed among the producers. The Watterson Gold Mining Company, Ltd., is still a constant producer. The Batopilas mines furnished their usual quota of silver. Numerous other properties are developing and sending out small shipments. The mines at Yoquivo are again working. The Reina mine near Cusihuriachic, formerly a bonanza, again started working.

The district to the east of the city of Chihuahua, along the line of the Kansas City, Mexico & Orient railroad is having a boom, and quantities of zinc ores are shipped to smelters in the United States. The gold mines at Guadalupe, formerly large producers, are being reopened. Nearly all the large properties at Parral were recently shut down. The Chihuahua smelter has three stacks in operation, and is shipping a car of lead bullion daily.

Coahuila

Activity in zinc properties was marked during the year. The coal mines produce their usual quota. The silver-lead mines of the Sierra Mojada district are reported to be shipping an aggregate of 8000 tons per month after a long period of comparative idleness. The several smelting plants situated in this state were in continuous operation during the year.

Durango

The various mining camps in this state showed a very considerable amount of activity during the year and I have no doubt that the production of metallic products will show a material increase as compared with that of the preceding year. The mines in the district of Guanacevi shipped 2000 tons of ore to the smelters, and bullion and zinc precipitates to the amount of about 68,000 pesos monthly. The most active mines in the Topia district are: San Jose de los Llanitos, La Portilla, Cardena and San Ramon. In the Mapimi district the producing mines are: Ojuela, owned by the Penoles Mining Company, San Jose; El Suerte, and several others. The Boca del Cobre mines in the Nazas district were large shippers of ore to smelters. The Promontorio mine in the Papasquiaro district is in operation. In the Tamazula district the Fernando Mining Company continued working during the year. The Las Reyes mine is reported to have been sold. The survey for the extension of the Durango & Sinaloa railroad, from Culiacan was completed to this district. A large number of mines in several districts are about to resume operations while many properties in various parts of the state were in process of development during the year.

Guanajuato

The various mines composing this camp showed increased activity during the year. At present it has a combined monthly production of more than 70,000 tons of ore with an approximate value of $1,500,000. The principal producing companies in the Guanajuato camp are: the Guanajuato Reduction and Mines Company; Perigrina Mining and Milling Company; Guanajuato Amalgamated Gold Mines Company; Guanajuato Consolidated Mining and Milling Company; Pinguico Mines Company; San Matias Mining and Milling Company; El Cubo Mining and Milling Company; Guanajuato Development Company; Mexican Milling and Transportation Company, operating the San Prospero and Nayal groups; and the Santa Natalia Mining Company. Other companies are developing mines and shipping ores to smelters. At Peñon Blanco the Benito Juarez Mining Company completed and placed in operation at the close of the year, a 200-ton cyanide plant. At Jesus Maria the Amalgamated Gold Mining Company completed the foundations for a mill; at San Felipe the Providencia San Juan de la Luz is shipping high-grade ores and continues to be a large dividend payer. Other mines in various parts of the state are making shipments.

Guerrero

The mining interests in this state, on the west coast, are still suffering from lack of transportation facilities. Guerrero, however, continued to produce a large quantity of silver, the Campo Morado district production alone being estimated at 300,000 pesos per month. The Socavon del Rey, La Borda, and La Conquistadora mines in the Taxco district are reported to be in bonanza. Considerable zinc is produced and a number of mills are under construction. General conditions are, however, in a state of depression owing to the low price of silver.

Hidalgo

The usual production from the great mines of this state continued. The districts of Pachuca, Zimapan, and Real del Monte are reported as fairly prosperous. The new mill of the Real del Monte of which the United States Smelting, Refining and Mining Company is the principal owner, is ready for operation. The Santa Gertrudis Company produces approximately two and one-half millions of pesos annually. The San Rafael is another large producer. The Blaisdell Coscotitlan Syndicate 500-ton tailings mill is ready for operation.

Jalisco

Mining in this state continued to show increasing activity during the year. Several new mills were placed in commission, and many mines increased their shipments to the smelters. The opening to traffic of 34 kilometers of new railroad by the Southern Pacific was announced on Dec. 10. The completed portion extends from Orendain on the Mexican Central to Tequila. An additional section is promised by March, 1909. Trains are now running on the Manzanillo branch of the Mexican Central from Guadalajara to Colima. Lignite of good quality has been discovered at Zapotiltic on the Mexican Central.

Mexico

Much activity was reported from the vicinity of Toluca, principally in the districts of Sultepec, Temascaltepec, and Taxco. In Zacualpan, the Alacran, Carhoncillo, and Seguranza mines are in bonanza. In the El Oro district, the El Oro Mining and Railway Company, Ltd. treated a large amount of ore with good results. The Esperanza mine opened up ore of high value and production continued to increase. The combined value of the product of the El Oro Mining and Railway Company, the Mexican mines and La Esperanza, for the first six months of 1908 was 9,285,782 pesos.

Michoacan

The El Oro district lies partly in this state. The Dos Estrellas in this district is the largest producer. The Ocotes Mining and Milling Company is developing property in the Tlalpujahua district. There are several other properties which ship to the smelters.

Oaxaca

The principal mining camps of this state maintained a fair production. The principal districts in the order of their importance, are Taviche, Sierra Juarez, Ocotlan and Ejutlan. Oil was found by prospectors south of Ejutlan, near the coast. A number of milling plants are in process of erection.

San Luis Potosi

Increased activity in the zinc-silver industry was noted. The production of sulphur now amounts to 2000 tons per month, which is exported to foreign countries from the port of Tampico. Exploration for oil in the Huasteca country was continued. The Tiro General mine at Charcas shipped 4000 tons of ore per month to the smelters at Aguascalientes during the early portion of the year.

Sinaloa

The government reports 51 mines as working during the year with a production approximating six million pesos. Railroad building was active. Many new mining projects were started.

Sonora

Notwithstanding the general depression prevailing in the financial world, mining in this state showed a marked advancement during the year. Among the many notable achievements of the last 12 months are: The completion and placing in commission of the 2000-ton concentrating plant at Nacozari. The smelter at Fundicion, in the Alamos district, commenced operation in June. The completion of improvements and the partial resumption of smelting at the works of the Greene-Cananea company was another event of the year. Many new properties were under development, while the old producing silver and gold properties maintained, and in some instances exceeded their previous production. In the southern and central portions of the state a scarcity of labor prevailed. Railroad building was actively prosecuted, some new mileage was opened to traffic, and more is promised for the early

months of 1909. More attention was paid to prospecting for gold mines than in previous years.

Zacatecas

In this state the mining industry passed through a period of extreme depression. The El Bote mine has rich ore; the Bohemia mines at Sombrerete are in bonanza, and other properties are developing. The Magistral smelter with a capacity of 300 tons per day was put in operation during the year. A railroad is building from Gutierrez station on the Mexican Central to Sombrerete.

Territory of Tepic

There are a number of mines, in this territory, the property of Americans, but most of them are as yet in the development stage. Since July, prospecting was reported to be very active, particularly in the western part of the province near the line of the proposed new railroad now being built by the Southern Pacific. The producing mines in the territory are those of the Buenavista Company; those of the Castellana Consolidated Mining Company, operating the Certuchena, Rondanera Soledad and others; San Jose de Ventanas, Santa Fe, La Libêrtad, El Macho Rucio, Ventanas, Pinadillo, La Mexicana, Palmera, Mina del Monte and Zopilote. The San Miguel and Zapotan mines are not producing at present.

The Transvaal

By W. Fischer Wilkinson*

During the year 1908, the mining industry of the Transvaal expanded considerably, both as regards gross production and profits. Several new mines commenced crushing and many producing companies increased during the year their reduction plant and output. Comparing the month of September, 1908, with December, 1907, there was a net increase of 242 stamps in the Witwatersrand district. The tonnage crushed per stamp was considerably increased due to increased weight and to the assistance given by tube mills. The statistics for these two months are given in an accompanying table:

INCREASE OF MILLING IN THE WITWATERSRAND

	Stamps at Work.	Tons Milled.	Tube Mills.	Tons per Stamp Month.
Dec., 1907	8,383	1,349,580	67	161
Sept., 1908	8,625	1,534,755	102	178

The new companies contributing to this increase were the Aurora West United with 60 stamps, and the West Rand Consolidated Mines with 80 stamps, both of which companies made their first return during September. Of the old companies the Ferreira Deep added during the year 40 stamps to its reduction plant; the Durban-Roodepoort Deep, 40 stamps; and the New Kleinfontein, 20 stamps.

In October, the production was still further increased by the entry into the list of producing mines of the Jupiter and Simmer Deep, which have a joint 300-stamp mill, and of the Cinderella Deep, which has a 50-stamp mill. In November, the Geduld company, which also has a mill of 50 stamps, made its first return. At the end of the year there will probably be about 9000 stamps dropping in the Witwatersrand district.

Production

Adding the estimated production of the outside mines, the total gold production of the Transvaal for 1908 will have in round figures a value of £30,000,000, which is, of course, a record production and represents 35 per cent. of the world's gold production, assuming that other countries maintain the production they made in 1907. The accompanying table, compiled from the returns of the Chamber of Mines, shows the gold production of the Transvaal from 1884 to 1908:

TRANSVAAL GOLD PRODUCTION.

Year.	Witwatersrand District. Tons Milled.	Value.	Value Per Ton Milled, s.	Outside Mines Value.	Transvaal Total.
1884–9	1,000,000	£2,440,000	48.83	£238,231	£2,678,231
1890	730,000	1,735,491	47.4	134,154	1,869,645
1891	1,154,144	2,556,328	44.2	367,977	2,924,305
1892	1,979,354	4,297,610	43.4	243,461	4,541,071
1893	2,203,704	5,187,206	47.0	293,292	5,480,498
1894	2,830,885	6,963,100	49.2	704,052	7,667,152
1895	3,456,575	7,840,770	45.2	728,776	8,569,555
1896	4,011,697	7,864,341	39.2	739,480	8,603,821
1897	5,325,355	10,583,616	39.74	1,070,109	11,653,725
1898	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48.84	661,220	15,728,693
1900	459,018	1,510,131	65.82		1,510,131
1901	112,006	1,014,687	49.25	81,364	1,096,051
1902	3,416,813	7,179,074	42.00	74,591	7,253,665
1903	6,105,016	12,146,307	39.79	442,941	12,589,248
1904	8,058,295	15,539,219	38.16	515,590	16,054,809
1905	11,160,422	19,991,658	35.82	810,416	20,802,074
1906	13,571,554	23,615,400	34.8	964,587	24,579,987
1907	15,523,229	26,421,837	34.04	981,901	27,403,738
1908*	18,000,000	28,750,000	31.8	1,210,000	29,960,000

*The December figures are estimated. Owing to the practice on some mines of keeping large gold reserves, which may or may not be declared in December, it is not possible to make a close estimate. The gold reserves at the end of November were about 118,000 oz. of a value of £500,000.

Large as the figures for 1908 are, a further expansion in the early months of 1909 may be confidently awaited, as there are several companies with reduction plants in course of construction. Among these may be mentioned the Knights Central, which will start with a mill of 100 stamps, the Vogelstruis Consolidated Deep with a mill of 40 stamps, and the Bantjes with 35 stamps. The Village Deep is increasing its plant, and the Robinson is adding to its reduction plant stamps to crush 12,000 tons of Main Reef per month.

The only company that retired during the year 1908 is the Bonanza, a small property which had a life of exceptional prosperity. The mill was bought by the Robinson Central Deep mine and the stamps are now crushing ore from that property. There are two other mines nearing exhaustion, namely the Champ d'Or and the Jubilee. It may be remarked that when mines are worked out, the mills are still available to crush ore from other mines, so that the productive power of the field as a whole does not necessarily suffer from the exhaustion of a mine.

Eastern Rand Developments

The most noticeable development of new ground that took place during the year was in the eastern section of the Rand. The successful results obtained by the New Kleinfontein, the Van Ryn, and the New Modderfontein mines, which are the most eastern producing mines, led to increased activity in this neighborhood, and the Main Reef series may now be regarded as proved without doubt as a payable ore deposit as far as Geduld. The extension of the reef farther east or south is still something of a problem; but that it will be traced farther in the near future seems certain. The Witwatersrand beds are in this district covered by a younger formation, so that the exact position of the Reefs and of the lay of the beds has to be determined by bore holes.

The theory of the extension of the Rand formation most generally accepted is that the Main Reef takes a turn to the south, running toward the Nigel district. While there is some uncertainty as to its course after leaving Geduld, all doubt as to its position and value as far as that farm has now been cleared up. The Geduld mine is now one of the crushing mines, and active development is proceeding on the Van Dyk, the Brakpan, the Rand collieries, and the Apex.

Below Modderfontein, a new company called the Modderfontein B. Gold Mines, Ltd., was recently formed to amalgamate into one block of 1467 claims, of which 67 are north of the outcrop, the claims of the Modderfontein Extension, Ltd., North Eastern Claims, Ltd., Transvaal Land and Mines Proprietary Syndicate, Ltd., and South Eastern Claims, Ltd. This com-

*Consulting mining engineer, London

pany is expected to have the reef in no place at a greater depth than 2000 ft. vertical, and the active development of the property will shortly be commenced.

On Daggafontein, another farm in this district, boring operations located the reef and a shaft is projected; and on Cloverfield the sinking of a shaft is also being taken in hand. As an example of the value of the ore met with in this district, recent development returns of the Brakpan and Van Dyk mines may be recorded. At Brakpan, No. 1 shaft is 3098 ft. deep, and three levels have been driven. In No. 1 the reef is displaced by a dike. In No. 2 level a drive of 131 ft. showed over 101 ft. low grade, and over the last 30 ft. 17.44 dwt. over 29.5 in. In No. 3 drive the ore was low grade. In No. 2 shaft the reef was cut at 3695 ft., where it averaged 16.38 dwt. over 81.75 in. In a raise put up 25 ft., the reef which was only partially exposed assayed 18.36 dwt. over 64.8 in. A dike is here met with, and on the other side assays averaged 8.5 dwt. over 52.7 inches.

On the Van Dyk the total lineal development to September 30 was 8954 ft., of which 6114 ft. were on the reef, assaying over this distance 8.47 dwt. over 30 inches.

Although none of the developing mines in the far Eastern Rand has been opened yet on a large scale, sufficient work has been done to demonstrate that good ore occurs and that the district will in the future yield a large gold production. Except for the break caused by the Witpoortje fault there is now a practically unbroken line of mines from Randfontein to Geduld, a distance measured along the line of outcrop of about 50 miles. There are a few gaps here and there in this line where there are no producing mines. Between Randfontein and the West Rand Central there is a stretch not yet developed, and in the West Rand a small length of outcrop belonging to the Roodepoort Gold Mining Company is standing idle. But this will shortly again be worked, an amalgamation with the Roodepoort United Main Reef having been announced in December. In the Eastern Rand there is an unworked piece between what was the Cason (now part of the East Rand Proprietary Company) and the New Kleinfontein. With these exceptions, the Main Reef beds have been exposed and developed over the whole distance from Randfontein to Geduld.

Labor

The decision of the Transvaal government to terminate the employment of Chinese at the mines was referred to in last year's review. At the close of 1907 there were 37,118 Chinese employed, which number was reduced to 12,317 at the end of October. Fortunately the industrial position was not seriously affected by this large reduction of labor, owing to the increased supply of Kafirs. It is partly due to more successful recruiting and partly to a decreased demand for this labor in other parts of South Africa, notably at the diamond mines, that the Rand has not experienced a labor famine as might have been expected. On the contrary, for the greater part of the year the demand for unskilled labor has been easily met.

It is satisfactory to be able to report that the efficiency of the native has undergone improvement, largely brought about, it is claimed, by the good example set by the Chinese. The standard of work, too, has been raised, at all events, at some of the mines. At the Simmer & Jack, for example, a 48-in. hole is now expected from hammerboys in place of a 36-in. hole, and, in the case of machine drilling, an 8-ft. hole instead of a 6-ft. hole. Greater efficiency in unskilled labor was also obtained by extending the period of engagement of natives to 12 months instead of shorter periods which had previously been customary.

While there is no great difficulty at the present time in obtaining a sufficient supply of unskilled labor, anxiety has been expressed that in consequence of the great expansion in the mining industry that is now taking place, the labor question may again become a serious problem. At a meeting of the Knights Deep mine, held in November, the chairman, a manager of one of the larger financial houses, said that the labor question was only temporarily solved, but expressed the hope that an adequate supply of native labor would be obtained from Central Africa and from Zululand and the neighboring territories, from which districts so far only a small number of natives had been drawn. There is also reason to hope that a further economy of labor may be obtained by substituting machine drilling for hand drilling, a change which is dependent on the discovery of a thoroughly reliable machine drill.

Economy in native labor is also obtained by employing unskilled whites and white apprentices on an increased scale. In some of the mills, for instance, natives are excluded, their places being filled by young white men. The extent to which unskilled white labor can be employed is regulated by considerations of cost. The low rate of native wages prevents the white man from competing successfully with the Kafir for the lowest class of manual labor; but for works where intelligence counts, it is different. Here, owing to increased efficiency, he can enter into successful competition with the Kafir, and it is satisfactory to find that those who control the mines are encouraging this competition, and are giving facilities to young men of the country to make themselves efficient miners, enabling them to find employment in positions which were formerly occupied by natives.

The total labor employed in all mines of the Transvaal, that is, including gold, coal, diamond and base metal mines, during September, was: Whites, 20,732; colored labor, 176,129; Chinese, 16,311.

LABOR EMPLOYED IN TRANSVAAL GOLD MINES.

Mines Department Statistics.

		White.	Colored.	Chinese.
1902..	July...	8,162	32,616	
	Dec....	10,292	45,698	
1903..	June..	11,825	66,221	
	Dec...	12,695	73,558	
1904	June	13,113	74,632	1,004
	Dec ..	15,023	83,639	20,885
1905..	June....	16,939	104,902	41,340
	Dec.....	18,159	93,831	47,267
1906	June....	17,959	90,882	52,352
	Dec.....	17,395	98,156	52,917
1907	June...	17,166	111,862	51,517
	Dec....	17,697	129,618	37,118
1908.	June....	18,181	147,557	21,460
	Sept.....	19,077	155,171	16,311

Amalgamation of Companies

During the year 1908 a number of amalgamations of companies were carried through. From one end of the Rand to the other the policy of creating larger units than formerly has been adopted. Whereas the standard size for a mining block used to be 200 claims, the area now selected as a unit is 1000 claims and more. In support of the adoption of this policy, it is urged that larger units produce economy in capital expenditure and a reduction in working costs, principles which will not be contested. The differences of opinion that have arisen have not been so much on the question of the size of a mine area, but on the valuation placed on the different interests included in the amalgamation, and generally on the question whether increased area and increased life, even though accompanied by a reduced cost of working, were worth the price. Many shareholders in a producing mine sufficiently developed to allow of there being no uncertainty as to its future, prefer their property to be worked out to a finish, rather than have a speculative piece of additional ground added at a considerable increase to their capital and consequent reduction in their dividend.

Although economy in working has been the main reason put forward in support of consolidation and amalgamation, the policy has also been largely influenced by financial considerations. In some cases the deep level areas, which have been amalgamated with producing mines immediately above them, have belonged to companies which had either exhausted their working capital, or had not sufficient funds to bring them to the producing stage. The mining houses who controlled them expressed their inability to obtain the necessary capital from the shareholders, or the public, and were not prepared to finance these companies from their own funds. The Simmer Deep, the City Deep, the Knights Central, the Jupiter, and the East Rand amalgamations may be quoted as

examples of consolidation brought about largely for financial reasons. A later example is the proposed amalgamation of the South Nourse with the Nourse Mines, the latter a company which had been not long ago joined to the outcrop mine, the Henry Nourse, an amalgamation which was attended with unfortunate results for the outcrop mine.

The position at the commencement of 1908 was that many deep-level companies were in a desperate financial condition. Their funds were exhausted, or insufficient to bring them to the producing stage. Fresh capital was wanted and was not obtainable, and it was evident that even if fresh capital was obtained it would be a long time before these properties would be able to pay dividends. The adoption of the policy of amalgamation saved the situation. By consolidation with the producing mines the necessity of raising fresh capital was avoided. The shareholders in the deep mines became partners in the dividends of the producing mines, giving in return their ground and whatever cash assets they happened to possess. The producing mines received as compensation for the increase to their capital the prospect of an extended life and were enabled with the funds supplied by the deep mines to work on a larger scale and consequently at a reduced cost of working.

The arguments used in favor of amalgamation mostly employed have been the arguments of longer life and of reduced working expenses which the working of larger areas brings about. There can be no question that the working of larger units tends to economy. There will be obviously a saving in administration expenses, while economy will be gained in having larger power plants. Fewer shafts are required, and the development of a mine can be carried out more advantageously with a large than with a small area.

The statistics of the working costs of the mines, which will be referred to presently, demonstrate the advantage of large units.

In principle, therefore, amalgamation into large units is sound. The question whether amalgamation or consolidation is advantageous or not depends on what valuation is put upon the various interests. And it is on this point that differences of opinion as to the justice of the amalgamations that have been carried through have arisen. Valuations are governed by many factors, some of which are arbitrary, such as the scale of operations, capital expenditure, rates of interest assumed in calculating the present value of profits, so that it is not surprising that conflict of opinion should arise as to the fairness of any scheme of amalgamation.

The question is, what is the most economical life of a mine, and the relation between capital expenditure and profits has been the subject of much discussion, and prominent engineers, such as Mr. Kötze and Ross Brown have shown that the economic life of a given area comes inside 10 years. If that is so, the argument of long life, which deep-level interests put so much weight upon, has to be treated with caution by the producing mines. They have to decide whether the present value of the profit to be secured from the deep ground is worth the price demanded, taking into consideration the decreased cost of working that the amalgamation will bring about owing to the increased scale of operations, a result which, it may be noticed, can be secured without amalgamation by devoting some of the profits to extension of plant.

From what has been said, it will be understood that amalgamation schemes require very careful valuation work, and it is only fair to say that the Rand mining houses have, in all the most important consolidations at all events that have been carried through, employed competent engineers to value the various interests involved.

The undesirable feature in these amalgamations is that the sellers are those who practically decide the price. Valuations are made by engineers, it is true, but if the valuation does not agree with the views of the financial house, the business may be dropped. In several cases the complaint has been made that the shareholders in the producing and dividend-paying mines have been forced to become partners in ground of unproved and speculative value without any real necessity. Unamalgamated, such mines had prospects of a certain, though limited prosperous career. The Henry Nourse, the Village Deep, and the East Rand producing companies could all have been worked to a finish without amalgamation. The shareholders in these mines hear of the advantages to be gained by amalgamation, but not the disadvantages, and probably if more prominence had been given to the disadvantages, the shareholders in the dividend-paying mines would have refused acceptance of the respective schemes of amalgamation. Opposers of a scheme have not, however, the same chance of making themselves heard as the promoters, and consequently the financial house, although perhaps representing a minority interest in the producing mine, generally wins the day.

Rand Finance

This may be a convenient place in which to notice the methods employed to restart some of the mines whose working capital has been exhausted. The usual practice is now for the capital to be first reduced by giving the old shareholders one share for each two, three or four held before. The capital is then immediately raised and the fresh capital is offered *pro rata* to the shareholders with options over further shares at varying prices and payable at varying dates, the controlling house taking options over some of the shares. Examples of this form of reconstruction are the Bantjes and Vogelstruis Consolidated Deep.

It seems a pity that the finance of mining companies cannot be conducted on simpler lines and that the complicated system of reducing capital and then immediately raising it, coupled with all sorts of option conditions, cannot be avoided. These complicated methods of finance, approaching almost to juggling, are exceedingly puzzling and unpopular with the ordinary shareholder.

Another matter connected with Rand finance that seems worth calling attention

LIST OF RECENT AMALGAMATIONS ON THE RAND.

Date of Amalgamation	Name of Enlarged Company.	Companies Absorbed.
1906	Simmer Deep: 1034 claims.	South Geldenhuis Deep. South Rose Deep. Rand Victoria Mines. Rand Victoria East.
1907	Jupiter: 500 claims.	Simmer West.
1907	West Rand Consolidated: 1785 claims.	West Rand Mines. Violet.
1907	Randfontein Central. 477 claims.	Randfontein Block A. Mynpadit Randfontein. West Randfontein.
1908	East Rand Proprietary Mines: 2896 claims.	Dreifontein. Angelo. Comet, Cason, H. F. Company, Angelo Deep. Dreifontein Deep (part of). Hercules, and sundry claims.
1908	Consolidated Langlaagte: 501 reef claims.	Croesus Deep.
1908	Knights Central: 893 claims.	South Knights.
1908	City Deep: 1084 claims and farm.	City Deep. South City. South Wolhuter. Wolhuter Deep. Farm Klipriversberg.
1908	Village Deep: 529 claims.	Turf Mines.
1908	Witwatersrand Deep.	Dreifontein Deep: 125 claims.
1908	Chimes West.	Benoni.
1908	Van Ryn Deep: 754 claims.	Klipfontein Deep.
1908	Modderfontein B. Gold Mines.	Modderfontein Extension. Northeastern Claims. Transvaal Lands and Mines. Proprietary Syndicate. Southeastern Claim.
PROPOSED AMALGAMATIONS NOT YET COMPLETED.		
1908	Nourse Mines.	South Nourse.
1908	Crown Reef: 1852 claims.	Crown Deep. Crown Reef. Paarl Central. Langlaagte Deep. Robinson Central Deep. South Rand and Central Deeps.
1908	Roodepoort Gold.	Roodeport United. Main Reef.

to, as it is something of an innovation, is the building up of a reserve fund out of profits and its investment in a new undertaking. The Jumpers mine is an example of this. This mine is nearing exhaustion, but the profits are not being fully distributed to the shareholders, but reinvested in another mine in the East Rand, the Chimes West and Benoni. It seems to me that shareholders would much prefer to make their own choice in selecting an investment for their profits. This practice of investing profits in outside properties, as well as the practice now largely prevalent of increasing the reduction plants out of profits instead of by an issue of new capital, is evidence that the Rand mining houses, having failed to get money from the public for new enterprises or for extensions, have adopted a policy of making the shareholders in the dividend-paying mines find the money.

Mining Industry Commission

The report of this commission was issued in March. The commission had been appointed by the government to inquire in what direction, and how far, the use of mechanical appliances could be extended on the mines, and what effect such extended use would have upon (a) the employment of white labor, (b) the cost of production (c) the demands of the mining industry for native labor and (d) on the mining industry generally. The commissioners were also asked to report on the means best calculated (a) to increase the employment of white labor on the mines, (b) to secure the more efficient use of native labor and (c) generally to secure greater economy and efficiency in mining operations.

The commissioners were not unanimous in their findings and there was a majority report representing the views of F. H. P. Creswell, a prominent advocate of all-white labor for the mines, and a minority report, which expressed the views of the average mining man on the Rand, which are that the present condition of things do not call for any drastic changes by legislation. The government appears to share this opinion. At all events no action has been taken to carry out the principal recommendations of the majority report.

Other Minerals

The following statistics of the Mines Department give the production of other minerals in the Transvaal for the statistical year 1907-1908:

	Value.
Copper ore	£32,400
Galena	21,761
Tin ore	81,677
Magnesite	900
Flint	12,350
Lime	52,474
Miscellaneous	17,364
	£218,926

Stope-drill Competition

During the latter end of 1907 a competition for machine-stope drills, promoted by the *South African Mining Journal*, was held, and excited much interest. Eight different makes of drill entered, the prize being awarded to the Gordon drill. The advantages to be gained from such trails are recognized by the mines, and a further competition on a larger scale is being organized by the Chamber of Mines to take place about April, 1909. The competition is expected to last more than six months, so that a thorough testing of the competing drills may be made. Entries for this competition closed on Dec. 31, 1908.

The object of the competition is to obtain a small drill, weighing less than 100 lb., that can be used in narrow stopes. The first prize of £4000 will be awarded to that drill for which the total cost, when divided by the total footage drilled by all machines of that entry during the competition, is least. There will be a second prize of £1000, besides special prizes for the drillmen. Having regard to the great saving in native labor that the discovery of a suitable drill would bring about, the competition promises to be of great importance to the industry.

OPERATIONS OF SEVERAL MINES SELECTED AT RANDOM (CHAMBER OF MINES)

		Yield.		Costs.		Profit.	
		s.	d.	s.	d.	s.	d.
Crown Reef	1907	38	4	18	10	19	6
	Sept. '08	31	11	15	4	16	7
Ferreira	1907	49	4	21	5	27	11
	Sept. '08	44	11	17	10	27	1
Knights Deep	1908	26	11	16	10	10	1
	Sept. '08	25	3	13	9	11	6
New Primrose	1907	34	6	20		14	6
	Sept. '08	31	2	17	4	13	10
Robinson	1907	62	4	18	2	44	2
	Sept. '08	49	10	11	7	38	3
Simmer & Jack	1908	32	3	16	2	16	1
	Sept. '08	31	2	11	11	19	3
Village Main Reef	1907	33	5	19	1	14	4
	Sept. '08	29	6	16	2	13	4
Robinson Deep	1908	36	2	21	5	14	11
	Sept. '08	34	3	15	1	19	2

Metallurgical and Mechanical Improvements

In metallurgical work several improvements appeared during the year. The new stamp batteries are being equipped with heavier stamps than formerly, the latest mills having stamps weighing 1650 and 1700 lb. Appliances are being put in for dewatering sands. A 15-ft. rotary sand filter, after the designs of W. A. Caldicott, is now running at the Simmer & Jack, and others are to go up at the new Simmer Deep plant. Attention is being paid to the removal from the tailings pulp by a magnetic separator of metallic iron, which otherwise accumulates in the tube mill. At the Robinson Deep a magnetic conveyer belt pulley is going in to pick out broken drill ends, etc., so as to keep them out of the mortar boxes. At the Bantjes mill the plates are to be placed in a separate building, while an outside stockpile and belt system will allow of reduced ben construction.

Warm solutions for slime treatment are doing well, and the system will probably be extended. At the Simmer Deep plant a large vacuum air pump, drawing 420 cu.ft. per min. has been installed and connected up to the sand-leaching pipes, so as

DIVIDEND LIST OF TRANSVAAL GOLD MINING COMPANIES.

Year.	Dividends.	Year.	Dividends.	Year.	Dividends.
1887	£12,976	1894	£1,532,284	1901	£415,813
1888	112,802	1895	2,046,852	1902	2, 121,126
1889	432,541	1896	1,513,682	1903	3,362,237
1890	254,551	1897	2,707,181	1904	3,928,487
1891	334,698	1898	4,864,973	1905	4,837,539
1892	901,470	1899	3,109,041	1906	5,735,161
1893	955,358	1900		1907	7,131,612

New Gold Law

A draft of a new gold law was published early in the year and met with considerable adverse criticism. The law was then referred to a select committee with the result that a gold law has been agreed to and is expected to come into force on Jan. 1, 1909. Although not entirely satisfactory from the point of view of the mining community, it has been accepted as an improvement on the old law. It is more liberal than the former law as regards prospecting. The principle of open prospecting has been agreed to by the govern-
ment, but its application is limited to government land and private farms not beneficially occupied.

Dividends

The dividends paid for the first half of the year amounted to £4,085,694, of which amount £3,975,071 was paid by 42 companies in the Witwatersrand district and £110,623 by three companies in the outside districts. The second half-year will show a considerable increase; and the total dividends for the year may be expected to be about £8,500,000.

to drain charges thoroughly and draw large volumes of air through the sand.

Electric stamp driving is carried on at some mills, some of the mines obtaining their power from their own central station while others purchase from an independent supply company. H. C. Behr's dense-air system is at work at the Simmer Deep mine. The exhaust of a winding engine worked by air at a very high pressure is delivered direct into the air mains for operating machine drills.

At some of the mines centrifugal pumps are being put in to do the work of the large tailings elevator wheels which are so conspicuous all along the reef. Particulars were given in the JOURNAL of Sept. 12, 1908.

Ontario

By Thos. W. Gibson*

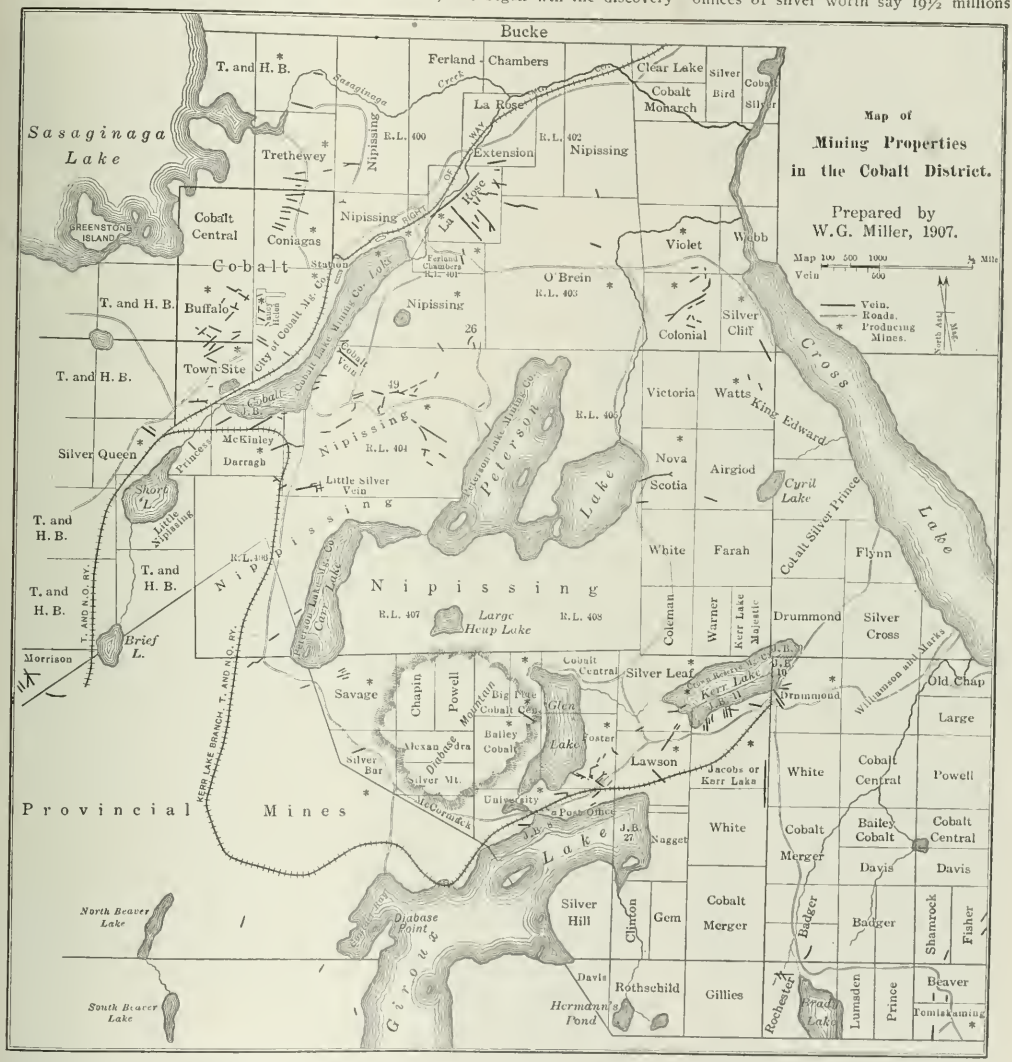
Silver and nickel dominated the mining industry in the province of Ontario in 1908. There have been two eras of silver production; one began wth the discovery of Silver Islet in Lake Superior 40 years ago and was prolonged by the subsequent opening up of the Rabbit Mountain, Badger, Beaver, Silver Mountain and other mines on the mainland. Production came to an end, however, when silver fell from its high estate. Statistics for that period are now unobtainable, so no definite statement can be made either in ounces or value, but the deposits were not so rich as those of Cobalt, and the latter camp has doubtless already surpassed the Lake Superior field in production.

The second era began with the discovery of Cobalt five years ago, since which time a total output of approximately 35 million ounces of silver worth say 19½ millions of dollars has been made. The development of the Cobalt camp is strikingly shown by the following table:

PRODUCTION OF SILVER FROM COBALT.

Year.	Production, Oz.	Value.
1904	206,875	$ 111,887
1905 ...	2,451,356	1,360,503
1906	5,401,766	3,667,551
1907	10,023,311	6,155,391
1908. .	17,000,000	8,200,000
Total. .	35,083,308	$19,495,332

The figures for 1908 are based on the



*Deputy Minister of Mines, Toronto, Ont.

output for the first nine months of the year, and are not likely to be far out of the way. For this period the production was 12,581,510 oz. The shipments for the same time amounted to 17,335 tons; consequently the average silver content of the ores shipped was 725 oz. per ton. This is an improvement over 1907, when the average had fallen to 677 oz. as compared with 1013 oz. in 1906. The improvement is, in part, due to the great richness of some of the veins opened during the year, and in part to the fact that the shipments this year included about 480 tons of concentrates, the product of the mills which several of the companies have erected to treat their low-grade ores.

The sensation of the camp in 1908 was furnished by the Crown Reserve mine. A portion of the bed of Kerr lake, containing about 23 acres, had not been staked out as a mining claim notwithstanding it was in juxtaposition to such mines as the Drummond, Kerr Lake, Lawson and Foster. In 1906 the Ontario government offered the parcel for sale to the highest bidder. The best offer received was $52,000, which was not considered high enough. Offers were invited a second time with the condition added that the purchaser should pay 10 per cent. royalty on the value of the output at the mine. The bids this time went up to $178,500. The buyers (a syndicate of Montreal brokers) formed a company, and for a time the shares sold for 15 to 20c. A diamond drill located a vein which for size and richness in native silver is probably not surpassed in the camp. Shares are now worth about $2.70, and the government's decision to reserve a royalty will undoubtedly put a large sum in the treasury of the Province.

The Producing Mines

The leading mines of 1907 continued their production in 1908, and most of them increased their output. Among those were Nipissing, La Rose, Coniagas, O'Brien, Kerr Lake, Trethewey, Silver Queen, Temiskaming, Temiskaming & Hudson Bay, Townsite, Right-of-Way and others. Crown Reserve was the chief producer added during the year. Temiskaming came well to the front, and is of interest from the fact that its leading vein is in the Keewatin formation, which at Cobalt is less prolific in silver-bearing ore than the conglomerate.

Most of the ore is still shipped out of the camp for treatment, the low-grade or "screenings" going principally to Denver, Colo., where it has been found suitable for mixing with ores from certain of the Western mines. Low-grade ore in Cobalt contains 100 to 150 oz. per ton. The high-grade ore which carries up to 7000 and 8000 oz. per ton is treated principally at the Canadian Copper Company's smeltery at Copper Cliff, and the Deloro Mining and Reduction Company's works at Deloro, both of these plants being in Ontario. The latter is owned chiefly by the proprietors of the O'Brien mine. The Coniagas smeltery at Thorald on the Welland canal, went into commission during the year, and operated on the product of the Coniagas mine.

There were no labor troubles at Cobalt in 1908, but the declining value of silver undoubtedly had a tendency to lessen production. The cost of producing silver is put by some of the leading Cobalt mines at 9 to 10c. per oz., so that even at 48 or 49c. there is a good margin of profit.

That the mines of Cobalt yielded nearly 60 per cent. more silver than those of any one State in the United States even at low silver prices is proof of the remarkable character of the deposits.

Outlying Districts

Extensions of the Cobalt silver field continue to be eagerly sought for and several have been found. The chief of those are: (1) South Lorrain; (2) Montreal river; (3) Everett and Miller lakes; (4) Gowganda lake.

South Lorrain is a patch of unsurveyed territory on the west shore of lake Temiskaming, and south of the township of South Lorrain proper. The formations are similar to those in the vicinity of Cobalt. Most of the promising veins have been found in the Keewatin but good silver ore has also been obtained from veins in the diabase. The chief properties in South Lorrain are the Keeley (H.R. 19), and the Haileybury Silver Mining Company.

The Montreal river runs in a southeast course for many miles before falling into lake Temiskaming, and about 40 miles northwest of Cobalt, in James township and vicinity, some good finds of silver have been made. The geology is similar to that of Cobalt except that the diabase is more prevalent, and in this the silver-bearing veins chiefly occur. Numerous claims have been staked in James, Smyth and Tudhope townships and also in Hubert, Silver, Bloom and other lakes. The Otisse, Downey, Gifford, Currie and other claims in the district and the Darby and White groups at Maple Mountain have promising showings. The last-named has been acquired by the Canadian Ores, Ltd., an English concern.

Miller and Everett lakes lie farther west in the Temagami forest reserve, and a number of excellent discoveries were made here and also at Gowganda lake, still farther west, whence some very fine samples of native silver have been brought during the year, resembling the bonanza finds made at Cobalt in 1903 and 1904. Gowganda claims most attention at the close of the year as the new silver field. "Snowshoe" staking is actively going on at present, and the coming of spring will undoubtedly see a big rush. Careful observers, comparing conditions with those at Cobalt, doubt whether the veins in any of these fields will prove so rich or permanent.

Manufacture of Cobalt Oxide

The cobalt-oxide industry suffered from the excessive supply of cobalt ore thrown on the market as a by-product from silver smelting. The world's consumption of oxide annually falls far short of the production from the mines of Cobalt, and consequently the price of oxide fell from $2.50 to $1.40 per lb. The only relief is on a widely extended use for cobalt, which is, at present, chiefly employed in making the color known as cobalt-blue.

Nickel and Copper

The output of the nickel-copper mines of the Sudbury district for 1908 was probably slightly less than in 1907. The general slackening off in the iron and steel trades has lessened the demand for nickel, and during the last quarter of 1908 mining and smelting operations were considerably curtailed. The nickel production of 1907 was 10,972 tons; for the first nine months of 1908 it was 7760 tons. Allowing for the falling off toward the close of the year, the output for 1908 was probably not more than 10,000 tons. The copper production will be about the same as in 1907, say 7000 tons. The leading producers continued to be the Canadian Copper Company and the Mond Nickel Company. The former's works at Copper Cliff were completed and well equipped. Ore was raised mainly from the Creighton mine, which is high in nickel and from the Crean Hill, which is rich in copper. The Mond Company's plant is at Victoria Mines, and its orebodies are at the latter place and in the township of Garson. A new concern, the Dominion Nickel Copper Company, has begun work on the northern range, where it controls a number of important deposits some of which, notably the Whistle, rival in size any yet opened on the southern range. The construction of the Moose Mountain branch of the Canadian Northern railway has provided the necessary shipping facilities, and the company proposes to develop water power on the Wahnapitae river for use in its mines. The parties principally interested are Canadian capitalists.

Iron Ore

Iron ore was produced from the Helen mine at Michipicoten and several deposits of magnetite in northwestern and eastern Ontario, the total tonnage raised being probably about the same as that of 1907, which was 205,295 tons. Search for workable bodies of ore in the extensive ranges of northern Ontario met with some reward. Moose Mountain beyond doubt contains a large quantity of good ore, and at Emerald lake, Steep Rock lake,

Woman river and elsewhere, diamond drill and other work was done on promising prospects. The pig-iron product of 1908 will probably be rather less than that of 1907, owing to the stoppage of the Deseronto and Port Arthur blast furnaces.

Other Minerals

In certain nonmetallic substances, older Ontario is rich. These include petroleum, natural gas, salt, mica, corundum, talc, graphite, feldspar, etc. The first three are obtained from the limestones of Devonian and Silurian age which underlie the southwestern peninsula or that part of the province north of Lake Erie and east of Lakes St. Clair and Huron. The oilfields of Petroler and Oil Springs continue to produce through thousands of wells the average yield of which is not more than one-quarter barrel per day; but the new field of Tilbury East now contributes at least 50 per cent. of the yearly output. In 1907 the total production was 27,621,851 Imp. gal. and in 1908 it was probably about the same, the greater flow of the new territory compensating for the declining yield of the older fields.

During recent years natural gas from the counties on the north shore of Lake Erie has been produced in increasing volume, and is now supplied to a number of cities and towns within reach of distribution. Chatham, St. Catharines, Hamilton, Brantford, Niagara Falls and other places are enjoying this cheap and convenient fuel, and preparations are being made to pipe gas from Kent county to Windsor and Walkerville. Gas still goes in considerable quantity from the wells in Welland to Buffalo, but the domestic consumption is increasing much more rapidly than the export. In 1907 the value of the natural gas produced in Ontario was $756,174, and in 1908 the output, in all probability was greater.

The salt production of Ontario is about $400,000 annually. The seat of the industry is the east shores of Lakes St. Clair and Huron, and the practice is to pump up the salt as brine and evaporate it.

Iron pyrites is abundant in eastern and northern Ontario, and the quantity raised has risen from 7469 tons in 1903 to about 19,000 tons in 1908. A good deal is exported to the United States, but a considerable part of the output is used in the manufacture of sulphuric acid at Sulphide in Hastings county.

The production of construction materials, of which Ontario contains a profusion, goes on steadily. Bricks, lime, stone and portland cement are produced in older Ontario within easy reach of market. Of portland cement the output increased from 2,033 bbl. in 1891 to 1,853,692 bbl. in 1907, and probably a larger quantity in 1908.

In all, the value of the mineral production of Ontario during 1908 will be, say, $28,000,000 valuing the products at their selling price at point of production.

Klondike District

By John Power Hutchins*

The gold production for the Klondike district in 1908 was about $3,300,000. This is slightly more than that of 1907. The following tabulation shows the gold production for Yukon territory, which includes Klondike and several other districts, since the discovery of gold in the Klondike. Most of the gold produced by Yukon territory has come from the Klondike.

GOLD PRODUCTION OF YUKON TERRITORY.

1896	$300,000
1897	2,500,000
1898	10,000,000
1899	16,000,000
1900	22,275,000
1901	18,000,000
1902	14,500,000
1903	12,250,000
1904	10,350,000
1905	7,000,000
1906	6,000,000
1907	3,150,000
1908 (estimated)	3,300,000

These figures show a rapid increase to a maximum output and then a gradual decrease representing a history similar to that of other placer districts. For the past three years the Klondike has been in a transition period. The one-man enterprise has had its day, and now a powerful corporation has control of several of the richest creeks. During these three years preparations have been going on to work these creeks on a large scale with dredges and other machines and a system to supply water for hydraulicking has been in the course of construction. It is expected that this will be finished early in 1909. When operations on a large scale are under way, an increase in the gold output may be expected.

Dredging Ground

The discovery of rich and extensive gravel deposits in the Klondike district in the future is improbable. There is no such intricate and large system of "dead rivers" as in California and the total volume of gravel in the Klondike that may be worked profitably is considerably less than the profitable dredging ground remaining in California, but which can not be mined because of anti-débris legislation. The principal deposits that will be worked are the creek beds and the "white channel."

The "white channel" is what is left of the ancient creek beds; it has a course approximately parallel to the present creeks but at an elevation from about 100 to 300 ft. above them. Where it has not been eroded, this channel usually appears with one rim completely removed. Locally, it is called a "bench deposit." There is one notable exception in the occurrence of the "white channel;" this is the deposit between Lovett Gulch and the Klondike river where the two rims are intact for several thousand feet.

New Methods

There was little novelty in the mining methods introduced in 1908. Dredging was carried on with better results than in 1907. This was due to several causes. Steam thawing was employed on a larger and better scale, and there were fewer attempts to dredge frozen gravel. Stripping had been found insufficient to thaw gravel to bedrock unless carried to such a depth as to leave a shallow gravel section. It had been found that thawing progressed to but a slight depth into gravel below the water level. Draining the gravel with cuts will be applied.

It is expected that stripping and draining with cuts 20 to 50 ft. apart will result in progressive thawing to bedrock, after the thawing of one or more summer seasons, and that this thawed ground will remain unfrozen. It is yet to be determined whether ground thawed during the summer, no matter by what method, will not freeze again during the subsequent winter and so make it necessary to thaw it again every summer. It is certain that gravel which has been stripped, drained and thawed has frozen again on hillsides where there was a southern exposure and where thawing had progressed to a depth of above 25 ft. in one summer. It may also be observed that in many creek beds both in Yukon territory and Alaska, frozen ground is often found even where there is no muck overburden. Frozen ground is also found where gravel is dry and has no overburden of any sort.

The average temperature for the year is considerably below the freezing point. The minimum temperatures are also considerably more below than the maximum temperatures are above freezing. Whether ground thawed in the three to four months of summer will remain thawed during the eight to nine months of winter, unless in some way protected from the extreme cold, is a matter of doubt. It is possible that flooding the thawed ground will protect it from the cold of the air. There would be a penetration of superficial frost to a depth of several feet even if the ground were so flooded. Whether the fact that the heat of thawed ground is reduced by the cold of adjacent frozen ground will have any important bearing, is an important consideration.

Frozen ground has been observed to a depth of more than 220 ft. in the Klondike. This means that between this depth and the surface, the ground temperature is less than 32 deg. F.; otherwise frost would not penetrate to such depths. As

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far as known, no accurate or detailed data as to ground temperatures have ever been taken in the far North. It is entirely probable that investigation will show ground temperatures considerably less than 32 deg. F. Where the average temerature of the air is about 20 deg. F. below the freezing point, it is not inconceivable that the ground may have, after exposure through geologic time, acquired a temperature below 32 deg. F.

It is to be hoped that thawing can be done as anticipated, for the same methods could be applied elsewhere with the opening of much ground, now thought undredgeable because of its frozen condition, for lucrative exploitation. A considerable gold content insures success if thawing can be done cheaply.

Electric Elevators

The operation of the new elevators installed during the year is as follows: Material of the creek bed is driven by hydraulicking with gravity water to a point at the base of a bucket elevator. This elevator lifts most of the material and some of the water to the sluice, the rest of the water being lifted by centrifugal pumps. The elevator and pumps are driven by electric power.

The greatest difference between this machine and those tried some years ago is in the buckets. The new buckets are more powerful and heavier and can, if necessary, excavate material that may have compacted after driving to the sump. The buckets are larger and can therefore handle larger boulders than could any of the older machines.

These elevators were installed in narrow creek beds and on bedrock for which floating dredges are not supposed to be well adapted.

The elevators must be moved occasionally, and it has not yet been determined how often this will be necessary or how large an acreage can be worked at one setting. They can not be called mobile as compared with other placer-mining machines, especially with floating dredges. There is also the difficulty of tailings disposal which is a direct result of immobility. Placer-mining machines should be easily movable for two important reasons; they must keep up with the excavation and out of the way of the tailings.

This type of machine is said to have worked well during part of 1908. The year was normal in most respects. There had been a heavy snowfall and this melted slowly, allowing considerable ground sluicing of overburden from the creek beds. The rainfall in the aggregate for the summer was about 5½ in. The time of the freezeup was normal.

Labor and the Merger

Since the merger of claims on Bonanza, Eldorado and Hunker creeks there has been practically no winter drifting, and there has been less of this kind of mining on most of the other creeks. There were a few dumps taken out on Quartz creek where "lays" were about 65 to 70 per cent. of the output to the "layman."

The labor supply was augmented by men brought in from Vancouver, and it was ample until autumn, when the demand was greater than the supply. There were no labor troubles, although difficulty was threatened when it was thought that large numbers of cheap laborers would be brought to work for the merged interests. Wages are still high; about 40c. per hour with board is the general pay for unskilled labor.

No paying quartz mines have been developed in the district. For several years work was done on a vein on Bonanza creek, but this has been stopped. At present considerable interest is being taken in some quartz prospects on the Dome, a mountain dominating the topography near Dawson and from the flanks of which several of the richest Klondike creeks radiate.

Hydraulic Mining

Hydraulic mining was carried on as usual; about three times as much material, or about 3,500,000 cu.yd., was washed as in 1907. The cost of hydraulicking did not vary much. It is probable that when water from the new ditch is available, a considerable reduction will be made. A duty of 8 cu.yd. per miner's inch per 24 hours was attained some years ago where about 275 miner's inches was used. Several factors influenced this result, the most important being an 8-per cent. grade, good dump and gravel of a favorable admixture of fine material and having no large boulders. A bedrock favorable for running and maintaining cuts assisted in keeping them close to the banks at all times so that little time was lost in "driving." There will be an opportunity of making some new records in the duty of the miner's inch, when a large volume of water is applied on the White channel.

The Klondike climate, with its extreme cold and the frozen ground, is hard on earth work. It is difficult to maintain roads, dams and ditches. Thawing results in the sloughing off of material from the banks of ditches, and where the course of the ditch is over "muck" and on northern exposures the strictest vigilance is needed to prevent serious breaks.

Costs

The cost of dredging is said to have varied from about 15c. per cu.yd. for a 7-cu.ft., close-connected bucket dredge in unfrozen ground to about 20 to 35c. for similar dredges working in ground originally frozen in part and thawed by stripping and steam thawing. An antiquated dredge of small capacity operating in partly frozen ground showed a cost of about 60c. per cu.yd. Thawing for dredging costs from 10 to 20c. per cu.yd. No figures are yet available for dredging solidly frozen ground, and the cost of thawing such material is not yet known. All the dredging done up to the present time has not been in what is locally called badly frozen ground.

Wood hauled in 16-ft. lengths on wheels cost about $14 per cord. Supplied in large quantities it was sold for about $8 per cord, where it could be rafted and floated down the Klondike river without much hauling.

Less coal was burned in 1908 than in previous years. The coal available has been found to possess poor steam-producing qualities; it makes dirty fires and much ash and clinker. One ton of coal has been found to have about the same calorific value as one cord of wood, and since wood can usually be purchased for less than coal it is generally used.

Dredging in Russia

There were 64 dredges at work in the Urals and the Yenisseisk district in 1908, according to the *Torg. Prom. Gazeta.* Of these 25 were in the Urals and 39 in the Yenisseisk jungle, Siberia. Fairly detailed reports have been received on the working of 46 of the dredges, which produced on an average 2 poods 6 funts and 67 solotniks. Their total working hours were 99,406, and they washed 594,405 cubic sajens of sand. The total production of gold and platinum was 99 poods, 28 funts, 21 zolotniks, 17 doli (52,467 oz. Troy). Compared with the preceding year, the amount of ground worked per hour has increased by nearly 15 per cent.

The California and Gulf (excluding the Corsicana) crude oils are, according to *Petroleum Review*, Aug. 15, 1908, the heaviest in the United States, but in both fields there are considerable variations in the specific gravity, especially in the California fields where considerable crude oil as heavy as 12 deg. B. and considerable as light as 30 deg. B. is found.

In 1908 two electric steel-making plants, according to the *Electrochem. and Met. Ind.*, January, 1909, were in operation in the United States. These use Héroult furnaces. In Europe there are 22 Héroult furnaces already in operation or being built; 11 Stassano furnaces; 8 Girod furnaces; 10 Kjellin furnaces, and 10 Roechling-Rodenhauser modified induction furnaces. In the United States a few small Colby induction furnaces are in operation, mainly for experimental work or for demonstrations.

Production of Other Metals and Minerals

Aluminum — Barytes — Borax — Phosphate Rock — Quicksilver — Cyanamide — Statistics of Production — Commercial Conditions

The most important development in the aluminum industry was the cut in the price of that metal, in October, from 33c. to 22@24c. The phosphate output of Tennessee showed a marked decline in 1908. There were important changes in control of properties and several new companies were organized. The barytes industry suffered greatly through lack of demand and foreign competition.

Although the production of quicksilver was practically the same as in 1907, the average price for the year was considerably higher, notwithstanding the fact that the production in California, the chief source of the metal, exceeded the demand. The borax industry was characterized by a year of continued low prices, which caused the closing down of many of the mines in California, the only State in which the mineral is produced. With the building of the plant of the American Cyanamide Company at Niagara Falls, a new industry is introduced in North America.

Barytes in Tennessee

By A. H. Fay*

Little work was done in the barytes industry in Tennessee during 1908. The majority of the mines were closed down the latter part of 1907, and only a few of the very best properties were operated the following season. The price of the ground and floated product was low, and the demand so limited that it has been difficult to place this material on the market at a profit.

While labor is cheap in the South, the actual cost of mining is high, for the reason that the deposits are pockety, uncertain and very irregular in size, which prohibits the installation of steam shovels and a good tramway system. The majority of the workable deposits are at a distance from the railroad, necessitating an average haul of five miles by wagon over very poor roads. This freighting is usually done by the farmers living in the immediate vicinity of the mine at the rate of $1.25 per long ton for a five-mile haul.

The mining as carried on in this section (Sweetwater) is all open-pit work, with pick, shovel and wheelbarrow. The barite occurs as nodules in a tough residual clay, and it is necessary to use some powder to break the heavy clay. The mining cost varies from 75c. to $2 per long ton, depending largely on the amount of ore in the clay, and the depth of the overburden. The royalty is usually 25c. per ton.

A very large percentage of the ore mined from these clay deposits has a scale of limonite inclosing the barite, which on account of the small difference in specific gravity of the two minerals, is very hard to separate by the present milling method, i.e., jigging. Unless a good separation is made before grinding, it is a very difficult matter to bleach the barite thoroughly. There is a field here for much improvement.

Sweetwater District

Most of the mining last year was in the Sweetwater district, the principal operators being John T. Williams & Son, W. D. Gilman & Son and R. B. Doherty. The output, however, was very small. A portion of the raw ore was shipped to St. Louis. Gilman & Son operated their plant in a small way most of the year. In addition to their plant for bleaching barytes, they have a small plant for manufacturing about one ton of barium-carbonate per day.

A little work was done in Cocke county near Wolf creek, in what is known as the French Broad district. There are at least two good properties in this county, one owned by the Commercial Mining and Milling Company, which produces a very white, crystalline ore, occurring as a vein in quartzite. The other one is owned by John T. Williams & Son and has been opened enough to insure a large tonnage of cheap ore from a 7-ft. vein between sandstone strata.

At Bristol, Tenn., John T. Williams & Son remodeled their bleaching plant; took out the bur mills and added tube mills for fine grinding. The capacity of the plant is 30 tons of finished product per day. It was in operation only about one-quarter of the year. A plant for the manufacture of barium-chloride was built which has a capacity of 10 tons of crystals per day. The crude material used in the manufacture of the barium-chloride consisted largely of jig tailings, slimes and very irony ore. The ore is mixed with coal and given a reduction roast in an 80-ft. rotary cement roaster, yielding a mixture of barium sulphide and carbonate. This is leached with hydrochloric acid, which is also manufactured at the plant. The chloride liquor is then filtered, purified by a secret process, evaporated to saturation point and then allowed to crystallize.

The barytes industry in the United States is not large, and it is a very difficult matter to compete with the foreign manufacturers. There is undoubtedly a large amount of ore in western Tennessee, North Carolina and northern Georgia, and to make the most out of these natural resources it will be necessary to evolve a more economical and efficient milling and bleaching system.

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Borax

Although California is the only State in the United States which produces the borates commercially, the prices for borax have fallen so low that most of the mines have ceased operations entirely; indeed nearly all of them have been closed down for a year or more, with little expectation of starting up again for some time. In some instances the plants have been removed altogether, and the properties closed for good; this is particularly the case in the neighborhood of Daggett, San Bernardino county, where the low-grade marsh muds, or superficial deposits, were being worked. Even the old colemanite mine at Calico, for many years the most productive mine in the State, has been permanently abandoned, as it has been virtually worked out by the Pacific Coast Borax Company. Some of the companies operating in that district produced in 1907, but none of them did during 1908. The companies which were working in Ventura county also closed down their properties in 1907, and they will remain idle indefinitely, for the long haul to market makes the cost of production too expensive in that region.

Refined borax, which now sells at about four cents a pound, brought about seven cents for a long time. Some of the companies made very little profit even at the latter figure and when so marked a reduction occurred in 1907, there was nothing for them to do but quit work.

It was about August, 1907, when the Pacific Coast Borax Company reduced the prices of the manufactured product; very shortly after that all the borax properties of the State, with the exception of the Lila C. mine belonging to the Pacific Coast Borax Company in Inyo county, ceased operations. In August, 1907, this company ceased operations entirely at Daggett and Calico in San Bernardino county, removed its plant, and commenced its activities in Inyo county. This move had been contemplated for several years, during which period the mine was being developed; so when the new railroad near the mine was com-

pleted the company concentrated its efforts at the new property. The deposit is a very extensive one, and being well developed, is in a position to make even a much larger annual output than the demand requires. The grade of ore mined is high and the facilities excellent for working, though labor is high in that region. The company being enabled to produce largely at less cost than formerly, was enabled to reduce prices, and thus put its competitors "out of business." Those companies which ceased producing in 1907 were the Western Borax Company, of Inyo county, the American Borax Company, the Western Mineral Company and Palm Borate Company of San Bernardino county, and the Columbus Borax Company and Frazier Borate Company, of Ventura county. None of these resumed operations in 1908 at former points of production, though some have exploited new fields.

There are many known borax deposits in the Death valley region; several of these are controlled by the Pacific Coast Borax Company, but others which with the present means of transportation would not pay, are still unlocated. The fact is that there has been an overproduction; so the larger companies are trying in every way to increase the use of borax products, and have done some experimenting in order to find new uses for boron compounds.

The only new properties of note are those of the Borax Properties, Ltd., a company backed by English capital, which in 1908 bought the property of the Palm Borate Company of Daggett, and also considerable other ground in that vicinity. The company has been engaged for some months in erecting a plant and carrying on extensive operations. The property has not produced any mineral, as only development has been done so far. However, the company expects before long to put its product on the market.

The Sterling Borax Company is the most prominent of the new concerns. It owns the Ventura County mines of the Stauffer Chemical Company, formerly known as the Frazier Borate Company, the mines of the American Borax Company at Daggett, and the new deposit found a year or so ago at Lang station in Los Angeles county. The refining plants at San Francisco, Chicago and New Brighton are all combined in this organization. The deposit is a vein of colemanite of good grade and is in a locality where the cost of production is cheap, as there is plenty of water available and the price of labor and of transportation is low.

The vein varies in width from a few inches to 10 ft. being like most of such veins, of a "pockety" nature and varying more or less in size. The owners of this property state that they are able to compete in output and price with any other mining company of the State. The mine began to produce about three months ago. The product is shipped from Lang's station to Chicago, New Brighton and San Francisco, the ore being shipped crude as mined, and then refined at the points named. About 700 tons monthly have been produced thus far but this amount can be readily increased when desired.

The mines of the Pacific Coast Borax Company and the Sterling Borax Company are the only two properties in the State which produced much borax in 1908. These figures of output are not available, but it is not probable that the total yield for the year was much over 50,000 tons crude.

As stated, under present conditions, there is little or nothing in the borax-mining industry for any companies except those with extensive high-grade properties, near points of railroad transportation, and with the prevailing low prices there can be little profit even for properties with exceptional advantages.

Calcium Cyanamide

In Europe progress in the manufacture of calcium cyanamide has been rapid and satisfactory. There are 11 plants in process of construction, or in operation, the aggregate annual capacity of which is 166,000 tons. The important works at Piano d'Orta, Italy, is being enlarged to increase its production from 4000 to 10,000 tons. In France, the Société Française des Produits Azotés is producing 4000 tons per year at its work at Notre Dame de Briancon. Other works of varying capacities exist in Italy, Switzerland, Germany and England.

The Industry in America

The American Cyanamid Company, with offices at 100 Broadway, New York City, is the exclusive owner of the American rights for the manufacture and use of calcium cyanamide. The initial plant of this company is in course of construction at Niagara Falls, Ontario, and it is anticipated that production will begin early in the spring of 1909. Pending the completion of its plant, the company is filling orders with material imported from Norwegian works. On the basis of 10 per cent. nitrogen content, the initial capacity of the half-unit plant at Niagara Falls will be 20,000 tons per annum. This cyanamide will yield from 12 to 15 per cent. ammonia. It is the intention of the company to follow this plant with others as the demand requires.

The Niagara Falls plant will differ from some works now operating in Europe, in that it will make its product complete instead of obtaining calcium carbide from outside sources. The price of the finished product will be the same as that of Chile nitrate; in Europe the prevailing price is from 5 to 10 per cent. less.

Manufacture of Cyanamide

In the manufacture of calcium cyanamide, calcium carbide is first made from coke and lime in an electric furnace. This product is then powdered, placed in closed retorts, and nitrogen, isolated from the air in the electric furnace, is led through it. This is the Frank & Caro process. The reaction between the carbide and the nitrogen is an exothermic one, and yields free carbon in the form of graphite, which remains distributed in the mass of material, giving it a black color. The equation for the formation of cyanamide from calicum carbide is as follows: $CaC_2 + 2N = CaCN_2 + C$. When lime and coke are employed as raw materials in place of calcium carbide, the reaction becomes: $CaO + 2C + 2N = CaCN_2 + CO$. This is a modification of the original process, on which Frank has secured a patent.

The carbide which will be manufactured by the American Cyanamid Company is expected to have about the following analysis: Nitrogen (expressed as ammonia) 12 to 15 per cent.; free carbon, 10 per cent.; calcium sulphate (land plaster), 25 per cent.; sulphides, phosphides and carbonate, 2 per cent.; iron oxide, 2 per cent. In deference to the requirements of the American trade, free lime is to be eliminated, and the nitrogen content reduced as compared with the foreign product.

Magnesite

The only important commercially utilized deposits of magnesite in the United States are in California, although small veins are found in Nevada, Arizona, Maryland, Massachusetts, and Pennsylvania. The California deposits are mainly in the Coast Range. Quite a number of deposits are known, but only a few are at present being worked; this is mainly due to the fact that the consumption on the Pacific coast is limited and that the material will not bear the cost of transportation to points in the Eastern States, where the magnesite must compete with that imported from Austria, Greece and South Africa. The domestic output, all from California, averages between 7000 and 8000 crude tons annually, worth at the points of production from $3 to $3.50 per ton. The present importations of crude and calcined magnesite to the United States amount in value to from $850,000 to $900,000 a year, and, of magnesite in the form of chemicals to between $30,000 and $40,000 a year. The largest quantity im-

ported comes in the form of calcined, but not purified magnesite. To make one ton of calcined material requires 2.4 tons of crude mineral. The calcined magnesite varies in value from $12 to $20 per ton according to the nature of the roast given the crude mineral. For the manufacture of brick, a much longer roast must be given than when the calcined mineral is to be used in the manufacture of paper from wood pulp, for which purpose most of the domestic material is utilized.

The use of magnesite in its various forms, but especially of the ordinary calcined magnesite, is increasing in the United States, as is shown by the heavier importations each year. The domestic output, however, varies but little, although more is now being used than formerly in making flooring, wainscoting, tiles, and other building material. Its use does not increase materially for furnace linings, as the imported material employed for that purpose can be obtained more cheaply than the domestic. The latter must be shipped from California by rail, while the imports all come by sea. The freight charges by rail are such that the California producers are unable to compete with the foreign at points where the largest consumption occurs. An effort is being made to induce Congress to impose a duty on foreign magnesite, but it is doubtful if this will be accomplished as the domestic producers are so few and the consumers are so many in number. Many deposits in California which are idle and undeveloped would be worked were there any hopes of finding a profitable market for the material. As it is, the few which are being worked are close to lines of transportation and are operated mainly in the interest of the manufacturers of paper from wood pulp or of liquid carbon dioxide.

Only two new deposits became productive in 1908, the one at South Tule in Tulare county, virtually owned by the Williamette Pulp and Paper Company, the other near Winchester, Riverside county, owned by the California Magnesite Company. At the Williamette company's mine, a calcining furnace was erected during 1908, and all the material produced is shipped in the form of calcined mineral, going direct to the pulp mills of the paper company. The deposit at Winchester furnished some material which is utilized in Los Angeles for manufacture of flooring, tiles, drain-boards, wainscoting, etc.

The most important producing mine in California continues to be the mine at Porterville, Tulare county, which is leased by the Williamette Pulp and Paper Company, and superintended by W. P. Bartlett. This mine is fully described, as are its calcining works, in Bulletin No. 355 U. S. Geol. Surv., by Frank L. Hess. For some years by far the largest proportion of the output of California has come from this mine. A few hundred tons per year are mined from the deposits at Cloverdale, Sonoma county, and at Red Mountain, Alameda county. Aside from the magnesite deposits mentioned, little or nothing is being done with the other known deposits of the State. There are now several factories in California which make different forms of building material from the domestic product.

The manufacturers of carbonic-acid gas, who market a liquid carbon dioxide, after calcining the material to obtain their product, dispose of the magnesia residue to the paper mills, where it is changed to a sulphite and used in the digestion and whitening of wood pulp for paper.

Phosphate Industry in Tennessee

By H. D. Ruhm*

The situation in the Tennessee phosphate field during 1908 was fairly well predicted in these columns a year ago when I said "the only possible salvation of the situation as to present prices is in the policy of curtailing production, and, unless the miners get together and consolidate in some way, their shrift is short for the maintenance of recent prosperity."

No such consolidation was effected, and in the meantime the manufacturers increased the efficiency of their mining organizations to such an extent that they now seem amply able to take care of their own needs for several years to come.

This almost entirely cut out the selling of rock on the domestic market, and, with the exception of a few old contracts and a few new sales (mostly for export), shipments in 1908 were lately confined to the operations of the Virginia-Carolina Chemical Company (Charleston Mining and Manufacturing Company), the Federal Chemical Company, the American Agricultural Chemical Company and the Independent Phosphate Company with its allied interests. The shipments from points in Tennessee on the Louisville & Nashville railroad for the years 1905 to 1908, inclusive, are given below in short tons:

Year.	Domestic.	Export.	Total.
1905	285,321	110,407	395,728
1906	379,894	110,514	490,408
1907	523,686	102,996	626,682
1908	320,634	81,123	401,757

While the drop in production was sudden and startling from the high-water mark of 1907, it is still above 1905, showing that, even with all the depression in

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financial circles, shipments still exceeded the 400,000-ton mark, which has come to be considered the normal amount of rock that the Tennessee field should legitimately supply to the territory dependent upon it.

However, as the large bulk of this phosphate rock was mined and shipped by manufacturers for their own consumption, it can well be understood that 1908 was a very lean year for the miners and producers of rock who are dependent upon the sale of their output on the general market. During the year there was a marked falling off in prices. In September, 1907, the prices were for 72 per cent. domestic, $5.25; for 75 per cent. domestic, $6.25; for 78 per cent. domestic, $7; 75 per cent. export, $6.75; 78 per cent. export, $7.50, f.o.b. mines. In September, 1908 (for what few sales could be made), the price ranged around 72 per cent., $3; 75 per cent., $3.50, and 78 per cent., $4.50 for local buyers, with some small contract buying at from 25@50c. in advance of above prices.

Very little phosphate rock was sold at these prices, however, so that during 1908 the principal diminution of available supply took place in the properties of the manufacturers. Since this condition is apt to be in existence for some time to come, it seems more than likely that the largest of the present producers will sooner or later be taken over by some one or other of the organizations representing the manufacturers, so that the ideal condition bids fair to come about when all the mining will be done by manufacturers for their own use, just as most of the iron ore is mined by the steel companies.

This will enable a regular tonnage output to be depended on, making it possible to solve many problems which, on account of the intermittent character that the business has always assumed, have not presented hitherto an easy solution.

The Independent Phosphate Company under the management of T. C. Meadows made a considerable reduction in the cost of output in comparison with that of 1907, so that after paying sinking fund, interest, and providing a surplus, it paid a 10-per cent. dividend on the basis of $3.60 per ton for rock containing 73 to 75 per cent. calcium phosphate.

The organization of the Independent Fertilizer Company was announced during November, 1908, its officers are reported to be Waldemar Schmidtman, president; T. C. Meadows, vice-president and general manager; J. H. Carpenter, treasurer. It is understood that this company has obtained control of most of the independent fertilizer companies in the United States.

This company will undoubtedly be in a more satisfactory position than any other fertilizer company in the country. Through Mr. Schmidtman, it controls enormous potash deposits in Germany, and through Mr. Carpenter and Mr. Meadows

it controls the output of the present phosphate mines of the Independent Phosphate Company, the Richland Phosphate Company, the American Phosphate Company, the Middle Tennessee Phosphate Company, T. C. Meadows & Co., the Mount Pleasant Dryer Company, Ruhm & Gregory, France & Co., the International Phosphate Company and the pyrites mines at Pyriton, Ala.; through Mr. Meadows it also controls the sulphuric-acid output of the Tennessee Copper Company. With the advantages derived from these sources of raw materials the new organization will undoubtedly be able to manufacture fertilizer from $2 to $3 per ton cheaper than anyone else in the business, so that it can furnish the farmer with goods at the same prices as do the other manufacturers and still make a handsome margin of profit over its competitors.

During 1908 the Swan Creek railroad to the Mayfield mines of the Virginia-Carolina company was completed, and that company began supplying a large number of its factories with their blue phosphate which is said to be much superior to the Florida pebble rock, and almost as good as the high-grade Mount Pleasant rock.

The Independent Phosphate Company completed its railroad to Estes Bend and has the machinery on the ground for its plant there. The railroad to Leatherwood starts from Nashville; enough grading has been completed to warrant the expectation that the company will commence operations at Leatherwood by June 1, 1909.

The Middle Tennessee Phosphate Company completed its washer during 1908, and now has one of the best washing and drying plants in the field. The Blue Grass Phosphate Company completed its second washer and dryer, and the Jackson Phosphate Company got its dryer in operation. T. C. Meadows & Co. completed their drying plant and have all machinery ordered for the washer. The Federal Chemical Company is installing washers of improved construction at both the Century and Tennessee branches. The Richland Phosphate Company's drying plant was completed and plans for a washer are under consideration.

The Columbian Phosphate Company, after having paid 10-per cent. dividends every six months for a number of years finally worked out to the point where it was not desirable to maintain a separate organization, so it was taken over by the Petrified Bone Mining Company, an affiliated concern. Both the Maury Phosphate Company and France & Co. have plans under consideration for a washer and dryer.

A new organization known as the Franco-American Phosphate Company has under option a large amount of undeveloped phosphate property and one going concern, the Volunteer Phosphate Company, of Centerville; it is said that this company plans to build two large plants.

The demand for phosphate properties is decidedly strong, and owners of phosphate land are still holding at high prices, although considerably lower prices prevail than were asked in 1907.

The most noteworthy development of the phosphate business during 1908 was the marked tendency to use washers for preparing all grades of rock for market. In the first stages of the phosphate business, washers were extensively used, but as the method of recovery was over screens entirely, and as nothing was recovered smaller than the oversize from screens having ⅛x⅜-in. openings, it was found not only that an enormous percentage of the rock itself was ground up by the logs and screens and carried off with the waste into the settling ponds, but also that a considerable percentage of the clay formed into balls and went with the phosphate oversize from the screens. This clay, which baked into hard lumps during drying, not only decreased the resulting percentage of bone phosphate, but also increased the amount of deleterious iron oxide and alumina in the rock.

The first departure was to abandon all the machinery and to return to the old-fashioned method of simply drying in kilns on cordwood. As the mining progressed and more effort was made to save the portion of the deposit formerly wasted, mechanical dryers of the cylindrical type were brought into use and the entire deposit saved. In this method the rock was also badly pulverized, and much of it was lost with the screenings when the making of high-grade rock was attempted. By screening or by proper selection in the mine, the entire product of the dryer can be saved, but it is of only an average grade, still having a considerable amount of the clay, while a large amount of rock is left in the rejects, or in the waste bank.

Producers then set about designing machinery that would save all of the rock and eliminate all of the dirt, with the result that practically everyone has turned to the combination of washers and dryers, the finest grains of phosphate being recovered by settling in water. It has been demonstrated that the very fine granules can be concentrated so as to contain 75 per cent. or better in phosphate of lime, and that by this method the saving is nearly double that made with the old wasteful method.

The best results so far have been obtained by the Federal Chemical Company which has perfected methods to the point where it has felt justified in spending many thousand dollars in the erection of plants to do this work. The method consists in washing the lump rock over drag conveyers, with hose pipes, passing the small pieces and clay through submerged screens and then through pug mills; by this method the small clay balls are entirely eliminated. The fine waste and water is then pumped into a series of settling tanks from which the fine settlings are washed out and pumped into wet storage bins; the water is then allowed to drain out for several hours, and finally the fine material is passed through cylindrical dryers.

The Charleston Mining Company uses log washers and passes the waste through hydraulic classifiers, the phosphate granules discharging at the bottom to the dryers and the clay passing out at the top to the waste ponds.

The Independent Phosphate Company and its allied companies are proceeding on a combination of the above principles, expecting to accomplish good results with a much smaller outlay of money.

The bad reputation achieved for Tennessee rock during the hurry-scurry methods of 1907 has been almost wiped out by the high-grade product shipped in 1908, and by another year it will be as easy to depend on getting uniform high-grade rock from Tennessee as it is now to get uniform low-grade rock from the Florida pebble district.

The use of Mount Pleasant raw pulverized phosphate rock for direct application to the soil and for mixing with barnyard manure received a great impetus during 1908, and more was shipped for this purpose than ever before. Farmers who have used phosphate rock in this manner for a number of years seem to get good results, and this may prove an outlet for the producer not connected with the fertilizer manufacturers.

Aluminum

The sole American producer, pursuing the stand-pat policy of the Steel Corporation, kept the price at 33c. until Oct. 1. Then the convention among the European producers expired, and there being a great excess of productive capacity in Europe and the accumulation of an immense unsold stock, active competition promptly and naturally developed, and the price fell to 13½@14c. The duty of 8c. per lb. on importation into this country was no longer a protection, and the American producer made successive reductions in its nominal price to 24c., which ruled at the close, but foreign aluminum could be had at 22c. The disruption of the European convention marked the appearance for the first time of aluminum as a commercial metal; not that it was not previously an article of large trade (the world's production in 1907 having been 32,500 metric tons), but previously it had not been an anticle of competitive buying and selling, like copper, lead, tin and the others. It is noteworthy also that in 1908 aluminum sold in Europe for less than copper, pound for pound.

The gold output of Rhodesia for September, 1908, was 48,573 oz., valued at £204,261.

Quicksilver

Reports from producers making about 75 per cent. of the production indicate approximately the same outut in 1908 as in 1907. On this basis we estimate the production in 1908 at 20,000 flasks against 20,932 in 1907.

The average monthly prices of quicksilver are given in the accompanying tables.

AVERAGE MONTHLY PRICE OF QUICKSILVER.
(IN DOLLARS PER FLASK OF 75 LB.)

	1907.			1908.		
	New York.	San Francisco.		New York.	San Francisco.	
		Domestic.	Export.		Domestic.	Export.
January..	$41.25	$39.50	$37.50	$45.00	$45.00	$43.50
February.	41.25	39.00	37.37	45.00	45.00	43.50
March..	41 00	38 50	37.25	45.00	45.00	43.50
April.	41 00	38.50	37.25	45.00	45.00	43.50
May.	41 00	38.50	37.25	45.00	44.53	43.00
June.	41 00	38.50	37 25	44.25	44 00	42.50
July...	41.00	38.50	37.25	44.00	43.50	42.00
August....	40 00	38.00	36 75	43.30	42 70	41.30
September.	40 00	38.05	36 70	42.87	42.25	40.50
October...	40 50	38.19	36.50	46.25	43.50	41.62
November.	45.00	45.00	43.50	46.60	44.50	42.50
December	45.00	45.00	43.50	45 75	45.12	43.12
Year...	$41.50	$39.60	$38 17	$44.84	$44.17	$42.54

Quicksilver in 1908

By H. W. Turner*

The larger part of the domestic production of quicksilver is consumed within the United States. Shipments to Mexico are small, and those to the Orient have practically ceased, since to compete with the Spanish product would reduce the price to a low figure.

Of the domestic consumption, most of the quicksilver is used in the manufacture of vermilion, of scientific instruments, and mirrors. The consumption for amalgamation of gold and silver ores is not large. It is estimated from careful records that not more than 2/10 oz. of mercury is used up in amalgamating the gold and silver of one ton of ore, and in the Alaska-Treadwell and some Mother Lode mines the amount is less. The amount now consumed in placer mining in the United States is not great, but in Alaska it must be considerable.

Metallurgy of Quicksilver

During 1908 there were no improvements of note in quicksilver furnaces. The most popular furnace is the fine-ore tile furnace built by Robert Scott, although some modifications of this have been introduced at New Idria and Oathill. The term *fine-ore* is used here to include both *tierra* (fines) and *granzita* (medium) grades of ore, as both are usually worked together in the same furnace. Coarse-ore furnaces, differing in detail, are in use at several of the mines, as the Newcomb furnace at New Idria, and the Maxwell furnace at the Great Eastern.

The Dennis fine-ore furnace at Blackbutte, Oregon, is not yet in steady operation, and it is doubtful if it is adapted to large operations. In this furnace there are a series of hearths, the ore being dumped from one to the next lower. Producer gas is used for fuel, which is a desirable innovation, as no soot is produced.

The loss in the Czermak-Spirek furnaces in use at Monte Amiata, Italy, is given at 4 per cent. It is altogether probable that the losses in the best American furnaces is much more than this. Now that the grade of ore treated is becoming lower, year by year, it would appear that the subject of furnace losses should receive the attention of a competent metallurgist.

Oil fuel is used at New Almaden, but at New Idria its use has been discontinued, as at the present price of oil, wood fuel from the neighboring forest reservation is cheaper. Coke is used in the Neate coarse-ore furnaces at the St. John's. These are shaft furnaces, the coke and ore being charged in alternate layers.

California

As usual, California produced the larger part of domestic quicksilver. Although many of the smaller mines were closed down, the production exceeded the demand. Notwithstanding this, prices were good. The main producers for the year were the New Idria, Napa Consolidated, New Almaden, Great Western, Helen and St. John's, with some production from the Guadalupe and the Oceanic.

At the Culver-Baer in Sonoma county a good orebody was developed, and a Scott furnace is to be erected. At the Karl mine in San Luis Obispo county, orebodies are being developed and the condensing system improved.

Other States

The new Dennis furnace at Blackbutte, Oregon, was fired up in February and soon after closed down. The Colonial company at Ehrenberg, Arizona, erected a 30-ton Scott furnace. The shaft is said to be 300 ft. deep. There was no production. The ore contains copper, gold and silver, and the plan is to recover the mercury by a preliminary roast, treating the cinders subsequently for copper, gold and silver.

In Texas the main producers for the year were the Marfa and the Mariposa mine, in Lower Cretaceous limestone, and the Chisos mine in the overlying Eagle-Ford shales. The Chisos is still using the Tigner 10-ton furnace, although a Scott furnace was completed in April at the mine.

The Texas-Almaden company at Big Bend has a deposit in an intrusive sheet of trachyte under which there was presumed to be shale. Diamond-drill borings through the trachyte have now penetrated the shale at a depth of 600 ft., and the cores are said to look encouraging. This company has a 20-ton Scott furnace, and made a small production in their first run.

Foreign Countries

Wm. Fleet Robertson, provincial mineralogist, reports that none of the prospects in British Columbia have as yet developed into working mines.

In Mexico the main production is at the Huitzuco mine in Guerrero, using a continuous furnace designed by J. W. C. Maxwell. The ore contains antimony.

At the Monte Amiata mines, Italy, the cost for mining and smelting was about $5 per ton. In the Czermak-Spirek fine-ore furnace, the loss of the mercury is claimed to be only 4 per cent.; if true this is probably a record saving. A cinnabar deposit was found near Pereta and opened up to some extent by shafts.

In 1907, according to Rogovin, the only mines producing in Russia were those of the Bachsmut district, the product being 8055 poods, equal to about 3879 flasks of 75 lb. each.

Quicksilver ore is reported from two new localities near Spizza in Dalmatia, Austria, but the deposits do not appear to be important.

The rediscovered mines of Koniah, Asia Minor, were reported on by F. F. Sharpless and F. P. Monaci. The ore is found in limestone accompanied by secondary silica, and in part associated with stibnite. The ore averages more than 1 per cent. mercury, and is treated in a 15 Spirek shaft furnace and in an eight-ton Czermak-Spirek fine-ore furnace. These were in continuous operation since May, 1906.

Monaci states that at the Kara Bornu mine, near Smyrna, there is a quicksilver deposit of sufficient size to be quarried so that 0.25 per cent. ore is profitable. In the year 1906-7 3000 flasks were produced.

*Geologist and mining engineer, San Francisco, Cal.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

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ALUMINUM

8172—BRITISH ALUMINUM COMPANY—The Kinlochleven Works of the British Aluminum Company. (Electrician, Dec. 4, 1908; 5 pp.) The works of this company are described together with auxiliary apparatus and equipment. Illustrated. 40c.

8173—USE FOR ELECTRICAL PURPOSES—Aluminum as a Factor in the Electrical Industry. (Electrician, Nov. 27, 1908; 1¾ pp.) Discusses briefly the preparation and uses of aluminum and compares the physical properties of aluminum and copper wires. 40c.

8174—USES—Aluminum and Some of Its Uses. J. P. W. Echevarri. (Min. Journ., Nov. 14 and 21, 1908; 2 pp.) Paper before the Brit. Inst. of Metals. Describes physical and chemical properties, methods of working and application by manufacturers. 60c.

CEMENT

8175—GERMAN MILL—Electric Driving of a German Portland Cement Mill. Alfred Gradenwitz. (Electrical Rev., Dec. 26, 1908; 2⅔ pp. Gives a description of one of the largest and most interesting German cement works, in which electric drive has been recently adopted. The works are known as the Rüddersdorf Portland Cement Fabrik. Illustrated. 20c. 20c.

8176—MICROSCOPIC STUDY — Ueber Mikrographische Zementuntesuchung. Ernst Stren. (Stahl u. Eisen, Oct. 21, 1908; 6¼ pp.) Describes methods pursued and gives some actual results in study of the structure of hardened cement by the microscope. 40c.

8177—PORTLAND CEMENT — Free Lime in Portland Cement. A. H. White. (Journ. Ind. and Eng. Chemistry, Jan., 1909; 5½ pp.) Describes tests for determining the amount of free lime in portland and other commercial cement and describes also the microscopic method of testing cement. Illustrated. 60c.

8178—PORTLAND CEMENT — Manufacture of Portland Cement from Materials High in Magnesia. Richard K. Meade. (Cement Age, Dec., 1908; 3¼ pp.) Discusses the effect of magnesia upon the properties of portland cement and suggests the addition of calcium chloride as a retarder. 20c.

8179—PORTLAND CEMENT—The Effect of Magnesia on Portland Cement. Rudolph Dyckerhoff. (Cement Age, Dec., 1908; 4 pp.) This is a translation by R. K. Meade of the paper by Dr. Dyckerhoff and gives a number of experiments with cement materials high in magnesia. The results indicate that 5 or 6 per cent. of magnesia are not detrimental. 20c.

8180—PROGRESS IN THE CEMENT INDUSTRY—Important Discoveries in the Lime and Cement Industries. H. S. Spackman. (Cement Age, Dec., 1908; 5 pp.) Describes tests on cements using calcium aluminate as an addition to hydrated lime and argillaceous or silicious material. 20c.

COAL AND COKE

8181—ACCIDENTS—Fatal Accidents in Coal Mines of America. F. L. Hoffman. (Eng. and Min. Journ., Dec. 19, 1908; 4 1/3 pp.) Shows statistically how more than 3,000 persons were killed in coal mining operations in 1907 and how 20,000 lives have been lost during the last decade. 20c.

8182—AUSTRALIA—Coalfields and Collieries of Australia. F. D. Power. (Aust. Min. Stand., Oct. 7, 14, Nov. 4 and 11, 1908; 11 pp.) Continuation of article previously indexed. 60c.

8183—CANADA—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can. Min. Journ., Dec. 1, 1908; 4¾ pp.) Describes the operation and development of this company's No. 2 colliery, including a brief description of the central electric plant and the central hospital. Illustrated. 20c.

8184—CHARCOAL—Tests with Car Kilns. Evert Norlin. (Jernkontorets Annaler, Nov., 1908; 44 pp.) Describes test runs and experiments for the determination of the heat conditions and the output of charcoal and by-products of car kilns of the American type.

8185—COAL CUTTING in Northern Coalfield, England. George R. Dixon. (Eng. and Min. Journ., Dec. 5, 1908; 1¾ pp.) Mining machines have increased the earning power of the men and have made their work less arduous. Compares the cost of mining. Illustrated. 20c.

8186—COAL DUST—British Coal-Dust Experiments. (Mines and Minerals, Dec., 1908; 1½ pp.) Describes an experimental gallery erected at Altofts and gives the results of 26 experiments with coal and stone dust. Illustrated. 20c.

8187—COAL DUST—Recent Demonstration of Coal Dust Phenomena. James Ashworth. (Coll. Guardian, Dec. 11, 1908; 1 p.) A paper read at a recent meeting of the North Staffordshire Institute of Min. and Mech. Engineers. Discusses a recent explosion as to whether it was caused by gas or coal dust. 40c.

8188—COKE—Jones and Laughlin's Coke Plant. W. A. Affelder. (Mines and Minerals, Dec., 1908; 4½ pp.) Describes the installation of 1500 coke ovens in the closely built part of the city of Pittsburg. Illustrated. 20c.

8189—COLORADO—Routt County, Colorado, Coals. R. L. Herrick. (Mines and Minerals, Dec., 1908; 4¾ pp.) Describes the location, geology, mines opened, different qualities of coal, thickness of seams, transportation and possible markets. Illustrated. 20c.

8190—COMPOSITION—Coal: Its Composition and Combustion. W. H. Booth. (Colliery Guardian, Dec. 11, 1908; 1¾ pp.) Discusses the heat of combustion of carbon and hydrogen and various characteristics of coal, considering only chemical composition and combustibility. Illustrated. 40c.

8191—ELECTRICITY in Modern Coal Mining. Harvey J. Nelms. (Eng. and Min. Journ., Dec. 5, 1908; ¾ p.) Gives certain precautions which should be adopted when electric power is used underground. 20c.

8192—ENGLISH COLLIERY—Notes on a Yorkshire Colliery. L. C. Ball. (Queens. Govt. Min. Journ., Nov. 14, 1908; 2¾ pp.) Gives a brief description of the general design, the geology, method of working and the washery of the Cadeby colliery, located in Yorkshire. 60c.

8193—EXPLOSION—Facts Concerning the Marianna Explosion. Floyd W. Parsons. (Eng. and Min. Journ., Dec. 12, 1908; 4½ pp.) The fan indicator diagram shows that ventilation stopped 25 minutes before the explosion. It is claimed that the clock was slow. Gives methods of mining and ventilating this mine in which such a large loss of life occurred on November 28, 1908. Illustrated. 20c.

8194—EXPLOSIONS—Dust as a Factor in Mine Explosions. William N. Page. (Eng. and Min. Journ., Dec. 5, 1908; 1¼ pp.) Paper before the W. Va. Min. Assn. The author believes watering coal mines is apt to be dangerous and recommends that air currents be split and auxiliary fans used. 20c.

8195—EXPLOSIVES—Safety Blasting Explosives. A. M. Comey. (Mines and Minerals, Nov., 1908; 4 pp.) Classes and properties of different explosives. Apparatus and methods used in testing. Illustrated. 20c.

8196—MINE SAMPLING and Chemical Analyses of Coals Tested at the United States Fuel Testing Plant in Norfolk, Va., 1907. J. S. Burrows. (Bull. No. 362, U. S. Geol. Surv., 23 pp.) Describes the tests of coals taken from Jamestown beds Nos. 1 to 17 inclusive. Gives chemical analysis of the coals sampled in the mine and in the car.

8197—MINING METHOD—Coal Mining on the Retreating System. Harvey J. Nelms. (Eng. and Min. Journ., Dec. 26, 1908; ¾ p.) Describes the general system of working on the retreating room-and-pillar plan which insures the operator of a greater amount of coal than when the seam is worked advancing on the room-and-pillar system. Illustrated. 20c.

8198—OKLAHOMA—The Coal Resources of Oklahoma. C. N. Gould. (Min. Wld., Dec. 12, 1908; ¾ p.) Discusses the value of Oklahoma's coal resources and describes the conditions in the district and the more important ledges. Illustrated. 20c.

8199—RESCUE WORK—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can Min. Journ., Nov. 15, 1908; 5¼ pp.) Continuation of article previously indexed. Describes the fire fighting organization and equipment of the Dominion Coal Company. Illustrated. 20c.

8200—SHAFT — Enlarging a Shaft Without Cessation of Working. M. Brien. (Min. Eng., Dec., 1908; 3½ pp.) Describes the method of enlarging No. 5 shaft of the Agrappe colliery between the 290m. and 380m. levels without interfering with the hoisting. Illustrated. 20c.

8201—WASHERY—The Operation of a Coal Washery in Colorado. W. F. Murray. (Eng. and Min. Journ., Dec. 26, 1908; 3 pp.) Describes the construction and method of operation including an aerial tramway used to dispose of waste. Illustrated by working drawings. 20c.

8202—WEST VIRGINIA—Coal Fields of West Virginia. H. H. Stoek. (Mines and Minerals, Dec., 1908; 3 pp.) Geology of the region, transportation routes, description of the coals with analyses from different seams. Illustrated. 20c.

COPPER

8203—ALASKA—Copper Deposits of White Horse. T. A. Rickard. (Min. and Sci. Press, Dec. 5, 1908; 1½ pp.) De-

scribes some of the copper claims in this Alaskan district. Illustrated. 20c.

8204—ALLOYS—Copper and Copper Alloys. J. T. Milton. (Iron Age, Dec. 17, 1908; 3 pp.) Discusses failure in copper tubes, annealing conditions, corrosion of copper and its alloys, the structure of copper alloys, gun metal and white metals, etc. From a paper read before the Brit. Institute of Metals. 20c.

8205 — ANALYTICAL METHOD — Permanganate Method for Determining Copper. Fred G. Hawley. (Eng. and Min. Journ., Dec. 12, 1908; ¾ p.) This method which is used in the assay offices of the Cananea Consolidated Copper Company gives satisfaction where quick results are required and many determinations are to be made. It ranks with the Iodide method for accuracy. 20c.

8206—CALIFORNIA—The Blue Ledge Copper Fields. A. H. Martin. (Min. Sci., Dec. 24, 1908; 1¼ pp.) Describes the copper properties in this district of Siskiyou county and gives analysis of the ore. 20c.

8207—COSTS—Calumet and Hecla Costs—I. L. S. Austin. (Min. and Sci. Press, Dec. 19, 1908; 1¾ pp.) Describes the conditions existing at the Calumet and Hecla mine, and gives costs of working the Osceola amygdaloid lode in 1906. The actual cost of producing a pound of copper is not given. 20c.

8208—ELECTROLYTIC COPPER—Influenza Dell'ssigeno Nascente Sulla Deposizione Elettrolitica del Rame. Corrado Agnolucci. (Rassegna Mineraria, Nov. 1, 1908; 2¼ pp.) Discusses the effect of nascent oxygen on the electrolytic deposition of copper. 40c.

8209—LABORATORY ROUTINE in Modern Copper Smelters. H. T. Waller. (Inst. Min. and Met., Nov. 12 and Dec. 10, 1908; 7 pp.) Discussion and contributed remarks on the above paper by members, in which additional information is given.

8210—MINE WATERS. Alfred C. Lane. (Proc. Lake Superior Min. Inst., June, 1908; 90 pp.) This is an elaborate treaties on the constitution of mine waters from the copper mines of Michigan. Illustrated.

8211—NEVADA—Mining and Reduction of Ely Ores. R. I. Herrick. (Mines and Minerals, Nov., 1908; 5¾ pp.) Continuation of article. Describes the concentrator site and construction, methods of concentrating and smelting, power plant and costs. Illustrated. 20c.

8212—SLAGS—Alumina in Copper Blast Furnace Slags. Charles F. Shelby. (Eng. and Min. Journ., Dec. 26, 1908; 1¾ pp.) Discusses the article by H. E. Hooper in the JOURNAL of December 5 and contributes additional information on the subject. 20c.

8213—SMELTING at Cerro de Pasco, Peru. L. W. Strauss. (Min. and Sci. Press, Nov. 7, 1908; 7¾ pp.) Describes the method of smelting the ore at this smeltery which is at an altitude of 14,000 ft. above sea level. Describes also the sampling plant and the furnace charges together with the analyses of the ore, matte, slag and flue dust. Illustrated. 20c.

8214 — TENNESSEE — Mining and Smelting in the Ducktown District. Edwin Higgins. (Eng. and Min. Journ., Dec. 26, 1908; 4¼ pp.) Describes the methods of mining and smelting at the Tennessee Copper Company's plant at Copperhill. The ore which averages 2 per cent. copper occurs in great lenses in metamorphic schist. Describes the sulphuric acid plant. Illustrated. 20c.

8215—UTAH—Ore Occurrence at Fortune Mine, Bingham. E. R. Zalinski. (Eng. and Min. Journ., Dec. 19, 1908; 4⅔ pp.) Describes the geology, the vein system, character of ore, secondary enrichment, the impregnated quartzite together with a description of the Fortuna and Mayflower veins. Illustrated. 20c.

GOLD AND SILVER

8216—AMALGAMATION METHODS. H. W. MacFarren. (Min. and Sci. Press, Dec. 12, 1908; 2¾ pp.) Discusses the care of plates, the use of amalgamators and the treatment of ore by amalgamation. 20c.

8217—AUSTRALIA—Walhalla and District Mines, Victoria. (Aust. Min. Stand., Nov. 11, 1908; 2½ pp.) Describes the orebody and the workings of the Walhalla mines and gives a flow sheet of the Long Tunnel Gold Mining Company. Describes also the mines outside of the Walhalla district proper. 40c.

8218—CALIFORNIA—The Calico Gold Mine. W. H. Storms. (Am. Min. Rev., Nov. 21, 1908; 2½ pp.) Describes the peculiar occurrence of a belt of gold ore, diagonally connecting two veins of silver ore. Illustrated. 20c.

8219—CALIFORNIA—The Success of the Orange Blossom Extension. Will C. Higgins. (Salt Lake Min. Rev., Nov. 30, 1908; 4¼ pp.) Describes the geology, operation and equipment of the mine and mill of the Orange Blossom Extension M. and M. Company which is operating claims in San Bernardino Co., Cal. 20c.

8220—COLORADO—The San Juan Region, Colorado—I. and II. T. T. Read. (Min. and Sci. Press, Nov. 7, and 14, 1908; 9 pp.) Describes the history, the mines, and methods of treating the ore of this district. Illustrated. 40c.

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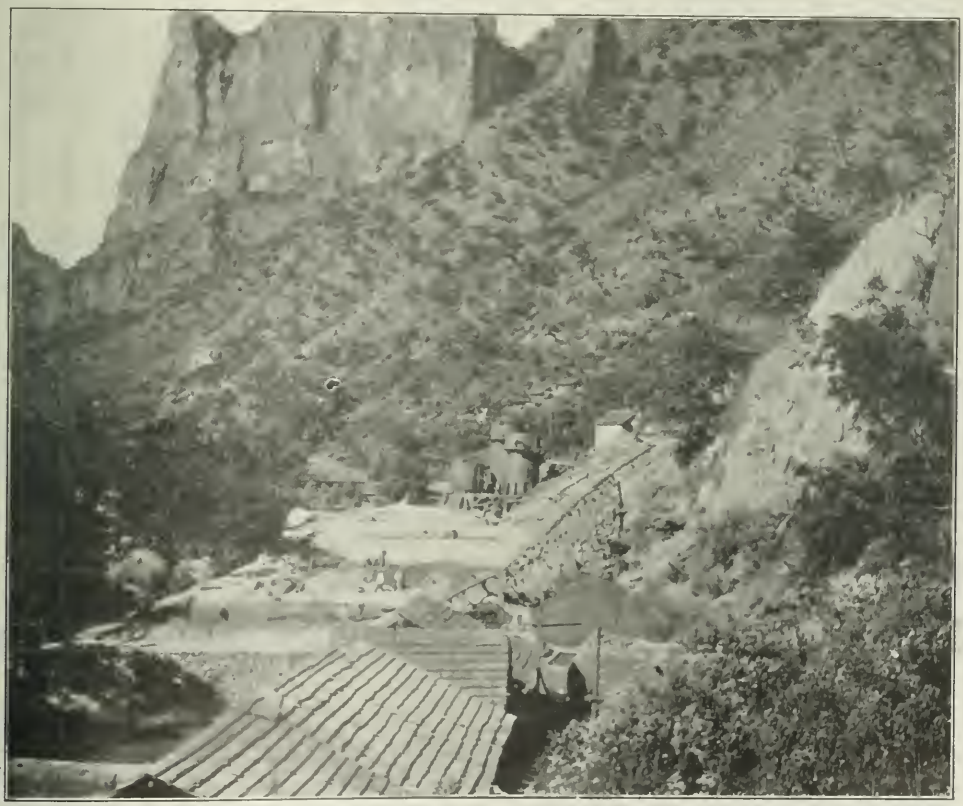
Rio Plata Mine and Mill, Western Chihuahua

The Vein Is Developed by Adit Levels from the Side of a Cañon, and the Ore Is Treated by Sliming and Cyanide Agitation

BY H. J. BARON*

The property of the Rio Plata Mining Company is situated in the Sierra Madre mountains, in the southwestern corner of the state of Chihuahua, about 20 miles from the Sonora and Sinaloa state lines. It is within the Arteaga mining district, municipality of Chínipas, and 6 miles from the old silver camp of Guazapares. It is distant from Chihuahua approximately 285 miles, and from Sánchez, the present terminus of the Kansas City, Mexico & Orient Railway, about 85 miles in a southwesterly direction. For the latter distance there is a good mountain trail. In its progress westward the railroad will pass within 20 miles of the company's Santa Bárbara mine, and this will minimize one of the difficulties attending the equipment and operation of the property.

The region is extremely rugged, towering mountains and precipitous cañons being features of the 85-mile trail to the camp, as well as of the camp itself. The elevation at the Santa Bárbara mine is 3100 ft. The location is within the rich and proved mineral belt extending north-south about 225 miles and east-west 100 miles, on the western drainage of the Sierra Madre range, and within whose boundaries are included many of the state's most productive mines. Beginning with the Guadalupe y Calvo section on the south and terminating at the Dolores mine at the north, are the Morelos, Batopilas, Urique, Barranca de Cobre, Palmarejo, Uruachic, Jesús María, Pinos



RIO PLATA MINE, TAILINGS PONDS IN FOREGROUND

*Manager, Mexican Chemical Company, S. A. Chihuahua, Mexico.

Altos, Concheño, Dios te Guíe, Bufa, Trinidad, República, Mulatos and others of past and present production records. The accompanying map gives the location of most of these mines as well as a good idea of the region's transportation facilities. The present railroad station for camp Rio Plata, Sánchez, is not shown, but it is to the south of Bocoyna at the point designated as "8152 ft., highest point on the Orient Railway."

The Mine

The company's holdings comprise mineral rights to 187 acres and surface rights to 2700 acres of timber and ranch land, all in one tract, together with water rights on the Septentrión river, a stream traversing the property for a distance of 6000 ft., and furnishing excellent power facilities. The mesas within the ranch tract are heavily timbered with pine and oak, the former of long-leaf variety, many of the trees being 3 ft. in diameter. The location of the mineral claims, on both sides of the river and within the ranch tract, is such as to cover every possible dip of the veins. It covers the vein for a distance of 2000 feet.

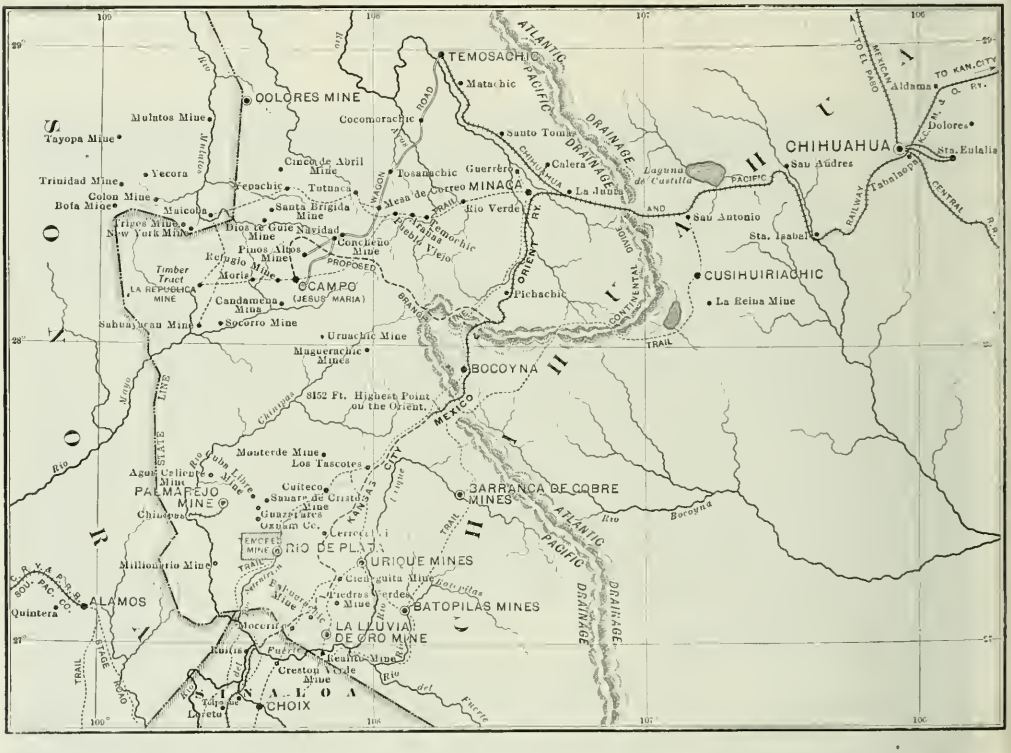
Historically and geologically, as well as topographically, the Santa Bárbara mine presents many interesting features. The mine is *not* an *antigua* with a past record, but is only four years old, now entering upon its earning career. It was formerly owned by Mexican ranchers, who made but one shipment, consisting of 22 tons of ore of a net value of 38,000 pesos. It was acquired by the present company a little more than two years ago, and on terms that almost resulted in its reverting to the original owners. The bond for its purchase required that the mill be placed in operation within six months from the date thereof, under penalty of forfeiture, and notwithstanding serious delays in machinery shipments, the mill was placed in operation on the last day of the prescribed period. At that time the nearest railroad point was 125 miles away, and the trail to the camp was a most difficult one.

The original discovery of the mine was made easy by the eroding cañon, Santa Bárbara by name and through which runs the Septentrión river, which cuts the vein at right angles, exposing it for a depth of nearly 1800 ft., from the top of the mountain to the river bottom.

Nature of the Deposit

The vein is a fissure in diorite, with a course south 25 east and a dip of 17 deg from the horizontal. Its uniform width is remarkable, the average of that exposed by nature, as well as by the 2500 ft. of workings, being between 4 ft. and 6 ft. In some places, as at the rich outcrop first worked by the Mexicans where faulting is noticeable, its width is as great as 12 ft., while the surrounding country rock to a like distance carries workable material. The richer ore runs in shoots, usually on the hanging-wall side and separated by variable areas of lower-grade ore. These rich shoots vary in width from 1 in. to 12 in. and in value from 200 oz. to 4000 oz. silver to the ton.

The gangue is mainly bluish-colored quartz, an approximate analysis being as follows: silica, 80 per cent.; iron, 0.75; calcite, 2; sulphur, 32; manganese, 0.13; alumina, 5 and magnesium, 2 per cent. The ore carries chiefly silver, which occurs as the sulphide, bromide and native, the predominating occurrences being in the order given.



MAP OF SOUTHWESTERN CHIHUAHUA, SHOWING SITUATION OF RIO DE PLATA

Development

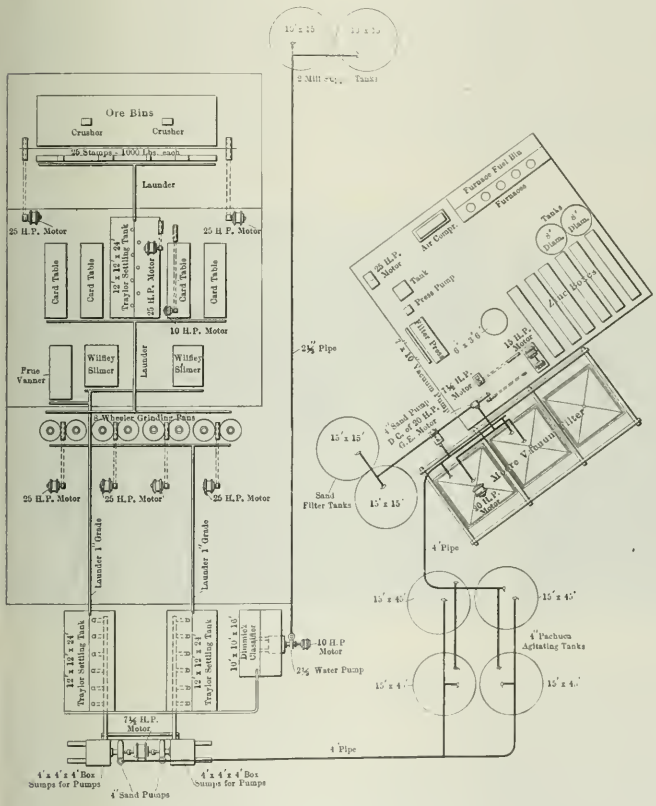
At the time of the transfer of the property, the development amounted to about 1100 ft. of tunnels and open cuts, while the total of laterals and verticals today is

more than 2500 ft. in addition to which there are several hundred square feet of stoped areas. The mine is so situated that it is readily exploited by means of short tunnels. The deep cañon has proved superior to a shaft of like depth in exposing the vein for more than 1800 ft., while the precipitous rise of the mountain, in a series of benches, makes economical the driving of adits at depth.

The extent and nature of the development is shown in the accompanying map. The six openings, the five upper of which are connected by winzes and upraises, are as follows: La Obra, 275 ft. in length, driven at a point 60 ft. above the river; San Antonio, or tramway level, 400 ft. long, 200 ft. above La Obra; San Miguel, 350 ft. long, 75 ft. above San Antonio; San Felix, 250 ft. long, 75 ft. above San Miguel; San Gonzalo, 180 ft. long, 85 ft. above San Felix, and San José, 300 ft. long and 100 ft. above San Gonzalo. The San José tunnel is vertically 1100 ft. from the apex of the vein on the mountain top. The San Felix is the original opening and is driven at a point where the Mexicans were able to make a "patio" and where they stripped the vein for 60 ft., to an average depth of 25 ft., in the progress of which the 22 tons of high-grade sulphide ore was mined and shipped. The walls of this pit have since been broken into; samples give assays as high as 1600 oz. per ton.

The workings, all of which are in ore, have demonstrated a remarkable continuity and permanency of the vein, as well as the comparative absence of serious faulting. In driving the lower tunnel some apprehension was first felt concerning the apparent faulting, but this has vanished since the opening up of a 6-ft. orebody in the bottom of a 60-ft. winze sunk from the tramway level above.

Throughout the workings the vein shows an average width of more than 4 ft and gives evidence of widening as the lower levels are continued. The high-grade shoots of bromides and native silver have been encountered on all levels. The average value of the ore exposed in the various tunnels, winzes and raises is estimated to be 100 oz. silver per ton, while that of the ore hitherto mined is 110 ounces.



FLOW SHEET, CONCENTRATING MILL AND CYANIDE PLANT

Method of Mining

The vein as stoped between the San Miguel and San Conzalo tunnels was 5 ft. in width on the average and in places as great as 12 ft. There has been mined between these levels in an area of 150 sq.ft., about 10,000 tons of 110-oz. ore. The breasts of the several adits as well as the faces of the raises and the bottoms of the winzes are all in ore and there are in reserve large bodies in all of the stopes. Engineers' reports place the value of the ore available from present developments at $2,000,000.

The ore for the entire width of the vein is mined by the overhead stoping method, the vein being well opened up into fairly even blocks by the several levels and winzes. All of the ore is dropped for extraction to the San Antonio or No. 2 tunnel, from which it is trammed in mule cars to the surface. Connections are now in progress between tunnels Nos. 2 (San Antonio) and the Obra by way of the winze from the former, and a 15-h.p. Girard hoist is installed in the tramway or San Antonio level for the hoisting all ore mined below that level.

The vein walls are throughout remarkably firm, regular and smooth, causing the ore to break away readily. No timbering other than an occasional stull is required. Nor is any provision for caring for water necessary; the workings are perfectly dry, with the exception of the lowest tunnel where the flow is about 2 gal. per minute. That the mine will continue dry seems assured, inasmuch as La Obra tunnel is at least 40 ft. above the highest known water mark of the river. The various connections between levels have up to date provided natural ventilation, which will probably be adequate for an indefinite period, under the blocking-out system of mining followed.

In ground-breaking hand drills only are used at present, but on the completion of the power plant electrically driven air drills will be substituted. The only sorting resorted to is the separation of the ore in the high-grade shoots, this separation being done in part in the breaking and in part by hand selection underground and at the surface. The amount of this high-grade ore of an average value of 1800 oz. silver secured is from 5 to 15 tons monthly. The daily tonnage of the mine now is about 60 tons, while the development work of the month totals about 200 feet.

The Milling Plant

From the main working tunnel to the mill, a distance of 1400 ft., the ore is transported in cars of 1000 lb. capacity, drawn by mules, one mule pulling a train of six cars. Electric haulage, both underground and on the surface, will later be used. One of the accompanying photographs shows the present concentrating mill and the cyanide plant now in process

of construction. Another shows the accumulated tailings and reservoir.

The cyanide plant will employ the all-sliming process, but on lines somewhat different from those ordinarily followed in the cyanidation of Mexican silver ores. The method was worked out by the company. The tests on a working scale have been very encouraging. The cyanide annex is expected to be in operation early in 1909.

The concentrating mill is a frame structure, built on the slope of the mountainside, so as to permit of gravity flow of material throughout. It has an equipment of 25 stamps and the necessary concentrators, pans, settlers, etc., to afford a daily capacity of 60 tons, while the cyanide plant is being built for handling 100 tons of accumulated and current tailings.

The ore is dropped from the cars into ore bins of 200-ton capacity, through 8x10 ft. grizzlies of about 1½-in. openings, the oversize from the grizzlies going to two rock breakers, of jaw type and Wheeler pattern, set to crush to less than 1¼ in. Plunger feeders facilitate delivery to the batteries, which include five stands of five stamps each. The stamps weigh 1000 lb. and drop 6 in. at the rate of 108 drops per minute. The cam shaft is 6 in. in diameter. The battery screens of 24 mesh are of the Tyler woven-wire type. The mortars are of the sectionalized type made by the Compañia Industrial Mexicana of Chihuahua; they are of straight-back, high-feed pattern with screen space 13 in. wide; they weigh, without the steel housings, about 3000 lb., but for mule-back transportation are built so that the heaviest piece is less than 300 pounds.

RIO PLATA MILL

NATURAL DIVERTING WALL, INTAKE DAM

Methods of Treatment

Crushing is performed in 0.1 per cent. cyanide solution. The battery pulp goes to a Traylor settling tank, 12x12x24 ft., of V-shape, from which the heavier material is drawn off at the bottom to Card tables, five in number, while the overflow, together with the table slimes, is launder-delivered to two Wilfley slimers and one Frue vanner. Concentrates are made over both the Card tables and sliming machines and the tailings from the former are sent by launder to eight Wheeler grinding pans of 5 ft. diameter for regrinding to about 150 mesh, from which the material is delivered by gravity launder to two Traylor settling tanks, of capacity and type as the one earlier noted. The overflow from the settling tanks goes to a 10x10x16-ft. Dimmick classifier; the clarified water from the classifier is returned by 2½-in. pump through a 2½-in. iron pipe, 162 ft. long, to the mill-supply tanks of 10x15 ft. dimensions, placed outside and at the head of the battery room.

From the settling tanks the pulp is delivered through a 4-in. iron pipe to four Pachuca agitating tanks 15 ft. in diameter and 45 ft. deep. These tanks, as is the case with all of the others in and about the reduction plant, are constructed of 3/16-in. steel. The pulp will be agitated 12 hours in 0.25-per cent. cyanide solution. After agitation, the pulp will be drawn off through a 4-in. pipe to the Moore vacuum filter press having 28 leaves, 6x10 ft., affording 100 tons capacity. The solution from the press is to be pumped to two 15x15-ft. sand-filter tanks, from which it will be drawn off to six 10-compartment zinc boxes. In precipitation, fine zinc shavings will be used, and the precipitates are to be filter-pressed before going to the retorting furnace in the melting room adjoining.

Motors and Equipment

The milling plant is driven by General Electric motors throughout. One 25-h.p. motor, of 600 r.p.m. constant speed, operates the crushers and two of like power and speed drive the stamps; one 10-h.p. motor, of variable speed, operates the concentrators and slimers and another of 25-h.p. variable speed drives the compressor for air agitation in the tanks; the eight Wheeler regrinding pans are driven by four 25-h.p. constant-speed motors, one motor to every two pans; one of 10-h.p. operates the 2½-in. pump which returns the water to the mill-supply tanks; one 20-h.p. motor runs the Moore vacuum filter while the 4-in. sand pump is operated by a 20-h.p. motor and the 7x10-in. vacuum pump is driven by a 15-h.p. motor, while one of 2½-h.p. operates the precipitate filter press. For a reserve pump set in the furnace room a 25-h.p. variable-speed motor is installed.

The milling machinery was furnished by the John A. Traylor Machinery Company, of Denver, and the Compañia Industrial Mexicana, of Chihuahua. The steel tanks were built by the El Paso Foundry and Machinery Company, of El Paso.

Concentration is at the ratio of 30 to 1, and very rich concentrates, containing about 50 per cent. of the value of the ore, are turned out, the mixed concentrate products from the tables and slimers averaging 1500 oz. silver per ton. The gold contents of the concentrates are only about 1 oz. to every four tons.

In the milling operations thus far carried on there has accumulated approximately 11,000 tons of tailings of an average value of 51 oz. silver. The tests have demonstrated a probable working extraction by cyanidation of 86 per cent. of this silver, by grinding to 150 mesh and treatment in 0.25-per cent. solution, with a cyanide consumption of about 5.6 lb. to the ton of tailings. The total extraction by concentration and cyanidation will, therefore, probably be more than 93 per cent. of the assay values of the ore.

The Power Plant

The abundant water supply from the Septentrión river has been utilized in the generation of electric power. At the mine

the stream has an actual fall of 205 ft. in 5000 ft., and at one place back of the camp there is one waterfall which is about 1200 ft. high during the rainy season. The water, taken from the river at a point 4000 ft. from the mill, is delivered to the storage reservoir in a wooden flume 5300 ft. long. The flume is 20 in. deep and 40 in. wide, and is constructed of 2-in. pine planking.

The in-take dam is at a bend in the stream where a 20-ft. rock face makes a natural diverting wall. For a space of 25 ft. square the uneven river bottom has been rock-floored and cemented to insure better storage. At approximately right angles to the diverting wall there is a 25-ft. face of vertical cliff which has been tunneled for a distance of 150 ft. for carrying the water to the flume system. The natural diverting wall and rock tunnel are shown in an accompanying illustration.

With a flow of 1200 ft. per minute and under a head of 163 ft., the water is delivered to the 6-ft. Pelton wheel, which drives, by means of belt connections, the two 100-kw. General Electric generators, of alternating current, 60-cycle, 480-volt type. This power, 266 h.p., is adequate for present purposes. It will not be difficult at any time, with the abundant water supply, to increase the capacity of the plant, if occasion arises. The present power is utilized in driving the mine and mill machinery. Another Pelton wheel 2 ft. in diameter drives a 25-h.p. General Electric generator which runs the electric-light plant of 150 lights. The cost of power is estimated at 20 pesos per horsepower-year.

Operating Costs

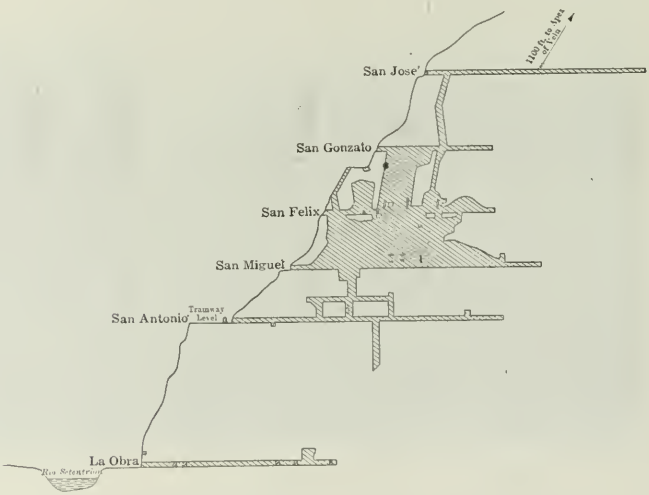
The operating costs at a point so far removed from railroad transportation are necessarily high. Mining costs are given as 3.70 pesos for ore-breaking and sorting, and 24 centavos for tramming, or a total of 3.94 pesos per ton of ore mined. The development costs are 12.34 pesos per foot of ground broken, the Mexican drillers being paid at the rate of 40 centavos per foot drilled. The cost of concentrating is 1.74 pesos per ton of ore treated while the cyanidation costs are estimated at about 4 pesos per ton. Mexican labor is employed, there being but six white men all told at the mine. Peon laborers, of which there is in the region an abundance of more than average efficiency, are paid at the rate of 1.50 pesos per day of 10 hours. The drillers alone work by the piece.

The freighting expenses from Sánchez on the railroad to the camp are as follows: Ordinary freight, 12 pesos per *carga* of 300 lb.; steel tanks, sectionalized, and similar articles, 15 pesos per *carga* of 300 lb. The cost of delivering ore and concentrates to the railroad is 12 pesos per 300 lb., or 80 pesos per ton, while from Sánchez to El Paso, Texas, the railroad freight is 10 pesos per ton, making the total cost of delivery of product to the smelter 90 pesos per ton. Twenty-two days are required for a round trip of the freighters to the railroad.

The Camp and Organization

The camp is picturesquely situated in the cañon between the mine and mill. The buildings, numbering five and substantially built of adobe, comprise a large boarding house, store, warehouse, assay office and officers' quarters. There is also a settlement of 400 Mexicans nearby. There are telephone and telegraph connections to the mine. The operating force at the mine numbers about 125. The superintendent in charge is H. W. Edmondson.

The Rio Plata Mining Company is capitalized at $2,000,000, the largest holders of the stock being a few New York capitalists. The officers of the company are as follows: President, H. W. Miller; vice-president, A. B. Cordner; and secretary-treasurer, John L. Toppin. These gentlemen and nine others, including D. W. Shanks, of Los Angeles, comprise the directorate. Mr. Shanks is also general manager, with offices at Chihuahua.



SANTA BARBARA MINE, RIO PLATA MINING COMPANY

A suction gas-producer system is used at the New Chums Goldfield mine, Bendigo, Australia, for running the mill. Formerly the cost of steam power generated by burning wood was, according to Donald Clark, *Aust. Min. Stand.*, Sept. 23, 1908, 1s. 3.5d. per ton of ore crushed. During the short time that the gas-producer system has been running the cost of power has been 3.18d. per ton of ore crushed.

Mexico's New Mining Law

The new mining law of Mexico consists of 150 articles embodying the present laws and the decrees and regulations that have been in force, with some important changes, mostly with the view of removing conflicting legal provisions. The regulation as to pertenencias remains unchanged. Article 3 provides that matters relating to mining property shall be subject to the civil code of the federal district, except when specifically determined otherwise in the law itself.

The provisions relating to the restriction of mining rights to Mexican companies is absent from the draft submitted; and the restrictions which required the foreigner to secure executive permission to locate claims in the border states is made to apply only to an 80-kilometer zone on the boundaries. The law will become effective July 1, 1909, except that the provisions as to prospecting permits become effective after the promulgation of the law.

Bismuth

The price for bismuth which was established by the European combination at 6s. 6d. per lb. on July 4, 1907, remained at that price throughout 1908. As in 1907 a small amount of refined bismuth was produced in the United States, but the production is still too insignificant to have any effect upon the price or even to attract the attention of the combination.

Diamond Mine in Pike County, Arkansas

The Gems Are Found in Peridotite Which Is Similar in Every Essential to the Diamond-Bearing Formations of South Africa

BY JOHN T. FULLER*

It is now nearly two years since the first rumors of the discovery of diamonds in their original matrix in Pike county, Arkansas, began to reach the East. This discovery has since been verified by competent engineers and geologists, and active preparations are being made to develop the field on an extensive scale.

It has long been a well known fact that genuine diamonds have been found from time to time on the continent of North America chiefly within the boundaries of the United States. Dr. George F. Kunz is authority for the statement that the first authentic find of a diamond in the United States was in 1832 in the State of Indiana. Since that time a number of authenticated finds of diamonds have been made in several States of the Union, among which may be mentioned Virginia, North Carolina, Georgia, California, Idaho, Montana, Indiana, Arizona, Michigan, Wisconsin and Ohio. It is to be noted that in all these cases the discovery was confined to either one, or a few scattered stones, and in no case has the locality where these diamonds originated been discovered.

Attempts have been made to trace the diamonds found in the glacial drifts of Michigan, Wisconsin, and Ohio back to their original source, which is supposed to exist somewhere in Canada, but so far without success. The discovery in Arkansas, therefore, is the first locality, not only in the United States, but also on the Western Hemisphere, where diamonds have been found in their original matrix.[1]

Locality and History

The exact location of this Arkansas discovery is Pike county, Sections 21 and 28, Township 8 South, Range 25 West. The diamond-bearing area lies on the east bank of the Little Missouri river near the junction of that stream with Prairie creek. The nearest town is Murfreesboro, the county seat, which is about 2½ miles to the northwest.

Direct rail communication to Murfreesboro will be established in the near future by a branch line which will connect with the main line of the Kansas City Southern at Ashdown, Arkansas. At present the easiest way to reach the property is by rail from Little Rock to Cooley's Crossing, via Prescott, which is about 6½ miles from Murfreesboro, the latter distance being covered by wagon.

The history of this Arkansas discovery presents several interesting features. First mention of this locality was made as early as 1842, but no report of any accuracy was made until 1890, when the region, including the volcanic area, was mapped and reported on by John C Branner, who at that time was State geologist.[2]

In this report Branner mentions that the rock resembled closely the diamond-bearing rocks of South Africa, but scouts the idea of its containing diamonds, due to the absence of any bituminous shales surrounding the "pipe," or crater, such as occur about the pipes at Kimberley, and from which it was at that time supposed that the carbon required for the formation of the diamond was derived.

No more notice was taken of this area until 1906 when John M. Huddleston, who had in the meantime purchased the property on which the greater part of the diamond area lies, found the first diamond on Aug. 1, 1906. This was a white stone of 4½ carats. On the afternoon of the same day a second diamond was found by Mr. Huddleston, who, suspecting that he had found something valuable, although he did not know just what, sent the stones to C. S. Stifft, a jeweler of Little Rock, who pronounced them to be true diamonds.

Mr. Stifft, realizing how important was this discovery, immediately, with several friends who joined him as partners, secured options on the Huddleston tract and on considerable other land adjoining, thus gaining control of by far the greater part of the igneous area. The company thus provisionally formed secured the services of competent geological and engineering advice, and on the strength of the reports made to them, a company, known as the Arkansas Diamond Company, was incorporated for the pur-

POINT AT WHICH FIRST DIAMOND WAS FOUND

PERIDOTITE OUTCROP ON SOUTH SLOPE

*Consulting engineer, Wilkes-Barre, Penn.

[1]Diamonds have never been found in South America in the true matrix.

[2]Geological Survey of Arkansas, Annual Report for 1890.

pose of mining diamonds on a large scale.

Geology

The matrix of the diamond is a peridotite which has been described by the late Prof. Henry Carvill Lewis as "a porphyritic volcanic peridotite of basaltic structure," which is named kimberlite.[3] This peridotite, or kimberlite, is more popularly known in South Africa as "blue ground."

The use of the term blue ground in connection with this rock is very misleading. Many people are deceived by this term and take it for granted that the diamonds occur in a soft clay soil, or ground which presents no difficulty, or much expense to wash and concentrate. This is not the case. The origin of the term blue ground is interesting. Like most peridotites the greater number of the "diamond-bearing peridotites" show marked changes on exposure to the atmosphere and "weather in place" to considerable depth.

known as a "pipe," which is the neck, vent, or stock, of an old volcano, or dike, filled up solid with the diamond-bearing rock and extending to unknown depth. The Arkansas peroditite has been demonstrated to be in every essential similar to the diamond-bearing peridotites of South Africa, and the most essential characteristic, the actual finding of diamonds within its mass, is fulfilled.

Varieties of Peridotites

I have heard it said, and seen it written, that this Arkansas peridotite shows marked differences from the peridotite of Africa. When it is realized that from the same pipe in Africa a dozen or more different hand specimens of peridotite can be taken, no two of which resemble each other either in inclusions or physical appearance, the folly of attempting to find differences in this Arkansas pipe from hand specimens brought from the African pipes, is evident. The only way they can

The harder varieties of the peridotite, which may and do occur in the same pipe with the softer variety and which are known as "hardibank," are of an entirely different nature. No amount of exposure to the atmosphere will have any practical effect on this rock. In hardness it is equal to the hardest quartzites, and to be concentrated at all, it must first be crushed by powerful crushers. This variety does not weather in place to any extent and forms the hard outcrop which first drew the attention of geologists to the Arkansas pipe.

The concentrate from this diamond-bearing peridotite contains many other minerals besides the diamond, among which may be mentioned mica, hornblende, magnetite, olivine, garnet, etc. In no instance have these minerals, or any other mineral except the diamond, been found in the diamond-bearing peridotite of such quality as to have any commercial value. There is no commercial

FIRST PIT SUNK IN PERIDOTITE

PART OF DIAMOND-BEARING AREA

The fresh peridotite is as a rule of a bluish green color, which changes on weathering to a dull grayish green or yellowish green. During the process of weathering, the rock disintegrates to a great degree and can easily be pulverized between the fingers. It is then, properly speaking, when in this condition, a "ground" and not a rock. This yellow disintegrated peridotite being naturally the top portion of the mass was the rock in which the diamonds were first found and became known as "yellow ground." In time the yellow ground was mined out exposing the hard undecomposed blue peridotite beneath, which was called in contra-distinction by the early miners blue ground.

The diamond-bearing peridotites of South Africa occur in what is there locally

be compared is to compare the masses as a whole, and by this method of comparison I can see no radical difference either in formation, occurrence or in the character of this peridotite from those of South Africa.

That the Arkansas peridotite occurs in a pipe similar to its occurrences in South Africa has also been sufficiently demonstrated, by means of bore holes, to be accepted as a fact. The peridotite of the Arkansas pipe, as is also true of the South African pipes, varies considerably in hardness over different parts of the pipe. In most cases the peridotite will disintegrate readily after a few months' exposure to the atmosphere. The softer varieties, which are comparable in hardness when fresh with ordinary sandstones, "weather in place" to depths varying from 20 to 60 ft. and form the famous "yellow ground" of the South African mines.

by-product from the mining of diamonds.

Inclosing Rocks

In the nature of the surrounding rock strata the Arkansas pipe differs considerably from those occurring near Kimberley, but it resembles many of the pipes found elsewhere in South Africa. So far as known at present the rock strata surrounding the Arkansas pipe are Carboniferous sandstones, and quartzites, unconformably overlaid by horizontally-bedded Cretaceous sandstones, which are in turn overlaid by a coarse Post-Tertiary conglomerate.

In two places within the peridotite area can be seen the outcrop of a dike of volcanic rock from 5 to 6 ft. wide and of a light blue color. This dike cuts through the peridotite with a strike nearly east and west. It is most probable that this

[3]Eighteenth Annual Report, De Beers Consolidated Mines.

dike rock contains no diamonds and that it will be found on further excavation to be of a similar nature to the barren dikes and floating reefs, which occur in the mines at Kimberley.

There is a second small dike about 12 in. wide exposed in Prairie creek at the point where that stream empties into the Little Missouri river. This dike is undoubtedly peridotite and will no doubt be found to join the main body of peridotite at some point which future excavation will disclose.

It may be remarked that the South African pipes have many of these small dikes radiating from them which lead nowhere in particular and which pinch out entirely a short distance from the pipe.

Genesis of the Diamond

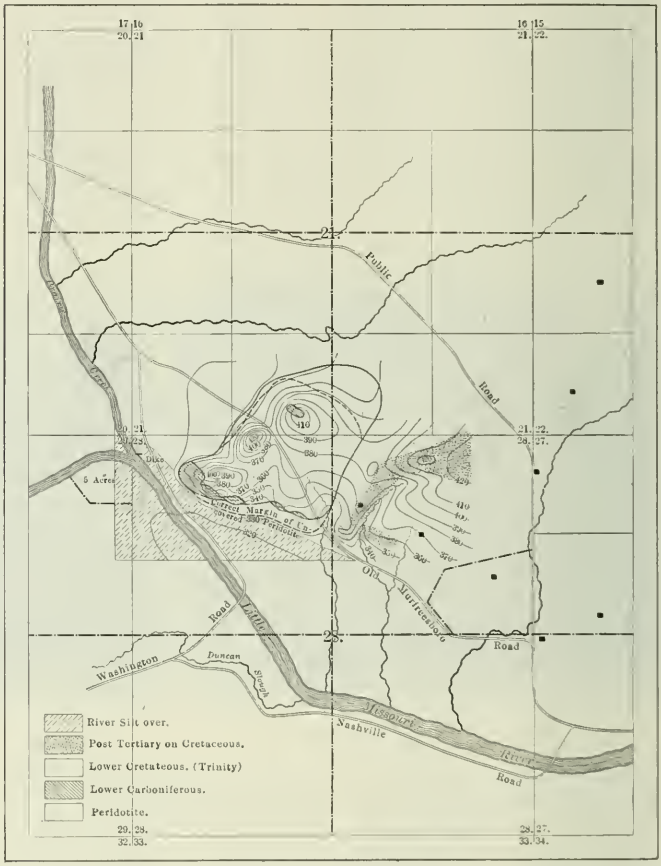
Many theories have been advanced and are constantly being advanced to account for the presence or formation of diamonds within these igneous masses of peridotite. It is not within the scope of this article to go into detail with regard to these theories. When it is remembered that we have several hundred of these peridotite pipes in Africa in all of which the peridotites are essentially the same, but in the great majority of which either no diamonds occur at all or so few diamonds occur as to make their recovery unprofitable, one is apt to come to the conclusion that diamonds, like gold, are wherever you find them. One has only to read the chapter on "The Formation of the Diamond" in "The Diamond Mines of South Africa," by Gardner Williams, to come to the conclusion that no one knows, or probably ever will know, just how or where nature has formed the diamond.

The Arkansas Diamond Area

The roughly elliptical area shown in the accompanying map represents as accurately as can be shown at present the peridotite pipe. The major axis which lies in the northeast-southwest direction, is about 2400 ft., while the minor axis is about 1800 ft. The area covered is approximately 60 acres. On a line which lies practically through the three hills shown and which are known as the West, Middle and East hills, are the outcroppings of the hard peridotite referred to as hardibank.

To the south of these hills the ground falls away gradually to the Little Missouri river. This south slope on the volcanic area is composed of a much softer peridotite than that of the hills. It has here weathered in place to a depth which may reach 60 ft., and is known to be weathered for at least 20 ft. This portion of the area which is also the largest portion, being at least 35 acres in extent, can be excavated easily without or with a minimum use of explosives to a depth of at least 20 ft. I estimate that there is at least 1,500,000 cu.yd. of this material that can be easily and cheaply mined.

Overlying the greater part of the whole area to a depth which does not exceed 1 ft., is a black vegetable soil locally known as "gumbo." This soil contains some peridotite and a mixture of other rocks and soils brought in by the surface waters. A number of diamonds have been found in this soil which were undoubtedly derived from the underlying peridotite.



THE ARKANSAS DIAMOND AREA

In several places of the pipe area, especially on the three hills, there is a considerable growth of pine and oak timber. The pipe lies in a hilly and broken country intersected by many streams and creeks. The soil in the river and creek bottoms is fertile and the climate healthful.

Operations

The operations to date have consisted chiefly of haphazard experimental tests of the peridotite from various places on the pipe. These tests were roughly made with inadequate washing machines, and the chances are that as many diamonds were lost in the tailings as were recovered.

Considerable work has been done in the way of clearing up the area of stumps and gumbo and plowing loose the weathered peridotite. During these operations a large number of diamonds were picked up by chance by the workmen. The number of diamonds found in this way is remarkable and is an indication of considerable richness.

Bore Holes

Three bore holes have been put down with a diamond drill on the pipe area to depths of 79, 184 and 205 ft. These holes are in the peridotite for the entire distance sunk and the peridotite continues beyond the bottoms of these holes to an unknown depth. One of the pipes at Kimberley has been developed down to 3000 ft. with no exhaustion of deposit in sight.

All work on the property is at present suspended until such time as a complete

mining, washing and concentrating plant can be designed and erected, when mining on a large scale will be undertaken.

Diamonds Produced

The total number of diamonds recovered from this area to date by chance finds or concentration is 540. Of these 540 stones 505 weighed 217 carats, or an average of nearly ½ carat per stone. The largest stone so far found weighs 6½ carats. Most of the stones found are white, while a few are yellow or brown.

A large number of these stones are of good water and of remarkable purity, many being of finer quality than African stones. Three of the stones found have been cut and have yielded beautiful gems which have been valued at from $60 to $175 per carat, with an average value for the three cut stones of $104 per carat.

Taking a parcel of rough, unsorted stones from this pipe it will easily average $10 or more per carat in value at the present prices of diamonds. This average equals the average of several of the large producing mines of Africa.

WEIGHT IN CARATS AND COLOR OF THE FIRST 75 DIAMONDS FOUND IN THE ARKANSAS FIELD.

No.	Weight.	Color.
1	2⅜–3/64	White
2	2⅛–3/64	Light brown
3	2 5/16–3/64	White
4	1⅜–3/64	White
5	1 13/16–3/64	Crystal white
6	⅞–3/32	White
7	¾–3/32–3/64	White
8	⅞	White
9	⅜–3/64	White
10	½–3/32	Light brown
11	½	Yellow
12	½	Yellow
13	¾	Cloudy brown
14	⅝	Cloudy white
15	½–3/32	Dark brown
16	⅝–1/16–3/64	Bort
17	7/16–3/32	Light yellow
18	7/16–3/64	White
19	7/16	Crystal
20	7/16–1/32	Light brown
21	7/16	Light brown
22	About ½	Yellow
23	2⅞	White
24	2⅛–1/16–3/64	Silver cape
25	3/16	Crystal
26	3/16	Crystal
27	⅜–1/16–3/32	Yellow
28	⅜–1/32	Light yellow
29	¼–3/64	Yellow
30	5/16	White
31	¼	White
32	¼–1/32	White
33	3/16–3/64	White
34	⅛–3/64	White
35	3/16	White
36	3/16–1/64	White
37	3/16	White
38	3/16–1/64	White
39	⅛–3/64	Brown
40	⅛–1/64	Brown
41	⅛–3/64	Green yellow
42	⅛–1/64	Brown, found in screen wash
43	1/32	White, found in dry wash
44	Diamond in rock.	
45	4⅛–1/32	Perfect blue
46	2⅛–1/64	Crystal
47	2 3/64	Brown
48	5/16–3/64	White
49	5/16–3/64	White
50	5/16–3/64	White
51	⅛	White
52	⅛–3/64	White
53	3/16	White
54	⅛	White
55	1/16	White
56	⅛	White
57	3/64	White
58	3/32	Yellow
59	3/64	Yellow
60	1/16	Yellow
61	3/32–3/64	Brown
62	⅛	Brown
63	⅛–3/64	Brown
64	3/32	Brown
65	⅛–3/32	Brown
66	1/16	Brown
67	3 5/16–3/32 (are diamonds found in two pieces.)	Brown
68	1⅛–1/16 (are diamonds found in two pieces.)	Brown
69	⅝–3/32	Brown
70 to 75	6 pieces bort. Total weight 2½ carats.	

Volumetric Determination of Uranium and Vanadium

W. D. Engle, in the *Western Chemist and Metallurgist*, November, 1908, describes a method for the determination of uranium and vanadium which is a combination of Sutton's method and that of other authorities. From 0.5 to 2 grams of the material is taken as a sample, the quantity depending on the amount of uranium present which, if more than 0.25 gram, filtering and washing the uranyl ammonium phosphate will be difficult. The weighed sample is transferred to a ¼-liter flask and, treated with 20 c.c of dilute sulphuric acid (1:5) and evaporated to fumes of sulphuric trioxide. Organic matter may be removed by the use of nitric acid with the sulphuric acid.

After cooling and diluting to 100 c.c., 3 c.c. of hydrogen dioxide are added to oxidize the uranium and vanadium. An excess of sodium or ammonium carbonate is next added and the mixture boiled a few minutes, partially cooled, filtered and washed. It will generally be necessary to redissolve the precipitated iron, etc., with dilute sulphuric acid and to repeat the treatment with sodium or ammonium carbonate, combining the filtrates and wash waters. Care at this stage must be used to keep the solution oxidized by the use of hydrogen dioxide.

The combined filtrates and wash waters are made acid with sulphuric acid and ammonium phosphate is added (0.5 to 1 gram). The solution is boiled vigorously to expel the carbon dioxide and made alkaline with ammonia. The thorough removal of the former is essential as the uranyl ammonium phosphate is soluble in ammonium carbonate. This difficulty is in part overcome by boiling the mixture after the addition of the ammonia until the solution has a slight acid reaction, or by the addition of acetic acid.

The uranyl ammonium phosphate must not be filtered from an alkaline solution, as a part of the uranium will probably remain in the solution. With these precautions the uranyl ammonium phosphate may be filtered and washed. Washing with an ammonium-sulphate solution (1:25) helps to prevent the carrying through of the precipitate in the colloidal form.

If the amount of the uranium is very small, a small amount of aluminum sulphate may be added to aid in the filtration and to prevent portions of the uranium from being carried through the paper.

The filtrate, which contains the vanadium, is treated with 10 c.c. of strong sulphuric acid and 2 grams of sodium sulphite. The excess of sulphur dioxide is boiled off, and the solution immediately titrated, hot, with permanganate solution. A twentieth-normal permanganate is recommended rather than a stronger solution. The iron factor of the permanganate multiplied by 0.9159 gives the vanadium factor, or by 1.631 gives the V_2O_5 factor.

The uranyl ammonium phosphate is dissolved with dilute sulphuric acid, granulated zinc of known purity is added and the reduction continued for 45 minutes. The solution is decanted from the zinc and the zinc washed. The solution with the wash waters is titrated with the permanganate solution. It is important that this be not stronger than twentieth-normal, as the atomic weight of uranium is so great that it gives a large factor for the permanganate. The iron factor of the permanganate multiplied by 2.133 gives the factor for uranium, or multiplied by 2.5167 gives the factor for U_3O_8.

This method, says the author, has been checked against pure uranium and vanadium salts with satisfactory results. None of the elements commonly found in ores interferes with it. The method has been repeatedly checked by the gravimetric methods with results that agree closely, and the saving of time is considerable.

New 506-ft. Chimney at Great Falls Smelter

The Largest Chimney, Both in Size and Capacity, in the World; Flue Dust Caught by Network of Wire Suspended in Dust Chamber

BY EDWIN HIGGINS

The new chimney at the Great Falls smelter of the Boston & Montana Consolidated Copper and Silver Mining Company was topped out Oct. 23, 1908. This chimney is 506 ft. in hight above the foundation and is the largest, both in size and capacity, in the world. The smelter, shown in plan in Fig. 1, is situated on the north bank of the Missouri river, about three miles from Great Falls, Mont. The plant, which consists of reverberatory and blast furnaces, McDougal roasters and converters, has a capacity of 4500 tons of ore per day.

Additions made to the plant in recent years have increased the production of furnace gases, so that at times as much as 2,000,000 cu.ft. of gases per min. are made. The old chimney is situated about 1500 ft. back of the plant, and the gases were led to it through large masonry flues buried to the level of the intervening ground. This chimney is 20 ft. in diameter and 185 ft. above ground; being situated on a slope rising gently from the smelter site, its top is about 400 ft. above the level of the blast-furnace floor. Under ordinary conditions its capacity is only about 700,000 cu.ft. of gases per min. This lack of capacity in the old chimney at times caused a serious loss in flue dust; moreover, its brick and mortar construction had exposed it to the action of the acids which formed in wet weather. In consequence of this its interior was badly eaten and disintegrated. Accordingly it was decided to build a new system of flues and a new chimney, the latter to have a capacity of 4,000,000 cu.ft. of gases per min. at a temperature of 600 deg. Fahrenheit.

Site and Foundation

The site chosen for the new chimney was 2000 ft. back of the furnace plant, the elevation here being 246 ft. above the charging floor of the furnaces.

It was first determined to excavate to a depth of 30 ft. for the foundation, but when 22½ ft. of depth had been attained, it was determined by tests that it was unnecessary to go deeper. The ground in which the excavation was made is hard shale. The foundation consists of an annular mass, the circular inner edge of which is 47 ft. in diameter at the bottom and the octagonal outer boundary 103 ft. across flats at the footing level, tapering to 64 and 81 ft. diameters at the top of the concrete. The foundation was constructed of 1:3:5 slag concrete. The sand and stone were obtained from the smelter furnaces. In the work of construction 5200 bbl. of cement, 2000 cu.yd. of sand and 4000 cu.yd. of slag were used; the cost of materials and construction was in the neighborhood of $50,000. Fig. 2 shows the completed foundation. Fig. 3 shows the first 25 ft. of the chimney, and two of the flue openings.

The Chimney

The chimney proper has an octagonal base 46 ft. high with a taper of 8 per cent. Above this point the section is circular, the first 180 ft. above the base having a taper of 7 per cent., the next 100 ft. 4 per cent., and the remaining 180 ft. 2 per cent.

The chimney was built in 23 sections; 19 of these are above the octagonal base. The thickness of the chimney wall varies from 66 in. at the base to 18⅛ in. at the top. The outside diameter at the base is 78½ ft., and 53¾ ft. at the base of the cap. The inside diameter at the base is 66½ ft.; at the top, 50 ft. In the base of the chimney are four flue openings. Fig. 6 is a view of the old and new chimneys, 185 ft. and 506 ft. high, respectively.

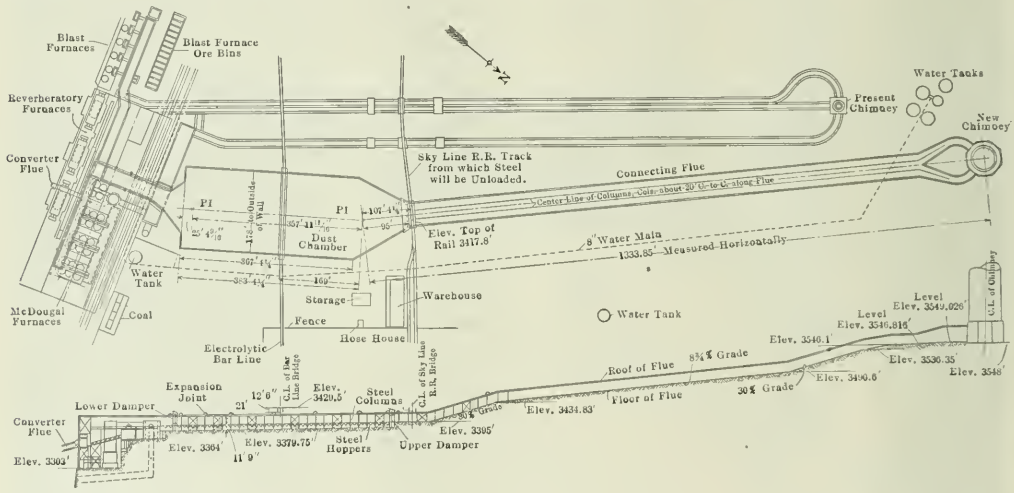


FIG. 1. GENERAL LOCATION PLAN OF SMELTER AND FLUE SYSTEM, AND SECTION THROUGH CONNECTING FLUE AND DUST CHAMBER

Chimney Lining

As a protection against the corrosive effects of the furnace gases, the chimney is lined with 4-in. radial perforated blocks, acid proof, installed in sections. Acid-proof mortar, made of silicate of soda, asbestos wool and other ingredients, was used. The chimney was first completed and the lining put in afterward. There is a 2-in. air space between the lining and the chimney proper, and every precaution is taken to prevent the gases

or metalliferous dust from entering the air space. In laying the cap for the protection of the top of the chimney from the action of acids which might form, special terra cotta blocks with interlocking sections for the joints were used. These blocks, or tiles, are laid in and pointed up with acid-proof cement mortar.

Protection Against Lightning; Ladderway

Protection against lightning is afforded by a lightning rod of 16 points, which projects 5 ft. above the top of the chimney. These rods are made of 1-inch round copper, coated with lead and tipped with 1¼-in. platinum points. Encircling the chimney a few feet below the top is a horizontal copper ring, from which two ⅝-in. stranded copper cables lead to the ground; this ring is connected to the lightning points. The copper ring and cables leading to the ground are coated with ⅛ in. lead 100 ft. from the top as a protection against acid. The copper cables leading to the ground terminate in 3-ft. ground plates, which are buried at a distance from the chimney.

On the outside of the chimney, built into the brickwork, is a ladderway consistin of one-piece rungs of ¾-in. round iron 12 in. wide, and one-piece guard loop of the same material, 30 in. wide. The rungs stand 6 in. clear of the wall. The guard loops are 18 in. out from the rungs. Both guards and rungs are coated with lead for the upper 100 ft,; below this they are painted.

Flue and Dust Chamber

The connecting flue and dust chamber are shown in plan and section in Fig. 1; Figs. 7 and 8 give an idea of their construction. Between the smelter and the dust chamber the flue is of rectangular cross section, 33x21 ft. Between the dust chamber and the chimney the dimensions are 48x21 ft. The whole flue system is framed in steel, with steel columns and cross-beams; the walls and roof are made of the same material as the chimney. All steel work is exposed, both inside and outside. The dry gases have no corrosive action on the steel framework or the walls.

Fastened to the bottom of the I-beams of the roof of the dust chamber is a heavy copper wire net, from which is suspended long iron wires about 4 in. apart, forming a suspended network. The gases in passing through the chamber come in contact with the suspended wires and deposit thereon the suspended flue dust. All the wires below their upper support are connected with a shaker beam operated by a motor outside the walls of the dust chamber. By this means the dust clinging to the wires is shaken off and deposited in the hoppers provided in the floor of the dust chamber. Under this floor are 22 tracks over which are run trains of electrically operated dump cars; these cars receive the contents of the hoppers. The tracks are shown in Fig. 8.

The dust chamber is 176 ft. wide and 478 ft. long with a hight of 21 ft. in the clear. The basement story is 12 ft. high. The dust chamber is divided into two parts so that either side can be shut off and made accessible. For this purpose heavy cast-iron dampers are provided, operated by means of motors. There are no wires or hoppers in the connecting flue proper, between the dust chamber and the stack. The blast-furnace flue is provided with a hopper bottom, but no network of wires.

FIG. 2. FOUNDATION FOR CHIMNEY

FIG. 3. FIRST 25 FEET OF CHIMNEY

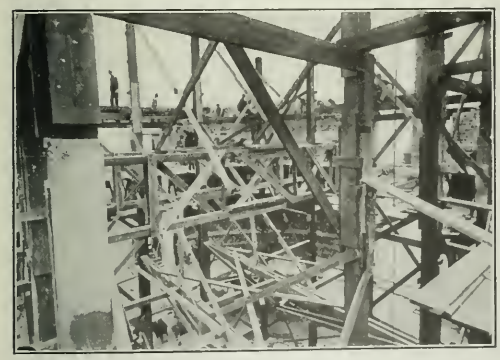


FIG. 4. DETAIL OF TOWER AND SCAFFOLD SHOWING TRUSS

FIG. 5. DETAIL OF TOWER SHOWING ELEVATOR POSTS

The Scaffold and Tower

In the design and construction of this flue system and chimney the engineers and contractors were confronted by many problems. Probably the most important problem of the construction, as far as the contractor was concerned, was the efficient and safe handling of the 17,000 tons of blocks and mortar required in the work. The problem was to keep the men continually supplied with materials and at the same time provide safe conditions under which they might work at great hights. The inside diameter of the chimney was too great to permit of a single-stick system to support the working floor, or a system of floor beams which could be caried up, as is usual, as the chimney pro-

gressed. The scaffold had to be of such a design that after the working hours of the bricklayers, the floor system could be raised in the least possible time and a new scaffold prepared before the following morning. Provision for a sufficient number of elevators and their safe and speedy operation in handling 200 tons of material a day was also a factor in the scaffold problem.

A 12-post square tower of 10x10-in.x16-ft. fir timbers was finally decided upon. The construction and arrangement of this tower is shown in Figs. 3, 4 and 5. At each flue opening two of these 10x10 posts were placed to form a set of guides within which to operate a 6x9-ft. elevator. Strips of 2x4-in. oak, spiked to the 10x10-in. timbers, served as guides. The distance between elevator posts was about 7½ ft. The center span between two opposite posts was 30 ft. The catheads spanning the elevator posts were built of two 3x10-in. fir timbers, reinforced longitudinally with ¼x6-in. steel plates. The 3x10 timbers were spaced 2½ in. apart and between them operated the 14-in. sheaves in the iron boxes. These sheaves carried the elevator cable of ⅝ in. cast steel, operated in three cases by electric hoists at a speed of 300 ft. per min. The fourth elevator was run by a steam hoist of 35 h.p., at a speed of 600 ft. per minute.

For rapid change of scaffold, it was necessary that the elevator heads be designed so that they could be easily lifted off the 10x10 timbers, and when another post had been added, quickly replaced. For this reason the catheads of 3x10 timbers carrying the head sheaves were supported at their bearing ends with 10x9x¼-in steel plates; one drilled to take a ¾-in. dowel pin from the top of the 10x10 posts, the other having a slotted ¾-in. hole to take up any slight variance in distance between the posts.

The ¾-in. dowel pins and plates held the elevator heads in place, with no further fastening, without accident, throughout the whole construction of the chimney. They were handled off and on by 18-ft. poles and a set of double blocks.

Throughout the tower the main posts were braced with 2x6-in.x16-ft. sway braces, bolted. Each section of post was doweled by a ¾x10-in. pin and spliced with 2x10-in.x5-ft. pieces, bolted. The sash bracing, which also formed the ledgers supporting the 8x8 timbers of the main scaffold, consisted of 3x10-in.x12-ft. timbers bolted to the posts. One end of the 8x8 floor beams of the main scaffold rested on the finished wall of the chimney; the other end was notched around the edge of the post and rested on the 3x10 against the post. The whole system bolted.

Spanning the 8x8 longitudinal main timbers were 6x6-in. floor beams, and on these were laid the 2x10-in. scaffold plank, forming a floor seven planks wide around the whole interior of the stack next to the wall, leaving the center open.

The maximum load on each post was calculated to be 18 tons. Being inside the stack, they were exposed to no wind pressure, except at the bottom at the flue opening for 36 ft, and that portion extending above the brickwork. It will be seen that the eight elevator posts which were carried to a hight of 516 ft. would have one side toward the elevator unsupported in that direction. To complete the rectangle and protect the unsupported side would have required an additional four posts with sway and sash bracing in the center of the stack. This would mean, at each raise of 17 ft. of the main scaffold, an operation necessitating speed, the raising of four 10x10 posts and the placing of all the extra bracing. To avoid this and prevent the crushing in of the posts, a system of four intersecting trusses was introduced every 30 ft. spanning the elevator posts. These were bolted together at their intersections and their upper and lower chords with connecting members, so designed as not to take a vertical load, but to resist a racking strain. These trusses were all framed and put together during the working hours of the bricklayers and were ready to hoist into place during the hours of raising the scaffold. Since they occurred at only every 30-ft. interval, it was at every other raise of the main scaffold that they became necessary. With a four-post system in the center, it would have been necessary to erect the posts and all their bracings at each raise of the scaffold; and the work would have to be done after the bricklayers' hours. The time consumed in raising the scaffold was between three and four hours, so naturally all the preparation for raising that could be made during the bricklayers' hours was that much saved.

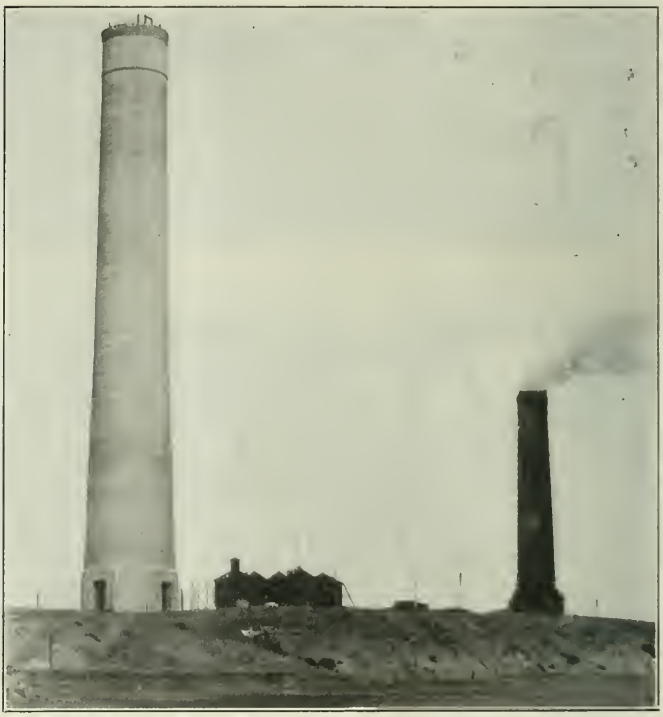


FIG. 6. THE NEW AND THE OLD CHIMNEY

On the main scaffold, when the wall had been built 6 ft., were placed a system of wooden horses, and a second floor built on them. From this point 6 ft. more wall was built, after which the men worked from benches 3½ ft. high and built 5 ft. more of wall, making 17 ft. from one main scaffold.

At the 17-ft. hight a second set of floor beams was put in, a new floor over these leaving the scaffold below intact so there were always three floors in place. The same wooden horses and benches were then used from this floor until the floor

below was stripped, after which it was used again above. In this manner a new scaffold was erected every 17 ft., the original floor being carried to the top, the heavy floor beams alone being left behind as braces for the main truss.

Plumbing the Stack

The method of plumbing the stack was unique. A 5-ft. plumb rule, set to the proper batter, was used on the outside of the stack. Each third course was plumbed around as the blocks were set in place.

FIG. 7. FRAMEWORK OF CONNECTING FLUE

On windy days, when a plumb bob was useless, the work was done from a set of levels fastened to a brass plate at the top of the plumb rule. By this means work could be carried on in a high wind. At times when the wind was blowing almost a gale, no delay was occasioned, although it took two men to hold the rule over the side of the stack.

In order to check the workmen, four transit points were set from ½ to ¾ of a mile away. These points were established before the stack was started, so that the transit line intersected the center of the stack. During the progress of the work this center from the foundation was thrown by means of instruments to the top of the stack and the center obtained on top by means of the intersection of two strings. The perimeter was then trammeled from this center. On calm days a check was taken to the center plug by means of a 30-lb. plumb bob. At no time was the center off over an inch, and at completion of the chimney no variation whatever could be determined.

As a means of communication between the men above and those below, a system of tin speaking tubes was maintained at each elevator well. This was fastened to one of the posts and the tubes extended with each raise of scaffold. The elevators were operated upon signals by electric bells, the push buttons being carried up with the scaffold.

The chimney was designed and erected by the Alphons Custodis Chimney Construction Company, of New York. The flue and dust chamber were designed by the Boston & Montana company.

Comparison of the Iodide, Cyanide and Electrolytic Methods for Copper

J. W. Howson (*Min. and Sci. Press*, Aug. 22, 1908) has compared the accuracy of the iodide, cyanide and electrolytic methods for the determination of copper.

FIG. 8. LOWER FLOOR OF DUST CHAMBER

The customary procedure in cyanide and iodide assays is to precipitate the copper on aluminum foil from a sulphuric-acid solution. This separation is not complete, and may often explain the inaccurate results obtained. The presence of nitric acid, due to incomplete expulsion by sulphuric acid, or the presence of large amounts of iron salts is the cause of the incomplete separation, which source of error may be overcome by precipitating the last traces of copper with hydrogen sulphide and using hydrogen-sulphide water in the subsequent washing of the precipitate. Finely divided metallic copper or the sulphide is readily oxidized and solution then readily takes place. If this hydrogen-sulphide treatment is omitted the results by the iodide or cyanide methods are usually lower than by the electrolytic method provided that the electrolytic precipitation can be accurately made from a simple solution. There is also always a loss in filtering a copper solution, sometimes amounting to several hundredths of 1 per cent., which amount is retained by the filter paper even after many washings.

Appreciable amounts of iodine are liberated by impurities in the precipitated copper or in the reagents in using the iodide method and cause high results. This error, it is true, may offset the loss in filtration, but the counter-balancing is uncertain and is dependent upon the carefulness of the analyst.

Comparing the iodide and cyanide methods, the cyanide titration is rougher, much is left to the judgment of the operator, and the accuracy depends upon the closest adherence to the same working conditions as to bulk, foreign salts, and free ammonia as prevailed in the standardization.

The electrolytic method on simple ores gives accurate results, but unfortunately there are many ores which contain interfering elements. Except in the case of great excess of iron salts, the errors are nearly all positive and yield high results. The removal of the interfering elements requires a high degree of skill, and for these reasons the iodide method is preferable on impure ores. As between the three methods the electrolytic method is preferable where no previous separation of the copper from interfering elements is necessary, otherwise the iodide is better. The danger of error in the standardization of the iodide solution is more than offset by the loss of copper attending the removal of the cathode from the electrolyte. The cyanide method is the least satisfactory.

The Coalfields of the United States

Production of Coal, Including Waste, up to January 1, 1908, Was 10,218,000,000: Estimated Original Supply, 3,157,243,000,000 Tons

2000 BILLION TONS AVAILABLE

The accompanying map, redrawn from one prepared by the U. S. Geological Survey, shows the coalfields of the United States as their outline is now known and the kinds of coal they contain. Up to the present time it has not been possible to prepare so accurate a map, on account of lack of data regarding the shape and extent of many of the western coalfields and the quality of their coal, but during the last few years a large amount of such information has been obtained in connection with the classification and valuation of coal land in the public land States of the West. In carrying on this work the Geological Survey has mapped most of the important coalfields and has tested many of the coals, so that information now at hand seems to be fairly complete. There is still, however, considerable uncertainty regarding the extent and value of some fields containing low-grade coal or lignite. This is particularly true of the lignite fields of the Gulf province, except those of Texas, in which there has been considerable development and exploitation. Little information is available regarding the lignite areas of south Dakota and the lignite and sub-bituminous fields of the Fort Union region, in eastern Montana. The extent and value of the coal beds of the Assiniboine region, in north central Montana, as well as those of the isolated Tertiary lake basins of the mountainous parts of the State, are also matters of speculation.

Information as to the extent, the value, and even the existence of the coalfields of the Pacific coast is very meager. California and Oregon probably have greater coal resources than those now known, but the beds in these States are generally of low-grade coal and are undeveloped. The fields of Washington doubtless embrace a much greater area than that shown on the map, but they are so covered by glacial gravel and heavy timber that it is impossible to determine their extent. Probably many of the areas represented on the map are really connected in a broad belt of coal-bearing rocks along the west slope of the Cascade range.

Little is known regarding the occurrence of coal or the extent of the fields in southern and southeastern Utah, where there are probably many areas of coal-bearing rocks but little coal of commercial importance.

On this map, for the first time, an attempt has been made to represent the coal in the deep basins or synclines of the Rocky Mountain States, where there is every reason to suppose that coal exists, although it is so deeply covered by later sediments as to be accessible with great difficulty if at all. The most important of these basins are the San Juan River basin of New Mexico and the Colorado, the Uinta basin of Colorado and Utah, the Green River basin of Wyoming and Colorado, and the Bighorn basin of Wyoming. None of the basins and troughs of the eastern part of the country is like these western basins, except, possibly, the central part of the Appalachian trough in West Virginia and a part of the Michigan basin, but both of these are comparatively shallow, and all of the coal they contain may be regarded as accessible.

Character of the Coals

From a commercial standpoint the most important feature of the map is the distinction between the various grades of coal. The Geological Survey recognizes the following six classes: (1) anthracite, (2) semi-anthracite, (3) semi-bituminous, (4) bituminous, (5) sub-bituminous (black lignite), and (6) lignite.

In almost all the western fields there is a transition from low-grade to high-grade coal in the direction of the principal mountain uplift. In the San Juan River region the coal changes from sub-bituminous in the southern part to bituminous on the flanks of the San Juan mountains, the transition in the field being gradual and not sharp. In the Uinta basin the coal is bituminous, and of fairly uniform quality in all parts of the rim. In the Green River basin most of the coal is sub-bituminous, but some around the Rock Springs dome in Wyoming is bituminous, as is the lower coal in the eastern part of the Yampa field in Colorado. In the Bighorn basin the coal does not differ much in composition from place to place; in general it is better on the southwestern side of the basin, but even there it hardly reaches the grade of bituminous. In the Fort Union region there is a decided change from the brown lignite of the North Dakota portion to the sub-bituminous coals of the Sheridan district in Wyoming. This change is gradual, affecting a wide region in eastern Montana.

Geologic Age of the Coals

The geologic age of the coal-bearing rocks of the United States ranges from Carboniferous in the eastern and interior provinces to Miocene (Tertiary) in California and other places on the Pacific coast. In a very general way the quality of the coal varies with the geologic age of the coal beds, but there are so many exceptions that such a generalization has little value.

In the main the best coals of the country are of Carboniferous age and are found in the anthracite and Appalachian fields; also in the northern, eastern, western, and southwestern regions of the eastern and interior provinces. In this broad area the coals of higher grade occur in the anthracite region, along the eastern front of the Appalachian region, and in the Arkansas fields of the western region near centers of great disturbance and mountain building.

In the Atlantic Coast region a number of basins of Triassic rocks contain workable beds of coal. In the early days of the colonies these were of great importance, but later they fell into disuse and are now practically abandoned.

The lignites of the Gulf province are of Eocene (Tertiary) age and are of low grade except in the vicinity of Laredo, on the Mexican line. Those of the Eagle Pass region are of better grade and are decidedly older, belonging to the Cretaceous system.

In the Rocky Mountain and Northern Great Plains provinces the coal-bearing rocks range in age from Lower Cretaceous to Eocene (Tertiary). The former occur in the Great Falls and Lewistown fields of the Judith basin, central Montana, and in the Black Hills region, Wyoming. These rocks are of Kootenai age, the age of the rocks of the Crows Nest Pass and other important fields of Alberta.

Upper Cretaceous rocks carry most of the coals in the San Juan River and Raton Mountain regions of southern Colorado and New Mexico, as well as those in most of the scattered fields of New Mexico. In the other fields of Colorado and Utah almost all the coal beds so far known are of this age. In Wyoming, Upper Cretaceous coals are present in the Hams Fork, Green River and Bighorn Basin regions, and in the Hanna and other smaller fields. In Montana they are limited largely to the Yellowstone and Assiniboine regions and to the Bridger field, in Carbon county.

The great expanse of coal of the Fort Union region of North Dakota, South

COAL FIELDS of the UNITED STATES.
Redrawn from a map published in May 1908 by the United States Geological Survey.
Bituminous and Anthracite Coal
A. Includes anthracite coal.
C. coking coal.
Areas containing workable coal beds.
Areas that may contain workable coal beds.
Areas probably containing workable coal beds under such conditions as are not to be available at present.
Areas that may contain workable coal beds.
Areas containing workable coal beds.
Areas probably containing workable coal beds under such conditions as are not to be available at present.
Areas that may contain workable lignite beds.
Areas containing workable lignite beds.
Bituminous Coal
Subbituminous Coal
Lignite
DOMINION OF CANADA
ATLANTIC OCEAN
GULF OF MEXICO
PACIFIC OCEAN
GULF OF CALIFORNIA
LOWER CALIFORNIA
MEXICO
NEW YORK
VERMONT
NEW HAMPSHIRE
MAINE
PENNSYLVANIA
OHIO
INDIANA
ILLINOIS
MICHIGAN
WISCONSIN
MINNESOTA
IOWA
MISSOURI
KANSAS
NEBRASKA
SOUTH DAKOTA
NORTH DAKOTA
MONTANA
WYOMING
COLORADO
UTAH
NEVADA
IDAHO
OREGON
WASHINGTON
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
OKLAHOMA
ARKANSAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
ATLANTIC COAST REGION
EASTERN REGION
NORTHERN REGION
WESTERN REGION
SOUTHWESTERN REGION
FORT UNION REGION
ASSINIBOINE REGION
NORTH BASIN REGION
YELLOWSTONE REGION
BIG HORN BASIN REGION
BLACK HILLS REGION
SOUTH DAKOTA REGION
SOUTHERN REGION
RIO GRANDE REGION
PARK DENVER FIELD
GUNNISON FIELD
UINTA REGION
SOUTHWESTERN REGION
SAN JUAN RIVER REGION
RATON REGION
MOUNTAINAIR REGION
SOUTHWESTERN REGION
CAPITAN FIELD
Silver City
Deming
Bisbee
El Paso
Tucson
Phoenix
Los Angeles
San Diego
Las Vegas
Salt Lake
Denver
Cheyenne
Helena
Butte
Spokane
Portland
Seattle
Tacoma
Sacramento
San Francisco
Boise
Cheyenne
Omaha
Kansas City
St. Louis
Chicago
Milwaukee
Minneapolis
St. Paul
Duluth
Detroit
Cleveland
Pittsburgh
Buffalo
Boston
New York
Philadelphia
Baltimore
Washington
Richmond
Norfolk
Charleston
Savannah
Jacksonville
Mobile
New Orleans
Galveston
San Antonio
Dallas
Fort Worth
Oklahoma City
Little Rock
Memphis
Nashville
Atlanta
Birmingham
Montgomery
Columbia
Raleigh
Knoxville
Louisville
Indianapolis
Cincinnati
Columbus
Toledo
Grand Rapids
Lansing
Madison
Milwaukee
Dubuque
Cedar Rapids
Des Moines
Omaha
Lincoln
Topeka
Wichita
Joplin
Springfield
Peoria
Quincy
Cairo
Vicksburg
Shreveport
Tulsa
Pueblo
Colorado Springs
Salt Lake City
Ogden
Provo
Reno
Carson City
Virginia City
Tonopah
Goldfield
Bisbee
Douglas
Globe
Jerome
Prescott
Flagstaff
Albuquerque
Santa Fe
Las Cruces
Roswell
Amarillo
Lubbock
Abilene
Waco
Austin
Corpus Christi
Laredo
Brownsville
Eureka
Ely
Winnemucca
Elko
Pocatello
Idaho Falls
Great Falls
Billings
Miles City
Bismarck
Fargo
Sioux Falls
Pierre
Rapid City
Sheridan
Cheyenne
Laramie
Rock Springs
Green River
Evanston
Ogden
Provo
Salt Lake City
Grand Junction
Durango
Trinidad
Raton
Las Vegas
Santa Fe
Albuquerque
Socorro
Silver City
Deming
Bisbee
El Paso
Tucson
Phoenix
Yuma
Los Angeles
San Diego
San Francisco
Sacramento
Stockton
Fresno
Bakersfield
Eureka
Redding
Portland
Eugene
Salem
Seattle
Tacoma
Spokane
Walla Walla
Lewiston
Boise
Pocatello
Idaho Falls
Great Falls
Helena
Butte

Areas, Estimated Tonnage, and Production of the Various Coal-fields of the United States.

[A = Anthracite. B = Bituminous. S = Subbituminous. L = Lignite.]

State and Field.	Area in Square Miles. Containing Workable Coals.	Area in Square Miles. May Contain Workable Coals.	Area in Square Miles. Coal Under Heavy Cover.	Kind of Coal.	Estimated Original Coal Supply in Short Tons. Coal Both Easily Accessible and Accessible with Difficulty.	Production in Short Tons. 1906.	Production in Short Tons. Total to January 1, 1908, Including Waste.
Alabama:							
Warrior and Plateau fields	7,845			B	63,513,000,000	11,301,993	
Cahaba field	325			B	2,994,000,000	1,635,907	
Coosa field	260			B	2,396,000,000	170,063	
Lignite field		6,000		L			
Total	8,430	6,000			68,903,000,000	13,107,963	247,000,000
Arizona	30			B	60,000,000		
Arkansas:							
Bituminous field	1,584			B	1,797,000,000	1,934,673	
Lignite field	100	5,900		L	90,000,000		
Total	1,684	5,900			1,887,000,000		36,000,000
California	500?			S, B	1,000,000,000	25,290	7,000,00
Colorado:							
Denver region	600	3,700		S	13,590,000,000	1,544,776	
Durango field	1,380		520	B, S	21,428,000,000	177,718	
North Park field	20	480		S	453,000,000	1,300	
Trinidad field	1,080			B	24,462,000,000	6,572,673	
Uinta region	6,000			B, A	271,810,000,000	1,145,310	
Yampa field	700		2,300	B, S, A	39,639,000,000	5,407	
Scattered fields	350			B, S	388,000,000	666,034	
Total	10,130	4,80	2,820		371,770,000,000	10,111,218	169,000,000
Georgia	167			B	933,000,000	353,548	12,000,000
Idaho	200	1,200		S, B	600,000,000	5,882	
Illinois	35,600			B	240,000,000,000	38,434,363	968,000,000
Indiana	6,500			B	44,169,000,000	11,895,252	239,000,000
Iowa	12,560	5,640		B	29,160,000,000	6,798,609	212,000,000
Kansas	3,100	15,780		B	7,022,000,000	6,423,979	136,000,000
Kentucky:							
Eastern Kentucky	10,270			B	67,787,000,000	3,768,651	
Western Kentucky	6,400			B	36,241,000,000	5,884,996	
Total	16,670				104,028,000,000	9,653,647	184,000,000
Louisiana	8,800			L			
Maryland	155			B	8,044,000,000	5,108,539	221,000,000
Michigan	11,000			B	12,000,000,000	1,473,211	21,000,000
Mississippi	7,500			L			
Missouri	16,700	6,300		B	40,000,000,000	3,983,378	116,000,000
Montana:							
Fort Union region	32,300	6,100		L, S	279,500,000,000		
Bull Mountain field	754			S	6,560,000,000		
Red Lodge and Bridger fields	17	100		S	2,000,000,000	557,148	
Judith Basin region	516	2,500		B	2,000,000,000	1,058,763	
Assiniboine region		8,000		S	10,000,000,000	13,550	
Yellowstone region	450			B	3,000,000,000	200,460	
Scattered fields		875		S, L			
Total	34,067	17,575			303,060,000,000	1,829,921	37,000,000
New Mexico:							
Raton field	1,360			B	30,805,000,000	1,292,241	
San Juan region	11,600		5,000	S	131,375,000,000	604,517	
Scattered fields	375			B, A, S	1,600,000,000	67,955	
Total	13,335		5,000		163,780,000,000	1,964,713	33,000,000
North Carolina	60			B	200,000,000		1,000,000
North Dakota:							
Western fields	31,240	3,900		L	500,000,000,000	317,542	
Turtle Mountain field		360		L			
Total	31,240	4,260			500,000,000,000	317,542	4,000,000
Ohio	12,660			B	86,028,000,000	25,552,950	739,000,000
Oklahoma	10,000			B	79,278,000,000	2,924,427	60,000,000
Oregon	230			S	1,000,000,000	109,641	2,000,000
Pennsylvania:							
Anthracite region	480			A	21,000,000,000	71,282,411	
Bituminous fields	14,200			B	112,574,000,000	129,293,206	
Total	14,680				133,574,000,000	200,575,617	5,652,000,000
South Dakota	2,000	4,000		L	10,000,000,000		
Tennessee:							
Bituminous fields	4,400			B	25,665,000,000	5,766,690	
Lignite fields	1,000			L			
Total	5,400				25,665,000,000	5,766,690	126,000,000
Texas:							
Bituminous fields	8,200	5,300		B	8,000,000,000	839,985	
Lignite fields	2,000	53,000		L	23,000,000,000	472,888	
Total	10,200	58,300			31,000,000,000	1,312,873	22,000,000
Utah:							
Uinta region	9,990			B	150,970,000,000	1,701,674	
Southwestern Utah region	3,140	1,500		B, A	45,438,000,000		
Scattered fields		500		B, S	50,000,000	70,877	
Total	13,130	2,000			196,458,000,000	1,772,551	28,000,000
Virginia:							
Southwestern fields	1,550			B	21,000,000,000	4,205,019	
Brushy Mountain fields	200				900,000,000	49,860	
Richmond fields	150			B	600,000,000		
Total	1,900				22,500,000,000	4,254,879	86,000,000
Washington	1,100			B, S	20,000,000,000	2,864,926	64,000,000
West Virginia	17,000			B	231,039,000,000	87,791,580	650,000,000
Wyoming:							
Fort Union region	11,530	3,060		S	174,600,000,000	1,091,499	
Bighorn Basin region	905	430	2,830	S	1,000,000,000	5,451	
Hanna field	1,435	240	290	S	33,000,000,000	450,636	
Green River region	4,855	1,350	20,750	B, S	199,152,000,000	2,122,253	
Hams Fork region	1,073	960	115	B, S	16,000,000,000	2,078,772	
Black Hills region	320			B	133,000,000	385,383	
Scattered fields	150	200		S	200,000,000		
Total	20,568	6,240	23,985		424,085,000,000	6,133,994	116,000,000
Total for United States	327,596	137,375	31,805		3,157,243,000,000	414,157,278	10,218,000,000

Dakota, Montana, and Wyoming is of Eocene (Tertiary) age. Coals of the same age occur in the Bull Mountain field, on Musselshell river, and in the Red Lodge field, on the southern boundary of Montana. Eocene coals also occur in the Green River basin east of Rock Springs, in the center of the Hanna field, and in certain parts of the Hams Fork region, in Wyoming.

The mountain basins in the western part of Montana, as well as some in Idaho, are of Tertiary age, although few of them have been mapped and the coals of only a few have been examined.

In the Pacific Coast province all the coals are of Tertiary age, though some of them have been locally metamorphosed into anthracite by intrusions of igneous rock. The Washington coals, as well as those of the Coos Bay field in Oregon, are Eocene; those of west-central California—at least those in Stone cañon, Monterey county—are Lower Miocene.

Estimated Tonnage of the Various Fields

During the last few years considerable attention has been given to the need of conserving the mineral fuels of this country for the use of future generations. Few persons were in possession of data that would enable them to make an estimate of the amount of coal yet remaining in the ground, and no one knew whether or not the present growing consumption would continue indefinitely; consequently there has been a general feeling that the supply of coal in the United States is inexhaustible, and that the present generation need give no thought to this troublesome question.

The uncertainty regarding future consumption still exists, but data are now at hand, except for certain little-known fields of the West, that will afford the basis for a fairly trustworthy estimate of the tonnage of coal yet remaining. These western fields, however, except those of Washington, are of small extent, and the uncertainty as to their content has little effect on the aggregate amount.

The latest available estimate of the total original tonnage of the coalfields of the United States, exclusive of Alaska, was made by the Geological Survey in 1906. This estimate gave 2200 billion short tons as the total original content of the fields, but was confessedly made without adequate information, since little was known at that time regarding many of the most important fields of the Western States. With the increased information at hand regarding these fields, it seems opportune now to present an estimate considerably larger than that made two years ago. Part of this difference is due to increase in information, and part to an increase in the limit of depth to which coal beds may be worked.

The limit of workable depth in the estimate here given is based on actual mining conditions abroad, especially in Belgium. This limit is 3000 ft. for coal and 1000 ft. for lignite. Twenty inches is regarded as the minimum minable thickness of bed for coal and 3 ft. for lignite.

The table shows the size of areas represented on the map, in square miles; the kind of coal; the production in 1906; the total production to date, including estimate of production for 1907, to which is added 50 per cent. for waste in mining; the estimated original tonnage; and the estimated amount remaining in the ground at the present time.

The figures given show that the area of the more accessible coalfields of the United States is about 327,000 square miles, and that they carry an estimated content available for future use of nearly 2000 billion tons. The rate of consumption cannot be predicted with certainty, but if the rate of increase that has held for the last 50 years is maintained, the supply of easily available coal will be exhausted before the middle of the next century.

TONNAGE (SHORT TONS) BY PROVINCES AND ACCESSIBILITY.

Province.	Area in Square Miles.	Original Coal Supply.		Easily Accessible Coal Still Available.
		Amount Easily Accessible.	Amount Accessible With Difficulty.	
Eastern	70,022	636,673,000,000	8,000,000,000	628,870,000,000
Interior	144,664	406,667,000,000	91,000,000,000	404,726,000,000
Gulf	84,300	13,045,000,000	10,045,000,000	13,031,000,000
Northern Great Plains	103,564	521,793,000,000	459,000,000,000	521,764,000,000
Rocky Mountains	92,396	414,740,000,000	374,280,000,000	414,382,000,000
Pacific Coast	1,830	11,100,000,000	10,900,000,000	11,027,000,000
Total	496,776	2,004,018,000,000	1,153,225,000,000	1,993,800,000,000

TONNAGE (SHORT TONS) BY GRADES OF COAL AND ACCESSIBILITY.

Kind of Coal.	Area in Square Miles.	Original Coal Supply.		Easily Accessible Coal Still Available.
		Amount Easily Accessible.	Amount Accessible With Difficulty.	
Anthracite and bituminous	250,531	1,257,766,000,000	505,730,000,000	1,247,672,000,000
Sub-bituminous	97,636	356,707,000,000	293,450,000,000	356,594,000,000
Lignite	148,609	389,545,000,000	354,045,000,000	389,534,000,000
Total	496,776	2,004,018,000,000	1,153,225,000,000	1,993,800,000,000

Coalfields of the Big Horn Basin

A party of coal geologists of the United States Geological Survey have been at work during the summer in the examination of the coal deposits of the southeastern part of the Bighorn Basin. The party consisted of E. G. Woodruff and Max A. Pishel, of Washington, D. C., Roy L. Nelson and J. H. Cather, of Lincoln, Nebraska and Jesse Gallaway, of Bloomington, Indiana. The region examined by these men lies between Nowater creek and Bighorn river. Preliminary surveys had shown that outside of this area no workable coal beds are to be found between the mountains and Bighorn river, south of a line running east from the mouth of Nowater creek. In the area where coal was known to occur, the geologists made careful examination of the coal deposits, measuring the thickness of the coal beds, determining their extent and gathering such other information as might aid anyone who wished to develop mines.

"The most promising beds of coal," said Mr. Woodruff, who was in charge of the work, "occur along Nowater creek and north of Kirby creek, near Bighorn river. These later deposits are the eastward extension of the beds mined at Gebo and Crosby. Less important deposits occur at several places along Nowater creek, also near the head of Bud Kimball Draw, and on the upper branches of Big Cottonwood creek.

Water and Gas Occur only in Small Quantities

Those coal beds generally are not so thick or extended as those found elsewhere in the Bighorn Basin. In fact, they seem to be too limited to warrant the construction of a railroad for their development alone. There is sufficient coal, however, to furnish an abundant and permanent supply to the ranchers living within reach of the various beds. The examination shows too that the beds dip at favorable angles for mining and that water and gas occur in such small quantities that no difficulty will be experienced from these elements which are often troublesome in coal mines.

The geologists class this coal as sub-bituminous. This means that the coal is better than the brown lignites mined at many places in the West, but not so good as the bituminous coal of Pennsylvania or West Virginia. The coal in the southeastern part of the Bighorn Basin is about the same grade as that mined at Gebo and

Crosby. It contains a small per cent. of ash, a low per cent. of sulphur and is non-coking. The coal ignites readily and burns freely. Such coal is best suited for domestic purposes, but, with proper grates and drafts, can be successfully used for steaming.

Samples of the coal were sent to the laboratories of the Geological Survey for analysis, so that the quality of this coal may be known exactly and compared with coal from other fields.

The work done this year completes the Survey's investigations of the coal deposits of the Bighorn Basin. Last year one party surveyed the west side of the Basin and another the area lying to the northeast. Reports on the areas mapped last year are now being printed at the Government printing office in Washington, and will soon be ready for free distribution. Anyone desiring these reports can obtain them by addressing the Director, U. S. Geological Survey, Washington, D. C. The report on the area surveyed this year will be written by the geologists in Washington this winter, and when published will be sent to anyone wishing to know about this coalfield.

The Tariff Hearings at Washington

Special Correspondence

Considerable numbers of briefs continue to be filed with the House Ways and Means Committee including many that deal with the duties on metals and minerals and their products.

Coal and Iron

In one of these briefs C. M. Freeman, for the National Grange, asks that forest, coal and iron products be placed on the free list. The Harrison Supply Company, Boston, Mass., asks abolition of the duty on iron sand.

I. W. Kuhn, Pittsburg, Penn., writes in advocacy of a policy of reciprocal free coal with Canada. The Fairmont Coal Company, of West Virginia, opposes free coal unless coupled with a reciprocity provision. The National Forest Conservation League has filed further argument and a mass of correspondence favoring removal of the duties on lumber in the interest of better conservation of resources. H. L. Stowell, Ellensburg, Wash., has filed argument in favor of the free admission of Canadian coal and lumber. Hon. Jas. Kennedy transmits a number of protests against the granting of drawbacks on tinplate. Ralph H. Stearns, New York, asks reduction or removal of the duties on steel.

Lead and Zinc Ores

A. B. Cockerill, Nevada, Mo., files a supplemental argument against the proposed duty on zinc ore. Edward Brush, of the American Smelting and Refining Company, files estimate of 81c. to $1.48 per ton as the cost of laying down a ton of 5 to 14 per cent. lead ore at the mouth of one of the four largest mines in Mexico controlled by his company. He also corrects some points in his previous testimony before the committee.

Rare Metals and Alloys

Charles Engelhard, New York City, asks that rhodium and ruthenium be placed on the free list along with platinum, iridium, palladium and osmium. W. B. Klee, Damascus Bronze Company, Pittsburg, Penn., submits correspondence showing that the Treasury refuses to make phosphor-copper and tin dutiable unless phosphorus is the element of chief value. R. F. Long, New York City, importer of phosphor-manganese and silicon-copper argues against any duty on phosphor-copper and tin.

Mineral Paints

Peter Zucker, New York, "in behalf of the manufacturers of dry colors of the United States" submits a dry-color schedule providing that Berlin, Prussian, Chinese and other blues containing ferrocyanide of iron remain at 8c. per lb.; that all chromium colors in which lead and bichromate of potash are used remain at 4.5 per lb.; that in either of the foregoing cases if there be a reduction a corresponding reduction in the constituents (potash, lead, etc.) be made; that colors containing quicksilver be raised from 10 to 15c. per lb.; that white sulphate of zinc now dutiable at 1.25c. per pound be particularly maintained at its present rate; that in case of any reductions in the tariffs on colors there be corresponding reductions on a large number of articles including barytes, white lead, whiting, oxide of zinc, quicksilver, etc. F. A. Reichard, New York, asks that ochers, umbers and siennas and dry zinc be free of duty; that orange mineral be reduced to 1.55c. from 3.375c.; red lead to 0.99c. from 2.875c. and white lead to 0.93c. from 2.875c.; that ultramarine blue be reduced by an indeterminate amount; natural oxides of iron 40c. per ton; artificial oxides to 15 instead of 30 per cent. English vermilion be taxed at rates varying from 5c. (the present duty) to free entry. These views are supported by a large collection of letters from paint-makers stating the rates they prefer and generally concurring with the above recommendations. J. Lee Smith & Co., New York City, urges maintenance of the present classification of ocher, sienna and umber.

Phosphates and Fertilizers

J. L. Hills, director Vermont Agricultural Experiment Station, asks that all fertilizers be admitted free. E. H. Jenkins, director Connecticut Agricultural Experiment Station, asks free entry for sulphate of ammonia. Wm. P. Brooks, director Massachusetts Agricultural Experiment Station, asks that guano, sulphate of ammonia, basic slag-meal and land plaster be admitted free. Similar views are taken by the directors of a number of other New England agricultural experiment stations.

Miscellaneous

Watson Brothers, Boston, Mass., importers of mica, favor removal of the present ad valorem rate of 20 per cent. and retention of the existing specific duty.

Hon. W. P. Brownlow files a letter from H. E. Graves, Bristol, Tenn., asking a duty of $5 per ton of 2000 lb. on crude barytes, $12 per ton on manufactured barytes and $25 per ton on barium salts, precipitated barytes and their compounds.

The Wadsworth Stone and Paving Company, Pittsburg, asks that the duty on asphalt be raised. Jno. W. Langley presents a letter from the Albany Mining & Investment Company, Monon, Ky., and asks a reasonable tariff on fluorspar. Thos. H. B. Haase, Princeton, Ky., asks a duty of $1 per ton. The Sunny Brook Lead and Fluorspar Company, asks a tariff of $3 per ton. The O'Rourke-McCabe Plastering Company, New York City, asks free entry for Nova Scotia gypsum. The Angels Marble Company, Vallicita, Cal., asks a reduction of the tariff on marble. The Chavant Manufacturing Company, Jersey City, asks that plastilena be placed in the tariff act as a classified manufactured article dutiable at 50 per cent. The American Emery Wheel Works, Providence, R. I., asks to have pulverized corundum placed on the free list.

New Method of Preparing Sand for Leaching

A new method for removing slime and water from gold-bearing sand, devised by W. A. Caldecott, has been in use at the Knights Deep and the Simmer & Jack Proprietary mines for some time, and is being adopted by the East Rand Proprietary Mines (*South African Mining Journal*, Sept. 12, 1908). The sand and slime are run to conical classifiers; the sand and water coming off at the bottom runs to a slowly rotating horizontal vacuum filter table. The moist sand is scraped off from the table by a fixed plow into a hopper where it is mixed with a constant flow of cyanide solution. The mixture of sand and solution is then transferred to a large vat where it is leached in the ordinary way. This vat before receiving sand is filled with solution, and the overflowing solution is returned to the hopper. By means of this process, costs have been reduced and the extraction increased as the sand is more leachable.

The London Copper Market in 1908

SPECIAL CORRESPONDENCE

January disclosed an increase of 1922 tons in the visible supply, bringing the total up to 19,710 tons. There was, however, considerable activity in trade, chiefly with India; and confidence was further inspired by the improved outlook in American finance, as also by the early reduction of the official English bank rate from 7 to 6 per cent. Standard copper, which had closed in December at £60 15s. for cash warrants, opened with an advance of 5s., advancing to £62 10s., with three months' warrants touching £63 10s.; and the price of Lake Superior brands advanced to 13¾@13⅞. This advance was partly lost by the early intervention of bears, whose operations were prompted by the aforesaid statistics; and the market remained uneventful for the first week or so. On Jan. 9 renewed activity was inspired by increased firmness on the part of American producers, coupled with improved American demand. Consumers and speculators bought freely, thereby carrying the price of three months' warrants up to £64 15s., which price was registered on Jan. 15; Indian and Chinese orders contributing to the improvement. Sales were largely covered with American supplies, whereby the American producers were relieved of substantial quantities and were accordingly firm in holding for full prices. The London market suffered some temporary relapse caused by bear sales, but quickly recovered in virtue of good trade. On Jan. 21 Wall Street began to display new signals of distress which induced a decline, which even reductions in the European bank rates could not arrest. The inertia thus produced became gradually more pronounced on the rumor of certain mines being reopened, notwithstanding the already ample scale of production. The closing days of the month witnessed restricted business and a gradual decline down to £61 2s. 6d. for cash warrants, and £61 15s. for three months; the American quotation being meanwhile reduced 12½ points.

February found the market devoid of any feature of interest to stimulate operations in either direction. The tendency soon became weak in response to unpromising advices from the United States, and values declined accordingly to £60 7s. 6d. cash, and £61 forward. These figures prompted bear covering, which quickly raised the latter value to £62 15s., which price was paid on Feb. 5. Heavy sales followed, coinciding with disappointing reports from the consuming centers and complications in the American industrial situation. An almost uninterrupted decline carried values down until on Feb. 19 three months' warrants touched £56 12s. 6d.; American prices being meanwhile reduced in proportion. Much of the selling on the London market was understood to be for American account, and was further prompted by grave apprehensions of trouble in the British shipbuilding and engineering industries. On Feb. 20 better news from Wall Street, and a brighter outlook in the labor question, caused a rally which carried three months' warrants to £59 10s. During the decline, however, bears had covered their commitments and the bull account now predominated. Important business with consumers in France and Germany infused some genuine vitality into the market, as also did persistent orders from China—chiefly for electrolytic. American business, however, remained very slack, and the New York price had drifted down to 12c. before any improvement set in. The remainder of the month saw fluctuations within narrow limits, and copper shares were strengthened by rumor of impending resumption of work at the Anaconda and other mines in Montana. The official price of sheet copper was advanced £2 per ton. The closing prices of Standard were £58 for cash warrants, and £58 12s. 6d. for three months.

In March, recent firmness was early dispelled by official announcement that the mines and smelters of the Amalgamated company would resume work to their full capacity. The news was not unexpected, but its effect was nevertheless depressing, and was followed by successive cuts in New York down to 12.37½@12.50c., or within a fraction of the lowest recorded in recent years. On the other hand some confidence was imparted by improved tone in the stock and share markets; and fluctuations were, therefore, within narrow limits, notwithstanding the restricted operations of consumers and the eager competition for their orders. On March 12 some revival was manifest, due to revived demand, especially for electrical work, and the low ebb to which consumers had allowed their stocks to diminish. A similar movement took place in America where the revival, though rather feeble, was none the less welcome. A good inquiry from Indian markets and a more cheerful tone on the Stock Exchange also imparted strength. The price of three months' warrants accordingly advanced from £58 2s. 6d. on March 11 to £60 which was paid on March 16. A temporary reaction then set in, mainly induced by bear selling; but sentiment was very diverse, and confidence was somewhat inspired by reduction of the official bank rate of interest to 3 per cent. By this time American producers had been largely relieved of surplus stock and were accordingly firmer in their quotations, and various industrial enterprises which had been retarded during financial unrest were again under consideration. The fourth week of the month witnessed a large speculative business in copper and tin, the former being apparently connected with operations in copper mining shares; but the consumptive trade was not so encouraging—at least in Europe, where consumers had by this time covered their requirements and were now holding aloof. It was better in America where electrical industry prompted an improved demand and producers had raised their prices gradually to 13⅜c. The London market improved in sympathy therewith to £62. Thereafter followed a distinct reaction primarily due to weakness in American shares and to slackening of trade inquiries. The closing prices were £59 17s. 6d. for cash warrants, and £60 5s.@£60 7s. 6d. for three months.

April opened with a flat market, holders having become impatient in face of the steadily growing production of the metal. For a time speculators absorbed offerings fairly well, and prices suffered only moderately; but reduced quotations from New York soon deepened the prevailing depression. Consumers were apathetic and business was restricted. American demand was further checked by recurrence of financial instability. On April 10 prices had fallen to £57 15s. cash, and £58 5s. three months; while leading American producers were readily meeting demand at 13c. for electro, and even this reduced price was undercut by some of the lesser producers. There were also rumors of wholesale reselling for Chinese account, some unshipped orders being certainly countermanded. The next feature was a recovery induced by covering of short sales, and a concerted buying movement which coincided with a bull campaign in copper mining shares, whereby values were carried up to £58 12s. 6d. and £59 respectively on April 16. On the resumption of business after the Easter holidays prices relapsed in a stagnant market, the turnover being small and mostly professional, while trade reports were generally discouraging. Toward the end of the month there was more activity, due chiefly to the desire to liquidate holdings in face of enormous shipments of the metal from Atlantic ports. Three months' warrants changed hands at £57 17s. 6d. on April 28. Thereafter occurred a transitory recovery caused by covering of May prompts and strong advances on the New York Stock Exchange. The trade, however, remained unresponsive and values fell away, closing at £57 10s. for cash warrants, and £58 2s. 6d. for three months.

May started with a fall of 10s. per ton, caused mainly by unfavorable statistics; but at the end of two days the selling pressure had subsided and a recovery of 17s. 6d. was recorded, due to buoyancy in copper mining shares and influx of speculative orders. The next feature was a reduction in American prices, which weakened the London market and brought back prices to the starting point. Toward the

middle of the month a well sustained bull movement was initiated in Wall Street, which created great activity in stocks and broadened so as to attract speculators toward the metal. Brokers—undeterred by actual conditions of trade—encouraged their clients to invest for the rise, and a large volume of business resulted. The expanded demand was met by heavy selling, supposed to be for American account. Cash warrants advanced from £56 15s. on May 12 to £59 on May 19; the three month's price being maintained throughout at about 15s. premium. Meanwhile producers were alert to take advantage of the improvement, and accepted in many cases prices which were well below the Standard parity. Japanese brands being prominent after a long period of inactivity. The consumptive inquiry meanwhile was far from satisfactory, manufacturers being unanimous in bewailing the scarcity of orders. Prices gave way at the first sign of reaction in Wall Street, and gradually fell to £56 17s. 6d. at which cash warrants changed hands on May 27. Thereafter cheerfulness was imparted by the termination of labor troubles in the shipbuilding industry, and by reduction of the Bank rate of interest from 3 to 2½ per cent. and the speculative movement again carried prices upward, the closing figures being £57 12s. 6d. for cash, and £58 5s. for three months. Manufacturers had meanwhile reduced their selling prices by £2 per ton, but without attracting much business thereby, and the general slackness of trade at home and abroad was very pronounced.

June was remarkable for the strength displayed by the market throughout the month in face of unfavorable statistics, poor trade, heavy offerings from Japan, unsettled and generally languid stock and share markets. There was sustained buying by speculative investors, who apparently regarded the future with confidence inspired by the improved industrial and political prospects in the United States. Leading producers were thus able to market their copper without conceding any substantial reductions in price, and were accordingly independent. The result was that fluctuations were very narrow; the three months' price ranging from £58 5s. at the opening, up to £59 5s. on June 11, and thereafter by easy stages down to £57 on June 29. The mid-monthly statistics were unfavorable and helped the decline. American sellers, after having sold fairly well early in the month, made some trifling concessions in price, but without attracting much business thereby. The disquieting feature was the steadily increasing stocks, not only in public warehouses, but also in the hands of producers; consumption meanwhile betraying a serious shrinkage, particularly in France and Germany. The support which the market received was, therefore, based more on sentiment than on sound economic conditions. Closing prices were £56 15s. cash, and £57 7s. 6d. for three months.

In July, prospects at the opening were not encouraging, trade being restricted and demand readily met by dealers. Statistics disclosed an increase of 6553 tons during the previous month, and stocks in private hands were heavy. Further shipments of the metal from the United States and from Japan promised to be heavy, and consumers were naturally reluctant to buy more than they actually required. Early in the month, however, speculation received an impetus from Wall Street where much optimism was imparted by prospects of a good harvest and by indications of expanding trade. The leading American producers of copper had meanwhile stood firm and now began to find a better home demand, and the London market improved in consequence. Three months' warrants, which had opened at £57 2s. 6d. changed hands in considerable volume at £58 12s. 6d. on July 9. Thereafter for a week or more operations were restricted and prices fell back a few shillings, the home trade being slack, though some improvement was noticeable on the Continent. On July 20 occurred a sharp rise in shares, whereby general optimism was revived; the sentiment soon extending to commodities, in which copper figured largely. Consumers now bought freely after a long period of abstention, and an industrial revival was manifest, particularly in electrical branches. Producers, having sold largely, held firmly for advanced prices, and the Standard market was correspondingly strong. Three months' warrants changed hands on July 24 at £60, a figure which had long been regarded as a remote possibility, and from which a temporary relapse of 5s. was soon recovered. American manufacturers bought largely at 13⅛@13¼c., apparently without satisfying their requirements even at the higher figure. The most noticeable feature in the Standard market was the absorbing power of the speculative demand, notwithstanding the poor support afforded by the home trade, which was adversely affected by the advanced prices. Bull accounts were freely liquidated, and bear selling assumed large proportions, while large quantities were marketed from Japan, Chile, China and European producers; but the speculative force absorbed all that was offered, and on the last day of the month £61 was paid for three months' warrants. This was the eve of the statutory holiday when the market would be closed for two days, and absentees would be numerous. The market closed amid diverse conjectures as to the immediate sequel, final quotations being £60 for cash warrants, and £60 15s. for three months.

In August when business was resumed the market displayed considerable buoyancy in spite of an increase of 4423 tons in the visible supply during the previous month. Prominent operators readily took over all that was offered by holders who naturally regarded the situation as unsound, in view of increasing stocks and diminished trade. The latter was indeed evident throughout the month, for consumers found orders few and were reluctant to buy the metal until obliged. Finance, however, was powerfully employed in keeping up prices of metals and of mining shares, and the cheapness of money contributed thereto. The situation was virtually governed by the New York Stock Exchange, while trade languished. American consumers found it necessary to cover accumulated requirements, and their purchases relieved producers of all superfluous holdings; and successive advances raised the selling price of electrolytic to 13¾c. Fluctuations on the London market were within narrow limits, the highest being touched on Aug. 10, when three months' warrants commanded £63, and the lowest on Aug. 25, when £60 7s. 6d. was accepted; and the month closed with a steady market, cash warrants at £61 2s. 6d. @ £61 5s., and three months at £61 17s. 6d.

In September the fortnightly statistics showed an increase of only 287 tons, which was generally regarded as favorable. Trade showed some signs of expansion, but the rising prices were checked by instability in the share markets. Consumptive inquiry mostly came from the Continent, where electrical enterprise was active, being chiefly manifest in the projected electrification of railways under the lead of the German government. Improved conditions in the iron and steel trades tended to inspire confidence, and prices rose until, on Sept. 8, up to £61 5s. was paid for cash warrants, and £62 5s. for three months. At this point the improvement was checked by the leading American producers unexpectedly reducing their price for electrolytic quality by £1 per ton. By the middle of the month recovery was in progress under the stimulus of buoyant share markets, but a relapse followed on the publication of statistics showing an increase of 3358 tons. American reports of trade and finance became less optimistic as the approaching presidential election engendered political excitement. Moreover it was known that production of the metal in the United States and in Mexico was now proceeding at full capacity and overtaking all previous records of output. By Sept. 22 prices of Standard had fallen to £59 2s. 6d. and £60 respectively. Thereafter the market improved for some days, but dealings were mostly professional and lacked trade support. The close was quiet, there being neither active demand nor eagerness to sell; cash warrants being held for £59 17s. 6d. and three months for £60 15s.

October found the market sensitive at

the outset, the continued increase in the visible supply inspiring caution. American consumers bought but sparingly pending the issue of the election, and the American producers found Europe their best outlet, particularly for electrolytic quality. In two days the London price dropped 12s. 6d. per ton. Grave political news followed, threatening war in southeastern Europe, whereby the share markets were much disturbed; but the copper market withstood the shock remarkably well. The lowest was touched on Oct. 9, when cash warrants stood at £59 2s. 6d. and three months at £60. Thereafter confidence was restored as political complications subsided and the share markets became buoyant, and prices advanced rather sharply, only to relapse gradually almost to the previous level. Trade generally was very slack, the electrical industries affording the only exception, and the increasing output from the mines gave promise of abundant supply. On Oct. 21 a recovery set in, due primarily to increasing firmness in Wall Street, and the price of the metal advanced £2 in two days. Producers' firmness contributed to this more than immediate demand; but with an improving demand from India and increasing evidence of the early electrification of continental railways, sentiment rapidly favored the rise which thereafter was gradual but steady. Toward the end of the month there were persistent reports of a powerful syndicate operating in support of the market. The rumor was not visibly substantiated, but it coincided with successive advances in the American price of the metal and a general improvement in the European demand. The month closed with a firm market, in spite of heavy realizations of speculative holdings, and with sentiment distinctly optimistic. Closing values of Standard were £61 15s. for cash warrants, and £62 12s. 6d. for three months.

November opened quietly under shadow of the impending election in the United States. The result was known on Nov. 4, and was the signal for a moderate improvement in values in the London market where, by Nov. 9, cash warrants commanded £65 2s. 6d. per ton, and three months' £66 5s. New York prices advanced more rapidly and touched 14⅝c. for Lake Superior brands, the consumptive inquiry being apparently unsatisfied even then. The speculative element was equally active, and was responsible for some reaction from the foregoing figures, particularly toward the middle of the month when profit-taking coincided with instability in the share markets. American prices of the metal also relapsed, but this was due to concessions made by dealers, producers having sold too largely to allow of any abatement of their prices. Offerings, however, were readily absorbed, and evidence of expanding trade were everywhere apparent. The lowest was touched on Nov. 23, when cash warrants changed hands at £62 12s. 6d. and three months at £63 12s. 6d. At this level influential support was forthcoming, and carried values up to £64 2s. 6d. and £65 respectively on Nov. 25, after which values receded a few shillings, but with strong undertone due to improved trade purchases and general optimism in regard to the next year's prospects. Closing values were £63 17s. 6d. for cash warrants, and £64 15s. for three months.

December was clouded at the outset by sinister political developments, as also by instability in the stock and share markets, while the approaching holidays and cessation of work during stock-taking tended to further restrict the consumptive trade. There was considerable liquidation of holdings—chiefly by continental sellers—early in the month, and prices fell back in consequence; but the market showed great power of absorption and was at no time demoralized. The lowest was touched on Dec. 8, when £62 2s. 6d. was accepted for cash warrants, and £63 2s. 6d. for three months. Producers were firm in maintaining their prices, and American advices were generally encouraging, though dealers occasionally shaded their prices. Speculative enterprise raised London prices to £63 7s. 6d. cash, and £64 7s. 6d. for three months, on Dec. 10; but at this level sellers predominated and caused a gradual relapse during the next few days to the extent of £1 per ton. At this time vague rumors were heard of a projected combination of the leading American producers to regulate the price and otherwise to steady the market. Trade generally was slack, and manufacturers apathetic; but underlying conditions were considered hopeful and values were well maintained. The closing quotations were £63 15s. for cash Standard.

The London Lead Market in 1908

SPECIAL CORRESPONDENCE

January found metals generally in improved demand and a tendency toward higher prices. There was considerable covering of bear sales in lead, £14 15s. per ton being paid for forward delivery, and consumptive demand was brisk until checked by the higher figure. Thereafter a few selling orders sufficed to depress the prices down to £14 on Jan. 9, whereat buyers showed renewed interest, and a fair volume of business was recorded. About Jan. 20 large speculative purchases were made, coincidently with bull operations in certain mining shares; and the price was again carried up to £14 15s., but again not maintained thereat. A temporary relapse, however, was soon recovered in virtue of active business which gradually raised the price to £15 5s. This figure induced realizations, followed by some easing of the price. Consumers' demand slackened, but with every indication of large requirements to be covered and stocks everywhere small. The closing prices were £14 17s. 6d. for foreign brands, and £15 2s. 6d. for English.

February found the London market active, but with few inquiries from provincial consumers, and these were readily met by cheap offers from America, and values receded accordingly until, on Feb. 12, spot parcels commanded only £14 2s. 6d. This figure attracted some speculative attention and a temporary rally of a few shillings. Heavy arrivals induced renewed depression, consumers holding aloof, and £13 13s. 9d. was accepted on Feb. 27. Thereat buyers showed more interest, and a fair volume of business took place at improving prices which, at the close, stood at £13 17s. 6d. for foreign brands, and £14 2s. 6d. for English.

In March, the tendency was rather strong at the opening, £14 3s. 9d. being paid for forward delivery; but prices receded on spot metal being pressed for sale. This touched £13 12s. 6d. on March 4, but thereafter holders were unwilling to sacrifice parcels at so low a level, and the price hardened to £14. Buyers, however, were intimidated by the plethora of prompt metal, and gave but meager support, whereby values were reduced by a few shillings until March 17, when a gradual recovery set in, prompted by the absorption of spot parcels and an influx of Russian orders. The improvement lasted until March 25, when £14 12s. 6d. was paid for forward delivery; but at this point speculative holdings were liquidated and support was lacking. Prices quickly receded to £14 5s.@£14 7s. 6d for foreign brands, and £14 7s. 6d.@14 10s. for English, at which figures the market remained uneventful for the rest of the month.

April showed a gradual and almost uninterrupted decline in values. Opening with foreign brands from £14 2s. 6d.@£14 7s. 6d. the market was depressed by the forced sale of numerous arriving parcels, consumers' demand being meager and readily met by keen sellers. Only on April 28, after £13 had been accepted for prompt delivery, did an improvement set in, raising the price to £13 5s. for prompt delivery and £13 10s. for July and August, English brands being quoted £13 10s.@ £13 15s. The month closed thus with a rather improved demand.

May was uneventful, with narrow fluctuations and only moderate consumptive demand. The market opened rather easier at 13 2s. 6d. for foreign brands, and £13 7s. 6d. for English. It developed some little strength toward the middle of the month, chiefly for forward delivery; £13 7s. 6d. being paid for foreign brands deliverable in July. On May 21 a decline set in, prompted by pressure of early arrivals in a market unsupported by trade demand, until in one case £12 15s. was accepted. The closing days of the month witnessed

a slight improvement, final quotations being £12 17s. 6d.@£13 2s. 6d. for foreign brands, and £13 2s. 6d.@£13 7s. 6d. for English.

June opened very quietly, consumers being reluctant to buy in view of the approaching Whitsun holiday. Foreign brands opened at £13, and receded to £12 12s. 6d., then stiffened moderately, but with little business passing. It was not until June 29 that any activity was manifest, when forced realizations brought the price down to £12 6s. 3d. for prompt delivery, and £12 10s. for September. This level proved attractive to buyers, and a fair volume of business took place. Closing prices were £12 6s. 3d. for July foreign and up to £12 12s. 6d. for extended delivery, English brands being held for £12 12s. 6d. to £13, according to time of delivery.

July found the market ripe for moderate improvement, partly in sympathy with other metals, but more in consequence of reduced selling pressure. Consumptive inquiry was fair throughout, and the improving tendency was manifest in higher prices paid for forward delivery than for spot lots. Toward the close of the month activity was very general both in Europe and America. The result was a slow but persistent improvement of about 15s. per ton from the outset to the close; final values being £13 7s. 6d. for foreign brands, and £13 10s. for English.

August found supplies under strong control and not likely to be pressed for sale. The gradual improvement in values continued until £13 15s. was paid. On Aug. 11 the metal markets generally showed weakness, and lead was found vulnerable to the attacks of bears, while consumers judged well to hold aloof. A reduction of 5s. eventually brought out a fair volume of business, but prices gave way further as demand was satisfied. Fluctuations were at no time important, and the month closed with a quiet market; foreign brands being quoted £13 5s.@£13 6s. 3d.; English £13 7s. 6d.@£13 10s.

September was an uneventful month, prices fluctuating within very narrow limits. Business was restricted at the outset, but showed early signs of revival as manufacturers came forward to replenish their depleted stocks. Russian and other continental demand coincided with restricted supply and tended to keep the market firm. Prices hovered between £13 5s. and £13 1s. 3d. until the closing days of the month, when available supplies were insufficient to meet the demand, and inquiries were more frequent. Final values were £13 7s. 6d. for foreign brands, and £13 10s. for English.

October was uneventful on the whole, and fluctuations were narrow. English consumers bought moderately, and there was steady demand from Russia and other continental countries. Some scarcity of prompt supply raised the price to £13 15s. early in the month, but the scarcity was soon relieved, and was followed by some depression consequent on political complications in southeastern Europe. The lowest touched for foreign brands was £13 5s. Later in the month prices stiffened on the news of labor trouble threatened at the Broken Hill mines; and with help of speculative buying, values rose to £13 10s. for foreign brands and £13 12s. 6d. for English, whereat the month closed.

November opened with a strong market, particularly as regards forward delivery. Speculative interest was aroused, and was further stimulated by rumor of increasing labor troubles at the Broken Hill mines. Up to £14 5s. was paid on Nov. 11 for forward delivery. Consumptive inquiry, however, was disappointing, its shrinking being largely due to slackness in the building trades. Later in the month prices were depressed by heavy arrivals in excess of requirements, and by adverse speculative operations. Confidence in the early revival of trade in the building and electrical industries helped to maintain relatively high prices for forward delivery; but the general trend was downward, and closing prices were £23 2s. 6d.@£13 5s. for foreign brands, and £13 5s@£13 7s. 6d. for English lead.

December opened with a depressed market consequent on heavy arrivals of the metal which at one time commanded no more than £13 2s. 6d. Thereat, and at a few shillings more, bears covered their sales, consumers bought moderately, and producers became independent. An improvement of 5s. per ton ensued, but was of short duration, the slack season tending to weaken a market only poorly supported. The undertone, however, was fairly good owing to the prevailing optimism regarding trade for the ensuing year. The closing price was £13 for foreign and £13 2s. 6d. for English lead.

The "Step Process" for Treating Iron Ores

From time to time articles have appeared in local papers with regard to a new process for treating iron ore devised by John T. Jones, of Iron Mountain, Mich., which was to "revolutionize" the iron and steel business. These articles, however, contained no definite information as to its exact nature. For the first critical and authoritative description of the process, which possesses considerable interest, we are indebted to the *Iron Trade Review*, of Cleveland, Ohio. It is known as the "step process," though the inventor calls it the "Ardis furnace."

The Step Process

Up to this time, all of the operations of the furnace have been purely experimental both as regards the mechanical and chemical problems to be worked out. These experiments have not involved the principles upon which the process is based, but have had to do with the regulation of temperatures, speeds and gearing, and the character and operation of the gas producer. Now it is claimed that a sufficient tonnage of ore has been successfully put through the furnace to establish the correctness of the principles involved, the economy and practicability of the process and the rate at which the product may be shipped.

The plant comprises principally a horizontal rotating furnace and a gas producer. The process consists of the reduction of the metallic oxides of any ores to the metal and applies, therefore, to copper or zinc oxides as well as iron. As applied to iron ore, for the reduction of which this furnace was particularly designed, the process yields a product which may either be charged into an ordinary "balling" furnace and thence to the familiar squeezing rolls and blooming mill to be made into muck bar, or it may be put into the open-hearth furnace, in place of scrap, to be manufactured into steel. The plant now erected and the operations so far carried out have to do only with the metallizing of the iron oxide. Beyond this step the operations are not new and have been successfully conducted for a long time. In the future of the project, it is expected to introduce at this plant the other operations and ship, from the immediate vicinity of the ore mines, only the finished product. The commercial success of the undertaking, therefore, carries with it, if it materializes, very great possibilities.

The Furnace

The furnace consists of a steel tube 8 ft. in diameter and 120 ft. long, lined with firebrick and very similar to the ordinary cement kiln. It is mounted almost horizontally with a slight inclination toward the discharge end to aid in the movement of the ores. The tube is equipped with two bearing rings and is supported on rollers mounted on concrete piers. A spur-gear ring encircles it by means of which and a train of gears driven from an electric motor, the furnace is rotated at the rate of one revolution a minute. The ore is brought in on a railroad track which parallels the furnace and is dumped from hopper-bottom cars into the boot of an elevator which raises the ore into a headframe at one end of the furnace. Here it is discharged into a rotating screen with a ¼-in. mesh. That which passes the screen is ready for charging into the furnace and the lumps are carried up to a crusher which breaks them down to the same size. The ore thus prepared is charged into the kiln.

The Gas Producer

At the other end of the furnace the gas

producer is erected. This is an ordinary water-sealed gas producer using any kind of bituminous coal and evolving a rich hydrocarbon gas. This gas is admitted into the end of the kiln in excess. Air is admitted through a slip ring or bustle-pipe which encircles the kiln close to this end. The mixture results in a combustion which produces the necessary heat in the kiln and the excess hydrocarbons reduce the oxide in the ore. The reactions are similar to those in the upper zones of the blast furnace except that the source of the carbon is different and, in the experiments so far, the temperatures have been about the same. It is understood, however, that some developments have operated to suggest a change in the temperature at which this reduction can be brought about. The operation in this furnace does not go far enough to carburize the metal and the product is practically as free from carbon as was the ore.

The Product

The product in appearance is similar to some specimens of sintered blast-furnace dust. It is hard and porous and when worked with a file shows clearly the metallic character of the sponge iron. In the product the metal is intimately associated with the gangue of the ore, largely silica. This is not affected by the process, but it has been found consistently that the phosphorus content is reduced in the operation. No explanation of this phenomenon is attempted. While sulphur is not at all troublesome in Lake Superior ores, it could be easily roasted out at the temperatures under which the kiln operates. The ore that has been used came from the Mitchell mine on the Marquette range. This is a high-grade ore and the silica content of such ore would have but little importance whether the product were used for making iron or steel. One of the possibilities which this process is expected to develop, however, is the use of low-grade, high-silica ores. This kind of ore, running in the neighborhood of 40 per cent. in iron and 30 per cent. in silica, abounds in the immediate vicinity of Iron Mountain and Antoine, where the furnace is located, and a large percentage of the ores of the eastern end of the Menominee range are of like character. The promoters of this furnace have secured an interest in the ores of the Randville district, a high-silica territory only a few miles from Iron Mountain, so that the freight on the ore delivered at the furnace should be not over half of the rate now charged for hauling from the mines to Escanaba. The crushing of the ore also for this furnace is no more than has to be done with a number of the ores from this district now, in shipping for blast furnace use.

With a large percentage of silica in the ore, however, there will be a corresponding percentage of this furnace product to be slagged off in the balling furnace. This will undoubtedly carry off some iron with it, just how much is a question, although this trouble would seem quite possible of remedy. Where the product is to be used for charging into open-hearth furnaces, the silica will be most objectionable and the added cost of treatment either by a compound acid-basic operation or otherwise is problematical.

General Conclusions

No general comparative statement of costs can be given at the present stage of operation. It is claimed by the inventor that it is possible to turn out the product at a cost of not more than $1.50 per ton. If this estimate is reliable, and if the product of the furnace can take the place in the manufacture of muck bar and steel that is claimed for it, it is apparent that even at plants far removed from Iron Mountain, pig iron and scrap, respectively, can easily be supplanted in these processes.

In brief, the claims made by the inventor are that the furnace will obviate the need of steel-making pig iron and the blast furnace producing it. It will render unnecessary the decarburizing portions of all steel-making processes and, most important, it will result in the restoration of wrought iron to common use. It is hardly necessary to add that much further work on a commercial scale is necessary before these claims can be fully accepted.

J. C. Buckbee & Co., Chicago, are the constructing engineers for the plant; the furnace, crusher and driving motors were built by the Allis-Chalmers Company. Current for driving the motors, which are five in number and respectively 75, 40, 30 and 5 in size, is supplied by the Iron Mountain Electric Company.

Railroad Rates on Iron and Steel

Special Correspondence

A complaint filed with the Interstate Commerce Commission by the Babcock & Wilcox Company against the Atchison, Topeka & Santa Fé railroad, the New York Central & Hudson River, the Lake Shore & Michigan Southern, the Pennsylvania and the Central Railroad of New Jersey raises some points regarding the transportation of iron and steel products which are likely to be of considerable significance when a decision has been rendered. The complainant is a corporation with works at Bayonne, N. J., while the rates complained of are those affecting transcontinental traffic and specifically shipments to Redondo, Cal. The schedule as published by the Atchison, Topeka & Santa Fé in a joint tariff designated by the commission as No. 375, and by the road as 5970, shows rates from New York, Boston, and common points (of which Bayonne is one) including the following provisions: "Boiler heads or ends, flanged, minimum carload 30,000 lb., $1.10 per 100 lb. Castings N. O. S. plain, as from sand, in no way hand or machine-finished except being drilled with bolt holes O. R. B. minimum carload 30,000 lb., 85c. per 100 lb. Articles of iron or steel O. R. wet or rust angles, channel beams, columns and girders, minimum carload 30,000 lb., 85c. per 100 lb." Prepaid shipments having been made from Bayonne to Redondo under these provisions the roads concerned declined to give up the goods at the California terminal unless additional freight under the same rating as that for boilers was paid. The assigned reason was that the boiler heads, rough castings, etc., shipped were ultimately intended for the construction of boilers and hence should take the rate published for boilers. Further, the roads declined to accept further shipments under this tariff for the same reason. The complainants ask for an order requiring the roads to accept rough iron and steel products at the published rate independent of their ultimate use.

Dredge Mining and Hydraulic Sluicing in Victoria

D. B. Sellars, the engineer in charge, reports (*Monthly Mining Report*, June 28, 1908) that the number of gold-dredging and hydraulic sluicing leases in force in Victoria on Dec. 31, 1907, was 323, the systems in use being: Bucket, 45; hydraulic pump sluice, 84, and jet elevator, 4.

One pump-sluice plant dealt with 12,200 cu.yd. of material in a week and five others from 10,000 to 11,000 each. The depth of ground worked varied from 6 to 62 feet. Forty-five bucket dredges in 1599 weeks raised 10,371,852 cu.yd. of material yielding 41,085 oz. gold. Eighty-four pump hydraulic sluices in 2092½ weeks dealt with 9,670,362 cu.yd. of over-burden and wash-dirt, yielding 55,272 oz. gold. Four hydraulic jet elevators in 76 weeks put through 157,678 cu.yd. of alluvium for a return of 1464 oz. gold. The total area worked by these 133 plants was 739 acres, the average yield 132.3 oz. gold per acre, and the number of men employed 2468.

Six plants using hydraulic sluicing by gravitation in 86 weeks handled 396,116 cu.yd., yielding 2394½ oz. gold. The total quantity of material treated during the year by dredge and hydraulic sluice mining by gravitation was 20,596,008 cu.yd., the gold obtained being 100,216 ounces. This branch of the mining industry shows an increase of 12,550 oz. as compared with the previous year.

Concluding, Mr. Sellars says that the introduction of some cheap, rapid, non-injurious and efficacious precipitants for the clarification of sludgy water would be of great benefit.

The Virginia & Mexico Cyanide Plant

By Mark R. Lame*

The Virginia & Mexico Mining and Smelting Company, under its general manager, Jesse Scobey, is building a modern cyanide plant at Hostotipaquillo, State of Jalisco. Mr. Scobey has had an extended experience in the States and in Mexico, and has brought together a plant combining the best features of accepted practice. The plant is being built in a mill formerly occupied by a lixiviating plant, which is so large that most of the cyanide equipment will be under cover. The question of power is still an open one in the district, though reports appear with great regularity that power from lake Chapala will be distributed over the entire State. The Oedro Analco power proposition contains possibilities of power for this entire district, and as the dam is already built this seems to be the probable solution of the question.

The extension of the Southern Pacific from the coast to Guadalajara will greatly help this section of Mexico, and as the Federal Government has declined to extend the time for completion of the railroad, work is being crowded in order to complete the road within the time limit.

The machinery for the Virginia & Mexico company was shipped by steamer from the United States to Tampico, and thence by rail to Etzatlan. From here it is packed on mules over the mountains to Hostotipaquillo. All this machinery is now at Etzatlan, on the trail, or at the mill, so the initiation of the plant will not now be long delayed.

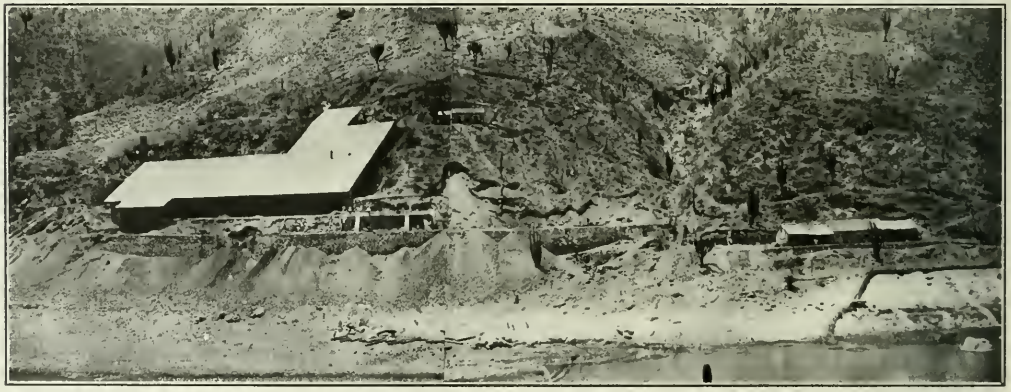
The ore, after careful sorting, will be crushed in Blake breakers and fed to 30 stamps, crushing in solution. Wilfleys will remove coarse concentrates. The tails from these will go through dewatering cones to two 16-ft. tube mills and then to a second set of Wilfleys for further concentration of the fine sand. Sand collectors with Butters-Mean distributers take the tailings from the second bank of concentrators, sending the slime to storage and air-agitation tanks, and the sand in cars to the leaching tanks. Slime will be washed in a vacuum filter of ample capacity, and solutions precipitated on zinc shavings, the bullion being melted rather than shipped as precipitate. One feature in the mill is given consideration which is usually overlooked. Emergency sumps are provided for accidental overflows. These occur in the best regulated mills, and wilfully ignoring the inevitable, usually result in the monthly loss of more than the cost of the necessary extra tanks and pumps with cement floors and drains. No plant milling in solution should be built without a complete system of such floors and drains.

The usual difficulties of mill construction are more than doubled by the difficulties of getting sectionalized machinery such as is required in this mill, followed by the difficulties of getting prompt transportation. An inquiry for delivery on a sectionalized pump will bring a reply from the manufacturer asking if the base, weighing 1200 lb., is too heavy for one piece. I wonder what kind of mules they think grow in Mexico?

In the illustrations two methods of transporting machinery in this district are shown.

WILFLEY TABLES ON BURRO BACK

PEONS PACKING IN MACHINERY



STAMP MILL AND CYANIDE PLANT, VIRGINIA & MEXICO MINING AND SMELTING COMPANY

*Mining engineer, Mexico City, Mexico.

The output of copper ore in the United Kingdom in 1907 was 6792 long tons, against 7758 tons in 1906. In 1863 the production of ore and precipitate was about 210,000 tons, valued at more than £1,000,000.

Mining Legislation in Congress

SPECIAL CORRESPONDENCE

Several bills have been introduced in Congress at the present session, which affect mining interests. Among these the following are noted:

REGULATING HYDRAULIC MINING

A bill (H. R. 25,547) relating to the regulation of hydraulic mining by the California Débris Commission has been introduced by Representative Englebright and referred to the committee on Mines and Mining. The bill provides that the California Débris Commission (created under the act of Congress of 1893) shall make an estimate of the number of cubic yards of mining débris or solid material that will eventually be carried into the navigable rivers or streams of California either through the operation of a given mine itself, or by escaping from the impounding basin appertaining to the mine. The commission shall then, under rules and regulations to be approved by the Secretary of War, provide for the issuing of a license or permit for the working of the mines and for the removal of the débris or an equal amount of solid material by those who are responsible for its being disturbed from the original places of deposit. The commission may, however, instead require the payment to it by the mineowner of the net cost of removing such solid material from the navigable streams; and the commission is to be empowered to expend all moneys received in this way from mineowners in dredging and improving the navigable streams affected, or their tributaries. In the event that the mineowners elect to remove the débris themselves, the commission may indicate to them the point or points at which the removal shall be made. The license for the removal of solid material from navigable rivers may be issued directly by the commission to those who already have licenses to mine by hydraulic process; but in the case of future applications for licenses the issue shall take place only in accordance with the new regulations to be made up and aproved by the Secretary of War.

SURVEYS OF MINERAL LANDS

The following bill (H. R. 25,396) for the relief of applicants for mineral surveys has been introduced by Representative Needham of California:

"That the Secretary of the Treasury be, and he is hereby, authorized and directed to pay, out of the moneys covered into the Treasury from deposits made by individuals to cover cost of work performed and to be performed in the offices of the United States surveyors-general in connection with the survey of mineral lands, any excess in the amount deposited over and above the actual cost of the work performed, including all expenses incident thereto for which the deposits were severally made. Such repayments shall be made to the person or persons who made the several deposits, or to his or their legal representatives, after the completion or abandonment of the work for which the deposits were made, and upon an account certified by the surveyor-general of the district in which the mineral land surveyed, or sought to be surveyed is situated and approved by the Commissioner of the General Land Office."

The Lick Branch Explosion

At 8:30 on the morning of Jan. 12, a second explosion occurred at the Lick Branch mine, of the Pocahontas Consolidated Collieries Company, in southern West Virginia. It will be remembered that 51 men lost their lives in this mine on Dec. 28. In this latest disaster, it is believed that 105 miners have perished.

All of the bodies so far recovered were badly burned and identification of the men has been made by means of effects upon their persons. The force of the explosion shook houses for half a mile around and windows were blown out of many buildings.

Mine Foreman Bowers, who was near the entrance, was blown from his feet by the explosion, but managed to crawl out safely, as did also Robert Smith, a miner. The main entry of the mine is four miles long, running from one side of the mountain to the other. Débris was blown from both entrances, which gives an idea of the tremendous force of the explosion. The fans which furnish ventilation for the workings, as in the former explosion, were not disabled, and are forcing fresh air into the mines.

A train was rushed from Bluefield to the scene of the disaster, carrying bratticing and other material to be used in the work of exploration and rescue. The debris from the explosion of two weeks ago had not been cleared away and twenty men were engaged in this work. Nineteen contract miners with their crews were at work in a new entry, and it is feared that all of these men were lost.

The majority of the miners employed in the workings were Americans. The last body of the 51 victims caught in the December explosion was brought to the surface only last Friday, Jan. 8.

According to *Le Génie Civil*, Oct. 10, 1908, a mixture of kaolin and less than 80 per cent. chromite is more fusible than pure kaolin. To obtain maximum refractoriness, the mixture should contain not more than 10 to 15 per cent. of the clay. The fusion point of a mixture containing about the amount of clay is said to be higher than that of platinum.

Joseph Wharton

Joseph Wharton, the largest individual iron manufacturer in the country and a man of varied experience and attainments, died at his home at Branchtown, near Philadelphia, Jan. 11, aged 83 years. He was born in Philadelphia in 1826; entered business as clerk in a mercantile house in 1845; afterward engaged in the manufacture of white lead, and in 1853 organized the Lehigh Zinc Company, for which, in 1860, he built the first successful spelter works in the United States. In 1873 he bought the Gap nickel mines in Lancaster county, Penn., and then established at Camden, N. J., the first successful nickel and cobalt works in the United States. He then entered the Bethlehem Iron Company, subsequently the Bethlehem Steel Works, founding there the first armor plant in the United States. He retired from this company when it was reorganized. Meantime he had become largely interested in iron mines and blast furnaces in New Jersey, acquiring the iron deposits at Hibernia, Andover and Wharton. He had three blast furnaces at Wharton and Philipsburg, with a capacity of 600 tons a day. He also bought and operated coal mines in Indiana county, Penn. His activities, which continued almost to the day of his death, were many and various. He was for 12 years president of the American Iron and Steel Association. He was also a large owner and active director of the Lehigh Valley railroad until a year ago, when he retired. He was a director of the Farmers and Mechanics' National Bank and had also been a director of the International Nickel Company, which absorbed his nickel properties. In addition he was a frequent writer on industrial and scientific topics, and took a deep interest in education. Some years ago he founded the Wharton School of Finance and Commerce of the University of Pennsylvania, which he endowed with $500,000. He leaves a fortune estimated at $25,000,000, chiefly invested in lands and industrial enterprises. He always conducted his business as an individual, but in 1907, as a provision for the future, he organized the Wharton Iron Company, to hold his iron properties.

Small air hoists mounted on a bar are used in some of the mines at Mount Morgan, New South Wales, Australia. These are easily put up, the bar being placed vertically, and are used instead of a windlass in sinking winzes. These hoists are simple in construction, are light and can be moved easily.

In order to obtain the best results in an upcast shaft all crosscuts above the levels being worked should be blocked off in order that cool air may be prevented from entering the upcast shaft and so decreasing the natural ventilation.

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Illustrated.

The Situation in Copper

Ever since the development of the Bingham and Ely mines was begun we have been talking about the great increase in copper production to come from those places. The debâcle in the winter of 1907-08 diverted attention from what was impending and consequently the great increase in production in 1908 that we reported last week, which occurred in the face of what is called a "low price" for copper burst upon most persons as a surprise. There are indeed surprising features in the statistics, chief of which is the failure of a 13¼c. average to restrict more severely the output of the small mines, whose aggregate made a handsome total in 1907. Alaska, Idaho and New Mexico did, in fact, suffer in 1908, but Wyoming, Missouri and Virginia held their own, while Colorado made a respectable increase. Vermont receded, but only temporarily pending the beginning of smelting by the Vermont Copper Company. Many of the small mines are, therefore, still able to live. This being so, the increases in the big camps were all clear gain.

In Arizona—Bisbee, Globe, Clifton and Jerome made increases, in some cases very large ones. At Butte, in spite of the shutdown in January and February, there was a gain of 29,000,000 lb. The great expansion of operations by the Mammoth swelled the output of California. The enlarged output of Nevada is, of course, explained by Steptoe Valley. The extension of the Garfield works in Utah made good the deduction of the United States, Bingham and Highland Boy smelters, and the Utah, Boston Consolidated and Utah Consolidated mining companies glutted it with ore. Indeed, the production of the mines in 1908 was doubtless larger than the production of the smelters, many of our reports showing much more copper received in ore than turned out as blister.

During the first part of 1908, Anaconda, Cananea, and three of the works at Salt Lake were idle. At that time production was below the rate of 1907. Anaconda resumed in March, and Cananea in the second half of the year. In the second half the Ely copper began to appear, and the porphyry mines of Bingham put additional capacity into operation. The Arizona districts and Lake Superior produced steadily right along. Lake Superior made about the same output as in 1907.

It is doubtful as to the refineries, which are at least two months behind the smelteries with respect to delivery of the finished product. In the early part of 1908 the refineries were operating at reduced capacity. They did not attain full capacity until after the blister copper of Washoe, Steptoe and Cananea began to reach them. This implies a smaller production from the refineries than from the smelteries and it is probable that the refinery production of 1908 was less than the refinery production of 1907.

For the reason that we are not yet in possession of the refinery statistics, it is impossible to determine what the deliveries for domestic consumption and the unsold stock at the end of the year amounted to. The exports were large—about 664,000,000 lb., against 509,000,000 in 1907. The deliveries for domestic consumption are thought to have been upward of 400,000,000 lb. (against 539,000,000 in 1907, and 668,600,000 in 1906), but how much above that figure there are not yet data to show. At the beginning of 1908 there was about 120,000,000 lb. of refined copper in stock at the American refineries. At the mid-year the stock was believed to be fully as large. Some large sales were made in the second part of the year, but the present production of North America necessitates the disposal of nearly 4,000,000 lb. of copper on every business day on the average. It is well known that much of the copper exported has gone into stock abroad, where the visible supply is the largest for many years. There can be no doubt also as to the existence of an unsold stock on this side, but whether larger or smaller than at the beginning of the year cannot be safely pronounced. The visible stock in Europe at the end of 1908 was 124,723,200 pounds.

Yet the stocks on both sides of the Atlantic are of no such magnitude as to cause concern, if only consumption would regain its normal rate. The world's production of copper is now upward of 720,000 metric tons per annum. Assuming the consumption to be equal to the production, which is the case in the long run, about 60,000 tons per month are required. Consequently, the present stocks in Europe and America are only about two months' supply. It is misleading to compare present stocks with those of 10 or 20 years

ago when consumption was much smaller. In those former times it was recognized that two months' supply for the world was no more than is normally required as a safety reserve; if stocks were to be absolutely depleted, we should see such runaway markets, with their inevitable mischief, as we had in 1906-07.

It is the recognition of the soundness of this reasoning, together with their confidence in the march of business revival and the easy money market that has lately made producers act so stiffly, most of them being in a comfortable position. Although they have had at times to whistle to keep up their courage, they feel that they have successfully steered their craft amid reefs, shallows and breakers, and are now in comparatively smooth water. After all, 1908 was not a bad year, except to the wildcatters and the owners of so-called mines that are mines only when copper fetches 18 or 20c. The average price for copper in 1908—about 13¼c. is nearly 2½c. below the average of 1898-1907, but that decennial average is inflated by the extraordinary prices of 1906-07. If the latter years be excluded, the average for 1908 is only a trifle lower than the previous decennial average. A large proportion of the copper of North America is produced at a cost of 10c. and under, meaning the real cost which includes all development, depreciation and maintenance charges.

As to the prospects for the near future: Production is now going on at the largest rate in the history of North America and it is increasing every day. This is largely a matter of smelting capacity. Nearly all of the new works begun in 1906-07 have now been completed, but some have not yet gone into operation. Steptoe and Cananea are just beginning to get their full gait; also Bully Hill and Balaklala. Teziutlan is to start in February. The Imperial works released smelting capacity at Douglas. Humboldt did not operate in 1908, but is likely to do so this year; also the works of the United States Smelting Company near Salt Lake. The installation of converters at Yampa in 1908 added to the capacity of Utah, which will be further increased in 1910 by the Tooele plant. It does not seem as if there would be any scarcity of copper. Given an increasing production the market will be determined by the needs of the consumers. Business is undoubtedly improving, but still very slowly. Some conditions lead to the belief that the revival in 1909 will not be so extensive as has been anticipated by the optimistic. It would not be surprising if the course of the copper market in 1909 should be on somewhat the same lines as in 1908.

Expert Advice

We have received a letter upon which we may base a word of advice, although in substance we have given the same many times previously. The letter is as follows:

"Will you please inform me where I can obtain some advice respecting an investment in a new gold mine in the * * * district of Colorado. I cannot afford to pay very much, because my investment will be only a small one in any case, but I cannot afford to lose my principal, and I should like to obtain some sound advice at a small cost. The mine is not a speculative offering (i.e., it does not figure in the stock market) but is owned by a few friends of mine who have excellent expert reports upon it and expect great things from it. It seems to me to be a good investment, but as I said in the first place, I feel that I ought to have advice of my own before risking my principal."

Our correspondent displays an intelligent recognition that mining is a business of which he is ignorant, and while offering attractions for investment, he ought to have professional advice. If every investor were so thoughtful and careful, the days of the wildcat promoter and the enthusiastic ignoramus and the visionary amateur would soon be numbered. The question is how can the small investor obtain good professional advice, the services of a competent engineer being necessarily costly? This difficulty is met ordinarily by the responsible banking houses, which are able to pay for the proper professional advice and pass it on to their clients with their own indorsement. In this way the banking houses which make a specialty of mining investments perform a valuable service. Their work is promotion in the highest sense of the term, and the profit which they realize is well earned. In all respects they are important and valuable members of the business community. The investor must, of course, learn to distinguish between the substantial houses of this class and the pinchbeck concerns which ape them.

However, these operations fall far short of covering the ground. There are many cases, in all respects legitimate and praiseworthy, like that which is mentioned by our correspondent. To him, and others in a similar predicament, we can offer only these suggestions: Employ an engineer resident near the mine in question, who can examine it at less expenditure of time and money for traveling than one who would have to go out from Chicago or New York. Let two or more prospective investors club together to pay the bill. Take care to obtain a reliable recommendation as to the local engineer. If necessary, pay some other engineer, known personally or by reputation, for such a recommendation. Proceed, in brief, in very much the same way as if it were a matter of securing legal assistance to be rendered in a remote place.

The Verdict on the Marianna Explosion

Under present conditions it is hopeless to expect any beneficial result from the investigations of coal-mine explosions by the coroner and his jury. The questions asked of the witnesses at the inquest are usually of such a nature and so framed that no one will be embarrassed. Any evidence that is likely to incriminate the mine officials, or place the responsibility upon the living, is either concealed or carefully avoided.

We do not question the truth of the statement that in the majority of instances the miners themselves are to blame, and that with their lives they pay the price of such carelessness; however, in many cases, the mining company is directly to blame, and in almost all instances the mine officials are responsible for the accidents because they have permitted their employees to violate rules and mine coal in a reckless manner. If the miner who is guilty of disobedience were alone to pay the price for his negligence, the question would not be so serious; however, in all cases, the innocent suffer with the guilty.

No mining official can cleanse his soul from the stains of censure simply because the coroner's jury renders a verdict, stating that disregard of rules on the part of some miner was responsible for the lives lost. It is not enough to formulate rules and ask that they be obeyed; it is the duty of those in authority to see that they are obeyed.

The Marianna mine, as we have before stated, was designed to become a model operation. The plan of the workings as originally mapped out for guidance in the development work, was as nearly ideal as present knowledge of conditions in the Pittsburg field permits. Excellent rules were established, and the precautionary measures were of the best.

The coroner's jury brought out the following facts: 1. The mine contained gas. President Jones stated that about 2 per cent. was the maximum amount found in the workings at any time after the fan was installed. 2. Official instructions had been issued requiring that the miners use only fulminate powder in putting off shots. This rule was later modified and miners were permitted to use carbonite powder in places where the holes were wet. The use of black powder had been absolutely forbidden. 3. After the explosion, it was found that some of the miners had been using black powder, and a can of this explosive was found in one of the entries. 4. The dust was sprinkled down before shots were fired at the working faces. 5. The fan's indicator card showed that the fan stopped at 10:30. 6. Mixed lights were used in the mine. 7. It was found that there had been instances of gross violation of the rules, and recklessness on the part of the miners. 8. In some instances coal dust had been used in tamping. A cartridge to be used in tamping was found filled with slack and dust. 9. The explosion occurred at 10:54 in the morning.

The above statements of fact comprise the important evidence submitted at the inquest. The jury which sat on the case was composed of five farmers and one machinist. The verdict of these worthies was that the explosion was due to a blown-out shot in Blanche entry No. 3, which ignited the gas and dust, and that a secondary explosion occurred in the main dip entry almost simultaneously.

It seems unnecessary to comment on the evidence. Every experienced miner knows that in a gaseous mine, where mixed lights are used and the holes are charged with black powder, having coal dust for tamping, an explosion may happen. It might have occurred even to a jury of farmers to ask why the fan stopped at 10:30 if the explosion took place at 10:54. However, such a question would only have delayed proceedings and might have been considered impertinent. The recent inquests to investigate mine disasters discredit the law; not the intelligence of the jurors, who are apparently selected for the absence of intelligence. Incidentally it may be remarked that Henry Louttit, inspector for the district, who was at the Marianna mine when the explosion occurred, has resigned his position.

Gold Production in the Transvaal

The cabled reports from the Transvaal indicate that the December report of production was swelled even to a greater extent than usual by the inclusion of miscellaneous amounts of gold, and of reserve gold by those companies which adhere to the reserve system. The total reported for the month was 660,600 oz. fine gold, which exceeds the November output by 46,229 oz., and is much greater than that for any other month in 1908. This large report brings the total for the year up to 7,054,574 oz., or $145,818,045 in value; an amount $318,000 greater than we estimated in the annual review. This is the greatest production ever made in a single country, and is greater than the entire production of the world only 17 years ago, in 1891 and for many years previous to that. In round figures, the Transvaal produced a little over one-third of the world's total for last year.

The causes for the increase over 1907, which was $12,466,000, were fully explained in the article on the Transvaal in the JOURNAL of Jan. 9. It does not appear that the climax of production has yet been reached, but it is hardly possible that as great gains can be recorded in the coming year as the last three years have shown in South Africa.

The Conservation of Mineral Resources

The first practical fruit of the recent report of the Conservation Commission was the withdrawal from entry, by executive order, of the public lands containing phosphate rock in certain western States, and all the public lands in the petroleum and natural-gas field in northwestern Louisiana, known as the Caddo oil field. Previous to the conference of the governors last May, the public coal lands in the western States had been withdrawn. This is proper action. It is to be regretted that the scope of the Government in this direction is so limited. But, although the President, with the advice of the Conservation Commission, will probably be unable to accomplish much directly in the way of preserving our natural resources, an immense stride has been achieved through the awakening of public sentiment to the necessity for reducing the waste of resources that cannot be replaced. We venture to predict that the historian of the future will pronounce this to be one of the greatest events of the present administration.

Conditions of Gold Production

The great production of gold in the United States in the year 1908 and the reason for it, are in considerable part due to the increased proportion of operations conducted on a large scale. While the prospector and small operator still survive and their influence is not to be neglected, the production of gold is year by year coming to be the result of corporate work and the use of capital, rather than of individual effort as it was in the days of early placer mining in California and the Rocky Mountain States; and even up to the time of the first rush of discovery in Alaska. One result of this is that gold mining is yearly becoming more systematized, and that the place of the individual is becoming smaller and less important. In other words gold mining has shared in the general concentration of industry; though this process has been slower, owing to the peculiar conditions affecting the discovery and mining of the standard metal.

THE FIRST week of 1909 brings with it the obituary notices of an unusual number of prominent men. Among these are James Corrigan, one of the pioneer shippers of ore from the Lake Superior country, and a large owner of iron mines and furnace property; Joseph Wharton, the oldest and largest independent ironmaster in the East, and a man of many activities, who had made his mark in nickel and zinc as well as in iron; and Herman Justi, a close student of labor questions, an able writer on them, and a successful adjuster of many labor troubles in the western coal trade.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Mining Safety Laws

The JOURNAL published, Dec. 5, a digest of State statutes relating to safety in metalliferous mines. The names were there recited of certain States that possess such acts applicable to coal mining only. Eleven States were also enumerated as having no mining safety laws at all. They include five New England States, two Southern and four Western States, the last group consisting of California, Washington, South Dakota and Kansas, all prominent mining regions.

Suspicion was aroused that this curious deficiency might be due to the fallibility of the source of information from which the syllabus was compiled. It is not to be presumed that letters received on request from mine inspectors and similar officials will be conclusive as to the laws standing on the statute books of their States. Those laws, however, are readily and perfectly ascertainable by reference to the books themselves. In most, if not all of our States, the statutes up to a recent year have been codified or compiled and so well indeed that the entire body of mining legislation may be found in a moment. Any subsequent enactments may be ascertained with almost equal facility by a glance at the volumes of session laws.

Recourse to the statute books has proved the defectiveness of those informal statements. Setting aside the New England States, and Virginia and Louisiana, it appears that all of the four Western States named possess more or less statute law on mining safety. California has a little. South Dakota has considerable, especially relating to the office and duties of the inspector of mines. Washington and Kansas have rather copious colliery codes, together with some legislation pertinent to metalliferous mines. A resumé of the acts in force in these States is presented herewith.

Common Law Also Applies

Statute law does not, however, comprise all that governs mining safety. Through the application of common law principles, by the courts, to cases of alleged negligence that are constantly arising, there has grown up a great body of definitions of the precautions that a reasonable mine owner must take, which rules have the force of law quite as much, though not quite in the same way, as if enacted by a legislature. Thus there are many cases on hoisting signals, machinery guards, tamping dynamite, etc., referring either to mines or to other work in which the same principles are involved.

Statute law is often a mere declaration of the common law. Legislatures formally enact those rules that have already been established by court decisions. Thus, an examination of judicial opinions is important in determining what precautions for safety are recognized as necessary and proper.

It is understood, however, that the purpose of the committee's present legislative recommendations is not a mere codification of the common law, but is to be distinctly in advance thereof. That is to say, the committee proposes to lay upon mine operators duties dictated by the views of a growing enlightenment, and will not rest content with the minimum of precaution under which, on traditional principles, a mine owner can escape damages for culpable negligence.

Further, it may be suggested that the mining inspectors of the States must have established many subsidiary rules and practices which, though not standing upon the statute books have virtually the force of law.

South Dakota

The Political Code, revised 1903, contains a chapter on "Mines and Mining" (Chap. 24, Secs. 2532-2586). In Article 6, "Miscellaneous Provisions," is found some legislation on safety in mines. There is also a chapter on the office and duties of an inspector of mines. Subsequent to the above codification, laws have been enacted relating to ladderways and bell signals.

It would appear that, while the statutes contain some specific provisions for mining safety, yet more generally the matter is left to the inspector's discretion, in concurrence with the opinion of the courts applying common law principles. How far the inspector's recommendations are binding, and how far subject to review by the courts, need not here be discussed; but were a thorough inquiry to be made as to the legal practice of the State on mining safety it would be necessary to ask what are the actual rules and precedents of the inspector and what has been established by the reported cases of litigation.

Safety Cages

"It shall be unlawful for any person to sink or work through any vertical or inclined shaft, where mining cages are used, at a greater depth than 200 ft., unless the said shaft is provided with an iron-bonnet and safety cage, to be used in lowering or hoisting employees or any other persons into or from such shaft. The safety apparatus, whether consisting of eccentrics, springs or other devices, must be securely fastened to the cage and be of sufficient strength to hold the cage loaded at any depth to which the shaft may be sunk. The iron bonnet must be made of boiler-sheet iron of good quality, at least 3/16 in. in thickness, and must cover the top of the cage in such manner as to afford the greatest protection to life and limb from any débris or anything falling down the shaft" (Sec. 2581).

A fine not exceeding $1000 is provided for violation of the foregoing section. (Sec. 2582.)

Exhaust Systems

Smelters or dry crushing reduction works are required to put in exhaust fans and dust chambers, or the like, under penalty of $500 to $1000 fine and failure to provide them shall be *prima facie* evidence of negligence. The mine inspector must visit such works at least once a month to see that this provision is complied with (Secs. 2583-2586.)

Inspector of Mines

An inspector of mines, shall be appointed by the governor with the advice and consent of the senate. He shall be not under 30 years of age, practically acquainted with mining in all its branches and not an officer, director or employee of any mining company. He shall have access to all mines provided he does not impede their working during the examination, and the owners, etc., are to render him any necessary assistance but not to bear the expense of the examination.

Upon formal specific complaint of three or more persons setting forth that the mine in which they are employed is dangerous in any respect, he shall examine the mine. He shall serve a certified copy of the complaint, without the names of the complainants, upon the superintendent or manager, before he visits the mine, and if on examination he finds it to be dangerous he shall notify the owner, lessor, lessee or agent and "shall require all necessary changes to be made without delay for the purpose of making such mine safe for the laborers employed therein; and in case of any criminal or civil procedure at law against the party or parties so notified, on account of loss of life or bodily injury sustained by any employee subsequent to such notice, and in consequence of a neglect to obey the

inspector's requirement, a certified copy of the notice served by the inspector shall be *prima facie* evidence of the culpable negligence of the party or parties so complained of. Nothing herein shall be construed to give the control of any mine to the mine inspector or allow him to interfere with the working of any mine."

It shall be the mine inspector's duty, at least once a year, to visit every mining county in the State and examine as many of the mines therein as practicable. He shall make such recommendations as in his judgment are necessary to insure the safety of the workmen, and upon finding a mine to be unsafe shall notify the owner, etc.

In case of a serious or fatal accident in any mine the inspector shall at once be notified and shall proceed to conduct an examination in a manner more particularly set forth. The owner, etc., who shall fail to give due notice shall be fined $200 to $1000.

Children under 14 must not be employed in mines.

The inspector shall annually report to the governor all serious or fatal personal accidents, with statistical and other information tending to promote development of the mineral resources of the State.

The inspector shall receive an annual salary of $1200 with an amount limited to $1000 for expenses, besides mileage. (Secs. 136-152.)

Bell Signals

At all mines where hoisting apparatus is operated in the State of South Dakota the following code of bell signals shall hereafter be adopted and used:

"One bell, hoist; one bell, stop, (if in motion); two bells, lower men; three bells, hoist men; four bells, blasting signal. Engineer must answer by raising bucket or cage a few feet and letting it back slowly; then one bell, hoist men away from blast. Five bells, steam on; six bells, steam off. Seven bells, air on; eight bells, air off. Three-two-two bells, send down tools. Nine bells, danger signal (fire, accident or other danger). Then ring number of station where danger exists. No person shall ring any signal bell except the station tender, except in case of danger or when the main shaft is being sunk. Engineers must slow up when passing stations when men are on the cage or bucket.

STATION BELLS.

Bells.	Pause.	Bells.	No. Station.
2	"	1	1
2	"	2	2
2	"	3	3
Etc.		Etc.	Etc.
5	"	5	20

"If cage is wanted ring station signal. Station tender will respond in person. If station is full of ore and station tender is wanted ring station signal.

"One copy of this code shall be posted on the gallows frame and one before the engineer." (Laws of 1903, Chap. 181.)

Ladder Ways

"In all mining shafts 50 ft. or more in depth containing two or more compartments, ladderways shall be constructed in a compartment separate from the compartment in which the cage or bucket runs, and platforms shall be built for landings at every 12 ft., with inclined ladders between said platforms." (Laws of 1903, Chap. 179.)

California

In every quartz-mining claim where 12 men are employed daily, no shaft on incline shall be sunk deeper than 300 ft. without providing a second mode of egress, by shaft or tunnel, to connect with the main shaft at a depth of not less than 100 ft. from the surface. (Act of 1872, in General Laws of 1906, Act. 2222, Secs. 1-4.)

Act 2223 (from Laws of 1874) relates to the protection of coal miners and covers such matters as maps, outlets, ventilation, inside overseer and boilers.

Act 2224 (from Laws of 1881) provides for a State hospital and asylum for miners.

Act 2225 (from Laws of 1893) establishes a uniform system of mine bell signals. A miner disobeying this rule cannot recover.

Washington

The "General Laws," compiled 1897, contain a chapter on "Mines and Mining." (Secs. 3145-3211). Article 3, "Protection of Coal Miners" (Secs. 3158-3185—see also ammendments in Session Laws of 1907, Chap. 105) contains numerous provisions for safety. It treats of inspection, maps, number of openings, escape, ventilation, bore holes, signals, hoisting, child labor, boiler examination, explosions, timber, stretchers, tamping tools, etc.

Safety Cages

Article 4 (Secs. 3186-3193) is entitled "Protection Against Accidents from Open Shafts." It contains, however, a section requiring the use of safety cages. Every vertical shaft sunk to a greater depth than 150 ft. must be provided with a safety cage suitably bonneted with boiler sheet iron of good quality, at least 3/16 in. thick, and provided with safety apparatus of sufficient strength to hold the cage loaded at any depth to which the shaft may be sunk.

Kansas

A fairly copious mining code is provided by the statutes of the State (Gen. Stat., 1905, Chap. 66a, Secs. 4304-4373—see also session laws of 1905 and 1907). While these relate largely to coal mining, for which there are many safety provisions, it will be noticed that Secs. 4333 *et seq.*, which are concerned with that matter, apply to underground workings in general. The regulations here digested are, therefore, applicable to metalliferous mines.

Rules are laid down for the regulation of break-throughs in coal or other mines operated by the room-and-pillar system. They shall be 40 ft. apart, at least 6 ft. wide and the full hight of the vein, when that is 6 ft. or less. They shall be filled with slate rock or closed by brattice to make them air-tight as soon as the succeeding break-throughs are made. Rules are also laid down as to the manner of ventilation and of daily inspection for detection of gas.

Stairways

"It shall be the duty of the owner, lessee or operator of any mine where the natural strata are not safe in or around all workings, pumping and escaping shafts, to securely case-line or otherwise make said places secure, and all escapement shafts shall be provided with stairways securely fastened so as to bear the combined weight of not less than 15 men ascending or descending the same. Said stairways shall be so constructed as not to exceed 45 deg. of elevation by each section of said stair, and each section shall have substantial guard rails securely fastened, and the stairways shall be separately partitioned from the parts of such shafts used as upcasts or downcasts, and the traveling ways between the bottom of the main shaft and the escaping shaft or stairways shall be at least 5 ft. in hight. Said traveling ways shall be kept clear of all obstructions, and standing or stagnant water shall not be allowed to accumulate in any traveling way between the upcast and downcast shafts. And in case of mine shafts which are over 150 ft. in depth, where stairways cannot be conveniently constructed, other safe means of hoisting the persons employed in such mine must be kept ready at all times, so as to be available in case of accident to the regular hoisting shaft or machinery in use at the same time." (Sec. 4337.)

Manner of Ascending

"It shall be the duty of the foreman, cager or whosoever may have charge of the bottom of any shaft, to give the proper signal to the topman and engineer whenever any six employees who work therein are ready to ascend, by day or night, and for the making of such ascent it shall be the duty of the bottom cager to give them an empty cage by which they can ascend. And every road on which persons travel underground, when the coal is drawn by mules, or other power, shall be provided at intervals of not more than 30 ft. with sufficient manholes for places of refuge." (Sec. 4338.)

Airways

"Airways of sufficient dimensions shall be provided. In no case shall the area of the air course be less than 21 ft. in mines operated on room-and-pillar system. Stag-

nant water shall not be allowed to remain in air courses, entries, traveling ways or rooms. Airways must be kept clear of obstructions. They must be examined twice a week and reported on once a month to the State mine inspector. Air gates shall be kept open no longer than necessary." (Secs. 4339-4343.)

To inforce the foregoing regulations the powers of the inspector, method of procedure and penalties are defined. The law is to be kept posted at or near the top of the mines. (Secs. 4346-4349.)

EDWARD P. BUFFET.

New York, Dec. 16, 1908.

The Elmore Process at Cobar

In G. W. Williams' article entitled "Cobar Gold and Copper Field, New South Wales," in the JOURNAL of Nov. 14, 1908, he says: "The Cobar gold mines erected three Elmore units but they have thus far not proved a success." This statement conveys a wrong impression, as the three units erected by the Cobar Gold Company have accomplished all that was expected of them, and indeed more.

The facts in the matter are very simple. The Cobar Gold Company has an ore which is exceedingly difficult to treat. A number of different processes were tried, and, among others, our own. The company appointed Johnson & Sons, of London to investigate the method. A bulk parcel of average ore was obtained and put through our testing plant under Johnson & Sons' immediate supervision. The result of these trials was that the Elmore plant was recommended.

The results obtained in the trials showed the crude ore to contain about 1.25 per cent. copper and about 0.55 oz. gold per ton. From this material an extraction was secured of about 90 per cent. of the copper and about 52 per cent. of the gold, leaving in the tailings from the Elmore plant about 0.15 per cent. copper and about 0.30 oz. gold. Johnson & Sons recommended the cyaniding of these tailings for the recovery of the remaining gold, so that really the Elmore process was intended to be applied in this case for the removal of the copper, the presence of which excluded the possibility of satisfactory direct cyanide work.

The plant in due course was erected, but the old battery which existed on the mine was in a state of great dilapidation, and this expression also fairly describes the power plant. Under such conditions of power and crushing plant, it was naturally impossible to secure continuous running, and as it turned out the battery produced an enormous proportion of slime material. Notwithstanding these obvious drawbacks the Elmore plant actually accomplished the same results on the mine as were secured in our testing plant in London.

We have, therefore, nothing to apologize for in connection with this installation, but the fact is that, owing to the presence of the very large amount of extraordinarily fine slimes produced from this particular ore by the battery, the Cobar company found it practically impossible to cyanide the tailings from the Elmore plant; and here the whole crux of the question lies at the present moment.

The consulting engineer of the Cobar Gold Company is about to leave for the mine to investigate this matter of the crushing and power plant, and it is hoped that the plant will soon start again with modern power plant and crushing appliances.

J. STOCKER.

London, England, Dec. 9, 1908.

Alunitization

I have read with much interest the two recent articles in the JOURNAL of Dec. 5 and 12, 1908, by Robert T. Hill, relating to gold deposits of the alunitic type, and your editorial comment on the significance of the association of alunite and gold. While I am gratified, of course, at the importance attached to the investigations at Goldfield, I feel that a word of caution is necessary. My remarks are not in criticism of Mr. Hill's interesting contributions, but are intended for readers who, it may be supposed, are less trained than he in careful discrimination and deduction.

It is entirely true that the Goldfield type of deposit is new and of unusual interest. It is further true that the presence of alunite is suggestive of chemical activity of a kind that may produce valuable deposits, and that it thus invites attention from prospectors. It should be borne in mind, however, that many of the occurrences of the mineral listed in my original paper* have no connection whatever with gold. Alunite, in short, may form wherever natural solutions of sulphuric acid, especially thermal or strong solutions, react on rocks containing potassium feldspars or sericite. The sulphuric acid may conceivably be derived from various sources. It may be directly volcanic; it may be produced by the oxidation of solfataric hydrogen sulphide; or it may come from the oxidation of pyrite.

The alunite at Cripple Creek, referred to in your editorial, occurs in small quantity and has unquestionably been formed in the oxidized zone by sulphuric acid derived from pyrite and acting probably on sericite. It is accordingly secondary and has no genetic significance as regards the unoxidized ores. The alunite at Goldfield, on the other hand, is very abundant, and its formation is certainly connected with the genesis of the rich ores. The precise nature of that connection is still under investigation and will, I hope, be explained in a full report on the Goldfield district now nearing completion.

The scientific worker is occasionally surprised by the readiness with which others attach practical importance to and draw sweeping conclusions from what to him is an interesting and suggestive, but not necessarily a revolutionary, discovery. This rapid application of new light to practical ends is, of course, most likely to outrun discretion where the illumination can supposedly be at once directed to so attractive an object as a rich gold deposit.

F. L. RANSOME.

Washington, D. C., Dec. 20, 1908.

*"The Association of Alunite with Gold in the Goldfield District, Nevada." Economic Geology, Vol. 2, 1907, p. 667.

The Origin of Coal

To the reasons urged by Hiram W. Hixon, in the JOURNAL of Aug. 1, 1908, in favor of a deep sea origin for coal, may not the usual presence of a bed of fire clay, immediately under the coal, be added?

It is difficult to imagine an abundant vegetation having its roots in such a clay and deriving any sustenance from it, while the origin of the fire clay, as a deep sea deposit is much more probable.

EDGAR HALL.

Silverspur, Queensland, Oct. 23, 1908.

Acetylene Lamps Underground

Acetylene lamps, according to W. F. Slaughter (*Proc.*, Lake Superior Min. Inst., Vol. XIII, p. 206), consume about one-fifth as much oxygen as candles do when giving the same amount of light. On that account, when it is necessary to work in badly ventilated stopes or headings, acetylene lamps should be used, not only because they consume less oxygen, but also because they give a bright light in air in which it is difficult to make a candle burn Acetylene lamps are now made small enough to be worn on a miner's hat; they are used at the Saginaw mine on the Menominee range, Michigan. While the lamps require some attention in order to keep the water feeding properly to the carbide, the miners soon learn how to care for them. The lamps then give little trouble. It is said that it costs about two-thirds as much for light when acetylene lamps are used as against candles. At the Michigan mine the cost of the carbide required to last a 10-hour shift is about 2 cents.

The frequent use of water for spraying in the carbonate workings and the compulsory use of water jets for machine drilling, according to the report for 1907 of the Department of Mines, New South Wales, page 89, has had a very beneficial effect in diminishing lead poisoning at the Broken Hill mines.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

C. W. Purington, who has been visiting New York and Boston, sailed Jan. 9 for London.

Edward K. Judd, of New York, mining engineer, is in Sonora, Mexico, on professional business.

Edward H. Cook, mining engineer, has removed his office from Tucson, Arizona, to El Paso, Texas.

Charles Sweeney has resigned his position as president of the Federal Mining and Smelting Company.

G. W. Wertz, recently in the Cœur d'Alene district, Idaho, has taken charge of the Southern Gold mine at Gold Hill, North Carolina.

Harry D. Quinby, of Denver, Colo., has arrived at Gold Hill, N. C., to install the Elmore oil vacuum concentrating process at the Union Copper mines.

Dr. William B. Phillips, of Birmingham, Ala., has just spent a month examining the brown-ore lands in western Kentucky owned by the Hillman Land and Iron Company, of St. Louis.

Herbert C. Hoover, of London, was in New York last week. He went to San Francisco Jan. 8, and expects to return about Feb. 1. He is to give some lectures on mine finance to the students of of Columbia University.

S. S. Rosentamm, representative of Adolph Lewisohn, of New York, who recently acquired control of the Kerr Lake mine, Cobalt, visited the property recently, accompanied by Benjamin B. Lawrence, consulting engineer.

Henry P. Louttit has resigned his position as mine inspector of the First Bituminous district of Pennsylvania. It was in this district that the Marianna mine explosion occurred recently. His successor is William H. Howarth, of Mount Pleasant.

Reginald Meeks, metallurgical engineer, who has been connected with the staff of the ENGINEERING AND MINING JOURNAL, has resigned and will be associated with Dr. Charles T. Hennig, managing the latter's testing and research plant in East 35th street, Brooklyn.

William B. Dickson, heretofore second vice-president, has been chosen first vice-president of the United States Steel Corporation, in place of James Gayley, resigned. His successor as second vice president is David G. Kerr, heretofore manager of the iron-ore interests of the Carnegie Steel Company.

W. A. Carlyle has been appointed professor of metallurgy at the Imperial College of Science and Technology, London, to succeed Professor Gowland. He is a graduate of McGill University, Montreal, 1887, and was a professor there 1891 to 1895. He has had practical experience in Colorado, in British Columbia and as manager of the Rio Tinto mines in Spain, and was Provincial mineralogist of British Columbia for three years.

James M. Swank has tendered his resignation as secretary and general manager of the American Iron and Steel Association, to take effect on the election of his successor. Mr. Swank was largely instrumental in the organization of the association; has been its secretary for 36 years and general manager also for 22 years. His retirement will be regretted by the many who appreciate the value of his hard and constant labors for the association and the care and fidelity with which he has collected and arranged the statistics of the trade.

Obituary

Frank Taylor died at Watford, England, Dec. 25, aged 59 years. He was connected all his active life with the well known firm of John Taylor & Sons, of London. For 18 years he had special supervision of the Australian interests of the firm.

Walter Richardson Crosby died in Berkeley, Cal., Jan. 2, aged 49 years. He was for a number of years connected with the Venable Construction Company, Atlanta, Ga., in the execution of important engineering works. Five years ago he went West, taking charge of the Butters Reduction Works at Virginia City, Nev. Two years ago he was made general manager of the Butters mining and metallurgical interests, with office at San Francisco.

Herman Justi, one of the best known men in the Western coal trade, died at Chicago Jan. 1, aged 56 years. He was born in Kentucky and lived in that State and Tennessee for 46 years, having been engaged in business on a considerable scale. As a chief of publicity of the Tennessee Centennial Exposition in 1897 he found temporary field for the exercise of his undoubted talents. Coming to Illinois the year following at the instance of his friend, the late W. P. Halliday, of Cairo, then a leading coal producer of southern Illinois, Mr. Justi helped found and for 10 years successfully and ably administered the affairs of the Coal Operators' Association. The problem of labor and capital deeply interested his mind and he wrote several valuable monographs on labor questions. As commissioner of the Illinois association he helped to settle many disputes, and secured many concessions from the miners, who had much confidence in his fairness and honesty.

James Corrigan, head of the firm of Corrigan, McKinney & Co., died at Cleveland, Ohio, Dec. 24, aged 60 years. He was born in Morrisburg, Ont., and as a boy went to Cleveland and found employment on a lake schooner. Later he engaged in the oil business, but afterward sold out to the Standard and entered the shipping trade, acquiring a considerable fleet of vessels. James Corrigan was one of the earliest to recognize the possibilities of the Lake Superior iron country, and it was a natural step from the carrying of ore to the mining and smelting of it. He became a consistent buyer of Lake Superior ore properties, and at the time of his death was the most extensive independent operator on the ranges. On the Mesabi range the firm owned the Admiral, Commodore, Jordan, St. James, St. Paul, Stevenson and Wallace mines; on the Gogebic, the Colby, Colby No. 2, Ironton, and Ironton No. 2; on the Menominee the Armenia, Baker, Basic, Crystal Falls, Dunn, Fairbanks, Genesee, Great Western, Groveland, Kimball, Lamont, Lincoln, Paint River, Quinnesec and Tobin; on the Marquette the Star West mine. The firm also from time to time acquired interests in blast furnaces. Their holdings included the Genesee Furnace Company, at Charlotte, N. Y., the Scottdale Furnace Company, at Scottdale, Penn., and the Josephine Furnace and Coke Company, at Josephine, Penn. At Josephine, the firm founded a town as well as a furnace. He had also planned to build a new furnace on the Cuyahoga river at Cleveland, under the name of the River Furnace and Dock Company. This is expected to be in operation in 1910. In recent years the firm gradually withdrew from the ownership of vessels, devoting attention more especially to the operation of mines. Mr. Corrigan also in recent years acquired large interests in copper mines in Mexico.

Societies and Technical Schools

Mining and Metallurgical Society—The annual meeting was held Jan. 12, at Columbia University, New York.

American Institute of Mining Engineers—The 96th meeting of the Institute for the reading and discussion of papers will be held at New Haven, Conn., beginning Feb. 23. Professor J. D. Irving, Yale station, New Haven, Conn., is secretary of the local committee of arrangements. A complete list of the papers to be presented at this meeting cannot be given; but it may be said that, among the leading topics of discussion, according to present expectation, will be: Professional Education (in connection with the inspection of the new Hammond laboratories, etc., of the Sheffield Scientific School); the Conservation of National Resources; and the Construction of a Sea-Level Panama Canal (in connection with a paper by Henry G. Granger, to be published in the January *Bulletin*). Various entertainments and visits to works in and near New Haven have been planned.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Goldfield, Nev., Denver and Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 8—A short time since mention was made in one of these letters of a merger of gold-dredging companies under the name of the Natomas Consolidated, taking in all the dredging interests near Folsom and some at Oroville. The capital stock of the corporation is $25,000,000 and bonds to a large amount are issued, the cost of purchasing the dredge interests in question being some $7,000,000. It was thought at the time that more or less of the capital required would have to come from Eastern sources, but at a meeting held in this city last week it was found that enough had been subscribed here. Eastern men who wished to become interested were unable to come in, as the California subscriptions were sufficient.

Action has been commenced in the United States Circuit Court in this city against the Trinity Bonanza King Mining Company for $2174, the value of certain Government timber alleged to have been cut for use in the mine for lagging and timbers. The timber was sugar pine and red fir. The miners have to be careful in these days where the timber supply comes from, even when they buy it from people supposed to own the land where it grew.

The Northern Electric Railway Company is endeavoring to have the city officials of Oroville modify in some manner the injunction against the Indiana Gold Dredging Company, to avoid prospective trouble with that company. The right of way of the Northern Electric Company runs over the dredging company's land and when the right was secured the railway people agreed to let the dredge cut through their track line; but this was to be cut only once. Since the city's injunction against the dredging company that company has changed its plan of dredging, and this involves three cuts instead of one, thus involving great expense on the part of the railway company.

Work is about being started by the Metropolis Construction Company on the contract to build the impounding reservoirs or settling basins planned by the Government engineers as part of the scheme to relieve the waters of the Yuba river of débris near the town of Hammonton where the gold dredgers are operating. Each settling basin will have an area of 1000 acres. In addition to the exact uses to which the basins are to be put, some advantage will be derived by the dredge operators at that point, above Marysville.

Quite heavy rains this week have succeeded the freezing days of last week in the mining regions of the State. There is still, however, some trouble with snow in the ditches and in the higher ranges there is much ice to contend with.

The Seal of Gold Mining Company in Virginia Dale district in the southern part of the State recently leased its group of mines to H. R. Slater. One of the directors subsequently instituted suit in the name of the company to have the lease canceled. The judge of the district court has now settled the matter by deciding that Slater has a right to his lease. W. L. Peters, of Riverside, is president of the company.

Goldfield, Nevada

Jan. 5—The State bullion-tax collector estimates the gold production of Nevada for 1908 at $14,000,000, this amount being calculated from the actual production of $10,019,730 for the nine months ending Sept. 30.

Dividends paid by Goldfield properties for the past year amount to $1,578,500 made up as follows: Florence Goldfield, $420,000; Engineer's lease, $570,000; Rogers Syndicate, $300,000; Mohawk Jumbo, $78,000; Frances Mohawk $45,500; Florence Annex, $50,000; Red Top Consolidated, $20,000; Little Florence, $30,000; Mohawk Combination, $65,000. Considering the inactivity of the two largest properties—the Consolidated and the Florence—pending the construction of their mills, this is a very creditable showing.

The Goldfield Traction Company last week commenced work in Columbia for the trolley system; grading will be carried on from that point into Goldfield where the road will traverse the principal business and residence streets while another loop will cover the mining territory to the east of town. The management expects to have six miles in operation by July 1, 1909.

Charles S. Thomas, ex-Governor of Colorado, and W. H. Malburn are reported to have withdrawn from the firm of Thomas, Bryant and Malburn. This firm has been legal adviser to the Goldfield Consolidated Company since it was formed. H. S. Bryant, together with J. P. O'Brien, former district judge of Nye county, under the firm name of Bryant & O'Brien, will continue as legal advisers for the Consolidated.

The Cedar Lake valley oil excitement [illegible] and that vicinity is the scene of [illegible] thousands of acres have been located, one syndicate alone holding over 50,000 acres. Oil shows at surface in a number of places; this oil is claimed to have a paraffin base. Fish Lake valley is about 75 miles west of Goldfield near the line between Nevada and California.

Butte

Jan. 7—The report of the State coal mine inspector for 1908 has been made public. The report calls attention to what the inspector calls the criminal disregard for the welfare of the coal miner, and advocates a more thorough regulation by law of the safeguards necessary for the miner's protection. The production of coal for the year ending Nov. 1, 1908, was 1,979,217 short tons, a decrease of 2.5 per cent. The fatalities for the year were 12 and the number of injured was 51.

The annual report of the Butte Mining Stock Exchange for 1908 shows an increase in the number of shares traded in during that period as compared with the previous year, although the values represented were less. There were sold on the exchange 1,593,345 shares of stock, valued at $455,740, during 1908, as compared to 1,520,183 shares, valued at $560,007, in 1907.

A reorganization has taken place in the lines controlled by the Chicago, Milwaukee & St. Paul Railway. The original corporation, which is organized under the laws of the State of Wisconsin, retains the same name, but the subsidiary companies, formerly known as the Chicago, Milwaukee & St. Paul railways of Washington, Idaho, Montana and South Dakota respectively will cease to have independent organizations and the entire line from Mobridge, on the Missouri river to Seattle will be controlled by the newly organized Chicago, Milwaukee & Puget Sound Railway, a Washington corporation. The entire stock of this company, capitalized at $100,000,000, will be held by the Wisconsin corporation.

Denver

Jan. 9—In the Cripple Creek district, the Portland Gold Mining Company advertises that it will now buy all grades of Cripple Creek ores, paying cash, and giving lowest treatment rates, though the rates are not quoted.

At Stratton's Independence, an initial run is to be made of 50 tons daily of low-grade ore in the dry mill. The concentration plant is to be run 30 days later.

A suit has been filed again Stratton's

Independence, Ltd., in the United States Circuit Court in Denver, by the Portland Gold Mining Company to recover $366,000, alleged to be the value of ore illegally extracted from the latter's territory. This is an old suit revived.

The suit against the county commissioners of Teller county for a readjustment of assessment on their properties by 40 mining companies as plaintiffs, has been commenced.

A report on the estate of the late W. S. Stratton, discoverer of the Independence mine, shows a value of $6,418,190, as against $6,307,166 at the time of his death. It is stated that the estate will be wound up at once, and the building of the Myron Stratton Home commenced.

One of the toughest mining fights ever waged has just been won by Allen L. Burris, a young man under 30 years of age, who, after a 12 years' struggle, has wrested the control of the El Paso Consolidated company from the Bernard faction. The property consists of about 65 acres on Beacon hill, in the Cripple Creek district, and has paid upward of a million and a quarter of dollars in dividends. The victor was backed by Eastern capital, and from being trammer underground, has risen to be president and general manager of the company.

The Moose Gold Mining Company is reported to have sold the Trilby and Ben Harrison claims to the Trilby Gold Mining Company, and to have thereupon declared a dividend of $85,000. The Moose was one of the early bonanzas of the Cripple Creek district, but has been idle for many years on account of the deadly gases encountered in the lower workings.

Toronto

Jan. 8—The wagon road to Gowganda is being rapidly pushed forward by the Canadian Northern Railway from Sellwood, the end of the railroad being built north from Sudbury, to the new camp—about 42 miles. The railway announces that its traffic department will receive freight for Gowganda from any Canadian point. This will be forwarded by rail *via* Sudbury to Sellwood, and there sent on by the company's teams to Gowganda.

The total output of ore forwarded to the smelters from Cobalt during 1908 is given as 25,463 tons, as compared with 14,851 tons for 1907. The increased value, however, is considerably greater than these figures would indicate, and a considerable proportion of the shipments last year were concentrates, and less lower-grade ore was sent. The total number of shipping mines was 32, the principal shippers being La Rose 4715 tons, Nipissing 3557; O'Brien, 3428, and McKinley-Darragh 1871 tons.

An expedition is being fitted out at Elk City under direction of Thomas Saville, a well-known guide and prospector, to look for a new silver field west of Gowganda. Mr. Saville claims to have obtained certain information as to its existence from the Indians of the region with whom he was associated for many years.

The Ontario government has issued an Order-in-Council withdrawing from prospecting a large area in the Gowganda district. This includes all the lands not already staked in the townships of Haultain and Nicol and two other as yet unnamed townships 50 miles northwest of Cobalt and 20 miles from James township; the area affected contains about 140 square miles. The bottoms of all lakes in the district and a strip of land 66 ft. wide around all lakes are also withdrawn. Among some of the lakes affected are Gowganda, Abusking, Wigwam, Everett, Bloom, Miller and Leroy. The order exempts all claims staked out before December 18. About two-thirds of the townships specified have already been taken up and Miller and Leroy lakes have also been largely staked. It is probable that the areas withdrawn will be offered for sale subject to royalties.

In several of the cases against mining companies for violation of the law regarding prospectuses an arrangement has been arrived at, under which a statement of facts will be submitted to the magistrate, and should he decide to convict, a stated case will be submitted for the decision of a higher court.

Johannesburg

Dec. 20—When the introduction of very heavy stamps was first attempted by the Consolidated Gold Fields, considerable opposition was raised to the principle, both by practical mill men and consulting engineers. Gradually, however, their special applicability has been clearly revealed and different interests appear to be rivalling each other in their efforts to install the weightiest stamps on the field. A mine in the Krugersdorp district—the West Rand Consolidated—is now about to install an additional 20 stamps weighing 1850 lb. each, for an estimated duty of 12 tons per stamp per day. This will constitute a record for gravity stamp work. It may be pointed out that the duty factor is dependent upon size of screening, and that comparisons of duty provide no test of efficiency, for regrinding has to be undertaken in tube mills as auxiliaries. In all cases, however, a limitation to very coarse crushing in the stamp battery is apparent, owing to the invariable use of amalgamating tables between the stamps and the tube mills. The heaviest stamps now actually in operation on the Rand are those of the Simmer Deep—1670 lb.—which have been working satisfactorily for two or three months. The East Rand Proprietary mines are now also adopting this standard of stamp weight.

Three or four years ago there raged a fierce controversy among certain medical men and chemists as to the cause of the sicknesses associated with underground life on the Rand, and those who maintained that gases and bad ventilation were inadequately appreciated factors and that dust was too constantly defined as the basis of all ills, are apparently ahead. Additional support has been provided by Mr. Cullen, who—as manager of the Modderfontein dynamite factory—spoke with familiar authority on "The Gases Resulting from the Use of High Explosives," and did not hesitate to emphasize the points of blemish in connection with blasting practice on the Rand. A result of Mr. Cullen's investigations on the field has been to indicate that there is a greater evolution of carbon monoxide by the detonation of blasting gelatin—the staple "powder" of the Rand—than is generally supposed. The points of importance are that the anti-fume mixtures or neutralizers are valueless; that clay tamping gives better results than sand cartridges; that fresh gelatin gives no better results than that three months old; that within this age limit, No. 6 detonators are as serviceable as No. 8; that blasting gelatin is improved by extra oxygen in its composition; that ordinary time fuse vitiates the mine atmosphere to a great extent; and that electrical firing not adopted in Rand working practice, gives better results than time fuse.

A promising addition to the constitution and rules of the Chemical, Metallurgical and Mining Society has been proposed which carries still further the idea of expansion. The scheme is for the formation of local sections in any district, in South Africa or not, where at least 20 members or associates reside and are anxious to hold meetings for the discussion of questions. The special advantages to outside members will be the use of the Society's *Journal* for the publication of proceedings, while they will also, of course, benefit by the influence and reputation of the parent body. The chairman of the local committee shall be vice-president of the general society and the local secretary a corresponding member of council. Reports of proceedings and papers contributed at section meetings will be edited and the expense of publication borne by the general funds, from which a grant may even be made, if the work undertaken is of interest, toward the expenses of maintaining the local sections. The society has already corresponding members of council in England, Colorado, Mexico, Sumatra and Queensland.

The Transvaal University College decided to establish a travelling scholarship for the student who comes first in the four-years' mining course. A sum will be provided to enable the successful graduate to visit any other mining field in Europe or America, to gain special influence in any approved line of study.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

Gila County

Miami—Plans are being made for a 2000-ton concentrator and a short line of railroad will probably be built this winter. A 120-ft. crosscut on the 570-ft. level is reported to be in 3 per cent. ore. A crosscut on the 800-ft. level is also in ore.

Graham County

Detroit Copper—This company has installed new boilers and crude-oil burners in the heating plant at the concentrator. The old tunnel which connects the mines and concentrator with the smelter has been widened to accommodate 36-in. gage cars. This saves much transferring of coal and heavy machinery to the small cars formerly in use.

Arizona Copper—Concentrator No. 6 at Morenci has been enlarged. A large amount of money is being expended for the improvement of the trails for the benefit of the workmen.

Chase Creek—This company plans to extend the 2000-ft. tunnel another 1000 feet.

Pima County

Imperial Copper Company—The report for the six months ending Sept. 30, 1908, shows that the company produced 4,109,078 lb. of copper and 62,728 oz. of silver. The company has blown in the second unit of its smelter and in December, 1908, turned out 800,000 lb.; January's output should be 1,000,000 lb. Conditions at the mine and smelter have been bettered during the past year, more ground has been opened, a large tonnage mined, capacity of the smelter doubled, and everything put in readiness for increased operations. An additional unit has been installed at the smelter, bringing the capacity of the plant to about 700 tons. In payment for the additional unit the company has received $100,000 additional capital stock of the smelting company, making a total of $900,000 held by the Imperial. The balance sheet as of Sept. 30 shows an item of $2,000,000 bonds and bills payable of $602,305, held entirely by the majority stockholder, the Development Company of America. Accounts payable amount to $148,960.

Santa Cruz County

Red Hill—At a point 285 ft. in the tunnel on the opposite side of the hill a body of chalcopyrite has been opened. The main tunnel cut into an ore body 420 ft. from the portal, thus indicating an ore zone 600 ft. wide. Drifts are being run east and west from this main tunnel.

Pittsburg Mine—The shaft is down about 200 ft. At 160 ft. a crosscut went through 8 ft. of low-grade ore. Ore is reported in the bottom of the shaft.

Yuma County

Clara Consolidated—Two new strikes are reported on the Morro group, carrying about 7 per cent. copper and considerable gold. Work is progressing on two inclined shafts.

California

Alameda County

Phoenix Quicksilver Mine—This mine, not far from Livermore, after three years idleness is to be started up again by a new company composed of M. J. Laymance, S. A. Knapp and other Oakland men. The works are being cleaned up and the retorts repaired. The mine has never made any product, but at the time of the death of Alvinza Hayward, its principal owner, was about to become productive.

Amador County

Argonaut Mining Company—A new station is being cut on the 3000 level of this mine at Jackson. The Hoffman field ground is expected to yield largely in the future.

Calaveras County

Four Hundred—This mine near Mountain Ranch is being opened by Oakland men under superintendency of A. Mauna. The rock is expected to mill from $6 to $10 per ton. A steam hoist will shortly be installed.

El Dorado County

Snow—This property near Newtown, which has been tied up in an estate for some years has been bonded by B. G. Haskell, C. A. Pugh and others of San Jose. There is a large gravel channel underlying this ground and it is now to be worked.

Humboldt County

Gem—At this placer mine, 10 miles from China Flat, B. G. Steele and others are preparing to operate a No. 3 giant. A new device of Mr. Steele's to save the gold and platinum is being installed.

Inyo County

Four Metals Company—The smelter of this company at Keeler is handling something over 150 tons daily of slag from the old furnaces. When the aërial tramway is finished, Cerro Gordo ore will be smelted.

Mariposa County

Mariposa Commercial and Mining Company—This company now has three mills crushing rock, most of the ore coming from leases on the company's mines.

Mono County

Wild Rose—H. G. Lowers and others are starting up this old mine eight miles west of Benton.

Nevada County

Golden Gate—At this mine, Grass Valley, a new 10-stamp mill, centrifugal pump, and other improvements have been added to the equipment. The mine is an old one and was reopened a year ago by C. C. Haub, but has been taken off the lessees hands by the present company. Electric power is to be used. W. H. Martin is the superintendent.

Placer County

Harlow—Laird and the Quinn Brothers have nearly completed the mill at this mine and will shortly commence crushing cement gravel. The mine is near Rocklin.

Orpheum—This company in Ophir district is putting the gallows frame over the new two-compartment shaft and will soon install an electric power plant.

Plumas County

Long Valley Mines Company—At this property, purchased this season by Capt. Adams and associates, the ore taken out is about to be milled. It is probable that work will continue all winter.

San Bernardino County

Anaconda—In this mine, near Twenty-Nine Palms, owned by the Mohawk Herald Company, high-grade ore has been struck in the shaft. This is in Gold Palms camp, five miles from the quartz mill at Twenty-Nine Palms.

Shasta County

El Dorado—At this mine, near the Tower House, owned by E. P. Connor & Son, and under lease to Sherk Brothers, of Redding, a small mill is being erected.

SIERRA COUNTY

Gray Eagle—A new aërial tramway is being built from this mine to the mill.

Brush Creek and Ante-Up—These two claims near the Mountain House have been bonded to L. L. Battey, of St. Louis, and L. A. Armstrong has been appointed superintendent. These are old mines once profitable, but long idle.

SISKIYOU COUNTY

Grouse Creek—This company is putting in a large flume and will start up as soon as there is sufficient water.

Gardner & Weed—This big hydraulic claim in Quartz Valley has been completely fitted up and a large amount of gravel can now be handled.

TEHAMA COUNTY

Tom Head Copper—A large ledge has been found in the lower or 300-ft. tunnel. Considerable underground work is being done this winter, but no machinery is running.

TRINITY COUNTY

Gem—At this gravel mine, 10 miles above Willow creek, in the old channel of the main Trinity river, the operators have installed a new plan of handling the rock and other débris by means of machinery driven by a Pelton wheel.

TUOLUMNE COUNTY

Central Mother Lode Mining Company—This company has been incorporated with E. C. Kavanaugh as general manager. A force of men has been set at work on the Mangante claim.

Kanaka—This quartz mine, with its mill, has been sold by C. M. Lindsay to Agnes D. Parr, of London, England. A water right is also included in the sale.

Kinkard—Cadamartori, Lambert & Ryland have leased this mine on the Ryland ranch three miles from Sonora.

Santa Ysabel—Good ore has been encountered in this mine, near Stent, and the 10-stamp mill is again running. Ten more stamps are to be added.

Tarantula—C. F. Crawford and associates, owning this mine near Chinese, have ordered a compressor and machine drills and will continue the main tunnel. Rich rock has recently been struck.

Colorado

CLEAR CREEK COUNTY

Banner Consolidated—This company, operating near Idaho Springs, is planning the erection of a 500-ton concentrating mill; also development along heavier lines.

GILPIN COUNTY

A. K. R. Gold Mining Company—Gold retorts weighing nearly 300 oz. were sold to the Denver mint during December, the gold bringing the unusual price of $19.80 per oz., believed to be the highest grade amalgam gold purchased by the Mint from any mine in Colorado. The concentrates also are exceptionally rich, the last carload shipment selling to the Argo smelters for $90 per ton. New machinery, consisting of air compressor, boiler and engine, is being installed and an additional battery of five rapid-drop stamps is to be added to the mill. George M. Ashmore, Rollinsville, Colo., is manager.

Oh Be Joyful—Denver people have become interested in a lease and bond and are erecting a new shaft building and installing machinery. C. H. Chase, Miners' Exchange building, Denver, Colo., is manager.

LAKE COUNTY—LEADVILLE

Garbutt—From the lower levels this mine, Breece hill, is shipping 30 tons daily of a good grade of iron sulphides and copper sulphides; the ore carries gold in addition to copper.

Helena—In this mine, Iowa gulch, a station is being cut at the 700-ft. level, where a large pump will be installed. When the station is cut sinking will be resumed; the depth of the shaft is now 720 ft., with 80 ft. still to go. In sinking several streaks of ore have been encountered, which will be developed later. As the shaft gains in depth the formation changes.

Majestic—This shaft, Mosquito range, is now down 100 ft. and a contract has been let to sink another 100 ft. The vein has been caught, and when the shaft reaches a depth of 200 ft., the owners expect to have shipping ore. The property adjoins the London, and the shaft is being sunk on that fault.

Progressive—In this mine, on North Fryer hill, the work which has been carried on in the lower levels for the past two months has developed a body of ore that bids fair to becoming a permanent shoot. In the north drift the ore has been opened and is now over the whole face of the drift, running well in silver and 60 per cent. lead. The orebody is being developed as quickly as possible.

Granite Tunnel—This enterprise is being driven from Granite in the direction of Leadville and is in several hundred feet; several veins have been cut, but none mineral bearing. During the week a vein, several inches wide, was encountered running high in gold. The enterprise is financed principally by local men.

Progressive—In this mine, North Fryer hill, with the new plant of machinery recently installed the lessees have been enabled to unwater the shaft, and are now handling the flow of water with ease. Drifts are being driven into new territory and from present indications the lessees are likely to catch the orebodies that trend through this section of the district.

Gallagher—A good body of ore has been opened in the old workings, Graham park, and as it carries considerable lead it is welcomed at the local smelter; the silver is also high. From this body 20 tons a day are shipped. Now that the old shaft has been cleaned out and retimbered, it is the intention of the leasing company to sink a new shaft to the north.

Half Moon Group—A company of local men have organized a company to operate this group of claims, Robinson, and work will be started within a few days. The group adjoins the famous Robinson mine.

Progressive Shaft—The body of ore recently opened in this shaft, North Fryer hill, is looking so well that the lessees have decided to sink the shaft deeper and open the orebody at greater depth. Ore shipments are being made to the local smelter.

Yak Tunnel—December was the banner month of the year as far as breaking ground in this adit was concerned; 358 ft. were driven in 30 days. The tunnel is now into Resurrection No. 1 shaft, and in a few days it is expected that several large bodies of water will be tapped. During the run from Ibex No. 4 shaft to its present breast the tunnel has cut four veins in the granite, all carrying gold.

TELLER COUNTY—CRIPPLE CREEK

Gold Sovereign—At the annual meeting last week the present management was successful, voting 926,000 shares, against 528,000 for the opposition, or Rapp party. The directors chosen were J. N. Auer, O. H. Hines, Le Mars, Ia.; M. F. Wendling, Quincy, Ill.; Henry Sachs, Colorado Springs, Colo.; E. J. Boughton, C. G. Jackson, H. L. Shepherd, Cripple Creek, Colo. Resolutions were passed approving the policy of the directors of the last year and deprecating and disapproving the action of the previous board in the granting of a lease on the properties to the Franklin Leasing Company. The board elected O. H. Hines president; M. F. Wendling, vice-president; H. L. Shepherd, treasurer; C. G. Jackson, secretary.

Mary McKinney—The Western Investment Company, leasing this mine on Raven hill, has found a promising vein, said to be of large size, in a crosscut run west from the shaft at the 500-ft. level. The vein is vertical.

Agnes—Work has been begun on this company's Four Brothers claim on Beacon hill. Machinery has been installed in the shaft-house and other preparations made. Eastern parties will operate the claim under lease.

Gold Dollar Consolidated—The Union Leasing Company, operating the Husted shaft of this company on Beacon hill, is shipping steadily ore taken from the large orebody between the 300-ft. and 400-ft. levels.

Londonderry and Manhattan—The claims owned by these companies on Bull, Gold and Ironclad hills have been placed

in charge of J. W. Parfat as resident manager. He will examine and report on these claims, and it is understood that he will have authority to lease blocks of the ground when the examination is completed.

Pike's Peak—In this mine, owned by the Stratton estate, two sets of lessees, Myers & Co. and Schoolcraft & Co., are operating, and are shipping ore.

Idaho

Boise County

Gold Hill—The company, E. E. Carter, manager, is arranging for leases on its surface workings, the ore to be treated in the Iowa mill. A power line is to be installed and machinery driven by electric power from the Payette river. Tests have proved that the ores can be cyanided with advantage.

Last Chance—The Columbia Mining Company operating this mine in the Quartzbury district has made a rich strike in the lower adit.

Shoshone County

Amy Group—T. W. Hunt and a number of Eastern associates are negotiating at present for the purchase of this group of claims on the west side of Pine creek. The price is said to be $25,000. The property has been extensively developed and one foot of clean shipping ore and several feet of concentrating ore opened up.

Atlantic—After an idleness of from four to five years this company has been reorganized and has purchased a group of seven claims in Cedar creek. A force of men is at work.

Evolution—Two feet of solid galena has been encountered on the 290-ft. level of this property. The crosscut from the bottom of the shaft was run about 100 ft. when it intersected the vein which has been crosscut for a distance of about 40 ft. on its dip.

Federal Mining & Smelting Company—A dividend of 1½ per cent. has just been declared on the common stock of this company, and involves a distribution of $150,000, the capitalization in common stock being $10,000,000. This is the only dividend that has been paid on common stock since about this time last year. The total now paid on common stock since the incorporation of the company is $2,643,750. On its $20,000,000 of preferred stock the company has disbursed this year $630,000 and a total in all of $3,934,250.

Flagstaff—At the annual meeting of the stockholders of this company held in Wallace, the following officers and directors were elected: President, J. S. Thomas; vice-president, Joseph Cook; secretary-treasurer, F. T. Millichamp and directors C. G. Matthews and O. B. Wallace. A financial statement showed that the company has still 130,000 shares of treasury stock on hand. It is believed that a resumption of work will be made in the near future. Development of the company's property ceased about one month ago.

Gold Back—At a depth of about 100 ft. this company has encountered 18 in. of solid, shipping galena together with several feet of good milling ore. The claims of the company adjoin the Pilot mine on the north and the Cornucopia on the south.

Hecla—This company has declared a dividend for the month of December at the rate of 3c. a share. This is the 60th dividend declared by the company and involves the disbursement of $30,000 making the grand total paid out by the company $1,710,000 and the total for 1908, $190,000.

Hector—Contracts for 350 ft. of work have just been let on the property of this company. These contracts are for a 250-ft. crosscut to the north vein and 100 ft. of drifting on the south vein which has just been encountered. Bonds have been taken by the company on two adjoining claims.

Hugo—An orebody carrying copper and gold has been encountered in the property at a point 75 ft. from the portal of the upper tunnel where a 40-ft. winze had been sunk.

King Solomon—After having been closed for about six months work on this property has been resumed and a contract let for 200 ft. of work. It is believed that in about another 60 ft. the ledge will be encountered when the balance of the work will be taken out in drifting.

Lead Tariff—Frederick Burbidge, representing the mining interests of the Cœur d'Alenes, has placed in the hands of Chairman Payne of the congressional committee dealing with the tariff revision at Washington, D. C., a formal brief containing the protest of the operators of this district against any attempt to reduce the tariff on lead ores.

Montana-Standard—The development of this property has practically ceased for the winter. It is the intention to put a full force of men to work again in the early spring and to erect a concentrator.

Indiana

Warrick County

While drilling a test well for oil on the Barkley farm in the northern part of this county, the drill passed through four veins of coal, two of which are 7 ft. thick. The last one is 600 ft. below the surface, and coal brought up is said to resemble cannel coal. All the veins have good roofs. The discovery has aroused considerable interest and steps will be taken at once to develop the new field. Jesse Barkley, of Lynville, owns the land.

Michigan

Copper

Isle Royal—The new shaft this company is sinking on the Baltic lode is down about 50 ft. in solid ground and sinking has been temporarily suspended while a concrete collar is put in. At shafts Nos. 4 and 6 the hoisting equipment will be ready to go into commission in the course of a few weeks.

Hancock—Drifts on the West Hancock lode which has been opened by means of crosscuts from the 9th, 10th, 11th, and 13th levels of No. 1 shaft are breasted in fine copper-bearing ground. No. 2 shaft will cut this lode at a depth of about 2000 ft. The working crosscut from the 13th level of this shaft will connect with No. 1.

Winona—Operations at No. 3 shaft of this property have been temporarily suspended and the working force transferred to No. 4; No. 3 shaft has been opened to the 15th level and it is now planned to center all activities at No. 4 and open this shaft in like manner, so that when stamping begins, which in all probability will be the coming spring, the company will have ample ground opened to maintain regular shipments. The lode opened at depth shows encouraging mineralization.

Atlantic—Section 16 shaft of this company is nearing the 20th level, and a crosscut from the 19th is entering the lode. Results will be awaited with interest as it is believed the shattered and disrupted condition found in the upper levels will be eliminated with depth.

Franklin—Drifting from the 24th level of this company shaft on the Pewabic lode is under way, and the same richness that was opened in the level above is in evidence. At the 23d level a stope 20 ft. high and about 75 ft. long has been cut the full width of the vein, which averages about 12 ft.; the mineralization is equal to any yet found on this formation.

Osceola—No. 4 shaft of the North Kearsarge branch of this property will soon be in shape to begin producing. The surface equipment will be ready as soon as the underground openings are sufficient to maintain steady shipments. The shaft house is ready for sheathing and the machinery is being erected at the hoisting and compressor plants. The shaft will command the ground tributary to the southern boundaries of the Ahmeek and Allouez properties, and is opening a most encouraging copper-bearing belt. This tract carries the outcropping of the Kearsarge lode.

Kearsarge—The lower levels of the company's shaft are revealing a much better grade of rock. At the 11th level a fissure vein was encountered, and drifting on this is under way with a fine copper showing.

Phoenix Mill—The plant continues operating one shift a day; with the improve-

ments inaugurated some time ago more satisfactory results are obtained.

Mass Consolidated—At the close of the year 1907 the company had net cash assets, over and above all indebtedness, of $94,000. This has been reduced by about $35,000 as the result of operations in 1908. The average monthly loss during 1908 was, therefore, $3000, although in the months of November and December the mine made a little money over and above all expenses. Of the small deficit in 1908 at least $25,000 represents the cost of diamond-drill explorations. The company will not be in the immediate need of funds, and if the metal market should advance from its present level the mine should be able to work out a small net profit. At one time during the year the company was carrying about a six months' supply of copper, or 750,000 lb., against which it was borrowing $100,000. At the present time this supply has been reduced to about 600,000 lb., while the borrowings have been reduced from $100,000 to $65,000. The present output is about 150,000 lb. of refined copper monthly.

Montana

Butte District

Butte & London—The annual meeting of stockholders will be held at Butte on Jan. 19. Directors will be elected for the present year and the policy of the company will be determined.

Jefferson County

Butte & Corbin Company—At a meeting of directors held at Butte this week, Lee Bever was elected president, Lee Williams, vice-president, and J. P. Fitzpatrick, secretary and treasurer. The company's property is located in the Corbin district and has been developed by a tunnel 300 ft. long.

Broadwater County

Keating Gold Mining Company—At a meeting of stockholders, J. B. Roote, James A. McKee, C. C. Willis, W. R. Kirk, and C. S. Blackiston were elected directors for the year. Mr. Roote was elected president to succeed A. P. Nipgen, resigned, and Mr. McKee was elected vice-president. C. C. Willis will be assistant superintendant. The management states that since the commencement of operations by the company last July the gross smelter returns on ore shipped has amounted to $82,542.

Carbon County

Bear Creek District—Since the sale of a large tract of coal lands to Thomas Ryan two weeks ago there has been much activity in the location of coal lands in the district. Within the last 10 days all of sections 22 and 26, and the greater part of sections 29, 30, 31, 32, 34, 35 and 35 have been located.

Nevada

Esmeralda County—Goldfield

Consolidated Red Top Lease—This lease on the Red Top claim of the Goldfield Consolidated company, has developed some high-grade ore in the south drift on 225-ft. level. The orebody, which was only a narrow talc seam where first found, has gradually increased to a width of 18 in.; the ore is a sulphide, showing considerable rusty gold. Eighty sacks of high-grade ore have been saved.

Daisy Florence Lease—This lease, operated by Mitchell & Fairfield, recently encountered ore in a raise from the 315-ft. level. Returns from the first shipment of 30 tons gave a value of $75 per ton. The raise is now 25 ft. above the floor of the level and shows 4 ft. of quartz which assays $40 per ton after the high-grade ore has been sorted out.

Goldfield Kewonas—The vertical shaft is now 470 ft. deep, and at that depth a crosscut is being run to connect with the old incline shaft, which, although good shipping ore was found, had to be abandoned at a depth of 500 ft., because of a heavy flow of water. The crosscut, which is now 75 ft. long, will be continued 275 ft. farther; at that point a raise of 115 ft. will be driven to connect with the old shaft.

Kewanas Extension Mining Company—This company, leasing on the north end of the Kewanas No. 2 claim, is sinking with a view of cutting the Hazel vein, which should pass through its ground. The shaft is now 360 ft. deep.

Combined Mining and Leasing Company—The officers of this company have secured a new 18-months' lease on their old leasehold on the Velvet claim of the Goldfield Merger Company; this dates from Jan. 1, 1909. A contract for 200 ft. of crosscutting has been let.

Hazel Goldfield—The shaft, which cut an orebody at a depth of 720 ft., is being carried down on the vein. It is now 740 ft. deep, being the deepest lease shaft in this district. The orebody, which in places is 75 ft. wide, is of milling $8 grade, with bunches of high-grade ore in it that assays from $25 to $300 per ton. This is thought to be a continuation of the Red Top vein.

Grizzly Bear Lease—Work on this lease, which is on the Grizzly Bear claim of the Consolidated company, has been resumed, and the shaft, now 200 ft. deep, is being sunk at the rate of 3 ft. per day. A six-months' extension has been granted the lessees provided that the shaft is 800 ft. deep by Feb. 1, 1910.

Kansas City Goldfield Leasing Company—This company, which is operating the old Ricker lease on the Velvet claim, recently developed ore in a winze; this ore improves with depth; 10 tons are ready for shipment.

Goldfield Consolidated—The new 600-ton mill commenced operations Dec. 26, and is dropping 60 stamps, which number will be gradually increased by the end of January to the full capacity of 100 stamps.

Esmeralda County—Rawhide

Nugent Lease—The shaft is 100 ft. deep; on the 100-ft. level several crosscuts have been driven at this lease on the Coalition property. In one of the drifts a north-south shoot of ore was struck that assayed high in silver; the silver was found mostly in the talc which is about 2 ft. wide; some of this talc ore went as high as $700 a ton. On this lease there is another vein about 7 ft. wide that will average $16 per ton.

Victor Lease—On the 100-ft. level one of the walls of the vein is very well defined; the ore on this level is about 4 ft. wide, 1 ft. of it running several hundred dollars in gold to the ton. On the 200-ft. level the vein widens to 15 ft., and is nearly all quartz; the footwall is porphyry as on the 100-ft. level. The ore from a width of 15 ft. across the vein assays about $25 a ton; the 8 in. next to the walls is very rich. This lease is on the main vein of the camp; apparently, this vein is also the best carrier of gold in the district.

Truitt Lease—The shaft at this lease on Hooligan hill is 70 ft. deep. On the 70-ft. level several long drifts have been driven and much ore has been mined. From this level a winze 100 ft. deep has been sunk following the ore. Most of the mining now being done is on this, the 170-ft. level. Machine drills are used, and shipping ore is being taken out. The ore is barren looking, but much brecciated, and the seams are filled with oxidized material carrying gold; the rock as broken assays about $50 to the ton. The vein matter for a width of 40 ft. will probably pay to mill. The Truitt lease has shipped 700 tons.

Miller Lease—This lease is on Hooligan hill between the Victor and the Truitt leases, and is the highest upon the hill. The first level is the 65-ft.: on this level the incline shaft is connected with the vertical shaft which is 165 ft. deep. The incline shaft follows the ore, and is continued to the 165-ft. level, the deepest in the mine. The orebody in the incline shaft seems to be the main one, as from it all the shipments have been made. On the 165-ft. level drifts have been run in several directions, and in each one milling ore has been found that assays from $12 to $20 a ton. The main oreshoot still continues in the bottom of the incline shaft and is about 6 ft. wide. The formation is the same in this lease as in the Truitt, but the vein is more regular and better defined, more quartz being found on the lower levels.

Bradshaw Lease—In the prospect shaft, 50 ft. deep, at this lease on the east side of Ballon hill a rich vein of talc has been found. The owners have taken out

some ore assaying as high as $600 per ton.

Murray Lease—A rich strike has been made on the 200-ft. level of this lease on the Rawhide Consolidated property. The Murray 10-stamp mill which is being built by the Allis-Chalmers Company is rapidly nearing completion; it is to be ready by Feb. 15. The stamps weigh 1250 lb. each.

St. Ives Lease—A rich strike was recently made at this lease on Ballon hill by A. A. Codd and associates. On Jan. 3 the lease began shipping ore from the new strike.

EUREKA COUNTY—EUREKA

Windfall—J. J. Jones, of Goldfield, and associates who purchased this property last October for $200,000 are sinking a vertical, two-compartment shaft; this shaft is now 175 ft. deep. The company plans to build a 100-ton cyanide mill.

HUMBOLDT COUNTY—SEVEN TROUGHS

Wihuja Lease—Stoping is being done on the 265-ft. level, and sinking has been resumed from the 365-ft. point at which depth on account of a large flow of water sinking was stopped. The last lot of 150 tons from this lease returned $175 per ton.

Mozuma Hills—The shaft is being sunk, and considerable drifting is being done. The mill will be started this week.

English George Lease—All of the machinery for the Huntington mill to be erected on this lease, has reached Mazuma and work of construction is being rapidly pushed.

NYE COUNTY—TONOPAH

Production for the week ending Dec. 26 was 5183 tons having an estimated value of $129,575. The West End mined 150 tons; Tonopah Mining Company, 2950; Midway, 100; Montana Tonopah, 658; MacNamara, 325; Jim Butler, 300; Belmont, 700 tons.

Belmont—During the week ending Dec. 26, 130 feet of new ground was broken. Considerable development work is still being done in the upper levels, but this week most of the development was done on the 1000- and 1100-ft. levels.

West End—Development work is quite satisfactory; while stoping is being carried on in several places, no attempt is being made to produce a large tonnage. The week's work showed a marked improvement in the paystreak on the 400-ft. level.

NYE COUNTY—BULLFROG

Pioneer—The rich strike in this mine at Springdale, ten miles north of Bullfrog, is causing considerable excitement. The orebody which is 12 ft. wide is of good grade. The gold is rusty and is quite evenly disseminated throughout the quartz. The first shipment to Salt Lake City was made Jan. 1. The mine is now employing 40 men.

NYE COUNTY—BERLIN

Blue Bell—At this property only sufficient ore is being taken out to supply 20 stamps. This ore comes from a winze on the 125-ft. level. Work is being rushed on the 400-ft. level in order to get beneath this orebody; then the 30-stamp mill will be run at full capacity. On the 125-ft. level the vein varies from 4 to 15 ft. in width and is of good milling grade. The mill clean-up for November amounted to about $10,000 in bullion and $15,000 in concentrates. This company also owns the Downieville mine, 15 miles to the west; at present the company is negotiating the sale of that mine.

NYE COUNTY—HELENA

Broken Hills—Three hoists are now operating on this property, and two more, to be used on leases, are in transit. The last carload, consisting of 600 sacks, that was sent to the Western Ore Purchasing Company at Millers, gave returns of $122 per ton.

WHITE PINE COUNTY

Giroux—Control of this company has been secured by Cole & Ryan, which explains the recent rise in the stock.

Cumberland-Ely—A syndicate has been formed which has taken from the treasury of the Nevada Consolidated Copper Company the remaining 125,000 shares of Cumberland-Ely stock at not far from the present market price. The Nevada Consolidated sold the shares in order to finance an extension of the Steptoe smelter and mill. The Nevada Consolidated company originally owned 200,000 shares of Cumberland-Ely stock acquired in part payment when that company sold the Cumberland-Ely a one-half interest in the Steptoe reduction works for $3,000,000.

New Mexico

GRANT COUNTY—SYLVANITE

Sylvanite now has a full fledged postoffice. Edwin J. Clark, one of the locators of the camp, has been appointed postmaster.

Wood Mine—Colorado capitalists headed by Jesse H. Waters, of Colorado Springs, president of the Midland Terminal and Florence & Cripple Creek railroads, have secured from the Pierson Brothers and W. E. Irwin a working bond and option on the Wood mine. Besides a substantial cash payment the vendors will receive shares in the company that is to be incorporated. Mr. Waters and associates also purchased the Ruth group of three claims on the eastern extension of the Clemmie vein. I. J. Russel, who sampled the mine for the purchasers, will have charge of the operations on both properties. A force of miners has been put to work.

Buchanan Group—Pierson Brothers & Irwin have bonded a group of six claims belonging to R. B. Buchanan, about a mile north of the Wood mine, for $40,000. Work of developing the new property will begin at once.

North Carolina

MONTGOMERY COUNTY

Iola Gold Mine—This mine has been sold by order of court to Capt. William Fleming, Waldorf-Astoria hotel, New York, for $50,000 cash. Capt. Fleming is well known as a director in several successful mines.

ROWAN COUNTY

Gold Hill Copper Mines—The sale of this mine in bankruptcy is ordered to take place Jan. 27. The property includes the large plant and several hundred acres of land. This is a well-known curb stock.

Tennessee

PUTNAM COUNTY

Georgia-Tennessee Phosphate Company—This company is now constructing a narrow-gage railway, half a mile long from its mines at Boma to a connection with the Tennessee Central Railroad. It is also putting in two 100-h.p. Walsh & Weidner, internal-fired boilers, and a hoisting engine, and will install a crusher with capacity of 500 tons per day.

Utah

BEAVER COUNTY

Newhouse Mines and Smelters—This company has a floating debt of $144,000. The company is producing 600,000 lb. of copper a month at a net profit of $20,000. New tables and machinery are being installed at the mill so as to increase the yearly output of the company to 12,000,000 lb. of copper.

Beaver Mine—The drift on the 700-ft. level has passed through the first oreshoot and now a raise is being driven in it. The 700-ft. level is being driven farther east, with indications of another oreshoot nearby.

SALT LAKE COUNTY—ALTA

Utah Mines Coalition Company—This company has filed articles of incorporation. The headquarters of the company are at Salt Lake. The capital is $1,250,000, in shares of $2.50 each, 250,000 shares remaining in the treasury. The officers are: Duncan MacVichie, president; James B. Risque, vice-president; Roland H. Strickland, secretary; Louis H. Farnsworth, treasurer. The property of the old Black Bess company and other patented claims near the head of Big and Little Cottonwood cañons have been taken over by the new company. There are four known veins in the property. One of these veins

has been developed to a depth of 350 ft. by shaft workings. The new company plans to drive an adit on the most northerly of the veins and to crosscut from this adit to the other lodes. This adit will be driven at a depth of 1000 ft. below the collar of the present shaft; its portal will be 75 feet above the level of Lake Solitude. From there a good wagon road extends to the railroad.

SALT LAKE COUNTY—BINGHAM

Bingham-Butte—Recently at a special meeting of the stockholders a bond issue of $200,000 was authorized. This issue will be secured by 400,000 shares of treasury stock and a mortgage on the property. Developments at the mine are promising. Part of the money raised by this issue is to be expended in purchasing nearby property.

SUMMIT COUNTY

Shipments—Shipments from the Park City mines amounted to 2108½ tons of lead ore during the week ending Dec. 26. The Daly-West shipped 750 tons; Silver King, 1069; Daly-Judge, 289½ tons. During the week ending Jan. 3 the Park City mines shipped 1769 tons of lead ore and 138 tons of zinc concentrates; the last from the Daly-Judge. The Silver King shipped 770 tons; Daly-West, 575; Daly-Judge, 279½; American Flag, 144½ tons.

Little Bell—The work has been resumed. At first this will be confined to the 300-ft. level as that is connected with the Quincy shaft of the Daly-West property through which the mine will be worked, and at present no attempt will be made to operate through the winze. Ed. Talbot, of the Daly-West mine, is in charge of the work at the Little Bell.

Silver King Coalition Company—One of the lawyers for this company is reported to have stated that the Silver King Coalition has refused and will refuse to deliver to F. A. Heinze ore claimed under the contract alleged to have been made several months ago. In the meantime the Heinze interests are putting the Majestic smelter at Milford in shape for operation.

West Virginia

MCDOWELL COUNTY

Pocahontas Consolidated—A second explosion on Jan. 12 wrecked the Lick Branch coal mine of this company at Switchback, killing 105 men. The mine had just been examined and declared safe by the State inspectors, and a force of 200 men had been put to work for the first time after the explosion of Dec. 28, when 50 miners lost their lives.

Philippine Islands

Benguet Consolidated Mining Company—This company's statement for October shows a production of 186 oz. gold and 150 oz. cyanide bullion. Work was stopped 10 days by a typhoon which caused a landslide breaking the flume and stopping the supply of water.

Paracale Gold Dredging Company—This company reports 630 oz. gold saved during the month of October.

Canada

ONTARIO-COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Jan. 2 were as follows. Coniagas, 54,060 lb.; City of Cobalt, 67,090; Kerr Lake, 61,000; La Rose, 406,510; McKinley-Darragh, 114,000; Nipissing 258,210; O'Brien, 124,325; Temiskaming, 120,000; Trethewey, 240,000; Total 1,454,195 pounds.

Chambers-Ferland—At 120 ft. in No. 1 shaft a marked improvement has occurred in the vein, which shows at this point 18 in. of high-grade ore. In the west crosscut from No. 2 shaft at a distance of 219 ft. a deposit of low-grade ore showing calcite, niccolite and galena was encountered 8 ft. in width.

Little Nipissing—On the Peterson Lake lease a crosscut is being driven at 150 ft. toward the main vein. When this is reached drifting will be carried 50 ft. along the vein to cut a rich cross-vein which yielded rich ore at the 100-ft. level.

Rochester—The main shaft is down 170 ft. but progress in sinking has latterly been slow owing to water. This difficulty has now been overcome and the work is being pushed.

Silver Queen—Underground development is being undertaken on a large scale. Sixty-five men and 7 drills are at work on the 75- and 150-ft. levels, and about 3500 ft. of drifting and crosscutting have already been done. A new shaft is being put down to the south of the main workings and is now down 75 ft. A sump a few feet in depth will be sunk and a station cut. Several veins giving good indications will be worked from this shaft.

ONTARIO-MONTREAL RIVER DISTRICT

Otisse—A rich find is reported at a depth of 30 ft., where a surface vein has widened to between 12 and 18 in. and is yielding high-grade ore. A carload of ore is awaiting shipment.

Mexico

CHIHUAHUA

Tecolotes Y Ancras—The mill at Santa Barbara is treating 800 tons daily. About 40,000 tons of zinc middlings are impounded about the mill and a plant for the treatment of this product is planned. Ore bins of 5000 tons capacity have been constructed at the mines, which will be connected with the mill by an aërial tram to be in operation May 10. The picking belts will be removed to the mines and only sorted ore sent to the mill.

Las Cuadras—This property, three miles north of Santa Barbara has been taken over by C. M. Dobson, the former manager. The work of retimbering the main shaft has proceeded below the 400-ft. level, and trial shipments from the dumps to the smelter have been begun.

Rio Plata—The cyanide plant near Guazapares is expected to be ready for operation in February.

Gibraltar—A strike of rich ore is reported in this property in the Naica camp.

JALISCO

Jalisco Exploration—Ore carrying gold and silver has been encountered east of the Cinco Minas in the Hostotipaquillo district. Thomas Henderson is in charge of operations.

MEXICO

Olvidado—This mine, at Zacualpan has shipped its third carload of high-grade ore to Toluca. The property is new and was opened six months ago. The ore shipped is the result of development work only.

Seguranza—This company, of San Luis Potosi, has begun the erection of a new 100-ton cyanide plant on the property at Zacualpan. The plant is to be completed within six months. Electric power is transmitted from Temascaltepec. The Seguranza is the old Coronas mine. Geo. A. Waddell, San Luis Potosi, is manager.

Carboncillo—A rich strike is reported from this property in the Zacualpan district.

OAXACA

Tehuantepec Silver Mines Company—This company, which owns the San Francisco mine, in Taviche has applied for a concession for the use of the water of the Arroyo De Exegea in Ocotlan. The power is to be used to operate a proposed stamp mill.

San Carlos—This property, at Taviche, which has been operating with a reduced force for the last seven months, resumed with a full complement of men on Jan. 10. Sinking and lateral development has been resumed.

Santa Catarina—The first clean-up from the new cyanide plant has been made with good results. Enough tailings have been stacked to keep the plant running many months.

Mascota—The Piocha adit has cut the principal vein on this property in the San Carlos district, after driving through 125 meters of diorite. The vein is large, mostly oxidized and of low grade, but carrying rich pockets.

SONORA

Greene-Cananea—The copper production for the month of December amounted to 3,450,000 pounds.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Jan. 13—The coal trade in the West seems to have relapsed into dullness for a time, the little spurt of the last half of December having passed over for the present. Continued mild weather has had its influence in the cities and the demand for steam coal seems to have dropped off for the time. In Indiana and Illinois most of the mines are working only half time, and in Ohio the condition is hardly as good as that. Operators are hopeful, however, that the steam-coal demand will shortly improve. It must do so as business revives, since very few manufacturers are carrying large stocks.

The Seaboard bituminous trade is quiet. No business is doing through New England territory, and in New York and Pennsylvania there seems to be a lull in buying.

The anthracite trade is also dull with very little doing at the principal centers. The companies, however, are keeping up shipments steadily. There has been abundant rain throughout eastern Pennsylvania, so that the reservoirs are filling up, and delays caused at the mines by short water supply are gradually disappearing.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Jan. 4, 1908 and Jan. 2, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	24,707	477	D. 24,230
Bituminous	362,376	127,014	D. 235,362
Coke	69,845	63,128	D. 6,717
Total	456,928	190,619	D. 266,309

Daily average was 114,232 tons in 1908, and 95,310 tons this year.

Anthracite coal shipments from Buffalo by Lake for the full season were 3,297,460 long tons in 1907, and 3,240,207 in 1908; a decrease of 48,253 tons.

Anthracite shipments in December again showed an increase, the total being 5,827,938 long tons, an increase of 484,461 tons over December, 1907. For the 12 months ended Dec. 31 the shipments were, in long tons:

	1907.	1908.	Changes.
Reading	14,018,795	12,578,883	D. 1,439,912
Lehigh Valley	11,532,255	10,772,040	D. 760,215
N. J. Central	8,714,113	8,495,425	D. 218,688
Lackawanna	10,237,419	10,088,697	D. 148,722
Del. & Hudson	6,562,768	6,461,666	D. 101,102
Pennsylvania	6,203,271	6,019,457	D. 183,814
Erie	7,151,683	7,450,175	I. 298,492
N. Y., Ont. & West.	2,689,089	2,798,671	I. 109,582
Total	67,109,393	64,665,014	D. 2,444,379

Two companies showed increases in 1908—the Erie and the New York, Ontario & Western. The largest proportional decrease was on the Reading; the smallest on the Delaware, Lackawanna & Western. The total decrease was 3.6 per cent.

The coal tonnage originating on the lines of the Pennsylvania railroad east of Pittsburg and Erie for the full year was, in short tons:

	1907.	1908.	Changes.
Anthracite	5,691,983	5,216,075	D. 475,908
Bituminous	39,718,356	34,246,864	D. 5,471,492
Coke	13,047,593	7,298,866	D. 5,748,727
Total	58,457,932	46,761,805	D. 11,696,127

Decrease in anthracite, 8.4 per cent.; in bituminous, 13.8; in coke, 44.1; in the total tonnage, 20 per cent.

Receipts of domestic coal at Boston for the full year, reported by Chamber of Commerce:

	1907.	1908.	Changes.
Anthracite	2,053,328	1,776,401	D. 276,927
Bituminous	3,184,964	3,302,929	I. 117,965
Total	5,238,292	5,079,330	D. 158,962

Receipts of foreign coal—chiefly from Nova Scotia—in 1908 were about 360,000 tons.

Coal tonnage Chesapeake & Ohio Railway, five months, from July 1 to Nov. 30, short tons:

	Coal.	Coke.	Total.
New River	2,752,948	88,566	2,841,514
Kanawha	2,133,767	12,954	2,146,721
Kentucky	148,013	.....	148,013
Connecting lines	108,294	26,814	135,108
Total	5,143,022	128,334	5,271,356
Total, 1907	5,133,664	195,339	5,329,003

Deliveries in 1908 were: To points west of mines, 2,706,247 tons coal and 76,271 coke; points east, 626,928 tons coal and 42,063 coke; tidewater, 1,805,757 tons coal; anthracite to line points, 4088 tons.

New York

Anthracite

Jan. 13—The hard-coal market continues very dull. The few frosty days of last week gave some hope of improvement, but the cold did not last long enough to give any special impetus to the trade. Supplies continue very good, both of domestic and of small steam sizes. In fact it is reported that the anthracite companies are storing considerable quantities in their yards in New Jersey and Pennsylvania, to provide against any possible shortage next spring.

Schedule prices are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

It is always expected at this season that local trade will be light, as very little business is usually done in the first week in January. This year, however, it is unusually dull, coming on top of a long quiet period. The far East is taking no coal just now and the Sound very little. New York harbor business is practically dead for the present. In the absence of business, prices may be said to hold at $2.45@2.65, New York harbor, for good grades of Clearfield. All-rail business is moderate. Cars are plentiful, but transportation a little slow.

In the Coastwise trade little is doing, but vessels are also scarce and rates are about the same. From Philadelphia, we quote: Boston and Portland, 75c.; Salem, Lynn and Bath, 85c.; Newburyport, 95c.; Portsmouth, 80c.; Providence, New Bedford and the Sound, 60@65c. per ton.

Birmingham

Jan. 11—Coal operations in Alabama promise to be steady for some time. The distribution of convicts among the coal companies will bring about some development. Heretofore but two coal companies have been using convict labor, the Tennessee and the Sloss-Sheffield. The Pratt Consolidated Coal Company and the Bessemer Land and Improvement Company are also using that labor now. There is considerable free labor still to be had for the mine work in this State, and it is being taken up more and more. The demand for coal is steadily improving. The quotations are holding their own. The larger consumers of coal in the Southern territory, the railroads in particular, are requiring more coal every month.

Much coke is being used in this district. The Tennessee company has considerable coke stacked up in various parts of the district, but not too much when it is proposed a little later on to start up several furnaces.

Chicago

Jan. 12—Cold weather for the last five days has increased materially the demand for domestic coals, throughout Chicago territory. There is still much coal in the bins of retailers and consumers, however, owing to the mild weather of December and a lively market has not yet appeared. It does not seem likely to appear for sev-

eral days, unless the extreme cold of the Northwest, where the demand is active, should continue throughout the upper Mississippi valley. Conditions at present, however, are decidedly better for wholesalers than they have been for several weeks.

The weather, both by increasing demand and checking the movement of incoming supplies, has done away with most of the demurrage selling that has persistently shaded prices on western lump, smokeless and Hocking for the last two weeks. Illinois and Indiana coals bring: Lump and egg, $2@2.65; run-of-mine, $1.65@1.75, and screenings, $1.40@1.60. Smokeless is still in large supply for the demand, for the lower-priced kind, though Pocahontas and New River hold up well toward the standard prices of $3.65 for lump and $3.15 for run-of-mine. Hocking has a good demand, but large shipments, with standard price—$3.15 for 1¼-in. lump—cut 25c. in some sales. Youghiogheny is quiet at $3 for steam and $3.15 for gas ¾-in. lump.

Anthracite has shown activity for the first time, with cold weather, and all sizes are in good demand in city and country, with supplies large.

Cleveland

Jan. 12—The coal market is dull, owing to the mild weather, which still limits domestic demand, and to an apparent falling off in the demand for steam coal. Lump and run-of-mine from Ohio districts are exceedingly quiet. The recent activity in slack has subsided for the most part. Prices, however, have not changed.

Indianapolis

Jan. 11—Indiana coal operators say with confidence that the coal-mining industry will take on an improved condition from this time on. They base this on the reports of the resumption of large coal-consuming mills and the certainty of colder weather. The closing month of the year was light in tonnage output, but operators believe the new year will open up good demand.

The indications for an improvement in the Block Coal district are better now than for some time. The season up to this time has been the worst in the history of the district, due largely to the mild weather. The average of work has been about half-time, while in some mines it has been even less. A few mines in this district have worked almost every day, but these are mines that were fortunate in getting large municipal contracts in Chicago and other cities.

The Mine Workers' legislative committee has prepared a bill to be introduced in the Legislature covering apprenticeship of miners. The bill provides that anyone starting work in a mine should first be employed under the direction of a practical miner for two years, to become familiar with the machinery and the condition of the mines. This is similar to the provisions of the Pennsylvania law.

Pittsburg

Jan. 12—The high water in the past 10 days made the rivers navigable and resulted in the shipment of between 3,000,000 and 4,000,000 bush. to Cincinnati and other lower river points. Large operators have reaffirmed the price for both river and rail coal on the basis of $1.15 for mine-run. Slack is strong at 75c. All the mines in the Pittsburg district are being operated at about 60 per cent. of capacity.

Connellsville Coke—The market has been easier, prompt coke being offered at 15c. or more concession from contract prices, which remain at $2 for furnace and $2.25@2.40 for foundry. The *Courier* reports production in the Connellsville region for the week at 148,710 tons, and in the lower field at 103,348; a total of 252,058 tons. Shipments for the week aggregated 6944 cars distributed as follows: To Pittsburg district, 3115 cars; to points west of Pittsburg, 3171 cars; to points east of Connellsville, 658 cars.

Foreign Coal Trade

United States Coal Imports—Imports of coal and coke into the United States, 11 months ended Nov. 30, long tons:

	1907.	1908.	Changes.
Anthracite	6,901	16,483	I. 9,582
Bituminous	1,890,754	1,378,211	D. 512,543
Total coal	1,897,655	1,394,694	D. 502,961
Coke	121,963	119,647	D. 2,316

In 1908, Canada contributed 1,017,746 tons of coal and nearly all the coke; Australia, 310,875 tons of coal. Imports are chiefly on the Pacific coast.

United States Coal Exports—Exports of coal and coke from the United States, with coal sold to steamships in foreign trade, 11 months ended Nov. 30, long tons:

	1907.	1908.	Changes.
Anthracite	2,553,901	2,579,865	I. 25,964
Bituminous	9,591,815	8,371,046	D. 1,220,769
Total exports	12,145,716	10,950,911	D. 1,194,805
Steamer coal	5,250,173	5,490,720	I. 240,547
Total	17,395,889	16,441,631	D. 954,258
Coke	813,914	546,019	D. 267,895

In 1908, Canada took 2,540,289 tons anthracite and 6,064,677 tons bituminous; a total of 8,604,966 tons, or 78.6 per cent. of the total.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Jan. 2: Best Welsh steam, $3.48; second, $3.36; thirds, $3.24; dry coals, $3.60; best Monmouthshire, $3.18; seconds, $3.06; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Jan. 13—The first two weeks of 1909 in the iron and steel trades have been marked by almost absolute dullness. Buyers probably are not yet through taking stock and are still uncertain as to the demand for finished products. At any rate there is evidence of a waiting market; the only question is how long this may last.

In pig iron there is considerable inquiry, but it looks as if most of this was of a tentative character; so far it has resulted in few actual sales. Foundry iron is selling in small lots and orders are not numerous. In steel pig there is nothing doing with outside furnaces. There are inquiries for some basic iron, but no actual sales of importance.

In finished material conditions are also quiet. Even structural steel remains dull for the present, no new contracts of any considerable size having been closed, although there are many projects under discussion and some have approached the stage of bids. The railroads are not yet ordering rails freely. The Pennsylvania order was expected to break the ice, but others are not following as yet.

In export trade it is reported that considerable business has been done in sheets, wire and wire products. There has been some talk of export orders for rails, but no actual business is reported. It may be noted that British makers have recently taken some large orders for South America which it was thought would be captured for this country.

Pig-iron Production—The reports from the blast furnaces, collected by the *Iron Age*, show that on Jan. 1 there were 220 stacks in blast, having an aggregate weekly capacity of 400,100 tons of pig iron; an increase of 20,000 tons over Dec. 1. Making allowance for the charcoal furnaces, we begin 1909 with production at the rate of 21,000,000 tons yearly.

Baltimore

Jan. 11—Exports for the first week in the year were light. The only important item was 4,534,800 lb. steel billets to Liverpool.

Birmingham

Jan. 11—Alabama manufacturers of pig iron are receiving some orders, though the buying this year has not yet opened up strong. The quotations remain firm at $13 per ton, No. 2 foundry, though 50c. per ton better has been asked. Some of the larger consumers have been making inquiry in the Birmingham territory for iron, ostensibly for second-quarter use and the sale of some 20,000 tons of iron, for eastern delivery, is announced. The cast-iron pipe people are preparing to lay in supplies, but for some reasons are not rushing the market.

The make is picking up a little in this section, though no furnaces were reported as going in blast during the past few days. The authoritative figures given out are to the effect that Alabama produced during 1908 something like 1,410,500 tons of iron, about 200,000 tons less than in 1907. The last month of the year was the best, the production going up to 146,803 tons against 86,036 tons in January.

At Ensley the Tennessee Coal, Iron and Railroad Company has acquired a large additional tract of land, and it is understood that structural iron and steel plants will be erected. The steel mill is in better operation now than it has been in some time. Efforts are being made to fill orders on hand, especially in steel rails.

Chicago

Jan. 12—The iron market continues quiet, purchases of pig iron and of finished materials being small in tonnage and not increasing materially in number from the holiday season. Prices remain firm, No. 2 Northern being sold at $17.50@18, and No. 2 Southern at $13@13.50 Birmingham ($17.35@17.85 Chicago) on first-half business. The demand for iron is scattered, some melters continuing to buy on short-time delivery, and others contracting for deliveries six months hence on a carefully conservative basis. Structural material, sheets, plates, bars and other iron and steel products are lagging in sales.

There are no evidences of weakness in the market and the quietness in pig iron is in part due to inventories by foundries and the making of changes which naturally come with the opening of the new year. Furnace agents do not display anxiety to hasten sales and profess faith in the gradual resumption of business.

Coke is somewhat dull and there is a tendency to ship in more than the market will stand. The price of coke remains $4.90@5 for the best Connellsville.

Cleveland

Jan. 12—The markets have been dull since the opening of the year, and little new business in iron and steel is noted in this territory. There is some inquiry for pig iron, but it has not resulted so far in orders of any importance, sales having been made chiefly in small lots.

Some increase is reported in shipments of ore from docks to furnaces. No action has been taken yet on the question of ore prices for the coming season.

Philadelphia

Jan. 13—Pipe iron and basic iron are engaging the attention of the market, but with only a moderate amount of business transacted during the week in this territory. While most consumers have only small quantities of iron in their yards, and not very much under contract for delivery, there is very little disposition to buy. Local makers are not receiving inquiries. Buyers who are accustomed to order far ahead are inclined to wait to see what is to be the probable outcome of tariff revision. Makers are not pushing iron on the market, and are renewing small contracts on former terms.

Steel Billets—No sales are reported. There is a rumor that quotations have been shaded, but no recent transaction corroborates them.

Bars—Buyers of bars are occasionally ordering enough to run them into April. Prices continue low.

Structural Material—The business is disappointing. Negotiations which started in December have not matured. Mill people say there is a general disposition to hold off. A lower level of quotations appear inevitable—on large contracts.

Scrap—Heavy steel scrap is snapped up wherever it is to be had, and at good prices. Some sales are being made daily of other kinds, but scrap dealers are obliged to hold the bulk of their incoming supplies, which they are confident they can get rid of in a few weeks at a good profit.

Pittsburg

Jan. 12—The iron and steel market seems to be reaching an interesting stage, as in some directions there is a heavy increase in the buying of finished steel products, while in others there has appeared severe cutting by some producers which, if continued, may force reductions in some products.

The most satisfactory accounts come from the wire trade, a prominent producer in this line reporting its business this week as at the heaviest rate for 14 months, and well distributed among the different lines of wire goods. As the wire trade touches more nearly the ultimate consumers, and the goods cover a wide range of consumers and practically the entire country, it is natural that the first evidences of reviving trade should come in this line, so that the showing is taken as foreshadowing a general improvement in the iron and steel trade as the new year progresses.

Pig Iron—There has been some improvement in inquiry, but sales have been very light. Furnaces are holding to prices firmly, although in some cases they are piling some iron. It develops that the purchases of basic by the Pittsburg Steel Company last month were larger than was then supposed, amounting to close to 20,000 tons, and covering the company for this quarter, with the iron it receives on the term contract made recently with the Penn Iron and Coal Company. The price paid was substantially $15.50, Valley, although a large part of the tonnage went through middlemen by the medium of coke deals. Another interest has been in the market for basic, and developed prices of $15.50, but latest reports are that it has not bought. Bessemer remains at $16.50, Valley, but is extremely quiet and the market is not strong. Foundry iron is held at $15.50@16, Valley, a number of furnaces not being willing to sell at the lower price. Forge is quoted at $14.50 Valley. Prices delivered Pittsburg are 90c. higher.

Steel—Shipments of billets and sheet-bars are up to the average maintained in the past two or three months, but are almost altogether on old contracts, there being scarcely and new buying. Prices remain on the basis of $25 for billets and $27.50 for sheet-bars, Pittsburg. Plates are nominally 1.60c., but are being shaded, particularly on the narrower sizes.

Sheets—Business in sheet is picking up and mill operations are maintained on about the same basis as last week. Black sheets are 2.50c. and galvanized sheets 3.55c., 28 gage, f.o.b. Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the 11 months ended Nov. 30, are valued by the Bureau of Statistics of the Department of Commerce and Labor at $182,068,912 in 1907, and $138,881,761 in 1908; a decrease of $43,187,151, or 23.7 per cent. Leading items of export, in long tons:

	1907.	1908.	Changes.
Pig Iron	70,599	41,964	D. 28,635
Billets, ingots & blooms	74,831	104,284	I. 29,453
Bars	92,638	61,251	D. 31,387
Rails	318,143	186,167	D. 131,976
Sheets and plates	113,544	93,560	D. 19,984
Structural steel	129,041	106,943	D. 22,098
Wire	147,207	124,214	D. 22,993
Nails and spikes	53,493	34,130	D. 19,363

Considerable decreases are shown in all items except billets, ingots and blooms.

Iron and Steel Imports—Imports of iron and steel, including machinery, into the United States for the 11 months ended Nov. 30, were valued at $36,740,291 in 1907, and $18,247,668 in 1908; a decrease of $18,492,623, or 50.3 per cent. Leading items of import, in long tons:

	1907.	1908.	Changes.
Pig iron	478,448	81,872	D. 396,576
Scrap	26,516	4,029	D. 22,487
Ingots, blooms, etc.	18,441	9,009	D. 9,432
Bars	36,077	18,565	D. 17,512
Wire-rods	15,807	10,556	D. 5,251
Tinplates	56,231	56,015	D. 216

There were considerable decreases in all items except tinplates, in which there was little change.

Iron Ore Movement—Exports and imports of iron ore in the United States for the 11 months ended Nov. 30 are reported as follows, in long tons:

	1907.	1908.	Changes.
Exports	261,869	301,342	I. 39,473
Imports	1,149,129	652,559	D. 496,570

Imports of manganese ore for the 11 months, 188,526 tons in 1907, and 170,662 in 1908; a decrease of 17,864 tons.

Metal Markets

New York, Jan. 13—The metal markets generally have not been strong, and the first full weeks of the new year have been quiet, almost dull, in the character of their business.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Nov. 1908..	$ 2,967,795	$ 2,892,225	Exp. $ 75,570
" 1907..	615,169	63,574,871	Imp. 62,959,702
Year 1908..	73,857,749	45,105,993	Exp. 28,750,846
" 1907..	54,211,240	98,949,557	Imp. 44,738,317
Silver:			
Nov. 1908..	3,951,987	3,275,609	Exp. 676,378
" 1907..	4,187,378	3,602,405	" 584,973
Year 1908..	47,111,382	37,814,676	" 9,296,706
" 1907..	57,212,168	41,690,324	" 15,521,844

Exports of specie from New York, week ended Jan. 9: Gold, $5500, to Chile; silver, $908,400, to London and Paris. Imports: Gold, $178,615; silver, $89,457, from Cuba, Central and South America.

Gold—In London the price of gold on the open market has advanced, bar gold being quoted at 77s. 10⅞d. per oz., and American eagles 76s. 5⅞d. The Bank of France again took all the gold offered. Shipments of gold from New York this week were $3,500,000, making a total of $6,500,000 exported since Jan. 1, all to Paris.

Platinum—Dealers report business quiet, but that is usual at this season. Quotations are $24.25 for refined platinum, $26.25 for hard, and $20@21 for good scrap.

Our St. Petersburg correspondent reports under date of Dec. 24: In Ekaterinburg, the small miners and forestallers offer crude platinum, 83 per cent. pure, at 5 rubles 10 kopeks per zolotnik ($19.15 per oz.) The large dealers in St. Petersburg offer crude metal of the same grade at 19,900 to 20,000 rubles per pood, or about $19.56 per oz. St. Petersburg dealers are holding back in expectation of higher prices.

Silver—The silver market has experienced a sharp advance during the past week on buying by Chinese banks and Indian bazars. Spot silver in London has been scarce, causing a premium of ¼d. for prompt over future deliveries. The market closes steady at 24¼d. in London.

SILVER AND STERLING EXCHANGE.

Jan.	7	8	9	11	12	13
New York....	51⅛	51⅛	51⅛	52⅛	52⅛	52⅛
London.....	23⅞	23⅞	23⅞	24 5/16	24 5/16	24⅛
Sterling Ex..	4.8695	4.8720	4.8720	4.8740	4.8760	4.8745

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Dec. 31, reported by Messrs. Pixley & Abell, London:

	1907.	1908.	Changes.
India.....	£10,541,354	£9,274,390	D. £1,266,964
China.....	457,350	741,400	I. 284,050
Straits.....	691,150	164,885	D. 526,265
Total.....	£11,689,854	£10,180,675	D. £1,509,179

Receipts for the week, £5000 from Mexico and £195,000 from New York; total, £200,000. Exports, £1000 to Port Said, and £127,000 to India; £128,000 in all.

Copper, Tin, Lead and Zinc

Jan.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
7	14⅜ @14⅝	14⅛ @14¼	63½	28½	4.17½ @4.20	5.15 @5.20	5.00 @5.05
8	14⅜ @14⅝	14⅛ @14¼	63	28¼	4.15 @4.20	5.15 @5.20	5.00 @5.05
9	14⅜ @14⅝	14⅛ @14¼	....	28¼	4.15 @4.20	5.15 @5.20	5.00 @5.05
11	14⅜ @14⅝	14⅛ @14¼	62⅝	28	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
12	14⅜ @14⅝	14⅛ @14¼	62¼	27¾	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
13	14⅜ @14⅝	14 @14¼	62¼	28⅛	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The reports from Europe have been rather discouraging and prices over there have given way from day to day. Foreign buyers have taken no interest whatsoever in the market, and domestic consumers could only be induced to place orders at concessions. A fair tonnage was sold at the decline. Lake shows less decline than electrolytic because there are fewer producers of that grade who have supplies that they are anxious to sell. The close is easy at 14⅜@14⅝c. for Lake copper; 14@14¼c. for electrolytic in ingots, cakes and wirebars. The average of the week at which business in casting copper has been done is 13¾@14 cents.

Copper sheets, cold-rolled, 20c.; hot-rolled 19c. per lb., base. Copper wire, 15¾c. base, carload lots at mill.

The London Standard market showed distinct weakness, prices crumbling away from day to day, and the close is easy at £62 2s. 6d. for spot, £63 for three months.

Refined and manufactured sorts we quote: English tough, £66; best selected, £65@66; strong sheets, £77@78.

Copper Producers' Association—At a meeting of copper producing, refining and selling interests in New York, Jan. 12, the report of the committee appointed at a previous meeting was received, and was adopted by the representatives present, subject to ratification by the companies. A provisional organization was effected, with the following officers: President, T. L. Livermore, Calumet & Hecla; secretary and statistician, L. C. Graton, at present with the United States Geological Survey; executive committee, Messrs. McLean, Broughton and Clendenning. The report adopted formulates the plan, which is to secure and compile reports of production and stocks on hand by the refiners, and such statistics as to the production of crude copper as may subsequently be deemed advisable; such reports to be made monthly and given out promptly, and, of course, to give totals only. The executive committee contains representatives of the three classes of members, viz., producers, refiners and sellers. It is expected that the statistical work will begin in February next. The first report will comprise a statement of the production of refined copper in 1908 and the stock on hand Jan. 1, 1909, probably.

Tin—The operators in the London market, who all along had been supporters of the market, turned around and became heavy sellers. It is difficult to tell what brought about this realization, but it may, on the one hand, be due to the unfavorable statistical position of the metal, or, on the other hand, to the impending Banka sale. At any rate, the market experienced a severe decline, and showed on Jan. 12, when it reached the lowest point, a maximum drop of over £5. At these lower prices some support became manifest, especially also from consumers on this side, in consequence of which the market rallied and closes firmer at £126 17s. 6d. for spot, £128 10s. for three months.

Sales, in this market were made at as low as 27¾c. but the close is firm at 28⅛ cents.

Lead—Consumers having covered their requirements for this month, the market has again become quite lifeless. The close is weak at 4.15@4.20c New York, and 4.05c. St. Louis.

The London market is also again neglected and closes somewhat lower at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—The market for this metal has been rather quiet throughout the week. But little spelter is pressed for sale as, on the one hand, producers are well supplied with orders, and, on the other, they have no margin in smelting the metal at the present prices for ore. The close is 5.12½@5.17½c. New York, 4.97½@5.02½c. St. Louis.

The London market has been firm throughout the week and closes higher at £21 7s. 6d. for good ordinaries, £21 12s. 6d. for specials.

Base price of sheet zinc is 7c f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market continues quiet, with no material change in prices. Quotations are 8¼c. per lb. for Cookson's, 8⅛c. for Hallet's, and 7¾@8c. for ordinary brands.

Aluminum—No change is reported, and the market is quiet. The Aluminum Company of America quotes 24c. per lb. base for No. 1 ingots; 33@34c. base for sheets. Offers of foreign metal at 22c. are still reported, but sales are said to be small.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Quicksilver—New York prices are steady at $45@46 per flask of 75 lb., with a moderate trade. San Francisco quotations are $45 for domestic trade and $43 for export. The London price has been reduced to £8 7s. 6d. per flask.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Imports and Exports of Metals

Exports and imports of metals in the United States for the 11 months ended Nov. 30 are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	279,561	84,775	Exp. 194,786
Copper, 1907....	197,452	106,681	Exp. 90,771
Tin, long tons....	206	33,105	Imp. 32,899
Tin, 1907.....	550	35,487	Imp. 34,937
Lead, short tons.	67,924	99,846	Imp. 31,922
Lead, 1907.....	47,481	72,137	Imp. 24,646
Spelter, sh. tons.	2,471	842	Exp. 1,629
Spelter, 1907....	493	1,768	Imp. 1,275
Nickel, lb.....	9,057,506	15,780,499	Imp. 6,722,993
Nickel, 1907....	8,221,889	17,081,281	Imp. 8,859,392
Antimony, lb.....	.....	7,542,997	Imp. 7,542,997
Antimony, 1907.	.....	7,870,411	Imp. 7,870,411
Platinum, oz.....	.....	38,857	Imp. 38,857
Platinum, 1907.	.....	68,712	Imp. 68,712
Quicksilver, lb...	224,494	.....	Exp. 224,494
Quicksilver, '07	363,473	.....	Exp. 363,473
Aluminum, value	$369,738	.....	Exp. $369,738
Aluminum, 1907	299,588	.....	Exp. 299,588

Ores, etc.:	Exports.	Imports.	Excess.
Zinc oxide, lb. .	22,056,313	.....	Exp. 22,056,313
Zinc oxide, '07..	25,002,199	.....	Exp. 25,002,199
Zinc dross, lb....	15,966,311	.....	Exp. 15,966,311
Zinc dross, '07..	17,848,258	.....	Exp. 17,848,258
Zinc ores, lg. tons	23,311	44,734	Imp. 21,423
Zinc ores, 1907.	16,011	.....	.....
Antim'y ores, lb.	.....	3,033,196	Imp. 3,033,196
Ant. ores, 1907.	.....	2,668,902	Imp. 2,668,902

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Zinc ores imported this year included 20,193 tons calamine and 24,541 tons other ores; in 1907 only partially reported.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 9—This week $[illegible] per ton was the highest price paid for zinc ore; the base price was $40@41 per ton of 60 per cent. zinc. For 80 per cent. [illegible] ore $48@50 per ton was paid.

SHIPMENTS, WEEK ENDED JAN. 9.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	663,440	.....	149,400
Galena.....	264,000	.....	.....
Benton.....	242,480	.....	.....
Hazel Green.....	179,900	.....	.....
Strawbridge.....	88,000	.....	.....
Days Siding.....	88,000	.....	.....
Livingston.....	80,000	.....	.....
Rewey.....	66,000	.....	.....
Total.....	1,671,820	.....	149,400
Year to Jan. 9.....	4,449,426	.....	401,200

Highland, Linden, Harker and Mineral Point are not reported. There was shipped to the Platteville Separating Company 167,100 lb.; to the Joplin Separator Works, 70,000 lb. zinc ore.

Joplin, Mo., Jan. 9—The highest price reported paid was $44.50 per ton, the assay base price ranging from $40@43 per ton of 60 per cent. zinc. The latter price was bid today for next week's delivery. Silicate of zinc sold at $19@22 per ton of 40 per cent. zinc and the highest reported was $26. The average price, all grades, was $38.80 per ton. The highest price reported paid for lead ore was $52.50, the bulk of the ore selling at $52, with medium grades selling down to $50. The average price, all grades, was $50.78 per ton.

SHIPMENTS, WEEK ENDED JAN. 9.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,534,100	373,470	$100,391
Joplin.....	2,034,370	275,160	48,859
Duenweg.....	1,038,560	39,140	21,788
Galena.....	749,950	29,990	16,779
Miami.....	511,300	309,850	16,716
Prosperity.....	788,120	16,410	16,188
Spurgeon.....	842,260	84,530	11,825
Alba-Neck.....	380,280	.....	7,605
Aurora.....	428,010	10,040	6,977
Carthage.....	342,540	.....	6,850
Oronogo.....	.....	288,800	6,738
Sarcoxie.....	201,360	.....	3,359
Quapaw.....	166,180	.....	2,991
Carl Junction.....	92,850	8,340	2,213
Badger.....	94,370	.....	1,934
Granby.....	158,000	4,000	1,846
Zincite.....	64,630	10,630	1,569
Cave Springs.....	72,300	.....	1,518
Wentworth.....	46,340	.....	589
Totals.....	12,375,520	1,450,360	$276,735
Two weeks.....	22,297,100	2,608,800	$495,656
Zinc value, the week,	$239,896;	2 weeks,	$429,872
Lead value, the week,	36,839;	2 weeks,	65,784

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February.....	48.30	36.53	47.11	34.92	84.58	49.72
March.....	49.75	36.19	48.66	34.19	82.75	49.90
April.....	49.25	35.40	48.24	34.08	79.76	52.47
May.....	46.90	34.19	45.98	33.39	79.56	56.05
June.....	47.00	33.06	44.82	32.07	73.66	60.48
July.....	46.80	34.55	45.79	31.67	58.18	59.90
August.....	44.56	36.63	43.22	33.42	59.54	60.34
September..	41.90	37.63	40.11	34.44	53.52	54.59
October.....	41.75	35.95	39.83	33.28	51.40	52.63
November..	38.60	39.13	35.19	35.02	43.40	54.53
December ..	31.50	42.75	30.87	39.63	37.71	49.08
Year	$44.36	$36.63	$43.68	$34.31	$68.90	$53.93

Note. Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

[illegible] sale, bringing almost zero weather, came Tuesday, closing down a number of mines for several days. In the Joplin field the gas company cut off the natural gas from all mines using it under boilers, and a number about Webb City had an insufficient supply to operate continuously. The result is that nearly all mines using natural gas under boilers have taken out the gas fixtures and ordered coal. The demand for coal was so great that it could not be shipped in fast enough to meet the increased consumption, on so short a notice. A careful estimate indicates about 10 per cent. reduction in output.

For the first two weeks in 1909, as compared with last year, there was an increase in value of nearly 100 per cent. on a 60 per cent. increase in shipment. The lead shipment was increased only 8 per cent. on account of so many producers holding this mineral for a higher market.

Chemicals

New York, Jan. 13—The market is steady, and trading is quiet. But little contract business is reported, but trade is coming fairly up to expectations.

Copper Sulphate—Prices are unchanged, and no shading is reported. Quotations are $4.75 per 100 lb. for carload lots, and up to $5 per 100 lb. for smaller parcels.

Arsenic—The market is sluggish. Quotations are 3⅛c. per lb. for white arsenic.

Nitrate of Soda—The position of nitrate in the United States Dec. 31 is reported as follows, in long tons, by Messrs. Mortimer & Wisner, New York:

	1907.	1908.	Changes
Stocks, Jan. 1.....	13,050	5,900	D. 7,150
Imports, 12 months....	304,245	278,650	D. 25,595
Total Supplies.....	317,295	284,550	D. 32,745
Deliveries, 12 months..	311,395	275,410	D. 35,985
Stocks, Dec. 31.....	5,900	9,140	I. 3,240
Afloat for U. S. ports....	68,300	83,200	I. 14,900

The quantities afloat include all cargoes due to arrive at United States ports by April 15 next.

Current quotations here are 2.17½c. for spot nitrate, and 2.15c. for futures.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States 11 months ended Nov. 30 were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	7,360,870	E. 7,360,870	
Bleach, lb.....	66,622,981	121,511	I. 66,501,470
Potash salts, lb..	245,655,997	993,072	I. 244,662,925
Soda salts, lb....	10,388,753	772,147	I. 9,616,606
Acetate lime, lb.	.....	52,666,154	E. 52,666,154
Nit. of soda, tons	293,424	9,526	I. 283,898
Phosphates, tons	24,305	1,174,942	E. 1,150,637
Sulphur, tons....	17,884	23,073	E. 5,189
Pyrites, tons.....	621,315	.....	I. 621,315

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 266,410 long tons.

Mining Stocks

New York, Jan. 13—The general stock markets this week were irregular, without any definite tendency, and weak rather

than strong. They were affected in different directions by various rumors, and to some extent by the steady outflow of gold to Europe. At the close a little stronger tone was manifest, chiefly because of a stronger feeling in the foreign exchanges.

The Curb market was also irregular and not particularly strong. The copper stocks were rather inclined to soften, on a moderate amount of selling. Other mining stocks were not in especial demand.

One sale of Homestake, of South Dakota, was reported, a small lot changing hands at $90 per share.

Boston, Jan. 12—Beginning the week with a rather irregular market, copper stocks steadied themselves and closed better. Superior mining became a leader in the trading today, advancing from $35.75 to $38.50, on sales of 3000 shares. Winona rose to $5.50, but Wyandot rose 50c., to $3.50 Wolverine gained $2.50, to $152; Copper Range sold at $78.50, with rally to $79.50; Atlantic rose to $18; Isle Royale to $25; Lake to $21.87½. Greene-Cananea sold freely at $11.50@12. North Butte held around $82, and Amalgamated sold between $81 and $82. The end was firm.

On the Curb business was generally good, but with no special feature.

It is reported that a new development company is to be organized to work a group known as the Live Oak, in the Globe district of Arizona. The company will probably be floated here.

STOCK QUOTATIONS

NEW YORK Jan. 12	
Name of Comp.	Clg.
Alaska Mine	‡¾
Amalgamated	81⅛
Anaconda	48
Balaklala	12 1/16
British Col. Cop.	8½
Buffalo Mines	3½
Butte Coalition	26
Colonial Silver	7/16
Cum. Ely Mining	8¼
Davis Daly	3
Dominion Cop.	7/16
Douglas Copper	2⅞
El Rayo	4
Florence	4 7/16
Foster Cobalt	.66
Furnace Creek	.10
Giroux	9
Gold Hill	⅜
Goldfield Con.	8 1/16
Granby	‡108
Greene Gold	¼
Greene G. & S.	7
Greenw'r & D. Val.	‡.75
Guanajuato	2
Guggen. Exp.	182
Hanapah	.16
McKinley Dar.	1.01
Micmac	1⅜
Mines Co. of Am.	1
Mitchell Mining	⅛
Mont. Sho. C.	1
Nev. Utah M. & S.	2⅜
Newhouse M. & S.	15⅛
Nipissing Mines	10
Old Hundred	13/16
Silver Queen	.92
Stewart	¾
Tennessee Cop'r	46
Tri-Bullion	13/16
Union Copper	⅞
Utah Apex	6¾
Utah Copper	44¼
Yukon Gold	4 7/16

BOSTON Jan. 12	
Name of Comp.	Clg.
Adventure	9⅝
Allouez	‡37
Am. Zinc	24⅛
Arcadian	3
Arizona Com	36¾
Atlantic	17⅞
Boston Con	16
Calumet & Ariz.	116
Calumet & Hecla	‡655
Centennial	32
Con. Mercur	.33
Copper Range	79
Daly-West	10½
East Butte	8
Franklin	16¾
Greene-Can	11¾
Isle Royal	25
La Salle	14¼
Mass	15⅛
Michigan	†12½
Mohawk	69¾
Nevada	18⅜
North Butte	81½
Old Colony	‡.60
Old Dominion	56¼
Osceola	‡131
Parrot	29
Quincy	93
Rhode Island	6¼
Santa Fe	2½
Shannon	16½
Superior	37⅞
Superior & Pitts	16⅜
Tamarack	80
Trinity	15⅜
United Cop., com.	14⅝
U. S. Oil	28
U. S. Smg. & Ref.	45
U. S. Smg. & Ref., pd.	46⅜
Utah Con	44⅜
Victoria	†3⅜
Winona*	6⅛
Wolverine	152
Wyandotte	3¼

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	36¼
Am. Smelt. & Ref.	84⅞
Am. Sm. & Ref. pf.	103¼
Colo. Fuel & Iron	40⅞
Federal M. & S., pf.	81
National Lead	77
National Lead, pf.	‡105¾
Pittsburg Coal	13¾
Republic I. & S.	24½
Republic I. & S., pf.	86¾
Sloss-Sheffield	78
Standard Oil	665
U. S. Steel	51⅞
U. S. Steel, pf	112¾
Va. Car. Chem	43¾

ST. LOUIS Jan. 9		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	2.00	1.50
Cent. C. & C.	78.00	76.00
C.C. & C. pd.	82.00	80.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	22.00	20.00
Doe Run	125.00	110.00
Gra. Bimet.	.30	.20
St. Joe	15.00	13.00

LONDON Jan. 13			
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton's Ind.	0	3	3
Camp Bird	0	15	3
Esperanza	3	4	6
Tomboy	0	18	9
El Oro	1	5	7½
Oroville	0	9	0

Furnished by Hornblower & Weeks, N. Y.

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Jan. 13.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.48
Best & Belcher	.50
Caledonia	.26
Chollar	.22
Comstock	.25
Con. Cal. & Va.	.80
Crown Point	.50
Exchequer	.40
Gould & Curry	.15
Hale & Norcross	.40
Mexican	1.00
Ophir	1.60
Overman	.22
Potosi	.16
Savage	.38
Sierra Nevada	.33
Union	.45
Utah	.06
Yellow Jacket	.80
TONOPAH STOCKS	
Belmont	.78
Extension	.60
Golden Anchor	.02
Jim Butler	.16
MacNamara	.34
Midway	.24
Montana	.68
North Star	.04
Tono'h Mine of N.	6.37½
West End Con	.35
GOLDFI'D STOCKS	
Adams	.03
Atlanta	.14
Booth	.25
Columbia Mt.	.17
Comb. Frac.	1.23
Con. Red Top	.11
Cracker Jack	.04
Dia'dfield B. B. C.	.09
Goldfield Belmont	.07
Goldfield Daisy	.64
Great Bend	.19
Jumbo Extension	.20
Kendall	.08
Lone Star	.06
May Queen	.04
N. Y. C. O. D.	.06
Oro	.11
Red Hill	.16
Roanoke	...
Sandstorm	.17

Name of Comp.	Clg.
Silver Pick	.10
St. Ives	.18
Triangle	.03
BULLFROG STOCKS	
Gibraltar	.03
Homestake King	.10
Mont. Shoshone C.	1.00
Tramp Cons	.09½
MISCELLANEOUS	
Bonnie Clare	.06
Lee Gold Grotto	...
Nevada Hills	1.50
Nevada Smelting	.87½
Nevada Wonder	.35
Nevada-Utah	2.75
Penn-Wyoming	.10
Pittsburgh S. Pk.	.85
Rawhide Coal	.70
Round Mt. Sphinx	.16

COLO. SPRINGS Jan. 8	
Name of Comp.	Clg.
Acacia	7¼
Black Bell	....
C. C. Con	‡3⅜
Dante	6
Doctor Jack Pot	8¾
Elkton	72¾
El Paso	62
Findlay	14¼
Gold Dollar	9½
Gold Sovereign	13
Isabella	24¾
Index	....
Jennie Sample	16
Jerry Johnson	4¾
Mary McKinney	40
Pharmacist	13¾
Portland	1.06
Un. Gold Mines	4¾
Vindicator	80
Work	7

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.	Jan. 8	Feb. 2	$0.10
Caledonia, Nev.	Jan. 8	Jan. 29	0.05
Challenge, Nev.	Dec. 11	Jan. 6	0.05
Chollar, Nev.	Jan. 11	Feb. 3	0.10
Copper King, Ida.	Dec. 10	Jan. 15	0.01
Ely Con., Nev.	Nov. 28	Jan. 11	0.02
Exchequer, Nev.	Dec. 30	Jan. 20	0.05
Federal-Ely, Utah	Jan. 9	Feb. 1	0.01
Lowe, Utah	Jan. 5	Feb. 2	0.02
Julia Con., Nev.	Dec. 21	Jan. 15	0.03
Lower Mammoth, Utah	Dec. 18	Jan. 8	0.05
Mountain Bell	Dec. 24	Jan. 12	0.02
New York Con., Nev.	Dec. 18	Jan. 8	0.03
Oro Cobre, Cal.	Dec. 31	Jan. 16	0.02
Savage, Nev.	Jan. 6	Jan. 28	0.10
Silver King Con., Utah	Jan. 6	Jan. 26	0.10
Union Con., Nev.	Dec. 23	Jan. 14	0.10
Wabash, Utah	Jan. 7	Jan. 30	0.10
Yellow Jacket, Nev.	Dec. 28	Feb. 3	0.16

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.506	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.614
August	68.745	51.683	31.637	23.858
September	67.792	51.720	31.318	23.877
October	62.435	51.431	28.863	23.725
November	58.677	49.647	27.154	22.933
December	54.565	48.769	25.362	22.493
Year	65.327	52.864	30.188	24.402

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	105.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.876	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.698	25.072	12.788	102.375	57.387
June	21.665	12.676	24.140	12.877	97.272	57.842
July	22.150	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	60.500
September	16.565	13.388	16.047	13.600	68.375	60.338
October	13.169	13.354	13.551	13.646	60.717	60.139
November	13.391	14.130	13.870	14.386	61.226	63.417
December	13.163	14.111	13.393	14.411	69.113	62.943
Year	20.004	13.208	20.661	13.424	87.007	59.902

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.657	29.942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.925	29.144
			Av. year	38.160	29.465

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.631	14.250
March	6.000	3.838	19.703	13.976
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.465	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.375
September	4.813	4.616	19.775	13.125
October	4.750	4.351	18.531	13.376
November	4.376	4.330	17.281	13.538
December	3.658	4.213	14.500	13.156
Year	5.325	4.200	19.034	13.439

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.613	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.627	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.069	4.776	4.909	21.438	20.875
December	4.254	5.137	4.104	4.987	20.075	20.625
Year	5.962	4.726	5.812	4.578	23.771	20.163

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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Spraying Coal Dust as a Colliery Safeguard

A Description of an Efficient Sprinkling System, with Detailed Costs of Installation and Operation as Carried on in the Mines of Utah

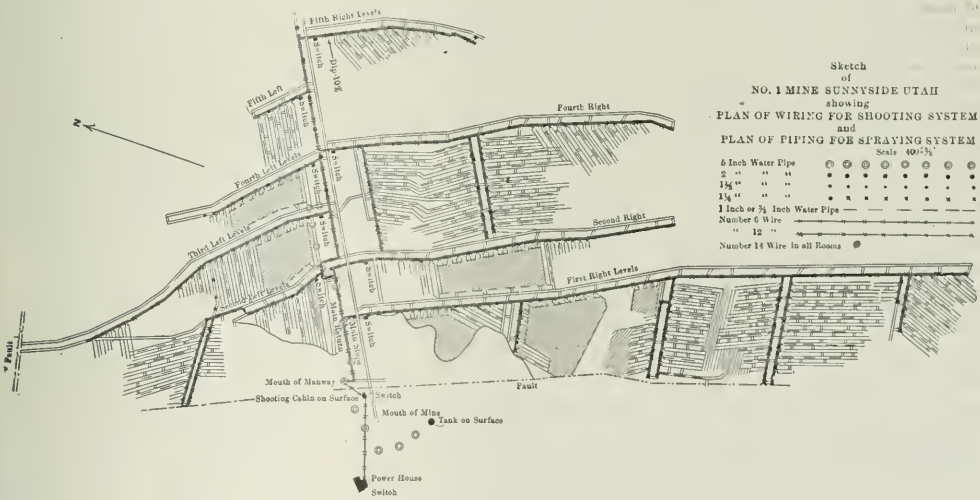
BY D. HARRINGTON*

"Man's inhumanity to man makes countless thousands mourn," said Robert Burns, referring to conditions existing a century ago; but the same statement applies very aptly to present-day industrial conditions in the United States and more especially to the coal-mining industry. The occurrence of disaster after disaster in late years in our coal mines, resulting in the loss of many hundreds of human lives, together with the publication of statistics proving that as compared with foreign countries, our coal-mining operations are far more destructive of human life than similar operations conducted by other nations, has awakened the humanitarian instinct of the American people; even the technical and trade journals are seriously occupying themselves in an attempt to discover causes of existing conditions.

At its best, mining is a hazardous occupation and coal mining is probably the most dangerous branch, due to conditions peculiar to the product sought and to the fact that the margin of profit is so small and competition so keen, that only by the movement of maximum quantity at minimum cost, can operations be maintained at all. The presence of explosive gas without coal dust, would, of course, compel any wide-awake manager to adopt all available precautions to protect his men and property; the presence of explosive gas and quantities of explosive dust demands even more careful attention.

Coal Dust Will Explode Without Gas

While the opinions of coal experts throughout the world differ as to whether dust, without the presence of explosive gas, will explode, and scientists bring forth many theories on this question, the people of Utah are absolutely sure that at least some kinds of coal dust do explode and do it without the presence or intervention of even the smallest trace of explosive gas. For over 20 years, the Winter Quarters mines in the east central part of Utah, were operated without encountering a trace of explosive gas, for the same length of time, the mine dust was regarded as absolutely non-explosive; windy, or blow-out shots without number had failed to create even a ripple on the usually calm surface of mining operations and on one occasion, the explosion of 20 lb. of FFF black powder, with fine dust almost ankle deep on surrounding objects, failed to do more than local damage; however, on May 1, 1900, the accidental explosion of a 25-lb. can, or keg, of the same powder precipitated a holocaust in which over 200 human lives were lost. As stated above, not the slightest trace of explosive gas had been seen during the 20 odd years the mine had been worked previous to 1900 nor has any explosive gas been seen there to this day as far as can be learned. Here at least is one case in which gas, unless thoroughly "occluded," cannot be even remotely blamed.



On another occasion, at the Sunnyside mine, some 45 miles distant from Winter Quarters, employees engaged at night on some repairs to the coal crusher used naked lights, and were severely burned by an explosion of coal dust, explosive gas being entirely absent. In the same plant, a 60-in. Steadman disintegrator was completely wrecked by an explosion, opinions differing as to whether the explosion was caused by the accidental intrusion of some giant powder from a car of coal

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coming out of the mine, or whether the finely divided dust within the disintegrator was responsible; later on, in the same plant, frictional sparks induced in the cages of a 60-in. Steadman disintegrator by the entrance into it of an ordinary short-handled shovel, dropped by a careless employee, caused a dust explosion, which burned the plant to the ground. The cause of this explosion was definitely determined to be due to finely divided dust, and here again, gas, as ordinarily understood, can hardly be said to be connected with the affair. The explosion at Winter Quarters, together with these later minor accidents, has convinced the coal-mining population of Utah that dry, finely divided coal in any quantity, either with or without the presence of explosive gas, is dangerous, and may be exploded; measures have been taken to render the mines of Utah safe as far as human ingenuity and human knowledge extend.

Utah Mining Laws

After the Winter Quarters explosion, the Utah legislature at the request of the State coal-mine inspector placed on the statute books the following: "Every owner, agent, manager, or lessee of mines within the State of Utah, shall provide and maintain a water system for the purpose of conducting water to the face of each and every working place and throughout the entire open part of the mine, in sufficient quantities for sprinkling purposes to wet down the dust that shall arise and accumulate in and around the mine, provided, that in mines and parts of mines where by reason of the natural wet condition, or the moisture derived from the introduction of steam into the air currents, or both, such sprinkling may not be necessary. And it shall be the duty of the superintendent, mine foreman and inspectors to see to it that this is done." This law still stands, hence all coal mines in Utah are compelled to install some system for watering down mine dust; in his reports to the governor of the State, the State coal-mine inspector places fully as much stress on the condition of the various mines as to dampness as he does to timbering, ventilation, or any other question affecting the safety or sanitary condition of the employees.

In order to make "assurance doubly sure," the Utah Fuel Company, realizing the dangers to both men and mine from indiscriminate shot firing, has devised and installed in two of its camps a system by which shots are exploded by electricity after all men are out of the mine. This system, which has been operated successfully for several years, almost completely eliminates any possibility of wholesale fatalities such as occur in collieries, and not even the long suffering shot-firer himself need dread the firing of the daily round of shots. As yet there is no law on the statute books of Utah bearing on this subject, but in his report of 1905 and 1906 to the governor, the State coal-mine inspector made the following recommendation: "I would suggest to the Honorable Legislature of the State of Utah, which meets in January, 1907, that they make an amendment to the coal and hydrocarbon mining laws of the State of Utah, as follows: That it shall be unlawful for any miner, or any employee, in the coal and hydrocarbon mines of the State to use, or set off, any high explosive for the mining of coal, or taking down rock, during working hours, as all shots must be fired after the men are out of the mine, excepting those that will be needed to fire the same." While the last legislature failed to enact any law on this subject, it is entirely within the limits of probability that some such measure as above outlined will be placed on the statute books the coming winter; it is to be hoped, however, that the clause "*excepting those that will be needed to fire the same*" will be omitted, and thus *all* human life safeguarded.

Spraying Coal Dust

The Utah coal is bituminous and hard, massive rather than laminated. It is not readily affected by weather agencies, and is of more or less coking character. The following is an approximate analysis: Fixed carbon, 46 to 57 per cent.; volatile matter, 36 to 44 per cent.; moisture at 115 deg. C., 1 to 4½ per cent.; ash, 2½ to 7½ per cent.; sulphur, 0.8 to 1.3 per cent.; calorific power, 5600 to 6000. The coal beds vary from 5 to 25 ft. in thickness, with generally sandstone roof and floor; the dip is from 1 to 6 deg., and the room-and-pillar system of mining is invariably used.

The mines are opened by means of slopes, or of level entries. If a slope is used the coal is let down out of the mine by electric hoists located underground, or pulled up from the mine by steam hoists from outside; if a level entry is used, the coal is handled by horses, or by electric locomotives, usually the latter. In two of the larger camps the coal is not cut or mined in any manner, all shots being fired "off the solid." In two of the camps, the coal is undermined by hand (Sullivan punchers having been tried and abandoned in one of these camps), while in another property, part of the mining is done by hand and part by puncher, the latter being used in the narrow work.

The Dust Problem

As human ingenuity has not yet devised a workable system of mining coal without the production of dust, all of these mines are afflicted with this troublesome substance and in considerable quantities; by common consent, since the Winter Quarters disaster, all dust is considered dangerous, and this fact, together with State law requirements, has led the Utah Fuel Company to install sprinkling systems, each being a parallel duplicate of the others. The letter of the law could easily be carried out and its spirit evaded, as is so frequently done by coal operators, when they use water-carts, or wagons, or similar useless subterfuges, and by so doing, the item of "spraying," on the operating-cost sheet as well as on the construction or capital-charge statement, could be made practically negligible; however, remembering the lesson of Winter Quarters and numerous similar examples in Colorado, Wyoming and other States, the Utah operators installed a spraying system worthy of the name and deserving of reproduction wherever it is conceded that wetting coal dust is beneficial.

Method of Spraying

To properly sprinkle a mine with accessible openings aggregating 50 to 75 acres and advancing at a rate of from 15 to 25 acres opened per year, requires about 20,000 gal. of water per day; such a mine with coal 5 to 8 ft. thick will employ 300 to 350 men and produce 1200 to 1500 tons per 8-hour day. The water should be under a pressure of about 50 to 100 lb. effective head at nozzle, to allow of reducing the water stream to as fine a spray as possible and to give sufficient force to wash all fine dust completely from roof, walls or ribs, timbers, brattice, etc. Where it is possible to do so, this pressure should result from gravity by installing a tank or reservoir at a sufficient elevation above the mine. This tank or reservoir, should have a capacity equal to at least two or three days' sprinkling requirements to insure continuation of sprinkling even if the original source of water supply should, by accident, be temporarily shut down.

From the tank, or other storage receptacle, the feed pipe leading to the mine should not be less than 3-in. diameter and may be larger, depending on length, number of turns, number of streams to be used, grade, etc.; 3 in. is a minimum diameter in order to insure sufficient water with good pressure for at least 3 streams from a 1-inch hose, and in case of mine fire to insure two efficient streams from a 2-in. hose. This latter use of the water system is only incidental, but is clearly worth consideration when contemplating installation.

On the surface, the 3-in. feed pipe should be thoroughly protected from possible accident and from freezing; this is usually accomplished by burying it well under the frost line. The pipe should enter the mine through the return air course, avoiding reverse grades if possible, and should extend into the mine in such a manner as to allow distribution to the working faces with a minimum of laterals. Tees should be placed in this main feed line at selected points, so that

the haulage entries may be reached with auxiliary lines; these tees should have at least a 2-in. opening, and at intervals of 400 or 500 ft. along the main and auxiliary lines, other tees with a 2-in. opening reduced to 1 in., and having a ¾-in. hose bibb, should be placed to be used in sprinkling the entry through which the pipe line runs, as well as any accessible neighboring place. The idea of placing the tee with a 2-in. opening and then reducing it to 1 in., or ¾ in., is to have all parts of the mine so equipped that in case of a mine fire, 2-in. fire-hose connections may be made with minimum delay.

The auxiliary lines into the main haulage entries should be at least 2 in. in diameter, and from this line, 1-in. pipe should be extended into all rooms. In case comparatively short side entries are turned off the main haulage entries, and rooms are driven from these side entries, 1½-in. pipe is sometimes used in the latter entries, and either 1-in. or ¾-in. pipe is placed in the rooms.

Details of the Sprinkling Installation

Gate valves are located at intervals along the main supply line, also on the auxiliary lines where they leave the main line and at intervals along these auxiliary lines in order that possible breaks may be repaired without interference with lines in other parts of the mine, and in order to be able to shut off the flow of water quickly in case of a break. These valves are either placed in boxes which can be locked, or the wheels, which act as levers, are removed and held by the waterman; the levers on the hose bibbs are also removed and kept by the waterman; this precaution prevents useless waste of water and possible damage to the mine by the irresponsible or malicious.

Men are Employed to do Nothing but Sprinkle

The actual work of wetting down the dust is intrusted to one or two men as the case may be, two being required in a mine where 15 or 20 acres are developed per year; these two men have absolutely no other duties, not being called from their sprinkling in any but the gravest emergency. Part of their time will be occupied in making necessary repairs, or extensions, the remainder in sprinkling; or one man may continually sprinkle and one man work on the pipe lines, helping each other when the work at hand requires the services of two.

The waterman carries 150 to 200 ft. of ¾-in. rubber hose which he attaches to the ¾-in. hose bibbs before mentioned, opening the latter with the lever which he carries; he is instructed to thoroughly wet the roof, sides and floor of all accessible openings paying especial attention to the very fine dust near the working faces and along the haulageways. He is expected to keep all dust so damp that when loose material is taken from the floor and subjected to pressure of the hand, the form thus fashioned will retain its shape on removal of pressure; all brattice must be kept damp, brattice on haulageways and manways being given particular attention.

By thus continually and systematically attacking the dust, the latter is at length saturated, a condition impossible to attain by spasmodic sprinkling, using a cart, pail or any other device by which the water must be transported on wheels. Moreover the playing of a finely divided spray under pressure not only settles that dangerous dust which keeps floating in the air, but penetrates dust bodies wherever located, while an attempt to wet them using pail or any other device not under pressure, would penetrate only a thin film of dust on the top, leaving the great body untouched and wasting at least 75 per cent. of the water used.

Spraying Has no Harmful Effect

The introduction of this considerable quantity of water into the mine workings has no visible harmful effect; the roof is not affected as it is by the introduction of steam into the intake air, and evaporation prevents any undue accumulation of seepage; the parts of the mine traversed by return air are kept moist by the condensation of moisture-laden air, thus insuring the elimination of dust deposits in those parts which are abandoned, but through which air currents must be sent. Objection to sprinkling has been made on account of the probability of causing spontaneous combustion, but not a single case has been reported, mine fires in Utah being almost unknown. This latter result is probably due to the fact that all parts of mines are kept damp, and the absence of heat thus prevents spontaneous combustion even where iron pyrites abounds; moreover, no fine coal is left in the mines except that which enters into the air temporarily, that which sifts from cars during handling and the small quantity which the miner fails to load out.

Cost of Installation

The cost of installation of a complete and effective sprinkling system will, of course, vary with the surrounding conditions, such as the extent of present mine workings, distance of water supply from the mine together with cost of bringing the water to the pit. We must also consider the possibility of getting elevation for a gravity head. As installed at Sunnyside, Utah, No. 2 mine, where partly pump pressure and partly gravity pressure were used, the cost was about $7000, of which $1500 was for labor and $5500 for material. The labor charges included $370 for carpenter work in building a 50,000 gal. redwood tank, and a 12-ft. timber trestle under same; $230 was expended in excavating for, and in building the tank foundations; the total labor cost on the surface, therefore, was $600. The expense incurred in placing the foundation for the 16x5½x10-in. Worthington duplex pump in the power house, also putting the pump on the foundation and connecting to the steam and water pipes was $175. The cost of laying 3000 ft. of 3-in. pipe, 1000 ft. of 2-in. pipe, 20,000 ft. of 1½-in. pipe and 17,500 ft. of 1-in. and ¾-in. pipe was $725. Carpenters received $4.50 per eight hours; masons, 50c. per hour; mechanics setting pump, laying pipe, etc., 37½c. per hour, and common labor, 25 and 27½c. per hour.

Material included the following, f.o.b. Sunnyside, Utah: Fifty thousand gal. redwood tank, 24 ft. diameter at bottom, 23 ft. diameter at top, and 16 ft. high, complete with bands, $625; timber for trestle under tank, and lime, sand, etc., for walls was $275; the 16x5½x10-in. Worthington duplex steam pump and fittings cost $825; pipe, fittings, etc., as enumerated above, totaled $3775.

The complete installation, therefore, cost about $7000, and was suited for a mine producing annually about 300,000 tons; if this installation were charged directly to coal output and distributed over a year, the cost would amount to 2⅓c. per ton; if distributed over five years, the cost would be less than ½c. per ton. The installation at Castle Gate, where the annual production was also about 300,000 tons, cost slightly more than $7000, while at Winter Quarters, where the annual output is 350,000 tons, and at Clear Creek with 350,000 tons, each installation cost considerably less than $7000.

The annual cost of operation at Sunnyside including both No. 1 and No. 2 mines with 630,000 tons production is as follows:

ANNUAL COST OF OPERATION.

Wages 2 pipemen and 2 watermen at $2.75 per day for 275 days	$3025
40,000 gal. water per day for 275 days at 12c. per 1000 gal.	1320
Labor, running pumps, supplying steam for same, etc.	550
6 per cent interest on investment of $14,000	840
Depreciation 10 per cent	1400
Extensions, repairs, hose, etc. (miscellaneous labor and material)	1000
Total actual operating cost yearly	$8135

As mine-cost sheets take no account of interest and depreciation, the total yearly operating cost to appear on cost sheet will be $5895, which on a yearly tonnage of 630,000 will amount to less than 1c. per ton; where water is plentiful and the gravity system may be used, the cost per ton for operating will be less than ¾c. per ton, certainly not an item to discourage any operator.

If this system was installed at the time of opening the mine, $2500 would suffice in any ordinary locality, and extensions could be made to keep pace with development, and be charged out to coal production without creating any particular notice. These extensions in a newly opened mine producing about 500 tons per day, or 11,500 tons per month in a seam 10 ft. thick where development is being rushed, will

amount to about 60 ft. of 3-in. pipe monthly, costing $15, 300 ft. of 2-in. pipe in main haulageways costing about $40 each month, and 700 ft. of 1-in. pipe with a monthly cost of $40; this makes a total of $95, or about 4/5c. per ton. This cost would probably increase slightly until such time as retreating work is begun, and then the time will soon come when the pipe recovered will amount to as much, or to more than the pipe extended; when this occurs, the total cost of spraying will be reduced to less than 1c. per ton, as shown above at Sunnyside.

Miners who have been employed in Utah mines and later go into neighboring States to work, are horrified at what they freely term the criminal neglect and carelessness of coal operators, and many of these miners refuse to work in the dry and dusty mines. Mine owners in Utah place such stress on effective spraying, that they have been known to close down a mine producing over 1000 tons daily until frozen water pipes have been thawed to permit resumption of sprinkling. The mine manager naturally hesitates to add 1c. per ton to his cost record, and directors and stockholders are not fond of parting with 1c. per ton on a large production, where the aggregate cost often totals several thousand dollars annually; however, when these operators and mine owners recall the bitter experience of Winter Quarters and other mines where the money loss to the company amounted to several hundred thousand dollars, without considering the human suffering entailed and the prestige lost, the added safety obtained by thorough spraying together with anxiety spared all connected with the company, generally causes the coal magnate not only to be reconciled to the addition of 1c. per ton to his cost sheets, but even to be thankful that by having done so, he has probably escaped paying a far heavier tribute to the gods of destruction. This article will be followed by a description of the modern system of firing all shots electrically in the Utah mines.

Safety Lamps in the Coal Mines of Foreign Countries

The Commission on Illumination, appointed by the Société de l'Industrie Minérale, begins its report, in the *Bulletin* of March, 1908, with a review of the laws of the several coal-mining countries of Europe relating to the use of safety lamps.

In France a safety lamp of standard and approved type is obligatory in all coal mines, except that a naked flame may be carried into a downcast air shaft. The safety lamps are supplied by the operator, and each one has a number, a record of which is required to be kept by the proper official on the surface. Each workman receives his lamp cleaned, burning and in perfect condition; if it is found subsequently open or out of order, he is held responsible and is disciplined.

In Austria naked lamps are forbidden except in downcast air shafts. The type of safety lamp required to be used burns benzine, has two gauzes, a magnetic lock and a magnetic relighter. Portable electric lamps are also permitted. All lamps are officially inspected once a year.

The Cost of Electric Lamps Has Hindered Their Adoption

In Germany the rules are similar except that portable electric lamps are permitted only under the same conditions as are naked lamps. The price of electric lamps and the cost of maintaining them have thus far hindered their wide adoption. Safety lamps have one or two gauzes, according to the places in which they are to be used. They do not have the mantle.

In Belgium naked lamps are forbidden in all coal mines whether gassy or not. In moderately gassy mines safety lamps of well known types and portable electric lamps are permitted. The former are required to have the mantle, but its condition of fixedness is optional with mine managers. Only phosphorus relighters, ignited by friction, are permitted. Relighting stations are located near downcast air shafts.

In Spain safety lamps are compulsory in gassy mines and incandescent electric lamps are permitted under certain conditions of isolation and protection. Arc lights are not allowed.

In England safety lamps are not demanded except in such parts of a mine as shall have "a dangerous proportion of inflammable gas," which loose terms leave a good deal to personal discretion. In Wales, however, naked lamps are very rare. The mantle, without being compulsory on a safety lamp, is widely used, even on lamps with but a single gauze, and workmen are generally forbidden to lift the mantle. Electric lighting is permitted under certain safeguards.

Accidents in Coal Mines

According to estimates made by the Geological Survey, there has been a falling off in the number of deaths in coal mines for the year 1908, and the number of deaths will be several hundred less than in 1907. In that year more than 3125 men were killed in the coal mines of the country—a death rate of 4.86 for every 1000 men employed—from three to four times as many men per 1000 as are killed in any coal-producing country of Europe. In December, 1907, four explosions caused the death of 700 men. During 1908 there were but two accidents in which the loss of life was heavy; one in January at the Hanna mine, in Wyoming, with a loss of 70 men; the other, Nov. 28, at the Marianna mine, in Pennsylvania, which resulted in 154 deaths.

All Explosives to be Standardized

The experiment station at Pittsburg announces that much of the danger heretofore experienced is due to the so-called "safety" explosives. It is the purpose of the Government to continue these experiments until the explosives of the country are standardized in such a manner that the miner will have a definite idea what these explosives will do. After the Government has gone far enough in its experiments, a bulletin will be issued recommending as permissible explosives, such as stand the test.

The Survey is also laying stress upon experiments said to show that coal dust is an explosive as dangerous as firedamp. The officers at the Pittsburg station are seeking to find some method by which this dust can be prevented from being a serious menace. These investigations are expected to accomplish a reduction in the number of men killed in the mines, and a saving of the waste in mining coal. The use of improper explosives, as well as the improper use of suitable explosives is said to result annually in the waste of great amounts of coal. The use of too high charges in blasting, or the use of unnecessarily violent explosives, shatters much good coal, converting fuel into dust which may itself be explosive and become productive of further damage. Such explosions often loosen the roof of a coal mine, causing falls of top rock, and resulting in increased fatalities.

West Africa, the Gold Coast Colony and Ashanti in 1908

By W. Fischer Wilkinson*

The gold production during 1908 will amount to a value of about £1,183,000, which is somewhat in excess of that obtained in 1907. No new mines are crushing and the increase is mostly due to the Taquah mine, which milled the whole year, while in 1907 its production was limited to the closing months.

The accompanying table gives a list of the principal mines showing the approximate results obtained, the returns for December being necessarily estimated.

Taquah and Abosso Mines

The Taquah mine, which heads the list, commenced regular crushing in September, 1907. This mine is working banket ore. The mill of 50 stamps is run by a gas engine and producer plant, the first on the coast; the plant is reported by the gen-

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eral manager to be an unqualified success. For the period September, 1907, to June, 1908, the 50-stamp mill crushed 46,234 tons (2000 lb.) for a return of gold of the value of £162,243 or 68.36s. per ton. During this period the mill ran only 59.55 per cent. of its possible full time owing to want of ore and breakdowns of the old machinery in use. The costs, including development redemption (6.5s.) and London expenditure (2.4s.) but not depreciation, were 42.1s. per ton milled. With better running time the costs will no doubt be less but the grade seems high compared with the other mines along the banket section. The ore reserves are given as 233,941 tons, value not stated, but they include 176,971 tons assaying 21.6 dwt. The greater portion of the profit made has been spent on capital expenditure, and no dividend for the financial year is paid, but the directors announce an interim dividend of 10 per cent. for 1908 payable in January, 1909.

GOLD COAST, 1908.

Company.	Stamps.	Tons.	Value.	Value per Ton.
Taquah	50	62,803	£216,788	68s.
Ashanti Goldfields	40	62,285	156,753	50
Prestea, Block "A"	50	89,643	153,489	34
Abosso	50	48,761	115,453	47
Abbontiakoon, Block 1	50*	65,280	114,333	34
Broomassie	20	19,547	111,607	114
Bibiani	45	49,876	97,531	39
Wassau	40	62,200	86,664	28
Akrokerri	40	33,660	61,677	
Dredging and other small producers			67,771	
			£1,183,066	

* Ball mills equivalent.

The Abosso mine, which is managed by the same men as the Taquah, has a 50-stamp mill, 20 having been added in February, 1908. During the financial year ending June 30, 1908, 44,021 tons were crushed, the recovery value being 50.4s., and the costs, including development (5.25s.) and London expenditure (1s.) but exclusive of depreciation, 35.2s. per ton milled. The costs were above the normal owing to a series of accidents at the mine, the lower levels being more than once flooded. The ore reserves at June 30, 1908, were estimated at 210,801 tons of 18.7 dwt. value. The dividend is the same as last year, namely 10 per cent.

Ashanti Goldfields Corporation

The Ashanti Goldfields Corporation showed a net profit for the year ending June 30, 1908, of £34,646, most of which was spent on capital expenditure, so that no dividend was declared. The company operates a group of quartz mines round Obuassi and treats the ores partly by wet stamp milling and cyaniding, and partly by dry crushing, roasting and cyaniding. For the 12 months ending June 30, 1908, there were crushed wet 43,135 tons, and dry 16,021 tons, total 59,156 tons of a total value of £171,033 equal to 56s. per ton The costs are given as 25s. 1d., made up of ore extraction and timbering 7s. 1d., treatment 10s. 11d., general charges 7s. 1d., but excluding development, London expenditure, depreciation and sundries which total up to another 16s. per ton, making a total cost of 41s. per ton compared with 40s. during the previous year.

The event of the year was the discovery by J. N. Justice and since called "Justice's Find," of a large orebody composed of a soft oxidized and decomposed schistose rock turning in depth (below the zone of oxidation) into a fairly hard basic rock still showing schistose structure, highly impregnated with pyritic mineral chiefly arsenical, and carrying fluctuating, but payable, quantities of gold. No. 1 level, which is about 35 ft. from the surface, over a length of about 400 ft. crosscuts across the deposit have given the following results: 61 ft., 21.2 dwt.; 80 ft., 12.7 dwt.; 83 ft., 11.5 dwt.; 68 ft., 11 dwt.; 69 ft., 7.6 dwt.; 77 ft., 35 dwt. and 66 ft., 17.4 dwt.

How far the value is maintained in depth is not yet known, but the indications in No. 2 level, 100 ft. vertical below No. 1, are promising. Enough work has, however, been done to allow of estimates being made of a large tonnage of 14-dwt. ore being available which can be cheaply won by open workings. The ore is refractory and the great bulk of the gold cannot be detected by simple panning, which may be the reason why the deposit was not worked by the natives. Although refractory a good extraction is obtainable, without roasting, by sliming and filter pressing. In consequence of this fortunate and unexpected discovery an extension of the plant is now being considered.

Other Producers

The Prestea Block "A" mine made a large gold production, but a yield of about 34s. does not allow of much margin of profit as costs are at present. In the November report it is officially stated that notwithstanding present conditions the mine is paying its way, so probably the costs are about the yield figure. Improved results are expected when the railway connection with Tarkwa is completed, the completion being expected next autumn.

The Abontiakoon Block 1, the Bibiani and the Wassau have also grades of ore that cannot leave much profit, if any, judging by the costs of the other mines. The Broomassie mine with 20 stamps treats very high-grade ore. For the year 1907 bullion to the value of £73,085 was recovered, an amount which was balanced by cost of working, development redemption, depreciation and London expenses. The working costs for the first three months of 1908 but excluding development and depreciation, were in round figures 30s. per ton. The returns for 1908 show a considerable increase.

Outlook

Looking at the results obtained at the different mines, it will be seen that the results of the year were not very profitable, yet there is a promise of better results in the future. The industry continues to gain by experience, and costs are certainly coming down. Gold undoubtedly exists in large quantities and over a wide area and if only the cost of working can be reduced to 20s. a ton instead of 40s. a ton as it now appears to average, when development redemption, depreciation, etc., are allowed for, a prosperous future awaits the industry.

In spite of the disappointing results that the country has given to those who have put their money into mines, there are not wanting those who have faith in a large reduction in working costs being possible. It was announced late in the year, an announcement that caused great activity in the "Jungle" market, that the Consolidated Goldfields of South Africa, which is already interested in the New Gold Coast agency and the Cinnamon Bippo mine, which was reopened last August, was providing working capital for three mining companies in the Wassau district, the Effuenta, the Fanti mines and the Wassau West Amalgamated.

An event of the year that needs notice is the discovery of petroleum in southern Nigeria. A company was formed to work it. A discovery of oil is also reported on the Gold Coast about 30 miles from Axim.

GOLD PRODUCTION OF GOLD COAST COLONY AND ASHANTI, SINCE 1880.

Year.	£	Year.	£
1880	32,865	1895	91,497
1881	45,240	1896	86,186
1882	61,188	1897	84,797
1883	52,435	1898	63,837
1884	66,188	1899	51,299
1885	89,981	1900	38,006
1886	74,878	1901	22,186
1887	81,168	1902	96,880
1888	86,510	1903	254,790
1889	103,200	1904	345,008
1890	91,657	1905	657,330
1891	88,112	1906	877,568
1892	98,805	1907	1,154,885
1893	79,099	1908	1,182,000
1894	76,795		

Water should not be allowed to drop down an upcast shaft, as it retards ventilation. In down-cast shafts the dropping water cools the air, but may increase the moisture in the air even to the saturation point. If the stopes are warm the cooling of the air is less beneficial than the saturation is detrimental.

Alluvial Working at Addison's Flat, New Zealand

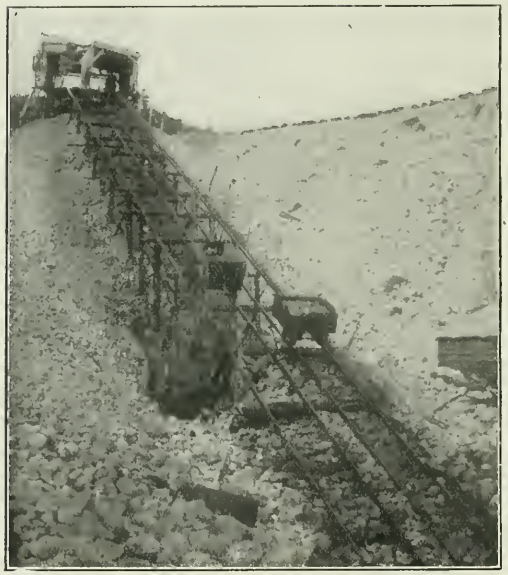
By A. Gordon Macdonald*

At Addison's Flat, about eight miles south of Westport, there are several alluvial claims worked by a system of hydraulic sluicing, the tailings being elevated by means of a "back balance."

The gold occurs in several leads at or near the bottom of the alluvial wash, which is about 50 ft. thick. The leads run in an approximately north-and-south direction. The bedrock is a blue, marly clay of Lower Miocene age,[1] known locally as "marine bottom," or "blue reef." On this rest layers of black sand and fine gravel, of marine deposition, varying in thickness up to 20 ft. It is this part of the alluvium that contains the leads of gold. Overlying this fine wash is a deposit, from 20 to 30 ft. thick, of coarse granite boulders. This portion of the wash contains little gold.

In the early days of the district these leads were worked by sinking shafts to them and then removing the richest portions by driving, the gravel being hoisted through the shaft; as soon as the leads began to get poor, they were abandoned. Some time later they were again worked, this time by driving tunnels to drain the workings. Generally two of these tunnels, one on each side of the old, original drives, and more or less parallel to them, were driven to work each lead. In time these were also worked out and abandoned. Some timbers used in these workings can be seen in the present working face.

At the present time water has been brought to the claims, and the whole of the ground, excepting a few "duffer bars" between the leads, is being sluiced away. The water is brought to the edge of the workings by a flume, and is then led by pipes to the face, thus giving a head of about 50 ft. This presure is sufficient for hydraulicking the gravel, but obviously insufficient to elevate the tailings by means of a "blow-up" or hydraulic elevator. Hence the back balance is used to hoist the coarse tailings out of the pit.



THE "BACK BALANCE" IN OPERATION

THE BOTTOM OF THE INCLINE, SHOWING TANK AND HOPPER

As many as possible of the large boulders are thrown to one side, the rest being sluiced down a launder about 200 ft. long, placed in a cut in the bed rock and lined with wooden blocks. From this sluice the gravel passes over a flat, punched screen about 12 ft. long by 3 ft. wide. The coarse material passing over the screen is delivered into a fixed iron hopper, called locally a cage, which is in the form of an inverted truncated pyramid, with a double iron door at the bottom, controlled by a lever. From this hopper these coarse tailings are loaded into a car and elevated by the back balance.

The Back-balance Hoist

The back balance is worked on an inclined double tramway, up which the truck, having a capacity of from 18 to 20 cu.ft., is hauled by a water tank, the two being connected by a steel-wire rope, which makes several turns around the brake drum at the head of the incline. The angle of inclination of the tramway is about 30 deg. from the horizontal, and the axis of the brake drum is perpendicular to the plane of the tramway. The length of the incline is about 120 feet.

The truck comes down underneath the hopper, and is filled with tailings by opening the bottom doors. At the same time the tank is being filled with water at the top of the incline by means of a 12-in. pipe fed from a cistern. When full the tank, weighing more than the loaded truck, hauls up the truck filled with tailings. On reaching the top the truck is disconnected and run out to the dump. Another truck is immediately hooked onto the rope, and filled with water from another 12-in. pipe. When the tank reaches the bottom an arm, connected with a door in the bottom of the tank, strikes a horizontal wooden bar, thus opening the door and emptying the tank. The truck filled with water then descends, hauling up the empty tank Another cageful of tailings is now discharged into the truck and is hauled up as soon as the tank at the top is filled with water. By this means about 30 truckloads of tailings can be disposed of in an hour.

The water used for filling the truck and tank is not wasted, but is run, together with the fine material passing through the hopper, over the gold-saving tables, which are about 800 ft. distant from the hopper,

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[1]Alexander McKay, report on the geology of the southwestern part of Nelson and the northern part of Westland, p. 56.

the two points being connected by a tunnel. The tables are arranged in five steps. Each step is 48 ft. wide by 3 ft. long in the direction of flow, with a baffle board and well, 8 in. wide, between each step. The total fall is 21 in., or a little more than 1 in. to the foot. The tables are covered with blanketing to give a better surface for catching the gold. To get rid of the tailings from the tables a tunnel over 2000 ft. long has been driven through the "blue reef." This tunnel discharges the tailings into a creek.

TOP OF INCLINE, SHOWING BRAKE DRUM AND TANK-CAR FILLING

Eight men work the claim; three in the face sluicing the ground, two at the hopper, and three at the head of the incline running the back balance and dumping the cars. In the evening all the men go to the tables, take up the blankets and wash them in two tubs, placed on rails to facilitate the work. The concentrates thus obtained are treated in the amalgamation barrel. Quicksilver and caustic soda are added and the charge is mixed, the barrel being run by a small water wheel, until the blankets are again washed, which is usually every 24 hours.

Notwithstanding the fact that the best of the leads has been worked out, that the tables do not make a high saving of gold, that amalgamation does not give a high percentage of extraction from the concentrates, and that only three of the men are engaged in sluicing down the dirt, the remainder performing what might be called dead work, the claim is giving good results, paying, on an average, £4 a week per man.

Rhodesia is expecting a boom in copper, consequent upon the success of the Edmundian copper mine.

The output of gold from the Gold Coast Colony, including Ashanti, for October, 1908 was 24,552 ounces.

Smelting Progress in California

SPECIAL CORRESPONDENCE

A conference has been held between the board of supervisors of Contra Costa county, Cal., representatives of the Selby Smelting Company, the Peyton Chemical Company and the Mountain Copper Company, and certain citizens of districts which had complained of smelter fumes from the smelting plants of these companies. As a result the smelting companies have been granted 60 days time in which to install appliances to prevent the distribution of damaging gases. This is in compliance with a recent ordinance passed in the county in the interests of certain farming districts, where it was claimed that vegetation was being injured. At the conference referred to the representative of the farmers declared that it was not the intention to force any hardship upon the smelting interests. The smelting men declared themselves ready to meet the requirements of the new ordinance. They wanted 90 days time but this was reduced to the 60 days.

What was formerly the Oakdale Ore Purchasing Company and is now the Richmond Reduction Works, has purchased the buildings of a foundry at Point Richmond, on San Francisco bay, where there is connection with both rail and tidewater. The buildings have been remodeled to suit the requirements for handling ores, concentrates, etc. The company is purchasing sulphurets, chlorination tailings, etc., in the Mother Lode counties of California and elsewhere, and treating them at Point Richmond.

Aluminum and Electrical Work

According to J. T. W. Echevarri in a paper recently read before the Institute of Metals, the price of aluminum now ranges from £65 to £100 per ton, which gives a wide and increasing field of usefulness. The saving that can be effected by substituting aluminum for copper for overhead conductors is so large that in countries where long overhead transmission lines are common the lighter metal is preferred. At its present low price, the author believes there is an extensive field for the metal for insulated underground cables. For busbars and back connections in switchboards it is already being increasingly used.

GENERAL VIEW OF THE WORKINGS, ADDISON FLAT, NEW ZEALAND

In 1907 four tons of silver ore, containing 2959 oz. silver were produced from the Perran mine in Cornwall. This was the only producing silver mine in the United Kingdom.

Developments in Gold Dredging During 1908

The Year Was a Prosperous One in the Industry and Witnessed Great Activity in California and Important Progress in the Klondike

BY JOHN POWER HUTCHINS*

The year 1908, one of strained financial conditions, had no bad effect upon the operation of gold dredges. On the contrary, there seemed to be unusual prosperity in comparison with mining other metals than gold, for mining for other metals was very seriously affected by the fall in prices. Gold dredging, in having an unlimited demand and a constant price for its product, is surely an attractive kind of mining.

The hard times interfered with progress in searching for and equipping new dredging enterprises, although there was a healthy search for new ground and this search was rewarded in several instances by finds of good ground.

Ground that can be worked successfully with floating dredges is hard to find. The most common drawback is a lack of sufficient gold. It is remarkable that there are so many areas containing only a few cents per cubic yard immediately adjoining ground which furnished rich diggings. Many instances can be cited of creek valleys having all the essential characteristics of dredging deposits except sufficient gold surrounded by old bench diggings with records of wonderful yields. There are also numerous creek gravels with sufficient gold, as compared with California dredging fields, but lacking the features that would make it possible to exploit them with floating dredges. There is usually too low a content of gold or if there is more than a few cents per cubic yard there are big boulders, or hard, rough bedrock, or too much clay, or hostile environment or some other factor to raise dredging costs to a prohibitive level.

There is at present an intensive search for new dredging fields and with good results. Countries possessing cold climates and frozen ground are attracting greater attention. It is probable that the search now being conducted in Siberia will result in developing important dredging fields. A similar activity is noted in tropic South America. Colombia is under investigation, and it is probable that several dredges will soon be installed there. There have been many dredging failures in South America, but only recently has a first-class modern dredge of California type been installed in that continent. This dredge was built on the Atrato river and is now being moved to the ground where it will be operated.

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California

Dredging was generally prosperous in the United States. California showed a healthful condition. Some very powerful dredges of large capacity were built and these are doing profitable work in ground that only a few years ago was thought to be undredgeable. Dredging at Oroville had no unusual incidents. A number of the older dredges were scrapped. The Anti-Débris Association was active and enjoined dredging operations where no real damage was done. The city of Oroville enjoined one dredge company which carried on work in the river in a way supposed to cause choking of the river bed so as to give trouble during freshets. There was more or less agitation in cities situated on other rivers in which dredging is carried on. As a notable instance, Sacramento took steps to investigate alleged damage done by the dredges near Folsom. None of these dredges work in the river, and the only possible damage that can be done is by the inconsiderable amount of material held in suspension in the water that runs from the dredge ponds. This probably amounts to not many hundredths of an ounce per gallon of water and it is of such character that it will not settle where there are no river or tidal currents.

The first large dredge to be installed in northern California began operations. This is the first large dredge to begin work in California in gravel differing from that at Oroville and at other places on the flanks of the Sacramento and San Joaquin rivers. The dredging province of California was extended somewhat by the investigation of rivers tributary to the San Joaquin and formerly considered undredgeable.

Montana

Some interesting dredging was done in Montana, furnishing an opportunity for a comparative test of a remodeled dredge fitted with gold-saving tables. This dredge formerly had a sluice box. It is reported that dredging the tailings from the dredge in its original form with the remodeled machine yielded a recovery of 5 per cent. of the original saving. This is about the same as that found in drilling the tailings to ascertain their gold content and is noteworthy. The sluice box was supposed to be less efficient as a gold saver than the tables, resulting in a considerable loss. These figures show that the loss was inconsiderable, and it is not improbable that, had the tailings been worked a second time by a sluice-box dredge, an equal saving might have been effected.

There is, unfortunately, still uncertainty as to the relative merits of sluice box and table, the relative merits of which are not easy to determine. Any procedure to gain knowledge is expensive, and it is extremely difficult to make accurate determinations when handling large volumes of material as in dredging. The gold dredge with the largest buckets in the world, 15 cu.ft. capacity, is owned by the same company. This dredge has a sluice box, and by reason of recent experience with the remodeled type and of other, though minor, considerations, it will not be immediately changed to the table type.

A gold dredge is being installed near Butte. It will operate in material that is by some mining men not considered to be placer material in the limited sense of the word. The ground has some peculiar characteristics, and the operations of the dredge will be watched with considerable interest. Montana has large areas of ground which may, on investigation, prove to be dredgeable.

Idaho and Colorado

Dredging was carried on in Idaho with success. In one instance ground worked several times by hand is now being dredged. In this area the richest returns are often obtained in the ground which has seemingly been most thoroughly worked by hand methods. In one place, an improved dredge is being installed on ground that has been idle for three years after being dredged for five years.

A similar change is reported in Colorado where dredges failed in the early days, and at present modern powerful dredges of large capacity are working successfully. Two dredges originally located in Clear Creek were moved, one to a place near Breckenridge, Colo., and the other in Calaveras county, California.

The Klondike.

Dredging in Klondike made important progress during 1908. Steam thawing was practiced on a large scale and at a lower cost, and less difficulty was experienced. Ground with a high gold content was found, and stripping accompanied with drainage so as to lower the water level produced progressive thawing. It

is expected that this stripping and draining will, after a time, make it unnecessary to use steam thawing except in rare cases. Thawing will (it is thought) progress deeper each summer until it reaches bedrock and the ground will then remain unfrozen. There is, however, nothing certain about this, for the ground may freeze again during the winter. The average temperature for the year is considerably below freezing. Gravel stripped, drained and thawed to a depth of more than 15 ft. has been known to freeze solidly during the next cold season. There is much ground that now has all the characteristics of stripped and drained creek beds, yet this ground thaws superficially in summer and freezes again in winter. It is to be hoped that stripping and draining will result in progressive thawing to bedrock in the Klondike creek beds, for if successful the practice could be applied elsewhere, thus extending the dredging province considerably.

Stripping by thawing alone did not prove successful in Klondike, for it was found that material did not thaw to any considerable depth below water level During 1908 the gravel was drained and much better results were accomplished. As predicted in this JOURNAL (Jan. 4, 1908, p. 58 and Mar. 7, 1908, p. 512) it was found that gravel does not thaw below water level when it is of the depth generally encountered in the Klondike creeks. When there is a considerable depth of overburden, which may be stripped by hydraulicking, and a relatively shallow section of gravel is left for dredging, this stripping, aided by draining will usually result in seasonal thawing to bedrock.

Dredging in its limited meaning is applied only to unfrozen areas. Where frozen ground is encountered other methods incorporating some of the features of drift, hydraulic, or other open-cut mining practice is applied. There was considerable progress in dredging in the Klondike, and the high gold content of some of the gravels will result in exploitation even though the working cost may be high.

Dredging in unfrozen ground has been carried on with great success. The fact that where most of the dredging was prosecuted the ground was only partially frozen, was a great advantage.

Recent installations of dredges include buckets of 7 cu.ft. capacity. Several dredges with 5-cu.ft. buckets were installed two years ago. A 7-cu.ft. dredge installed in 1905 was successful from the beginning. The larger bucket seems to have shown its advantages in Klondike as elsewhere. This experience is similar to that of dredge men in California where there was for a time a retrogression toward small buckets for working ground suitable for large dredges.

Electric Elevators

The electric elevators used in Klondike in 1908 may be classed with dredges. The machines were installed in the creek beds where it was thought that dredging could not be prosecuted advantageously. The elevators consist of a chain of buckets mounted on a ladder, the buckets being heavier than the stacker buckets of a dredge because they must stand the strain of excavating material from a sump. The material is conducted to the sump by driving with a stream from a hydraulic nozzle. Two centrifugal pumps are used to raise the excess of water that the buckets do not lift.

The method which is one form of open-cut mining employing sluices for saving the gold, allows the sun and air to do most of the thawing; it also exposes the bedrock and allows it to be thoroughly cleaned by hand. The elevators are not mobile, and since they must be moved occasionally they involve a loss of time.

A machine of this type used in Australia has some advantages in the matter of mobility. Material is hydraulicked into cuts that conduct it to a sump; it is not driven to the sump as in Klondike. It is raised by a centrifugal pump to the sluice, the pump being placed on a barge. When it is advantageous to move, the pit is flooded, the barge floated to a new position, the water pumped out, the barge settling on bedrock and the work is resumed. This arrangement gives fair mobility.

There are no data for comparison of the two methods. For the Australian plant, a working cost of 4.6 to 5.6c. per cu.yd. is given when gravity water is available and 6 to 9c. per cu.yd. when water must be pumped by steam power to the hydraulic nozzle.

It is interesting to note that the operation of the elevators in the Klondike is similar in all essential features to one carried on in 1903 on El Dorado creek, also in the Klondike. Material was hydraulicked with but small pressure to a bucket elevator operated by steam. A centrifugal pump run by steam handled the excess of water. This plant operated on a small scale with but little water under low head and the fuel cost was heavy. Its operation was discontinued and other methods were applied.

The new operations with elevators will have plenty of water under high head, which will permit working a large pit thus exposing large areas to the thawing action of sun and air. The use of electric power on the elevator and pump will also effect a great saving as compared with steam power. This enterprise is a good instance of what may be accomplished by a powerful corporation working on a large scale.

The open-cut method most commonly used by the one-man proposition of recent years in the Klondike and the so-called elevator method recently installed possess several similar features. By the old methods stripping was effected by ground sluicing, by means of horse or steam scrapers or in some other way. The bedrock gravel was shoveled into cars or skips or other receptacles and elevated to the sluices. As now worked the stripping and transportation of gravel to the elevator is effected by hydraulicking and the elevator lifts it to the sluice. Had a supply of water been available elevators would have been used very generally in the early days.

Seward Peninsula

On Seward peninsula, in Alaska, dredging was successful wherever proper methods have been employed. Where failures have occurred, management such as would have resulted in failure elsewhere was responsible. There are, to be sure, a number of difficult problems connected with the hostile conditions of the far north. Frozen ground is a drawback more than a "bugaboo." There are areas of unfrozen ground in Alaska and some of these will be dredged at good profit. Whether the large volumes of tundra gravel will ever be exploited successfully by the dredging method is problematic, but it is likely that if frozen ground can be thawed out successfully in Klondike by stripping and draining the tundra gravel may be treated similarly. However, the problem of preventing gravel thawed in summer from freezing solidly during the following winter is yet to be solved.

Other Countries

Investigations are being carried on in Siberia and new dredging ground is being developed. Where there has been such a large output of gold, most of it by placer methods, it is likely that there will be a considerable development of dredging ground.

Dredging in West Africa experienced the difficulties encountered elsewhere in the tropics. The bad sanitary conditions had a considerable effect upon costs. In one instance much time was lost by reason of continued high water. Buried timber was also an obstacle.

In Australia, dredging was carried on as formerly. The water-power dredge, which is operated by impact water wheels the water being conducted upon the dredge through an articulated pipe, worked satisfactorily. Dredges have failed on areas in Australia because of their inability to excavate difficult material or bedrock. It is probable that if large, powerful dredges of the California type were installed on some of these areas success would be attained. Some of the California dredges are now operating in ground so hard that it cannot possibly be

dredged at a profit by small, weak dredges, such as are generally used in Australia. It is well to compare the cost of a large California dredge, about $150,000, with that of the type used in Australasia, about $35,000.

In the Philippines the industry had its vicissitudes, but it is hoped that changes and improvements in the dredges will result in better working. Difficulties due to tropical environment are experienced in the Philippines as elsewhere in the torrid zone.

Another dredge was installed in Dutch Guiana and it is said that although it operated in rich material, mechanical difficulties have caused much trouble. This dredge was manufactured in Europe and is lighter and much less powerful than the California type.

Two dredges were installed in Brazil, where it is expected that both gold and diamonds will be extracted. Neither of these dredges has as far as I know worked profitably as yet.

In Tierra del Fuego, dredging seems to have been successful in but few operations. In several cases, machines of poor design and material were installed. No dredges of the California type have yet been built in Tierra del Fuego. In one instance, peat excavated from the over burden ahead of the dredge is said to have been used as fuel. English coal at more than $15 per ton has been generally used. The dredging season is about 10 months in duration.

Design and Construction

There were no radical changes in dredge design and construction during 1908. There were improvements in the nature of refinements in details of design and manipulation. The close-connected bucket was again found to work more satisfactorily than the open-connected type. In several cases in which 3-cu.ft. close-connected buckets were substituted for 5-cu. ft. open-connected buckets, considerable gains in capacity and saving in power were noted. This was particularly noticeable where indurated material was dredged on a headline anchorage. Considerably less wear, tear and breakage was also noted, for there was much less surging with the close-connected bucket Heavier construction is more common and the limit does not seem to have been reached in this respect.

No gold dredges with steel hulls have yet been built in the United States. Wood en hulls have not been satisfactory, the life of the wooden hull in California being only about 10 years. Wooden hulls also become much distorted in a few years. To prevent distortion more structural steel has been used and longitudinal and lateral trusses are now incorporated. Time alone can determine whether these trusses will prove effective. Steel hulls would probably be more rigid and more durable than those of wood, and would also be more costly. There seems to be no immediate prospect of a dredge with a steel hull being built in the United States.

Steel hulls should be more generally used in tropical climates where wood-boring insects and decay make the life of a wooden hull a short one. Easier transportation of the steel plates than lumber is also an important consideration where inaccessible regions are concerned.

The respective advantages of quicksilver riffles and cocoa matting were better determined during the year than ever before. It is now generally accepted that under normal conditions, where there is a clean dredge pond and clean gold, little difference in the respective percentages of saving will be noted. When the dredge pond is dirty, as generally occurs with dredging not conducted in a river, the quicksilver riffle is superior. Where there is gold that will not amalgamate, cocoa matting is the better. Considerations of convenience in cleaning up the gold-saving areas often govern the choice.

Costs

Dredging costs in the United States did not vary materially from those of former years. Operations on a larger scale in Klondike have lowered expenses, but no work has yet been done in tropical South America with a first-class modern dredge so that no figures are available for comparison. It has been variously estimated, by competent authorities, that for an operation involving the dredging of about 1,000,000 cu.yd. per year, where transportation is not difficult, a working cost of 10 to 25c. per cu.yd. may be anticipated. To one familiar only with dredging in California and having no knowledge of the disadvantages of tropical environment, these figures will seem excessive; but until dredging is conducted on a considerable scale in the torrid zone, it will be advisable to allow a working cost of not less than 10c. per cu.yd. as the minimum figure.

Small Dredges

The need of a small dredge for the exploitation of areas not suitable for a large dredge is recognized in some quarters. The tendency since the introduction of dredges in California has been to build larger dredges with larger buckets. To be sure there was a time after the installation of the first 5-cu.ft. close-connected bucket when several 3-cu.ft. close-connected bucket dredges were installed. This was because of constant difficulty with the first 5-cu.ft. close-connected bucket resulting from bad design and weak construction. Recent practice has approved the use of larger buckets.

The small bucket has come into disfavor largely because it was used as at Oroville in ground that was essentially suitable to working with large buckets. There is a distinct demand for a small dredge suitable to work inconsiderable areas or on areas of such shape and irregularity as to make it difficult to manipulate a large machine. There is also the consideration of cost which is a vital one. A dredge with 5-cu.ft. buckets costs about $100,000; a dredge with 2½-cu.ft. buckets should cost about $30,000. The capacities of these dredges should be about as three to one.

The record of failures has given the small bucket a bad name that it does not merit. There are areas in the tropics where the small dredge can be used to good advantage. Its light weight makes transportation, installation and operation easy and cheap; high gold content will compensate for the small capacity. By its means shallow ground of inconsiderable total acreage can probably be made the basis of a company when the first cost alone of a large dredge would make final profit an impossibility.

The small dredge has a function as a means of prospecting ground preliminary to the installation of large dredges. Small dredges have been used in this way in but few instances. Stewart river, in Canada, was prospected by this means in 1903. The common way of prospecting is to use steam or hand drills and results can thus be attained that are reliable and detailed. Drilling is cheap by comparison and a large acreage can be drilled so as to get detailed information at a much lower figure than the first cost of the prospecting dredge. The sectionalized gold dredge for muleback transportation is yet to be designed. The small dredge naturally will be more easily arranged for such transportation than larger and heavier dredges.

Gold dredging has been conducted with an unusual confidence in the honesty of the men who work on the dredges. On only a few dredges are there devices to prevent theft of gold from the gold-saving areas. During 1908 it was found that considerable amounts of gold were being stolen from dredges in California. This incident will probably lead to the incorporation of devices to keep under lock that part of the gold-saving areas where most of the gold is caught. This can be done easily and it will be good practice on all dredges. Even if not necessary, such procedure will be no more than a good business precaution.

Another large merger of dredging companies was recently consummated in California. A total acreage equal to all of the dredging ground at Oroville was

included. It is expected that lower working cost will be attained than when operating under several corporations. Standardization of dredge machinery in size and design will be attempted and the merged interests will build their own dredges. Dredging is one kind of mining that is particularly amenable to merger.

The Rare Metals VII—Tungsten

By Charles Baskerville*

Tungsten is commonly associated with granite. It is not found free in nature, and its ores are not numerous. The tungsteniferous minerals are shown in the following table:

TUNGSTEN MINERALS.

	Tungstic Acid Content.
Scheelite, calcium tungstate	71–80%
(a) Cuproscheelite, see cuprotungstite	76–80%
Wolframite, iron and manganese tungstate	74–78%
Hübnerite, manganese tungstate	73–77%
Stolzite, lead tungstate	51%
Ferberite, ferrous tungstate	70%
Powellite, calcium molybdate	10–11%
Reinite, iron tungstate	75%
Raspite, lead tungstate	49%
Tungstite, tungsten trioxide	100%
(a) Wolframine, tungsten trioxide	100%
(b) Meymacite, hydrated tungstic oxide	71–75%
(c) Cuprotungstite, copper tungstate	56%

Copper and calcium tungstate is also called cuprotungstite.

Tungsten and tungstates are prepared from scheelite, wolframite and hübnerite. Tungsten is used quite extensively in the manufacture of steel for special purposes. Alloyed with steel, either by itself or with molybdenum and chromium, a product is obtained which possesses great toughness and ability to resist shock. This grade of steel is employed for high-speed tools, armor plate, projectiles, car springs, etc. Special alloys with aluminum, copper and various other metals have been prepared. An alloy of copper and aluminum containing tungsten possesses great strength and toughness. Tungsten is now utilized in manufacturing filaments for electric lamps; such lamps give good light, have low power factors and are less expensive to manufacture than the Cooper-Hewitt and Nernst lamps. Sodium tungstate is used as a mordant in dyeing, for rendering materials non-inflammable, as a decolorizing agent for acetates, and as a decorticator in preparing raw fibers for manufacturing. Sodium and potassium tungstates are employed in the production of "Magenta bronze" and "Saffron bronze," respectively; a mixture of these bronzes yields a violet pigment. Tungsten trioxide is used as an oil and water color, and in the manufacture of a yellow and blue pigment.

The demand and prices for tungsten are strong.

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Scheelite

This mineral is usually associated with crystalline rocks, and is found with cassiterite, topaz, fluorite, apatite, molybdenite, or wolframite, in quartz, and associated with gold. Molybdenum is often present and may replace a considerable amount of the tungsten. Didymium, cerium, lanthanum, and tantalum may also be present. It is found in this country in Connecticut, Massachusetts, North Carolina, Nevada, Idaho, Colorado, Montana and California.

Scheelite occurs in heavy brownish white or white masses, square pyramids, and in crusts of yellowish or brown crystals. It is a brittle mineral, having a vitreous luster inclining to adamantine, and may be found in a variety of colors—white, pale yellow, yellowish white, brown, green, or red; it is sometimes almost orange yellow. The streak is white; the hardness is 4.5-5.0, and the specific gravity is 5.9-6.1.

Scheelite fuses before the blowpipe with difficulty; the edges of the mineral fuse under prolonged treatment to a semi-transparent glass, not coloring the flame. It is soluble in borax in the oxidizing flame, forming a clear glass, which soon becomes milk white and crystalline. With salt of phosphorus, it dissolves easily in the oxidizing flame to a clear bead which becomes deep blue in the reducing flame from the formation of tungsten dioxide. Varieties containing iron give a brownish glass in the reducing flame, so they require to be treated on charcoal with tin before the blue color appears. The blue salt of phosphorus bead dissolves in dilute hydrochloric acid to form a deep blue solution, especially if metallic tin is added. When scheelite is pulverized and digested in a test tube with hydrochloric acid, the tungstic acid separates as a yellow powder; upon adding a piece of tin, the whole solution is colored blue. Scheelite is also decomposed in nitric acid.

Scheelite is distinguished from other non-metallic minerals by its weight and behavior before the blow pipe, especially in salt of phosphorus.

Cuproscheelite fuses before the blowpipe to a black glass, coloring the flame an intense green. With the fluxes, it gives characteristic tungsten reactions, and dissolves in hydrochloric acid with the separation of tungsten trioxide.

Wolframite

Wolframite is a frequent companion of tin ores, the cassiterite and the tungsten minerals having developed in much the same way. In some tin mines wolframite is an annoying impurity. It is also often associated with quartz, native bismuth, scheelite, pyrite, galena and sphalerite. This mineral is found in this country in Connecticut, Maine, North Carolina, Missouri and Nevada. Wolframite occurs in heavy dark-gray to black sub-metallic crystals, orthorhombic, and also in coarse divergent columnar and granular masses. It is a brittle mineral with an uneven fracture and sub-metallic luster, and is generally of a dark brown to black in color. The streak is greenish gray to black; the hardness is 5-5.5; and the specific gravity is 7.2-7.55. Sometimes wolframite is feebly magnetic. It sometimes occurs altered to scheelite.

Wolframite fuses easily before the blowpipe to a globule, which has a crystalline surface and is magnetic. With salt of phosphorus it gives a reddish yellow glass while hot, which is paler on cooling; in the reducing flame, this glass becomes dark red and opaque. If this bead is pulverized and dissolved in dilute hydrochloric acid with the addition of tin, a blue solution is produced. With borax, a clear glass is produced in the oxidizing flame, and the iron or manganese reaction predominates. Wolframite fuses to a bluish-green manganate with soda and niter. It is decomposed by aqua regia with the separation of tungstic acid as a yellow powder, and is partially soluble in hydrochloric acid. The latter solution becomes intensely blue upon the addition of metallic zinc or tin. Wolframite is distinguished from titanic iron by its fusibility and deportment with salt of phosphorus.

Hubnerite

This mineral is abundant at Osceola, Nevada, with some scheelite, in veins of white quartz in a porphyritic granite. The tungsten deposits of the Dragoon mountains, Arizona, are of similar character. It is also found in Colorado, Montana and New Mexico.

Hubnerite is found usually in bladed forms, rarely in distinct crystals. The color is brownish red to hair brown to nearly black, and the streak is greenish gray to yellowish brown. It is less fusible than wolframite and with the fluxes gives manganese and tungstic acid reactions.

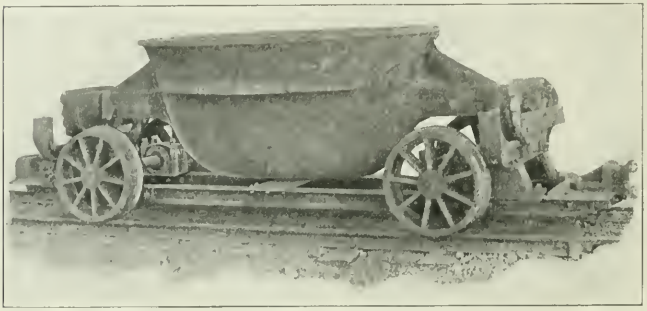
Mining and milling costs per ton of ore crushed at the Simmer & Jack East property, South Africa, for the fiscal year ending in 1908 were: Mining, 10s. 6.224d.; pumping, 4.067d.; sorting and crushing, 4.487d.; transport of ore, 6.161; milling, 1s. 8.195d.; cyaniding, 1s. 0.756d.; slime expense, 4.977d.; general charges, 1s. 4.496d.; total, 16s. 3.365d.; redemption of development, 3s.; grand total, 19s. 3.365d. per ton of ore crushed. During the year 200 stamps ran 334.27 days and crushed 400,760 tons, or 5.995 tons per stamp per day. The ore milled assayed 5.942 dwt. per ton. The total saving was 92.09 per cent., 56.82 per cent., being saved by amalgamation. The tonnage mined was 464,395; of this 13,696 per cent. was sorted out as waste rock.

Slag Car Used at the Cananea Smelting Works

The Cast-steel Bowl Has a Capacity of 45 Tons and Is Held Rigidly Upright by Means of Steel Spring Latches upon Its Truck

BY CHARLES F. SHELBY*

The Cananea Consolidated Copper Company has developed a new slag car especially adapted for use in smelting plants where the tonnage to be handled is large and the available head room is limited. The car, which is shown in the accompanying illustrations, has a capacity of 45 cu.ft.; one train crew with six of these pots easily handles 1000 tons of slag per day. There are larger slag cars in use, but in designing the pot here illustrated, all the best features of the many different cars employed for handling large quantities of slag seem to have been combined.



NEW SLAG CAR, CANANEA CONSOLIDATED COPPER COMPANY

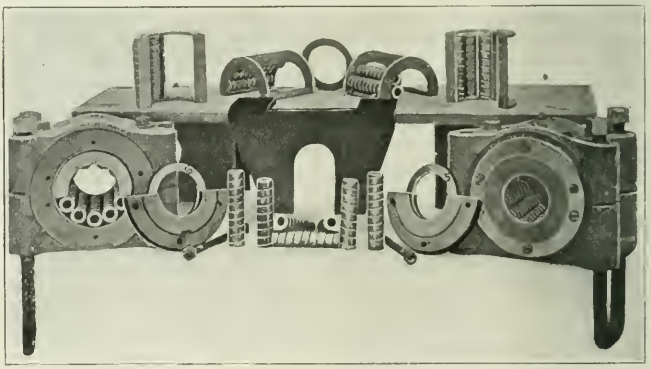
The bowl is of Midvale cast steel and the trunnions are so placed that the pot is "bottom heavy" when empty and "top heavy" when full. The pot is held rigidly in an upright position on the carrying truck by means of two spring latches, consisting of flat bars of spring steel ⅜ in. thick attached at one end to the trunnion face and the free ends engaging catches on the frame of the carrying truck. There are two of these latches, one at each end of the pot, and the respective catches are on opposite sides of the truck frame. A special tool is used to dump the bowl; it is called the spring-release lever, and is formed so as to grasp the loose end of the spring latch; a long handle of 1½-in. pipe enables the operator to spring the latch at one end of the truck free from its catch and to start the bowl from its center of equilibrium. The pot then rolls over on its rocker runners and dumps its contents automatically.

Over all the length of the slag car is 13 ft. 7 in., the wheel base being 8 ft. The bowl casting is 9 ft. 10 in. long; 5 ft. 2 in. wide and 39½ in. high. The thickness of the steel at the bottom of the bowl is 3 in. and at the sides 2½ in. The trunnion shafts are of wrought steel 3¾ in. diameter and are attached to the body of the bowl by means of 2-in. keys.

Both the body frame of the truck and the frames upon which the bowl rocks, are constructed of 75-lb. rails. The rocker frames do not rest directly upon the main frame, but are elevated above it upon 7-in. cast-iron chairs. The pot does not swing in trunnion bearings, but rocks upon cast-iron rockers, or segments of wheels, provided with tread and flanges.

The body of the truck is a bent-rail frame with rounded ends, braced at the center with a ⅜-in. plate and near the ends by the rail frames upon which the bowl rocks. Upon this body are mounted the draw-heads and the bearings for the wheels. The truck is suspended below the axles of the 24-in. wheels by means of U-bolts, which secure the bearing boxes to the frame. The wheels are of manganese steel, which seems to stand up exceptionally well under the severe conditions of the work. The truck is built for a 2-ft. 11-in. gage track.

The Hyatt roller bearings, shown in detail in the accompanying illustrations have, with the design employed, practically eliminated all trouble due to failure of truck bearings. The rollers are helical coils of tempered steel, having sufficient spring to eliminate much of the unnecessary friction due to strains. The strenuous duty required of the bearings of these large slag cars is particularly severe because of the heat to which all parts are subjected. The ordinary means of lubrication, the box bearing with oil cellar and waste, usually fails under these conditions. The Hyatt bearings used in this Cananea car eliminate practically all of these difficulties.



HYATT ROLLER BEARING, CANANEA SLAG CAR

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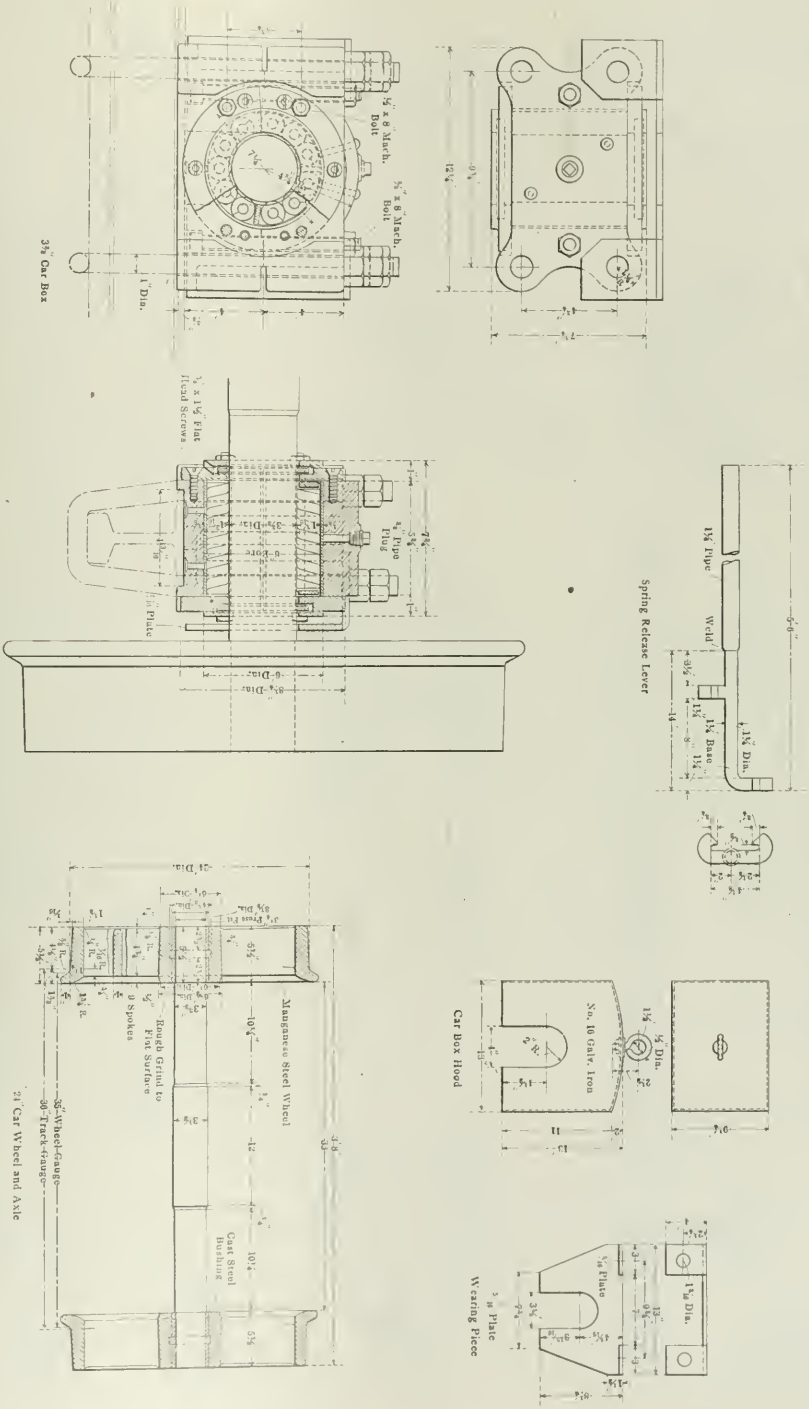
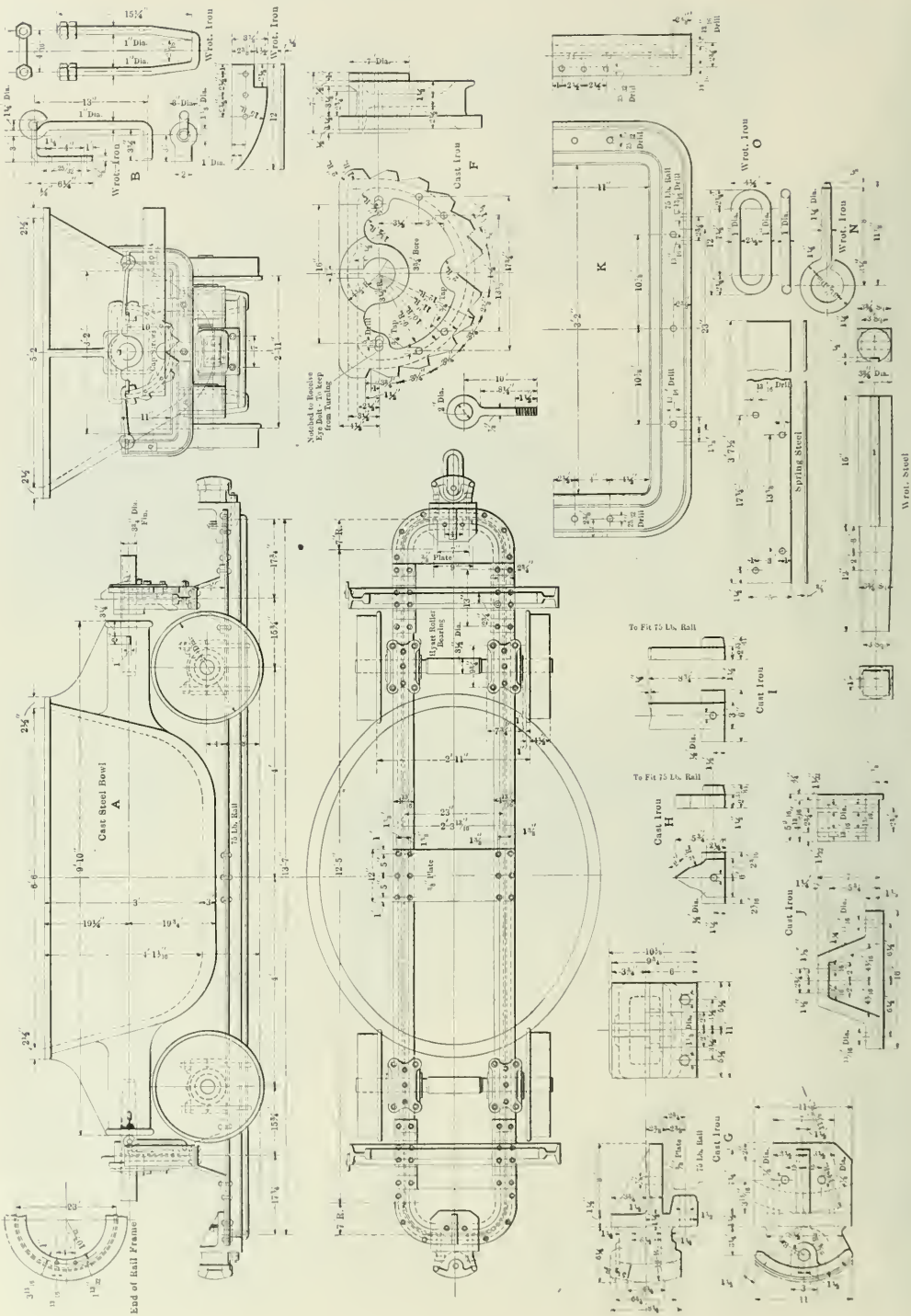
As a general rule, air-courses should always have as large an area as possible; this reduces the rubbing surface per square foot of section.

The Broken Hill Proprietary Company is going to install a baghouse in connection with its smeltery at Port Pirie.



CANANEA SLAG CAR. DETAILS OF WHEELS, HYATT ROLLER BEARINGS AND SPRING RELEASE LEVER



SECTIONS, PLAN AND DETAILS OF SLAG CAR, CANANEA CONSOLIDATED COPPER COMPANY

The London Tin Market in 1908

SPECIAL CORRESPONDENCE

January started with an advance of 25s. per ton, bringing the price of three months' warrants up to £122. This was inspired by news of unexpectedly small shipments from the Straits, coupled with a reduction in the English bank rate of interest. Eastern and other sellers were alert to profit by the enhanced values, and bears followed their lead, whereby prices were temporarily depressed to £121 5s. for cash warrants, and £122 5s. for three months. On Jan. 9 considerable activity developed in consequence of improved American demand coinciding with the withdrawal of Eastern sellers. Further strength was indirectly imparted by the improved market for copper, until—on Jan. 15—£125 15s. was paid for cash warrants, and £126 10s. for three months, at which point the movement spent itself and the market lacked support. The relapse, however, was of short duration and was more than recovered when it became known that large American purchases had been made in the East, whereby bears were prompted to cover their recent sales. Later reports of heavy shipments from the East indicated unfavorable statistics, and the market was subject to some manipulation in view of the approaching Banka auction. Prices were thereby forced down to £122 10s. and £123 5s., respectively. This reduction, however, attracted some attention, particularly in America where stocks had run low. Moreover, the Banka sale produced the respectable average equivalent of £122 10s., whereupon sellers held back and prices moved up, closing at £124 5s. for cash, and £125 for three months.

In February the opening coincided with the Chinese new-year holiday, and afforded opportunity for operating on the bull side, whereby values were sharply raised, three months' warrants touching £131 on Feb. 5. Bears covered their commitments eagerly, and consumers bought freely, the turnover of the first week amounting to 3900 tons. Trade prospects, however, were not encouraging, and caution was inspired by the prospect of increased supplies. There was a speedy relapse which, on Feb. 18, caused cash warrants to change hands at £126. During that period the market was active, but irregular and confused, with occasional rallies due to the bull party controlling most of the supply and thereby forcing bears to cover their sales. Thereafter speculative interest subsided and business was restricted. Eastern holders refused to follow the downward trend, and as offers became scarcer the market improved, being further strengthened by the improved aspect of copper as well as by an increased demand from America. Cash warrants rose at one time to £132, but the demand for prompt supplies was soon satisfied, and the market lacked support beyond what was afforded by bears covering. There was, moreover, assured evidence of ample supply. The closing prices were £129 10s. for cash, and £129 for three months onward.

March was an eventful month, opening with a fall of 30s. to £129 10s. for cash warrants, and £127 10s. for three months; the fall being induced by unfavorable statistics. On March 4 it was announced that the Dutch Government had revoked its recent decision to augment the sales of Banka by 1500 tons during 1908, so that the year's supply would be approximately the same as last. This announcement completely altered the tone of the market, and bears rushed in to cover their commitments, thereby raising prices to £136 10s. and £132 10s., respectively. This, however, was too sudden to last, and demand for early delivery was freely met by bull speculators and by Eastern holders. The volume of business during the first week was about 4000 tons, and prices closed at £133 10s. and £130 5s., respectively. On the resumption of business a further advance was made, due partly to purchases of forward metal by Chinese operators, and the market was practically controlled by the bull party for the rest of the month. Cash warrants were scarce, but the diminished American demand obviated serious trouble, and consumers generally were careful to buy only from hand to mouth. Some little relapse occurred during the third week when Eastern dealers sold freely, thereby depressing the cash price from £140 to £137 15s.; but skilful manipulation followed, carrying prices up until—on March 25—£147 was paid for cash, and £144 10s. for three months' delivery. On that day the Banka auction disposed of 1870 tons at the average equivalent of £147. Again followed a reaction due to realization of profits and withdrawal of support, and the fourth week closed at £143 10s. and £142, respectively. Excitement was engendered by a successful raid on the bear party, resulting in an advance to £145 10s. and £144 10s., respectively, fluctuations being very sharp. Final quotations were £144 5s. for cash, and £143 for three months.

April opened under more normal conditions than had lately prevailed, the excitement having greatly subsided. Eastern operators were ready sellers, and European holders liquidated hurriedly, thereby lowering the three months' price at the outset to £139 10s. At this juncture American and other buyers came in with good orders for consumption, and statistics of supply were regarded as favorable. Prices advanced in two days to £145 5s. cash, and £143 15s. three months, followed by a further advance of 15s. on April 6. This rapid advance brought out sellers who met demand freely, a sharp bear attack being followed by pronounced weakness which brought down values to £141 10s. and £140 10s. on April 7. Another two days brought about a recovery to £145 and £143 5s., respectively, due to the support of leading interests. This again was followed on April 13 by a relapse of £2 15s., which in turn gave place to a sharp recovery on the news of a strike at the smelting works at Singapore. On the whole the market was erratic and subject to incessant manipulation in Europe and America. High-water mark was reached on April 23, when values stood £145 and £143 15s., respectively. Further fluctuations followed, business being mostly speculative; and closing prices were £143 for cash warrants and £142 for three months.

May opened with cash warrants at £142 5s., and three months at £141 10s. Shipments from the East were small, and statistics showed a decrease of 2493 tons in all; but the market was unresponsive, and prices dropped under pressure of realizations until—on May 13—the figures stood at £133 and £132, respectively. At this point short sales were briskly covered and some speculative purchases ensued. May and June supplies were found to be under strong control, and prices advanced in consequence to £137 15s. on May 19. On the following day prices broke sharply under forced realizations and general selling pressure until—on May 28—cash warrants changed hands at £126 5s., and three months at £125 10s.; the bull party being powerless to arrest the decline in face of enormous shipments from the Straits—estimated at 6800 tons for the month. The Banka sale in Amsterdam on May 26 realized the average equivalent of £133 10s. Throughout the month the consumptive demand was unimportant as compared with the speculative turnover. Only at the close of the month was some improvement effected, when a sharp rally carried values to £129 5s. and £128 5s., respectively.

June revealed an increase of 2731 tons in the stocks during the previous month, and prospect of heavy shipments from the Straits. The market opened weak, with heavy liquidations by tired holders. The cash and three months prices touched £126 15s. and £125 10s., respectively, but improved in sympathy with other markets and with some renewal of speculation. It was not until June 11 that any decided improvement was manifest, when Eastern offerings were reduced and three months' warrants were commanding a premium. On that day the cash and three months' prices closed at £129 2s. 6d. and £129 17s. 6d., respectively. Business, however, was almost entirely professional and lacked the support of genuine trade. American demand was conspicuously lacking, manufacturers being amply supplied. The rest of the month saw declining values and restricted business, the market

being sensitive to the frequent realizations by importers. There were feeble rallies as offers subsided and operators tried to support the market, but the close was featureless and dull; cash warrants being quoted £125, with £126 2s. 6d. for three months.

July looked unpromising at the outset, consumptive demand being restricted and Eastern holders selling freely. Statistics, however, revealed a decrease of 1288 tons, whereupon bears took advantage of reduced prices to cover their commitments, and the market improved to £125 and £126 5s. At the advanced prices importers and Eastern sellers were for a time quite ready to meet the demand, but the market displayed considerable power of absorption, even at a rise of £2 on July 8. Thereupon bears became alarmed and hastened to cover, while demand set in from all sides. On the following day an advance of no less than £5 per ton was registered, and the advance culminated on July 10 when £133 15s. was paid for three months. Again a temporary reaction foldominated for some days, it being manifest that the movement was purely speculative and unwarranted by the conditions of the trade. Prices gradually fell back to £129 and £130 respectively, when speculators resumed buying and absorbed all offerings at advancing prices until, on July 16, a price of £135 was paid for three months'. Again a temporary reaction followed, induced by realization of recent purchases from the East; but by this time the notable advance in the share market had set much speculation in motion, and brokers were able to induce clients to take an active interest in metals. Strong buying ensued, in which consumers participated, whereby three months' warrants were raised to £140 on July 23. A healthy reaction followed, induced by Eastern and other sellers, as well as by the approaching Banka auction. When it became known that the latter had resulted in sale of 1800 tons as high at £142 speculation revived, and three months' warrants rose from £137 10s. to £139 15s. Statistics at the end of the month showed an increase of about 1600 tons. The consumptive industries appeared well employed, though the American tinplate trade left something to be desired. Speculative purchases sufficed to counteract the liberal offers of holders and of bears, and the month closed with cash warrants at £138 10s., with £139 15s. for three months'.

August opened, after the statutory holiday, and in the absence of several prominent operators, with a decline to £136 10s. cash, and £138 for three months, due to bear pressure which, however, failed to dislodge any important quantity. The lower level rather attracted speculative purchasers, resulting in improved values and followed by moderate consumptive buying. Eastern holders showed enough reserve to harden the market until £140 was paid for distant delivery. This figure prompted realizations which, however, were well absorbed; while the continued firmness of Eastern sellers kept prices fairly steady until Aug. 12, when it became known that shipments from the Straits during the first 10 days of August amounted to the large total of 3000 tons. Thereupon selling pressure ensued which, for a while, was counteracted by the uplifting of fairly large quantities falling due; whereby the value of cash warrants was relatively enhanced and the contango reduced to 5s. Amid numerous fluctuations weakness predominated, and the second week closed at £135 12s. 6d. and £136 respectively. The third week opened with a break of nearly £4, caused mainly by continued heavy shipments from the East, both of current production and accumulated stock. There was an active business at the reduced prices, and some recovery in values; but bearish sentiment prevailed, and the improvement was partly lost. The fourth week opened still lower, due to fears inspired of further increase in the Eastern supply; and the lowest was touched on Aug. 25 when heavy realizations and bear selling combined to bring cash warrants down to 130 15s. and three months to £131 10s. Shipments, however, were found to be less than had been expected, and a recovery of almost £3 ensued but was not fully maintained. The close was dull in the absence of consumptive demand, with cash warrants at £132 7s. 6d., and three months £133 2s. 6d.

September found the market weak at the outset for lack of leading bull support, whereby the recent improvement was wiped out. At £131 15s. buyers of three months' warrants came forward, encouraged by the absence of offers from the East, and speculative interest broadened until £133 10s. was reached; from which point values receded to £132 10s. in sympathy with other markets. The second week opened strongly on the continued reserve of Eastern holders, and three months' warrants advanced to £133. American consumers gave the market no support and speculation subsided at this point, whereby holders were tempted to realize, more especially as Eastern offers became more frequent. Fluctuations were mostly downward until Sept. 21, when cash warrants stood at £130, and three months' at £131 7s. 6d.; from which point a sharp rally ensued, prompted by renewal of American demand. At the Rotterdam auction on Sept. 24 about 1800 tons Banka were sold at the average equivalent of £133 2s. 6d. Statistics at the end of the month disclosed large supplies, but these were disregarded in face of large demand, both speculative and consumptive. Closing values were £134 for cash warrants, and £135 10s. for three months.

October opened with a weak market, influenced by increased supplies and the prospect of an increased quantity of Banka to be auctioned in the next year. Fluctuations were numerous and induced by improved American demand, alternating with heavy realizations of speculative holdings. The lowest was touched on Oct. 13, when three months' warrants changed hands at £133 10s. Eastern sellers were not pressing, and American consumers bought but sparingly; but prominent operators judged the movement favorable for an improvement in sympathy with other commodities, and offerings were plentifully absorbed. Thereafter, with numerous fluctuations, the tendency was upward; and the month closed with cash warrants at £136 5s., and three months £137 15s. per ton.

November statistics were more favorable than had been anticipated, and prompted a concerted bull movement which gathered strength after the result of the American presidential election was known. Opening at £137 10s. for cash, and £139 for three months, prices were carried—with occasional relapses due to speculative realizations—up to £142 5s. and £144, respectively, after which the buying power was insufficient to arrest the decline caused by persistent realization of old holdings; and values drifted down to £135 5s. and £137 5s. on Nov. 16. America sent substantial buying orders at each decline, pointing thereby to an improved statistical position ultimately in spite of heavy shipments advised from the East. Values again improved to £137 and £139, respectively on Nov. 19, relapsed again to the extent of 30s.—at which decline large quantities were marketed—and recovered to £137 7s. 6d. and £139 7s. 6d. on Nov. 25. Thereafter depression ensued on unfavorable statistics and heavy shipments from the Straits. At the Banka auction in Amsterdam on Nov. 26 a total of 1870 tons was sold at the average equivalent of about £140. The month closed with a dull market at £135 2s. 6d. cash, and £136 15s. three months.

In December persistent selling, chiefly by Eastern holders, caused weakness from the outset. The consequent decline in values was temporarily arrested, but proceeded farther as a result of bear selling. Reduced prices attracted buyers, and large quantities were absorbed, sometimes causing a temporary rally; but at each improvement in values sellers competed keenly and renewed the depression until —on Dec. 14—£130 10s. was accepted for cash warrants, and £132 5s. for three months. At this point the market was steadied by a fair consumptive demand—more from America than from Europe—and rallied somewhat; but heavy shipments from the East, coupled with readiness of Eastern holders to sell, checked further improvement, and values remained for several days round about £132 and £133 10s., respectively; closing weak at £131 7s. 6d. for cash and £133 for forward tin.

The London Spelter Market in 1908

SPECIAL CORRESPONDENCE

January opened with some activity due to improved Indian demand for yellow metal, and in a lesser degree to active buying for galvanizing. Competition, however, was too keen to allow of any improvement in price until Jan. 13, when it became known that the leading European producers were convening a meeting to discuss a policy of curtailment in production. Speculators were alert to forestall the improvement thus foreshadowed, and a large business developed in spelter and also in sheet zinc. Some revival of demand for galvanized iron also stimulated the upward movement which culminated on Jan. 20 with £21 7s. 6d. paid for ordinary brands. Thereafter values fell away under pressure of realizations by speculators, producers remaining firm, however, and holding little unsold, while the continental inland transport was impeded by ice and so tended to reduce available supplies. Closing prices were £20 12s. 6d. per ton for ordinary brands, and £21 7s. 6d. for Silesian specials.

In February uncertainty prevailed at the opening concerning the projected convention of the German producers, and some little weakening of prices resulted; but offerings were small and demand fair, so that the relapse was insignificant and transient. It soon became known that the convention was definitely established, and the market firmed up in consequence to £21 17s. 6d. for ordinary brands. Consumers and dealers alike bought freely, some improvement in the galvanizing trade serving as an additional stimulus, as also a large business in sheet zinc. The advanced price induced some realizations about the middle of the month; and demand being now satisfied, prices were allowed to drift downward while consumers held off awaiting the result of negotiations for extending the convention so as to include Belgian and other continental producers. The decline was gradual during the remainder of the month, closing prices being £21 2s. 6d. for ordinary brands, and £22 7s. 6d. for specials.

March was singularly devoid of interest, and fluctuations were unimportant. Producers for the most part had sold well and were holding aloof. On the other hand consumers were slow to purchase, and their few orders were keenly competed for by dealers. Opening at £21 for ordinary brands, it at once relapsed 2s. 6d. per ton, and thereat remained for eight days. Demand then revived and caused a recovery of 5s., which ruled up to March 19, when a slight relapse was induced by pressure of second-hand parcels. At the end of the month large transactions with continental producers imparted renewed strength to the market, which closed with ordinary brands at £21 2s. 6d., with £21 17s. 6d. for specials.

April opened with an active market, stimulated by many consumers' inquiries. Ordinary brands, quoted at £21 2s. 6d.@£21 5s., advanced 7s. 6d. per ton until April 8, after which inquiry dwindled chiefly as a result of the disappointing quietness prevailing at the quarterly meeting of the Iron Trades in Birmingham. On the Continent a large business was done extending into September, and foreign producers were consequently firm in their quotations, but numerous speculative parcels were placed on the London market at constantly receding prices, consumers remaining very apathetic. The rest of the month saw a slow but persistent decline in prices, which closed with ordinary brands from £20 17s. 6d.@£21 2s. 6d., and Silesian specials from £21 10s. to £20 15s.

May opened with a fall of 5s. per ton, due to dwindling demand and the keen competition for the few orders which consumers had to place. For a week or so the market was steady in view of producers' firmness and the inability of dealers to cover their speculative sales without loss. The next feature was a sudden drop to £19 17s. 6d. which was accepted for a speculative parcel thrust upon an unsupported market. Sellers continued to offer at a fraction over this figure for some 10 days, but the slackness of trade was too general and persistent to avert a further fall to £19 12s. 6d. The close was a trifle firmer, with ordinary brands from £19 15s. to £20, and Silesian specials from £20 to £20 5s.

June found the market destitute of support, consumers being apathetic, and dealers keen in competing for the few orders obtainable. The prolonged stagnation caused continental producers to become impatient, and their quotations eased off in consequence. The protracted and unfruitful negotiations in regard to the projected Producers' convention also tended to depress the market. Price of ordinary brands opened at 19 15s. and fell gradually but persistently during the month to £18 7s. 6d., closing thereat, Silesian specials being offered from £19 5s. to £19 10s. per ton.

July found a stagnant market at the outset, values being depressed by forced sales of arriving parcels. These were in most cases marketed at £18. Early in the month, however, considerable speculation developed in metals generally, wherein spelter participated to a moderate extent. The movement originated on the Continent, where operators turned to London as the cheapest market to buy in. The consequent improvement in values was more manifest as regards forward delivery than for prompt. Consumers followed the lead thus given, and additional firmness was imparted by increasing business in sheet zinc at advancing prices. The highest price recorded was £20 paid on July 20 for December delivery; but at the same time prices were very erratic for early delivery, and the trade requirements were not sufficient to impart steadiness. The market thereafter was neglected, and prices fell away toward the close, when ordinary brands were quoted £19, and specials £19 7s. 6d.

August opened quietly, the consuming industries being slack and not disposed to support the market. Early in the month, however, good business was reported from Germany, and improved reports from America helped to raise values. Speculative orders from abroad strengthened the upward movement, and consumptive demand followed. The close was firm at £19 5s. for ordinary brands, and £19 15s. for specials, with indication of recovery.

In September, business, though restricted, was fairly steady throughout the month, and fluctuations in price were unimportant. The gradual improvement in iron and steel was reflected in improved demand for galvanized wares, while sheet zinc was in increased request and helped to maintain prices of spelter. Producers, having sold well, were at no time pressing in their offers, and consumers were encouraged to cover requirements in view of the approach of winter. Ordinary brands opened at about £19 7s. 6d., advanced gradually and touched £19 17s. 6d. once or twice, and closed at £19 15s., with from £20 5s. to £20 10s. for specials.

October saw a steady trade throughout; consumers found the ruling prices reasonable and the prospects of trade more encouraging, and a fair volume of business resulted. Buyers were keen to obtain early delivery of what they bought, which is always an indication of improving trade, and this proved to be the case as the month advanced. Producers were firm in their quotations, and orders were taken mostly by dealers whose concessions caused a trifling relapse in prices down to Oct. 21, when £19 12s. 6d. was accepted for ordinary brands. Thereafter the market strengthened with expanding business, and closed at £19 17s. 6d.@£20 for ordinary brands, and £20 5s.@£20 10s. for specials.

November found the London market active on trade demand coupled with renewed speculative interest in the article. Opening at £20 for ordinary brands, the price steadily advanced, and the month closed with ordinaries at £21 7s. 6d.@£21 10s., and £21 15s.@£22 for specials.

December opened with some welcome activity in the consuming branches, and with no plentiful supply; business extending in some cases well into the next year. Early in the month, however, demand was satisfied, and further business was checked by the approach of the holiday season and stock-taking. Some speculative holdings, pressed upon an unsupported market, caused a gradual relapse to about £20 12s. 6d. toward the middle of the month; but producers were in nowise disposed to fol-

low the decline, and their firmness caused a gradual improvement. The closing quotations were £21 for good ordinaries and £21 5s. for specials.

Conveyer System for Disposing of Waste

By Edwin Higgins

Since writing the article on "Stripping Clinton Iron Ore in New York State"[1] I have secured additional information regarding the conveyer used at Ontario Center for disposing of waste material. Sufficient interest attaches to this machine, on account of adaptibility to the work and the rapidity with which it handles the waste, to warrant the following description:

Construction

The conveyer, shown in the accompanying illustration, consists of a platform 36x40 ft., mounted on four 4-wheel swivel trucks which have 33-in wheels on standard 5½x10-in. journals. The truck frames are of cast steel especially designed for this service, and in order to reduce vibration no springs are used, although the journal boxes are the usual type with brasses and oil reservoirs.

On the center of the platform is a superstructure of two trusses with an inclination of 26 deg. on the upper plane; two 6-yd. cars travel on this plane. These cars are handled separately by a double friction-drum steam hoist situated on the platform on one side of the incline. The hoist is a 12½x15 double-cylinder skeleton machine rated at 75 h.p., and is supplied with steam from a 100-h.p. boiler on the opposite side of the incline.

Operation

The loaded cars are each hauled to the upper end of the incline by a single rope, where they run on tracks which cause the rear end to raise until the car is in a vertical position. The dumping position of the cars is 70 ft. above the ground and 68 ft. beyond the side of the platform. The total travel of the cars is 130 ft., and as long as the shovel can fill the cars a round trip is easily made in 30 seconds. This speed, however, is not maintained on account of delays common to steam-shovel work.

To operate the conveyer with reasonable speed a force of three men is required, viz., a fireman, engineer, and brakeman. The engineer handles the throttle and frictions and hauls the cars to the top, and as soon as they are dumped he instantly releases the drum, which is then controlled by the band brake operated by the brakeman. In this way each car is entirely independent, and can be handled at full speed in either direction without reference to the condition of the other car. In case of needed repairs one car can be operated alone, thus giving at least one-half service.

In addition to the men required on the conveyer a track gang is necessary; this gang prepares the track in advance of the machine The track has four 100-lb. rails at standard gage and is merely placed on the ground approximately level, but without any ballast.

To move the conveyer, wire-rope blocks with five parts of ⅝-in. cable are used. On the end of the cable is bent a manila rope which is wrapped around the winch heads on the drum shafts. The entire machine, which was built by the Dobbie Foundry and Machine Company, of Niagara Falls, N. Y., weighs approximately 140 tons.

DOBBIE CONVEYER. ONE SKIP IN POSITION FOR LOADING; THE OTHER DUMPING

[1]Eng. and Min. Journ., Dec. 12, 1908, p. 1150.

Work of United States Geological Survey in 1908

The field work of the United States Geological Survey in 1908 shows great variety and range, as it included investigations of practically all the natural resources and their dependent industries, and extended over the entire country.

Beginning in 1879 with the appropriation of $100,000 for the classification of the public lands and the examination of the geologic structure, mineral resources, and products of the public domain, the duties imposed by Congress on the Survey and the appropriations made for its work have steadily increased until now its field of operations covers the whole country including Alaska. The appropriations for 1908 amounted to $1,782,770, and over 150 parties were in the field. The work ranged from that of the explorer and geographer making reconnaissance surveys in interior Alaska to that of the coal-mining engineer carrying on experimental gas and coal-dust explosions, for the purpose of saving human life, and to that of the geologist determining the presence of coal, water, or petroleum thousands of feet beneath the earth's surface.

Geologic Investigations

The primary work of the Survey is to make a geologic map of the United States Geologists have been at work during the year in all the coastal plain States, from Maryland to Texas inclusive, investigating the distribution of the rock formations and correlating the underground water-bearing beds. The States of Maryland, Virginia, North Carolina, South Carolina, Georgia and Florida have coöperated with the Federal Survey in this work, paying one-half the cost: Louisiana has similarly coöperated in the investigation of the new Caddo oilfield in that State In Pennsylvania, detailed studies of the coal beds and the oilfields in the vicinity of Pittsburg and farther up the Allegheny river were made in coöperation with the State; similar geologic work was also carried on south of Altoona and east of the Allegheny front. Indiana also cooperated with the Survey, and advantage was taken of the thousands of recent drillings and of the data procured in many new mines to revise the old State report on this coal field. In Illinois detailed investigations of the coal and oilfields was continued in coöperation with the State survey as in the past few years. About $20,000 was contributed in 1908 by the various cooperating States for geologic work, the Federal survey furnishing a like amount.

Work in the Oilfields

In the oil and gas surveys in Oklahoma the approximate elevations of all wells in the surveyed districts were obtained by running level lines. As one of the important objects of this work is to determine the structure of the oil-bearing sands and their relation to the surface and as the oil and gas operators understand the nature and purpose of these surveys, they willingly aided the work by furnishing drill records and other data. In the California oilfield important work has been done classifying public lands, and several temporary withdrawals have been made where oil land was being entered as agricultural land. In the Caddo oilfield in Louisiana, all the Government land has been withdrawn from entry pending an effort to stop the enormous waste of natural gas, estimated at 75,000,000 cu ft. per day.

Through the economic work of the geologists of the Survey it has become evident that one of the greatest needs of the petroleum industry is a general chemical examination, by uniform methods, of all the crude petroleums of the United States in order that the petroleums in one part of the country may be compared with those of another part. The importance of choosing standard methods of chemical examination for petroleum was seen from the first, so consultations have been held with the principal petroleum specialists of Europe and a system of examinations has been developed which is being practically applied as rapidly as possible.

Prominence of Mining Geology

Mining geology—the scientific study of metalliferous deposits—is now recognized as the basis of the highest type of mine development, so that the demand for Survey geologists to do this work is so great that it is not possible to satisfy it. During the season the Government mining geologists worked in several mining districts in northwestern and northeastern Nevada; in the Randsburg mining district in California; in southeastern Oregon and in the Bohemia district of that State (in connection with the work of the Forest Service); in the Frisco district, Utah; in the Caspar district, Wyoming; in the Breckenridge and the Lake City mining districts, Colorado; and in the district south of Dahlonega, Georgia. Reconnaissances were also made in the Frisco, Pioche, Cima, Hart, Rawhide and Aspen districts. Work was continued on the Shasta County, California, copper deposits; on the Leadville district; on the New Mexico mining district; and on the Joplin and Oklahoma districts.

Classifying and Valuing Coal Lands

The Survey had nearly 100 men engaged during the season in the geological examination, classification, and valuation of the great area of public coal land in the West. They classified 11,500,000 acres of coal land in Colorado, Montana, New Mexico, North Dakota, Oregon, Utah, Washington and Wyoming. The valuation of the coal deposits includes not only the determination of geologic conditions, but also physical tests of efficiency in the Survey testing plants. Reports presented to the Conservation Commission on the rapid exhaustion and exportation of phosphates have resulted in the withdrawal of the entire area of public phosphate land, pending legislation by Congress.

Mining and Geologic Work in Alaska

The work of the Alaskan division has embraced investigations of a varied character and has been widely distributed throughout the Territory. Reconnaissance, detailed geologic and topographic surveys and explorations were made as well as special investigations of the gold, copper, and coal deposits. In the placer districts data were collected on stream flow; some general stratigraphic and geologic studies were made; and statistics of mineral production and data on the progress of mining were collected.

Thirteen parties, including 23 technical men and 25 camp hands were engaged in Alaskan surveys and investigations. The field season for the different parties in 1908 varied greatly, but the work was carried on between March and November. Four parties were engaged in geologic work, four in both topographic and geologic surveys, and two in investigating water resources. The areas covered by geologic reconnaissance surveys (maps, 4 miles to the inch) embrace 4850 square miles, detailed geologic surveys (maps, 1 mile to the inch), 668 square miles. Topographic reconnaissance surveys (maps, 4 miles to the inch) were completed of 3975 square miles, and detailed topographic surveys (maps, 1 mile to the inch) of 427 miles. As a result, about 21 per cent. of the reconnaissance topographic base map of Alaska is completed, and about 17 per cent. of the reconnaissance geologic map. These results have been accomplished since 1898.

In the Yukon-Tanana region 21 gaging stations were maintained during 1908; these furnished data on the water resources of 4000 to 5000 square miles. In the Seward peninsula 32 gaging stations were maintained, yielding data on about 2000 square miles.

To consider the work geographically, two parties were in southeastern Alaska, two in the Copper and White River basins, one on Prince William sound, one on the Alaska peninsula, four in the Yukon basin, and three on Seward peninsula.

Among the important results of 1908 were the completion of detailed surveys of the two most important copper districts on Prince of Wales island; the finishing of the reconnaissance survey of copper-bearing areas of the Prince William sound and the Copper-White river regions; and the completion of the reconnaissance survey of the coal deposits in the Alaska peninsula region. The base map of the entire Yukon-Tanana region has been completed, and also the detailed geologic investigation of the Fairbanks placers.

Through this work much new information on the general geology and mineral resources of the Seward peninsula was obtained, while the stream-gaging work in both the Seward peninsula and Yukon-Tanana regions yielded important results on the water available for placer mining.

Twenty-seven Thousand Square Miles Mapped

The first step toward making a geologic map is a topographic survey; the topographic branch of the Survey is, therefore, one of its most active parts. During the last field season 26,994 square miles of topographic mapping was completed; 6024 square miles in the Atlantic division, 6069 square miles in the Central division, 3875 square miles in the Rocky mountain division, and 11,026 square miles in the Pacific division. The surveys included work in 32 States and Territories. Special drainage surveys were made in Minnesota, Mississippi and California. In Minnesota the special drainage survey of the ceded Chippewa Indian lands, authorized by Congress, was completed, 2385 square miles being mapped in 1908. The data will be used in making drainage plans by the Survey as directed by Congress. In Mississippi a topographic map of 1200 square miles of swamp land in the Yazoo delta was made in coöperation with the Tallahatchie Drainage Commission, which will use the data for drainage construction. This survey has been made on the especially large scale of 2000 ft. to the inch, with 5-ft. contour intervals and with 125 elevations established to the square mile. In California the work of mapping the Sacramento valley, including the tule swamps, progressed well; 1054 square miles were mapped with 5-ft. contour intervals on a special scale of 2 inches to the mile.

Notable sections surveyed in the Pacific division are the oil-belt region extending from Coalinga to Mount Hamilton, in California, where the surveyors are still in the field; the Crater Lake National park and the Eugene quadrangle in Oregon; the Carson Sink quadrangle, an area of 3688 square miles in Nevada including the larger part of the Truckee-Carson project of the Reclamation Service; and the Flagstaff quadrangle, Arizona.

In the Rocky mountain division, the Breckenridge Special quadrangle in Colorado, was mapped, and a tablet was set on the summit of Pikes Peak, correcting the mountain's elevation. In New Mexico, 25 miles of the Fort Bayard military reservation was mapped on a large scale with a 10-ft. contour interval. A survey was also made of the Fort Missoula reservation, on a scale of 4000 ft. to the inch with 5-ft. contours.

A large proportion of the topographic work has been done by the Survey in coöperation with States, which pay one-half the cost of the work. The total amount so contributed by the various States is approximately $100,000; the States contributing are California, Mississippi, Illinois, Iowa, Kentucky, Maine, Maryland, Michigan, Missouri, New York, Ohio, Oregon, Pennsylvania, West Virginia, North Carolina, and Virginia. In Mississippi the drainage commission, which is the agency of coöperation, is paying the bulk of the cost. Forest fires in various parts of the country interfered considerably with the map making, the Survey's loss in field work by reason of smoky conditions amounting to about $10,000.

Mine Explosions and Rescue Work

While the National Conservation Commission and others have been educating the public to the fact that there are enormous avoidable losses in the natural resources of the United States, the Technologic branch of the Survey has been quietly demonstrating that many of these losses may be stopped. The investigations made have tended to show not only the waste of natural resources in the mining and consumption of coal, but also the terrible loss of life in this industry. A notable event in 1908 was the opening at Pittsburg, Penn., of the experiment station, established for the purpose of investigating the causes of mine disasters. This station had been in operation for several months before its formal opening early in December and the experiments made there have already shown that many mine disasters can be prevented. At this station, it has been demonstrated conclusively that coal dust is as dangerous an explosive as firedamp. The possibility of coal-dust explosions has been a mooted question among miners, and its solution will go a long way toward reducing fatal accidents in the mines. It has also been shown that many of the "safety" explosives are not safe. The Survey's purpose is to standardize these explosives, so that when a miner explodes a charge of powder he will have some definite idea of what it will do. This too cannot fail to result in a reduction of accidents, and it also means the saving of much coal, as the use of improper explosives makes a great deal of unnecessary slack and dust. An important feature of the experiment station is the gas-filled room where miners equipped with oxygen helmets are being trained in rescue work. Mine owners have been invited to send picked squads of their men to the testing station, where they are taught how to work with helmets. This should unquestionably result in a further saving of life.

Utilizing Fuel Waste

In trying to decrease the waste of coal, interesting experiments are being carried on at the Survey's fuel-testing plant at Pittsburg. This plant is now being successfully operated on "slack" coal costing 88c. per ton delivered and on "roof coal," which is usually left in the mines. These experiments show immense possibilities in the use of fuels and add a considerable amount to the usable coal reserve. The coals are burned in scientifically constructed furnaces, without smoke, and in this way the Survey is furnishing an object lesson to the entire country. Manufacturers and engineers are watching the experiments with keen interest, and in many plants improvements in the coal-burning apparatus are directly attributable to the Survey's pioneer work.

At the fuel-testing plant at Denver, Colo., investigations have proved that practically all the coals of the Rocky mountain fields, when they are washed and are properly treated in the process of coking, will produce coke that can be used for metallurgical purposes. This was not known and, in fact, was not believed before the Geological Survey took up these investigations. The big metallurgical interests were at that time sending East for their coke.

Testing Building Materials

At the structural-materials laboratories at St. Louis, Mo., tests of the strength of the different materials of construction and of the fire-resisting qualities of these materials were continued throughout 1908 and the deductions therefrom given to the public. These tests indicate the possibility of so reducing the amount of material used in public buildings and structures made wholly or in part of reinforced concrete that the cost may be reduced 10 per cent.; for, owing to the present lack of knowledge of the behavior of concrete and of reinforced concrete, high factors of safety involving the use of excessive quantities of material are now necessary in designing structures of this material. The establishment of a fully equipped laboratory at Pittsburg for investigating the chemical and physical properties of clays and clay products has already proved to be of value to the Government in connection with its purchases of such materials.

The nominal strength of detonators, at least those used in Western Australia (E. A. Mann, chief inspector of explosives for that State, *Journ.*, Chamber Mines, West Australia, July 31, 1908) is not rigidly adhered to in manufacture. Missed holes in mines, therefore, may be caused by the detonator cap, for probably the caps furnished in Western Australia, where explosives are rigidly examined, are of at least as good grade as those furnished elsewhere

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The Ural coal production for the first half of 1908 is given in the *Torg. Prom. Gazeta* as 24,577,914 poods against 21,158,845 poods in the same period of 1907.

The Turquoise Mining District, Arizona

By James M. Platt*

The Turquoise mining district is nine miles south of Pearce, Arizona; as it is a highly mineralized area, the camp is rapidly coming into prominence as a future producer of copper. The geology of this part of Arizona has not been mapped, at least so far as I know; consequently I will roughly indicate the geological features of the vicinity. Starting from the granite of the Dragoon mountains, about four miles west of the present active camp, and going east, the general order of occurrence of rocks is: Granite; quartz-porphyries traversed by iron-stained quartz lodes and forming a belt about three miles wide; a range of hills about half a mile wide of rock locally called quartzite, but which I think is quartz-diorite; a limestone belt varying in thickness, but averaging about 1500 ft., in which are the Leadville and the old Great Western mines; a belt of quartzite or quartz-diorite, from 100 to 400 ft. wide; limestone of Carboniferous age about 1500 ft. wide; from there into the Sulphur Spring valley dioritic porphyries.

Taking the different belts in the same order I will describe the work done in each. The vein country (quartz) is entirely undeveloped, although located. In the main ridge of quartzite some turquoise has been developed. On the first quartzite-lime contact, large bodies of sulphide ore have been developed on the 200- and 300-ft. levels of the Leadville mine; most of this ore carries from 3 to 5 per cent. lead and some of it assays from 8 to 12 per cent. This is a stock company, having a capital stock of 600,000 shares of a par value of $1. The stock is held almost entirely by local people, and has not been handled by any outside promoters. In the lime country east of the contact this company has also developed several small veins of galena. Adjoining the Leadville property on the south and on the same quartzite-lime contact is the old Great Western mine. This property has in the past produced over $250,000 worth of sulphide and carbonate ore, all from above the 300-ft. level, but during the last three or four years it has produced very little ore.

Next to the east in the first lime belt is the property recently bonded by Martin Costello to the Copper Queen Consolidated Mining Company for $200,000. In this property good carbonate ore has been developed from a shaft 250 ft. deep; the mine is now being studied by the Copper Queen engineers.

On the next lime-quartzite contact the Calumet & Arizona Mining Company has several claims bonded; in them it has developed large amounts of carbonate ore. The Great Western property extends to this contact, and some fine carbonate ore has been developed from that company's shaft. It is reported that the Calumet & Arizona company has taken over the Great Western property at a price of $750,000, but I am unable to obtain exact information.

In the lime belt just east of this last contact there is a big "iron blowout," or gossan, covered by the Maid of Sunshine claim; under this gossan a large amount of carbonate ore has been developed. This claim together with its north extension is owned by the Leadville company, but has been bonded by them to the Calumet & Arizona company for $200,000; $10,000 being paid at the time of signing the option. South of the Maid of Sunshine and adjoining the Great Western property on the east are 20 or 25 claims in lime country with several good gossan cappings. These have been bonded by D. W. Brown and his brothers, to the Copper Queen company for $200,000.

Many other claims in the camp have been changing hands, and people are talking of town sites. There are several good locations available, but as yet almost everyone lives in a floored tent near the various operations. Many men come to the district seeking work, but few are put on. Development is being pushed by the three main companies, and at present all the ore comes from this development work, for all are waiting the advent of a railroad. A railroad can be easily built either from Pearce, whence a line runs to the Southern Pacific, or from Douglas, about 34 miles to the southeast. As is well known, the Copper Queen and Calumet & Arizona smelters are in Douglas, on the El Paso & Southwestern railroad. It, therefore, is more probable that a branch will be built from Douglas rather than from Pearce into the Turquoise district. This branch would be very easy of construction, as it would pass through a smooth valley, the only difficulty being to provide for drainage in the rainy season.

The name of this camp is in debate. The original locators stick for "Leadville," but the Calumet & Arizona company calls its little town "Courtland."

*Mining engineer, Tombstone, Arizona.

The Cement Industry in 1908

The following statement regarding conditions in the American portland cement industry during the year 1908 has been prepared by Edwin C. Eckel for the U. S. Geological Survey. Although detailed figures are not yet obtainable, an estimate based on the information available indicates that the production of portland cement in the United States was somewhat less than forty million barrels. This compares as follows with the output of recent years: 1905, 35,246,812 bbl.; 1906, 46,463,424; 1907, 48,785,390; 1908 (estimated), 40,000,000.

The falling off from the 1907 output was heavy, and is particularly notable because it is the first decrease shown in any year by the American cement industry since its inception. The decrease was not uniformly distributed throughout the country, for New York, Pennsylvania and New Jersey will probably show the highest percentages of loss, while in some portions of the West and the Middle West the decrease was relatively slight.

During the year several small companies went into the hands of receivers and the financial stress also led to a change of control in a group of plants operating chiefly in the Pacific States. A fortunate effect of the depression was that it put a stop, temporarily, to the flotation of fraudulent or doubtful cement securities; though with improvement in general business conditions it is likely that promotion schemes will again be taken up on an even larger scale than before the depression.

The year 1909 opens with heavy stocks of cement on hand at most mills, but with good prospects for a steady, though slow, revival in the cement trade. It is unlikely that this revival will be sufficiently rapid to push mills to their capacity during the year, and it is, therefore, possible that the high record for output made in 1907 will remain unbroken for another year at least. The total maximum capacity of existing plants is now about 60,000,000 bbl. a year. Despite the business depression, or perhaps partly because of it, there were a number of important technical and industrial developments in the cement industry during 1908, and others are still pending.

C. O. Schmitt (*Journ.* Chem., Met. and Min. So., of South Africa, July, 1908) suggests that at mines where, during part of the day, as for instance, when blowing out powder smoke between shifts, compressed air is used for ventilation, the low- and high-pressure cylinders should be arranged so that at such times each cylinder can exhaust directly into the air main. This would, in most cases, add 50 per cent. to the volume of air delivered into the main, and where a certain amount of air must be supplied the coal consumption would be reduced one-third. The air, as it passes through only one cylinder, would be less contaminated with oil.

The capacity of the De Bavay process plant at the North Broken Hill mine, New South Wales, according to *Aust. Min. Stand.*, June 3, 1908, is being increased to 1500 tons.

The South Lorraine Silver District, Ontario

A Partially Developed District Which Promises Future Importance; Prospecting on 10 Claims Shows a Geology Similar to That of Cobalt

BY WILLIAM B. PHILLIPS*

The unsurveyed portion of Lorram township, east and southeast of Cobalt, which is known as South Lorrain, is the scene of considerable activity. The district is best reached from Haileybury by boat on lake Temiskaming, but when navigation has closed it is accessible over the winter road from Haileybury, by way of the Green-Meehan, Martineau bay and the old mission. From Haileybury, by boat, the distance is about 22 miles, the trip occupying 2½ to 3 hours. The landing place on the lake is known as Silver Center, near which the Government dock is being built, with promise of completion next summer. There is a private dock, a mile below, known as Maloney's.

From Maloney's there is a fair road into the heart of the new district, 4 miles west, and another road from the Government dock, or "666," as it is called. The country rises rapidly from the lake and reaches an elevation of 500 to 600 ft. above the lake in a distance of 4 miles.

Geology

Roughly speaking the new district is in the contact between the diabase (and gabbro) and the series known as Keewatin, the oldest recognized formation. The Keewatin here is characterized by the usual greenstones, quartzites and conglomerates that distinguish it in the Cobalt district proper, 20 to 25 miles northwest. On the lower road, from Maloney's, diabase and gabbro principally are seen, while on the upper road, from the Government dock and Sullivan's, the rocks are, for the most part, Keewatin. The line of contact runs between these two roads and may be seen near the properties known as the Williams, Keeley, Elkhart, Emerick, Haileybury Silver, etc., and generally to the west of Loon lake.

The Principal Claims

Active work is now in progress on the following properties, all within 1½ miles of each other: Jowsey (now known as the Keeley mine), Haileybury Silver, Keeley, Gibson, Ferneri, Taylor, Nugget, Elkhart, Williams and Wettlaufer. The Keeley mine and the Haileybury Silver have about three or four cars of ore sacked and ready to ship. Excellent veins containing smaltite and native silver have also been exposed by trenching on the new Keeley property, west of the Keeley mine. The show place in the district is Wettlaufer's, where a beautiful vein in the diabase and gabbro was uncovered at the bottom of a trench less than three feet deep. This vein is not as wide as the famous Lawson vein near Kerr lake, in the Cobalt district, nor exposed over as great a distance as the native silver vein on the La Rose property, but the fineness of the silver is said to exceed that of either of these localities. It is reported, but I am unable to quote the authority, that in general the quality of the silver from this new district is superior to that from the Cobalt district, and that less smaltite, cobaltite, niccolite, etc., are found. Whether this is true or not it is certain that a more beautiful sight than the Wettlaufer vein, or some of the Keeley and the Haileybury Silver ore would be hard to find.

In this district the silver occurs largely as flattened plates and sheets and appears to run into the wall rock. On either side of the calcite (or calcite and quartz) veins, the wall rock is distinctly worth saving, many of the planes of fracture showing plates of silver. Just prior to my visit a 900-oz. assay had been obtained from an open cut on the Haileybury Silver property and the material did not seem to be so rich, judging from a cursory examination. But a closer inspection showed that it was penetrated by fine plates of silver, very thin and crusted in appearance. These were distributed through the wall rock of Keewatin greenstone having a somewhat slaty structure; they were found not only along fracture planes, but even in the body of the rock itself and not always in any close association with calcite. On the West Keeley property the rock is also Keewatin and here some good specimens carried native silver in quartz.

In fact silver-bearing quartz is more prevalent in this district than in the Cobalt district proper and the association of this mineral with the silver is more pronounced. Some of the calcite and quartz veins carry galena and this is often barren of silver, as is also the pyrite and chalcopyrite associated with the galena.

It is a curious circumstance (proved, however, by more than one prospecting pit) that the bedrock on top of some of the hills is covered to a depth of to to 20 ft. with earth carrying loose and rounded boulders. On the slopes of some of the hills the bedrock is much nearer the surface than on the summits, but this may be due to greater erosion below the summits. This seems to be more especially the case where diabase and gabbro are the rocks in place. The Keewatin hills do not appear to carry so heavy a cover of earth, etc.

After the ice on lake Temiskaming has become thick enough for travel and when the winter road from Haileybury is open for traffic, shipments from this new district may probably attract attention to it.

Fuel, Timber and Power

The district is fairly, although not abundantly, timbered and there is no lack of water. The winter is severe, requiring snug camps and plenty of wholesome provisions. Those who own claims and wish to develop them are strongly advised to build camps early and gather and pile wood for fuel and timber for mine purposes. The forest fires that swept through that region during the last summer did little damage to mine timber, but they caused much of it to fall. The timber is scorched and blackened, but the heart is still sound and the "lumber jacks" are hard at work, securing all they can get. In the case of fallen timber it seems to be "first come, first served." The result will be that in addition to the standing pine which the lumbermen are entitled to, they will take everything they can find. Next spring when camps are to be built and timber must be provided for development work, etc., some of the claims will have difficulties.

Of interest in connection with the further development of the district is the power plant on the Montreal river that proposes to pipe air to the mines around Cobalt. A great deal of money has already been expended on this undertaking and it is now said to be so far along as to warrant the expectation that the power will be available next summer. This new district is much nearer the power plant than is Cobalt and it may be able to secure power at a lower cost. If, however, this should not be the case there is a fine waterpower at "The Notch," near the mouth of the river, that could be utilized either for compressed air or for electric power. It is not more than 7 miles from the Notch to the heart of this district. Cheap power would greatly aid the development of this district. It would solve the question of water supply, by no means an unimportant one even in this land of lakes and rivers.

Prospecting

A large amount of work, especially trenching, can be carried on during the winter to better advantage than during the summer or fall. There is much less trouble

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from water and the ground being frozen, stands better. Trenching is characteristic of the Ontario silver regions and is necessary. While the general course of the veins may be known—in this district they bear northeast-southwest—there are other veins that run north-south and east-west. Each promising "draw," or depression, must be prospected by trenching and pitting and a well opened property looks like a freshly plowed field. A prospector in the Cobalt district put the matter well when he said that a bucket of water and a broom were as necessary as a pick and shovel. Not every crack is worth investigating, but, as a rule, every fissure that shows calcite, especially if Cobalt bloom is present, should be opened. Cobalt bloom (hydrous arsenate of cobalt) is usually associated with silver. It is to be regarded as a more positive indication than annabergite (hydrous arsenate of nickel) and wherever it is found in association with calcite considerable work is warranted. The mud seams that lie next to the wall are also of importance in this connection. These are generally of a red-brown color and have a pasty consistency; they may go down to a considerable depth. Some of them carry considerable native silver and they are by no means to be neglected. On panning this mud many small fragments of wall rock and calcite are found with grains of yellowish sand and black iron sand. The silver in this material is nearly always badly corroded; the little nuggets are eaten into and the plates are honeycombed. These mud seams sometimes afford beautiful specimens of Cobalt bloom and nickel bloom, the former in radiating clusters of needle-like crystals of an exquisite rose color. While native silver is the chief ore of this new district yet argentite is also present and some cobaltite, smaltite and niccolite are also silver-bearing.

This district is likely to come into prominence as a silver producer within the next 12 months. It is easily accessible, has favorable geological conditions and is a promising field.

The Washoe Smelter

The accompanying illustration of the Washoe smelter of the Anaconda Copper Mining Company shows all the departments of this enormous plant. Its chief supply of ore is obtained from the mines of the Amalgamated and subsidiary companies at Butte, Mont. The plant has a capacity of 10,000 tons of ore per day, and is the largest of its kind in the world. The illustration tells its own story.

WASHOE SMELTER, ANACONDA COPPER MINING COMPANY, ANACONDA, MONT.

Shaft Sinking Through Faulted Ground

C. B. Saner (*Journ.*, Chem., Met. and Min. Soc. of South Africa) gives an account of how, at the Turf mines, sinking through heavy cross-faulted ground was accomplished. The shaft in question is a seven-compartment one, and the bad ground was encountered at about 2650 ft. According to a custom of the region the shaft was sunk with the long axis across the formation. This gives greater strength, no long ledges of rock being exposed on the strike as in the case when the long axis is parallel with the strike of the formation.

The method of sinking employed was as follows: Six-foot timber sets were used, bearers or foundation girders being placed under each end piece and every alternate divider or vertical at about 100-ft. intervals. When the running ground was encountered 5 ft. sets were substituted. The faults, being nearly vertical, caused the rock to scale off continually. Finally a set of three bearers, 9 in. wide under the end pieces and 7 in. wide under the dividers by 27 to 36 in. deep, all firmly wedged into hitches cut from 1 to 4 ft. deep were placed to take the weight of the timbers. A floor was built upon these, leaving only the hoisting compartment open; the shaft was then lined to near the top of the caving ground, and waste, hoisted from below, was filled in behind the lagging.

When more bad ground was encountered farther down three diagonal supports were placed below and supporting the bearers; two of these were 36 in. deep, the other only 24 in. They were set in cement in hitches cut about 5 ft. in the wall of the shaft and were, of course, made to fit as nicely as possible for they had to clear the steel guides. These cross-braces served to hold the worst part of the wall. Sets at 3-ft. centers, close lagged with 3-in. material, and with extra blocking behind every divider, firmly wedged in place and afterward filled in behind with waste, were continued until good, solid walls were again met.

This sinking was slow, for the timber had to be kept within 6 ft. of the bottom of the shaft, thus necessitating careful blasting and working of the bottom. The result justified the trouble taken and the work, now completed, is in good shape.

Pyrites in 1908

By J. J. Rutledge*

Conditions in the pyrite trade during the year 1908 were very much better than for the preceding year, and indeed much better than the outlook at the beginning of 1908 seemed to promise. Shipments were much larger than during the preceding year, and, as the market will only absorb a certain amount of pyrite, prices were cut to a considerable extent in order to get the business. Moreover, as the demand was not materially greater than during 1907, prices could not be maintained, and considerable cheap material was sold. It is hardly probable that 1909 will experience as low prices as the past year, for in 1908 several of the mines in Canada and the United States sold their product very nearly at the cost of production.

Generally the acid manufacturers make contracts for three or more years in advance, in order to insure them a constant supply for their furnaces; this fact has helped to tide over what would otherwise have been a bad year, for some of the producers. Unfortunately several of the largest contracts expire at the beginning of 1909, and, owing to present market conditions, as well as the recent money panic, the acid makers are not in a hurry to make new contracts, feeling sure that they will be easily able to secure sufficient supplies for their use no matter what new developments may appear in the market.

The Tennessee Plant

The close of the year finds the pyrite miners and acid manufacturers anxiously watching the developments at the new acid plant of the Tennessee Copper Company, at Ducktown, Tenn. The 1000-ton acid plant, recently put in operation at this plant, has caused considerable apprehension. The fact that the Ducktown Company has also under way an acid plant equal in capacity to that of the Tennessee Copper Company, has caused the acid men to delay in making new contracts for pyrites, thinking that they may ultimately be able to secure acid from the Tennessee company at such a price that they will not be under the necessity of making their own acid.

The formation of a new fertilizer combination to take over the plants which were not taken over by the two preceding combinations, to utilize the acid made by the Tennessee company, does not seem to progress rapidly, doubtless owing to the fact that the terms offered some of the largest independent producers for their plants, does not seem attractive to them. While ultimately, to be sure, the large production of acid by the copper company, will greatly cheapen acid, and correspondingly demoralize the market for acid, still it is not thought that this will occur for some time, as the company would have little to gain by such a course. The cheapening of acid will have a stimulating effect on all industries which employ chemicals. Especially will it benefit the farmer, for he will ultimately secure cheaper fertilizers. The fact that such States as Wisconsin, Illinois and Ohio are now commencing to use fertilizers, is of great importance. The field for the fertilizer manufacturer of the future is the Middle West, and some manufacturers are already planning to erect plants at such points as St. Louis.

Another probable effect of the reduction in the cost of acid will be that many small manufacturers of fertilizers, located in the farming districts, will purchase the cheap acid from the large acid makers and mix their own fertilizers. This has heretofore been done in a small way, and the advent of cheaper acid will doubtless result in more of this sort of manufacture.

The zinc smelters in the Middle West, who make acid as a by-product, and who have usually heretofore disposed of their surplus in the Southern States, will now, of course, be compelled to dispose of their product elsewhere, since the copper company will supply this market. The erection of fertilizer plants at such points as St. Louis, will operate to the advantage of the zinc smelters.

While the Tennessee company will doubtless control the market for acid in the Southern States, and may even displace considerable Spanish pyrite at Gulf and Atlantic points, freight rates will not permit of its shipment north of the Ohio river. It is cheaper to transport pyrite than acid, and this fact will limit the markets of the new acid plant.

It is not certain that the present acid makers would be willing to dismantle their plants and depend wholly upon the new works for their supply of acid, since such a course would place them wholly at the mercy of the large acid producer.

Effect on Pyrite Miners

It is a singular fact that those pyrite mines which have always held securely a certain local market adjacent to themselves, seem more strongly intrenched than ever, for only in one or two instances does the new order of things in the acid business affect them.

The recent developments in pyrite mines are in Canada and Georgia, the former, as in past years supplying a high-grade material, shipped mostly as lump, while the latter is producing almost altogether fine mineral. At every mine methods of mining and concentration are being constantly improved, and the cost of producing gradually lowered. Breaking is gradually coming to be done by mechanical means instead of by hand, the Blake type of crusher being used at some mines, while at least one new plant is using a Gyratory crusher.

The outlook for 1909 is not very encouraging, since producers of acid are not inclined to make forward purchases, but it is thought that the market will ultimately work out satisfactorily.

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Bogus Mining Experts

Employment by the U. S. Geological Survey, for even a short time or in any capacity, appears to have a commercial value that is rated high, says that organization in a recent press bulletin. Even the cooks and teamsters of the field parties refer proudly to their connection with the Survey and reap the reward of popular credit that attaches to their public service.

The advertisement of such connection after it ceases, however, has sometimes been the source of trouble or embarrassment to the Survey, especially where it is used for the furtherance of doubtful mining schemes, and the Survey desires to give emphasis and wide publicity to the fact, now fairly well known, that no member of its scientific corps is allowed to do private professional work in the United States during the period of his employment. The public is warned to look carefully into the statements and the standing of any practicing mining engineer who advertises present connection with the Survey.

The fact that the staff of the Geological Survey is not composed exclusively of geologists is too often overlooked. Of the 1200 or more persons connected with it in 1908, not more than 10 per cent. are geologists, and not more than 1 per cent. are engaged in work whose character implies ability to determine the merits of a mining prospect of enterprise.

Flotation Process Litigation

In the case of the British Ore Concentration Syndicate, Ltd., and Alexander Stanley Elmore *vs.* The Mineral Separation Company, Ltd., Justice Neville, of the High Court of Chancery, pronounced judgment to the effect that the Mineral Separation Ltd., was not infringing the patents of the plaintiff. The latter appealed from this decision. The Lord Justices of the Court of Appeals rendered judgment Dec. 2, 1908, to the effect that the Mineral Separation, Ltd., was not infringing the patents of 1898, but was infringing the patents of 1891. The case will now probably go to the House of Lords, which is the final court of appeals.

It is not always an advantage to connect several mines, since the farther air travels through mine workings the more it becomes vitiated.

The London Silver Market in 1908

The following concise review of the market in London, where most of the silver produced in the world is handled, is made by Messrs. Pixley & Abell, of that city.

The Course of Prices

The heavy fall in silver, which took place toward the close of 1907, was followed during the opening months of this year by a reaction, due chiefly to large purchases for the Indian bazaars, and during January the quotation rose to 27d., the highest of the year, an advance of 2⅝d. from the closing price of 1907. This steadiness continued until the beginning of April when weakness again set in, and from that time the tendency of the market, with the exception of a temporary advance in June, was downward until December 2, when 22d., the lowest quotation of the year, was touched. From this point the market steadily improved until the end of the year, when the closing quotations were 23 3/16d. for spot and 23⅛d. for forward silver. Important purchases for China and some buying for India, where the position has of late become more satisfactory, account for this sharp advance during the last few weeks. The average price for the whole year is 23 13/32d. per ounce.

Shipments to India

Shipments to the Indian bazaars were throughout the year on an unusually large scale. The net imports, chiefly from this country, into India probably amounted to 70,000,000 oz. against 44,500,000 in 1907, and 32,750,000 in 1906. This demand may to a great extent be attributed to a desire on the part of the natives, attracted by the low prices, to convert their hoards of rupees into bar silver, and this action has doubtless been partially responsible for the increase of rupees in the Indian treasury. There were an unusual number of marriages during the early part of 1908, as in July commenced a period which will extend until October, 1909, and which is considered by the Hindoos to be unpropitious for matrimony, and this fact doubtless stimulated purchases during the earlier months. The cheapness of silver has also probably conduced to the purchase of this metal instead of gold, of which only about £3,100,000 in bars has been sent to India in 1908, against £5,700,000 in 1907, the difference representing in silver some 25,000,000 ounces.

Indian speculators have during the last six months operated largely both in London market and Bombay. Though these speculative accounts have not yet been liquidated the immediate result has been to transfer large amounts of silver from London market to Bombay, where, in spite of some substantial purchases for China, the stocks are still heavy, amounting, it si estimated, to nearly £400,000, while in addition there are £840,000 now in transit.

The Indian Government made no purchases during 1908. Its holdings of rupees have largely increased and amounted at the beginning of December, when the highest point was reached, to about 29 crores in the paper currency reserve and to 18½ crores in the gold standard reserve. Since then, owing to the opening of the export season, the paper currency reserve has fallen to just under 28 crores (£18,500,000), and the gold standard reserve to 18 crores (£12,000,000). At the commencement of the year the Government's holdings were 21 crores (£14,000,000) in the paper currency reserve and 6 cores (£4,000,000) in that of the gold standard. Under these conditions the prospects of further purchases during the coming year are rather remote. To coin 1 crore of rupees requires 3,437,500 fine oz. silver. As 15 rupees equal £1, a crore of rupees equals £666,666⅔.

Chinese Buying and Selling

Though China has at times been a seller, and has shipped about £220,000 in sycee to London for sale, yet she has, on the whole, been a considerable buyer. The low exchanges ruling in China have greatly stimulated the export trade, and adversely affected the import trade so that the banks have been forced to buy silver as cover for or as a hedge against their exchange operations. Part of these purchases have been shipped to China, but a large amount is still under the control of the China banks. Whether this will be re-sold or shipped to China remains to be seen. In addition to her purchases in London, China has bought fair amounts in Bombay and has as well received regular shipments amounting to about £1,000,000 from San Francisco. An important feature in the future will be the effect of the prohibition of the import of opium into China, should this result from the recent efforts to suppress the use of this drug. Unless the import of other commodities should greatly increase, it would seem probable that China will be a still more important buyer of silver than heretofore.

In Shanghai the stock of sycee is unusually heavy, amounting to about 19,000,000 taels, while in addition there are 10,000,000 Mexican dollars.

Mint Buying

A convention was signed in November by the members of the Latin Union whereby it has been arranged to increase the circulation of subsidiary coins from 12 to 16 fr per head of the population. This convention comes into force on April 1 next, and the increase is to be made at the rate of 60 centimes per head per annum. There are also provisions to allow Italy and Greece, where the circulation is now below 60 centimes per head, to bring the circulation up to that amount. As a large part of the silver required will be provided by re-coining five-franc pieces, or coins of similar value, the amount of new silver required will be unimportant. Excepting 5000 kg. bought during December, the Paris Mint made no purchases by tender in 1908. Silver, however, was brought for French account during the earlier part of the year, and this presumably was required for colonial coinage. Switzerland has been a moderate buyer at times, while Portugal bought £250,000 in October.

In Germany a bill has passed the Reichstag for the purpose of increasing the silver currency of the country by 5 marks per head during the next five years. This is estimated to require about 1,250,000 kg. of silver; but so far, we understand no purchases have been made.

During November, the Mexican Government offered to buy 5000 kg. monthly for currency purposes.

Effect of Low Prices

The low average price of silver, which has ruled during the last 15 months, has, no doubt, caused some diminution of production. Where ores are mined principally for copper, lead or other metals, and silver is but a by-product, low prices for silver can have had little effect, but many of the poorer mines, especially those which depend mainly on the production of silver, have certainly reduced their output. Against these reductions must be set the increased production from the Cobalt district of Canada, but it is probable that, when reliable figures are available, the world's production will show some decrease.

The Future

With silver at low level—almost down to that of 1902-3, when 21 11/16d. was the lowest quotation touched for spot silver—it becomes interesting to review the present situation and consider the prospects for the future. Though the Indian government is unlikely to be a buyer for some time to come, and though China has unusually large holdings of silver, the larger offtake by the Indian bazaars and the possible falling off in production will, in all probability, suffice to prevent any further material decline. Much, however, will depend upon whether China resells any of the silver under her control in London, or whether fresh purchases are made on her behalf.

An alloy of iron, cerium and lanthanum will give off luminous sparks when struck with steel, the sparks being capable of igniting illuminating gas. The behavior of this alloy varies with the percentage of iron, the maximum sparking effect being observed when the iron is about 50 per cent. The sparking phenomenon is brilliant.

Standard Oil Companies

The following list of companies controlled by the Standard Oil Company of New Jersey, the most complete list of the kind ever made available for public inspection, was compiled by the New York *Sun* from the exhibits made in the present proceedings of the Government against the company:

I. COMPANIES WHOSE STOCK IS OWNED DIRECTLY BY THE STANDARD OIL COMPANY.

Name.	Total Capital Stock.	Per Cent. Owned by Standard.
Anglo-American Oil Co., Ltd.	$5,000,000	100
Atlantic Refining Co.	5,000,000	100
Bedford Petroleum Co.	350,000	99.3
Borne-Scrymser Co.	200,000	99.9
Buckeye Pipe Line Co.	10,000,000	100
Carter Oil Co.	2,000,000	100
Chesebrough Mfg. Co.	500,000	55.5
Continental Oil Co.	300,000	100
Colonial Oil Co.	250,000	99 7
Crescent Pipe Line Co	3,000,000	100
Clarksburg Light & Heat Co.	100,000	51
Deutsch - Amerikanische Petroleum Gesellschaft	2,250,000	100
Deutsch - Amerikanische Petroleum Gesellschaft (share warrants)	5,250,000	99.9
Empire Refining Co.	100,000	78 5
Empreza Industrial de Petrollo	500,000	70
Eureka Pipe Line Co	5,000,000	100
Forest Oil Co.	?	?
Gilbert & Barker Mfg. Co.	40,000	100
Galena Signal Oil Co., pfd	2,000,000	74 4
Galena Signal Oil Co., com.	8,000,000	70
Hazelwood Oil Co.	?	?
Hope Natural Gas Co	500,000	100
Indiana Pipe Line Co	1,000,000	100
Interstate Cooperage Co	200,000	100
Lawrence Natural Gas Co.	450,000	100
Mahoning Gas Fuel Co	150,000	99 9
Marion Oil Co.	100,000	50
Mountain State Gas Co	500,000	100
National Transit Co.	25,455,200	99 9
New York Transit Co.	5,000,000	100
Northern Pipe Line Co.	4,000,000	100
Northwestern Ohio Natural Gas Co.	2,775,250	59 4
Ohio Oil Co.	10,000,000	99.9
People's Natural Gas Co	1,000,000	100
Pennsylvania Lubricating Co	50,000	60
Pittsburg Natural Gas Co.	310,000	100
Romano-Americana	2,500,000	100
Reserve Gas Co.	2,225,000	50
Raffinerie Française	80,000	100
River Gas Co.	190,000	52 6
Solar Refining Co.	500,000	99.8
Southern Pipe Line Co.	10,000,000	100
South Penn Oil Co.	2,500,000	100
Southwest Pennsylvania Pipe Lines	3,500,000	100
Standard Oil Co., California	17,000,000	99 9
Standard Oil Co., Indiana	1,000,000	99 9
Standard Oil Co., Iowa	1,000,000	100
Standard Oil Co., Kansas	1,000,000	99 9
Standard Oil Co., Kentucky	1,000,000	99.9
Standard Oil Co., Nebraska	600,000	99 9
Standard Oil Co., New York	15,000,000	100
Standard Oil Co., Ohio	3,500,000	99 9
Swan & Finch Co	100,000	100
Underhay Oil Co	25,000	98 8
Union Tank Line Co	3,500,000	99 9
Vacuum Oil Co.	2,500,000	100
Waters-Pierce Oil Co	400,000	68 6
West India Oil Refining Co.	300,000	50
West Virginia Oil Co	200,000	50 6
West India Oil Co	100,000	99 3
Washington Oil Co	100,000	71 4

II. COMPANIES WHOSE STOCK IS OWNED PRIMARILY BY SUBSIDIARY COMPANIES.

Amerikanische Petroleum Anlagen	187,500	100
Automaat Co.	10,000	100
Eschweiler Petroleum Import	7,500	25
Ghent Petroleum Co	200,000	60
Hollandsche Petroleum Vereeniging	12,000	100
Mannheim Bremer Petroleum Actien Gesellschaft	750,000	100
Petrolifere Ghent	20,000	74.5
Petrolifere Nationale	10,000	100
Petroleum Raff. vorm August Korff	375,000	54 6
Societe Anonyme H. Reith Co	412,500	61
Rheinische Petrol. Actien Gesellschaft	250	100
Street Tank Wagon Business-Duren	4,250	71
Actien Gesellschaft Atlantic	287,500	60
American Petroleum Co.	3,140,000	51.3
Gibraltar Petroleum Co.	25,000	100
Imperial Oil Co., Ltd.	1,000,000	83.1
Det Danske Petroleums Aktieselskab	756,000	51 3
Tidewater Oil Co.	20,000,000	31.1
Tank Storage and Carriage Co., Ltd., pfd	300,000	100
Tank Storage and Carriage Co., Ltd., ordinary	12,195	100
Societa Italo-Americana pei Petrolio	1,000,000	60
Aktieselskabet Ostlandske Petrol. Cie.	162,000	9 2
Krooks Petrol. and Olje Aktiebolag	270,000	10
Skanska Petroleums Aktiebolaget	135,000	60
Svenska Petroleums Aktiebolaget	27,000	75
Sydvenska Petroleums Aktiebolaget	98,550	24.7
Vestkustens Petroleums Aktiebolag	177,500	15.3
Koenigsberger Handels Compagnie	575,000	49 8
Petroleum Import Compagnie	80,000	100
Schweizerische Petroleum Handels Gesellschaft	60,000	60
Societe Anonyme Petrolea	80,000	66.5
Wachs. & Flossner Petrol. Gesellschaft	25,000	100
Westphalische Petroleum Gesellschaft	25,000	100
S. T. Baker Oil Co.	50,000	100
Galena Oil Co.—Société Anonyme Française	40,000	100
Queen City Oil Co., Ltd.	200,000	87.4
Connecting Gas Co.	825,000	49.9
Cumberland Pipe Line Co	1,000,000	99 9
East Ohio Gas Co.	6,000,000	100
Franklin Pipe Line Co.	50,000	39
New Domain Oil and Gas Co	1,000,000	99.9
Prairie Oil and Gas Co	10,000,000	100
St. Paul Petroleum Tanks (Lim.)	250,000	55
Societa Meridionale pei Commercio del Petrolio	120,000	?
Societa per gli Olii Minerali	156,000	52.1
Société Tunisienne des Petroles	80,000	65
International Oil Co., Ltd.	2,750,000	99 4
Vacuum Oil Co., Proprietary Limited	500,000	100
Vacuum Oil Co., Reszvenytarsasag	2,100,000	100
Vacuum Oil Co., Limited	275,000	99 9
Vacuum Oil Co.—Société Anonyme Française	400,000	100
Deutsch—Vacuum Oil Co.	625,000	100
Vacuum Oil Co.—Societa Anonyme Italiana	100,000	100
Vacuum Oil Co.—Aktiebolag	27,000	96 6
Taylorstown Natural Gas Co	10,000	70
Total	$229,963,195	
Standard Oil Co. of New Jersey	98,338,300	
Grand total	$328,301,495	

Of course to a certain extent the capital stock of the Standard Oil Company of New Jersey represents a repetition of some of the recorded capital stock of certain of the subsidiary companies.

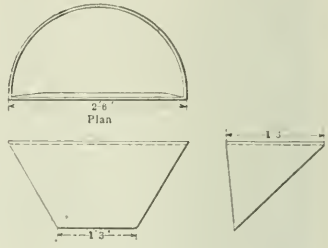
Rhodesian Gold

Completed returns from the Rhodesian Chamber of Mines value the gold production in November at $957,118; a small decrease from October, and a considerable gain over November, 1907. For the 11 months ended Nov. 30, the total value of the production was $9,677,370 in 1907, and $11,235,631 in 1908; an increase of $1,558,255, or 16.1 per cent.

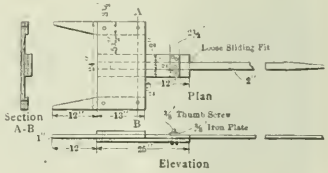
Sampling Devices

In sampling shafts and winzes two devices, described by H. E. Hooper in *Bull.* 49 of the Institution of Mining and Metallurgy, are useful. One is a chair with an adjustable arm projecting from behind so that by means of this arm and a thumbscrew the sampler can secure himself at any point in the winze or shaft. The projections in front serve as the forward braces. The chair is swung by four short ropes from the windlass cable.

The bag for catching samples, shown in an accompanying illustration, is semicircular in shape. The top consists of a semi-circular loop of ⅜-in. round iron to which a canvas bag is sewed so that it falls vertically from the straight edge of the hoop. The semi-circular side is convenient in catching the sample from



SAMPLING BAG



SAMPLING CHAIR

ordinary depressions, the straight side for regular faces, and the corners for acute depressions. When used in conjunction with the chair the bag is attached by a cord from the center of the circular side to the rope above the sampler's head so that when the back of the bag rests against the sampler's knees the bag is horizontal.

In Australia considerable State aid is given to mining. In Western Australia there are 29 State stamp mills and 21 State cyanide plants. Prior to Jan. 1, 1908, 505,286 tons of gold ore was treated, and gold amounting to £2,036,156 was extracted in the stamp mills and £277,166 in the cyanide plants, while tin, valued at £52,915 was obtained from the 31,166 tons of tin ore treated in State batteries. Except for expenditures on additions and improvements, these State batteries were self-supporting.

The Zinc Corporation, Ltd.

This company was organized several years ago to deal with the tailings at Broken Hill, of which it purchased several million tons. H. C. Hoover was largely instrumental in organizing the company and has been its technical director. It was the intention to employ the Potter flotation process, but this proved a failure and the company passed through a series of experimental vicissitudes which carried its fortunes to a low ebb. Under the orders of Mr. Hoover the Elmore vacuum process was finally installed, and from the beginning of its application in 1908 the indications have pointed to success. At the end of 1908 it could be pronounced that both the process and the Zinc Corporation are successes. This is a great, and well-deserved triumph, for Mr. Hoover. In this connection the statement made by him at the annual meeting of the company, last July, is of peculiar interest. In substance it was as follows:

The ore at Broken Hill contains lead, zinc and silver. The mining companies there crush this ore to the fineness of sand and extract from it, by water concentration, about 60 to 70 per cent of the lead and silver contents. The residues from this treatment, which are sent to the dumps, contain, therefore, practically the whole of the zinc and between 30 and 40 per cent. of the original lead and silver in the ore. We have already bought and paid for a million tons of these residue dumps, and we have the right to buy some millions of tons more. The residues we are treating at the present time are those from the Block 10 mine, and they average about 20 per cent. of zinc, about 8 oz. of silver, and 5 or 6 per cent. of lead. We take the residues from these old dumps by our own railway and dump them into large bins which we have prepared underneath the track at our works. From here the material is carried by a belt-conveyer to bins at the top of the mill. Thence they pass to Huntington mills and grinding pans. After this regrinding, the material passes to agitators, where it is mixed with oil and sulphuric acid, and is drawn from the agitators through the Elmore vacuum machines which deliver a mixed zinc, lead, and silver concentrate.

The second stage of the treatment is the separation of the lead from the zinc in this mixed concentrate, making one in which zinc predominates and one in which lead is the principal content. The zinc smelters will pay only for lead in excess of 8 per cent., and then only half the value of the lead. Likewise, they will pay only 1s. 3d. an ounce for the silver over 5 oz. a ton, and then pay for the zinc content at the average price of zinc over the year of purchase, less the cost of shipment to Europe, smelting charges, loss in recovery, and their profits on smelting. Nor will the lead smelters pay for zinc in the lead concentrate. In fact, he penalizes us if we have over 12 per cent. zinc in our lead.

The average contents of the mixed concentrate is about 43 per cent. zinc, 12 per cent. lead, and 16 oz. silver. From this we are now obtaining lead concentrates at the rate of 230 tons per month, and by doing so we have increased the contents of the zinc concentrates from 43 per cent. to 47 per cent. zinc. On our present output, if we sold the mixed concentrate as it stands, we should realize about £3500 less than we do realize by first separating a portion of the lead. On the basis of our last week's output we are earning a net sum of £7000 per month above all expenses, out of which about £3000 should be set aside for cost of tailings worked up, or a net amount of about £4000 per month, or £48,000 per annum profit. I am in this taking metals at the bedrock prices I have mentioned (zinc, £19¼ and lead £12½) and taking working expenses at their average for June.

This profit is, I believe, capable of very important increase from many directions, and it is the directions from which these increases may be anticipated that I wish to make clear. First, the working expenses are always high at the initial stages of a new plant. Although our plant is absolutely mechanical, and no human hands touch the material from the beginning to the end, it takes months to train men and organize them to the best advantage. In this business men have had to be trained from the ground up, as this is entirely a new business in which no men of experience can be obtained. Moreover, we have been buying water, and we shall soon have our own supply for at least part of the year. Our expenses at the start were about 14s. per ton, and for the month of June were reduced to 12s. 3d. per ton. I believe it will be ultimately decreased to 8s. per ton, which would give an additional profit of over £2500 per month. Second, the mill is treating about 13,000 tons per month. I believe that by gradually strengthening the weaker links of the plant this can be increased by 1000 or 2000 tons a month. This would mean an increase in working profit by £500 to £1000 per month. Third, we are obtaining an extraction of over 88 per cent. of the original zinc contents of the residues. This shows an increase from about 72 per cent. the first month. We have obtained in systematic experimental work as high as 92 per cent. extraction of the zinc, so that we may make a minor improvement here, although we have not much room for improvement over present results on this line. Still, an additional 4 per cent. recovery would augment our profits by £500 per month. Fourth, the improvement in treatment of the mixed lead and zinc concentrate is one of the most important matters with which we have to deal, and in which very important possibilities lie. The expectations of Mr. Hoover as to increased profits have already been realized to an important extent.]

The lead extraction from the original residues at present average about 70 per cent. in the Elmore concentrates; but we get out of the mixed concentrates only a part of the lead in them, equal to an actual extraction as final salable lead of only 17 per cent. of the lead in the original material. In experimental work we averaged a recovery of 40 per cent. of the original lead, instead of 17 per cent., as above. We hope eventually to duplicate this in regular operation of the plant. If we do so, the increased profit from the extra lead and the further increased purity of the zinc would, on present tonnage, and at the metal prices I have given, amount to between £2500 and £3000 per month. We have, therefore, a possible increase of the present profit from reduction of expenses of £2500 per month, from increased zinc extraction £500, from increased tonnage £500, and from increased lead extraction £2500—or a total of £6000 per month, or £70,000 per annum, and this without increased price of metals. To do this, or something approaching it, we shall need to lay out £7000 to £8000. To recapitulate, at the present moment we are earning a profit above the cost of the material we treat, and on present low prices of metals, of about £48,000 a year. If we succeed in these technical improvements we shall raise it to over £100,000 per annum. I cannot guarantee that we shall accomplish all this. We have had such results for short periods, and every week since we started has shown some improvement. One thing I can say, and that is, we will accomplish part of it.

A New Vertical Duplex Pump

The Blake and Knowles Steam Pump Works, of New York City, has recently perfected a vertical duplex pump of new design, and small in size, for boiler feed or general work under high pressures. The pump cylinders are of the piston pattern, lined with brass, and the steam cylinders of the company's regular duplex design. The cast-iron cradle or center piece, which ties the steam and water ends together, is extremely rigid. The cylinders are fitted with brackets for bolting the pump to a bulkhead or wall. The pump is suitable for a working pressure as high as 200 lb. per square inch.

When dynamite burns, the chief danger, other than from its liability to explode, is from breathing NO formed by the combustion and which oxidizes in the presence of oxygen to NO_2, the red fumes. Both these gases are very irritating to the throat and air passages of the lungs. Acute bronchitis frequently results from breathing them.

Colliery Notes

When shots are fired by electricity, the button of the battery should not be pressed until a high speed has been obtained in the armature.

In firing shots electrically, many precautions must be observed. The cable, or firing line, should not be allowed to "kink;" it should either be "reeled" and "unreeled," or otherwise carefully coiled. If a "kink" does occur in the firing line, it should not be given a short pull to straighten it out. It should be twisted carefully back again into its straight line; the operator should always remember that much trouble is caused by the wire becoming broken inside the insulation; this is what usually happens when "kinks" are pulled vigorously.

In analyzing the common type of direct-current motor as used today, it is safe to say that the "starter" is a most important part of the controlling apparatus. A good starter should possess the following points: (1) A dead handle or lever so constructed that no current passes through the handle proper. (2) No current should pass through hinged or movable joints. (3) Completely inclosed and fireproof resistances. (4) A frame which cannot become "alive" due to burned out coils. (5) Easy replacement of coils. (6) No soldered connection.

In connecting up the wires, when all shots are fired by electricity, the extremity of the wires should be carefully cleaned by scraping them bright with a knife, laying the extremities across each other, in scissor fashion, and then twisting the free ends over each other a few times. The jointing is very important, for if the connection is made with dirty ends, the external resistance is so increased as to materially affect the firing capacity of the exploding machine. It is also a fact that a clumsily formed joint may be so ineffective as to cause a misfire.

Two English miners have designed a simple invention, with the object of providing greater safety for those riding in the shaft. The scheme is to have two ropes attached to each cage; one of these cables will be the working rope, while alongside of this there will be another rope, slightly longer. If the working rope were to stretch, which would be the case when it approaches the breaking point, then this additional rope would come into operation and take its share of the weight and thus prevent the accident. In case the working rope should break, then the auxiliary rope takes the full weight of the cage and its load. The invention is effective and inexpensive.

Many dangers always attend shaft sinking, and because of the hazardous nature of the work, every possible safety precaution should be observed. In carrying on sinking operations, the foreman should see that all loose stones or suspicious sides are properly timbered or drawn down. This is most important when a shaft is crossing a disturbance, for shafts have been known to collapse after a sharp-angled fault has been crossed. The shots should be fired by electricity, thus minimizing the risk of miss-shots; also they should be fired simultaneously in order to avoid the danger of returning for new connections when firing singly. When approaching a coal seam, it is essential to keep a sharp lookout for firedamp blowers. The engine driver should at all times have full view of the pit.

In the arrangement of "winding signals" from different levels in a shaft, the old system of having a galvanized wire leading from a bell in the engine house and being worked at the different levels by levers, has been almost entirely replaced by the adoption of electrical signaling. In this latter system, a battery of the Leclanche type is suitable, being simple in construction and needing but slight attention. The single-stroke bell is much superior to the trembler bell. The signal wires leading from the bell in the engine house down the shaft, should be properly insulated and be carried down the shaft in grooved boarding; this method is more expensive, but will be found cheaper in the end. The diameter of the insulated wire should be slightly larger than the groove, so that the former can be gently tapped into the groove and covered over by a light boarding. When this plan is followed, there will be no danger of leakage of the current.

It is a matter of great importance to the safety of our miners, that every precaution be exercised when entries or chambers approach old workings. Our mining laws in many States neglect to prescribe rules tending to create greater safety under such circumstances. When an entry is approaching a place likely to contain a dangerous accumulation of water, the heading should not at any point within 100 ft. of that place, exceed 8 ft. in width; it is advisable to further require that at least one bore-hole in the center of the heading should be at least 15 ft. in advance; several flank bore-holes should be drilled on each side. The following signs will sometimes indicate that a heading is approaching a dangerous place: A large number of breaks or cracks are found in the roof, floor and coal; the coal is often discolored to a brown or yellowish hue; an absence of gas in the coal; oozing of water from the strata; lights burn dull, due to the amount of carbonic-acid gas given off from the breaks in the strata.

An investigation of accident statistics, as compiled by the mining departments of several European countries, shows that in recent years, since all explosives have been made to conform to set standards of safety, accidents due to blown-out shots have decreased more than one-half. The question now confronting European coal-mine managers, is concerned with the advisability of using safety lamps exclusively in all underground workings. There are two arguments advanced against the adoption of safety lights: First, the men demand an increase of wages when safety lamps are introduced, and the mine owners raise objection on the score of economy; second, it is contended that the safety lamp does not give so good a light as the naked flame, and that the former, because of its inferor illumination is dangerous to workers because of their inability to see the roof plainly, and thus avoid falls of top and sides. The first objection to the abolition of naked lights is prompted on the part of both miner and operator by their desire for material gain. As to the second argument, the reports of a number of inspectors in districts where safety lamps have been introduced, do not show that the introduction of these lights has increased the number of accidents; on the other hand, the report of one of the inspectors shows that of 184 explosions of firedamp or coal dust, no fewer than 160, or 87 per cent. were attributed to naked lights.

Because coal-mine accidents have left so many widows and children without support, it is being widely suggested that the different States levy a tax on all the coal produced so as to create a relief fund to aid these unfortunates. Among the many schemes proposed, the chief inspector of Pennsylvania has suggested that the State levy a tax of ¾c. per ton on all bituminous coal sent to market or used in the manufacture of coke, and a tax of 1½c. on each ton of anthracite coal sent to market. Anticipating a fair average increase in the production of coal in Pennsylvania during the coming years, this plan would insure the State an annual income of about $1,500,000. Statistics show that on an average, coal-mine accidents in Pennsylvania leave 574 widows and 1316 orphans each year. The Pennsylvania inspector's proposal would insure each widow $100 to defray funeral expenses and a weekly benefit of $2.88 during widowhood; each child under 14 years of age would receive a weekly benefit of $1.92. In addition to furnishing this relief for widows and orphans, approximately $100,000 per annum would be distributed for the succor of disabled miners. The additional cost of production entailed by the adoption of this system would eventually have to be paid by the consumer. The person who consumes ten tons of coal in a year would have an additional expense of about 7½c.; the person who uses 40 tons of coal a year would have an additional expense of 30 cents.

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The U. S. Geological Survey in 1908

The report of work done by the U. S. Geological Survey in 1908, published nearly in full elsewhere in this issue, shows once more the extent to which this organization has abandoned its proper field—the field in which it won its spurs—in order to disport itself in paddocks wherein it has no real business to be. The science of geology and the study of ore deposits are relegated to the background while attention is concentrated upon statistics, water resources, development of water power, mine explosions and rescue work, the testing of building material, etc. Its own statement is good evidence of the commercial spirit that now pervades the Geological Survey.

One reason for this is not hard to find. The results of study of science are generally non-spectacular. To but few is it given to surprise a secret of nature, to discover a new element or disclose a new scientific principle. The work of the multitude of scientists is to add laboriously, brick by brick, to the great structure, generally without any identifying mark that lives. On the other hand, investigation of economic subjects may win immediate applause from the public. Bulletins can be issued to the press, which to more or less extent gives them circulation. The organization is kept constantly before the public eye and so it becomes easier to secure appropriations, which is what the organization wants.

Director Smith means well, but he has not yet been able to shake off the malign influence under which the Survey suffers. At present, his organization has gone mad over what it considers to be economics. The conservation of resources has been hailed as a new idea that promises an expansion of the last appropriation of 1¾ millions of dollars. Learned essays are written about waste that may be prevented, with little or no attention to the economy of doing so. (Such a sober consideration would seldom lead to the spectacular result that is desired in order to gratify the imagination of the public).

What the miners really want is advice and information respecting the discovery of ore. If the Geological Survey will aid in that, the engineering profession will take care of the rest. But apparently this is not what the Survey is now most anxious to do. Let us point out to the Survey that a Leadville report and the discovery of a scientific principle, like that of secondary enrichment, are of vastly more importance to the mining industry than all of the frothy information that has been communicated during recent years.

The European Zinc Convention

The European zinc convention, of which we reported the organization in our issue of Jan. 9, is the consummation of plans that have been under consideration for a year or more. We are unable yet to give the full details of the program, but what we have already reported is sufficient to show that the plan and scope have been devised with unusual ingenuity, in order to avoid the pitfalls that have caused disaster to previous conventions. The fundamental purpose of the new convention is to regulate the price for spelter, which means, of course, to keep the price at a high figure. Such a purpose is unholy and is to be condemned. We suffer in the United States from evils arising from the trusts, but we have not gone so far as the European countries, which permit cartels and conventions that would be illegal here.

The European zinc convention is organized at an opportune time, inasmuch as no immediate danger of importation of spelter from America is to be anticipated there. The cost of producing spelter in this country has risen so much because of the necessity to mine a very low grade of ore in order to supply our domestic consumption that the chances are that our smelters will not be in a position to export spelter for some years to come. Yet, we are disposed to think that the present tendency toward a rising price for spelter will not be permanent. Sooner or later, new discoveries of zinc ore will be made that will restore us to our old position of economic production. Moreover, it is possible that zinc smelting may some day be inaugurated on the Atlantic coast, importing ore from Mexico, South America, Australia, and elsewhere. Such a scheme would be by no means impracticable, and if the European convention maintains a high price for spelter, American financiers may be attracted to go into it.

THE INDEX TO volume 86, covering the second half of 1908, is mailed to all subscribers with this issue of the JOURNAL.

Some Reflections on Coal Mining

The coal industry in the United States has grown with amazing rapidity. Since 1899 when this country wrested the supremacy from the United Kingdom, its coal output has increased so that at present we are producing upward of 200,000,000 tons more each year than the United Kingdom, our nearest competitor. However, an examination of the statistics of coal mining in this country shows that in spite of our successful growth, we have no reason to feel any great elation. In 1908 we produced more than 419,000,000 tons of coal, of which 80,000,000 were anthracite. Each ton of anthracite coal had a value of $2.30, while each ton of bituminous coal was valued at $1.15. Against these values the British coal operators can show that every ton they produce brings them $2.16 at the mine, so that after all is considered, we in the United States cannot flatter ourselves on showing as great a profit per ton mined as our British cousins. Safety is also an important consideration, and when we place a money value on each life lost, it seems that we have small reason for rejoicing at our monster strides in mining coal.

Future Copper Resources

Fears are frequently expressed that the world's resources of copper are not going to be sufficient for the further expansion of the electrical age that is anticipated, and that for this reason higher prices for copper are to be looked for permanently. Good copper mines are indeed hard to find, but among the many worthless properties developed, some good ones are found nearly every year, and the experience up to date shows that these have been sufficient to maintain the required production at an average price not very different from what copper fetches at present. The resources of the world still being so far from measured why should not this condition be expected to continue? We are now beginning to realize large amounts of copper from the porphyry ore of Bingham and Ely, which only a few years ago were not thought of as possible sources of production. In 1908 an immense new deposit of this kind of ore was blocked out in the Miami mine, near Globe, Ariz., which was the most important development of the year in America. This mine showed nothing but iron stains on the surface. The experience at Mt. Morgan in Queensland, and at Ely, Nev., and Globe, teaches that certain occurrences making no surface showing of attraction to the prospector of old may be underlaid by immense deposits of this kind of copper ore. This is an important geological discovery, leading to the belief that there are important copper resources, hidden from the eye, which may be found by the application of modern science.

The British Iron Trade

While full returns are not yet available, the signs of depression in the British iron trade in 1908 are not wanting. The return made by the Scottish Association—usually regarded as a close guide to the general production of iron—shows a reduction of more than 12 per cent. in the make of iron, while the stocks on hand increased by 90,000 tons; the actual sales for consumption having decreased by nearly 20 per cent. This indicates a nearly parallel reduction throughout the United Kingdom. It is true that this decrease is much less, both actually and proportionally, than that in our own iron production; but fluctuations in the British iron trade are never so sharp nor so quick as in our own, and a loss of 10 or 15 per cent. is a very serious change.

Another indication is found in the export trade, which last year was less than in 1907 by nearly 11 per cent. The British exports form a larger proportion of the total trade than in this country, and such a loss implies an important reduction in activity. Moreover the loss was especially marked in finished materials, which constitute the more important and profitable part of the trade.

Prices of crude iron are also low. The latest advices show Middleton pig selling below $12 per ton, and Scotch hematite, corresponding to our bessemer pig, under $14. Tin-plate bars are quoted about $21, with billets at a corresponding price. Moreover light demand and small sales are reported in all the market. Evidently the British iron masters do not open the year in much better condition than our own.

Recent Colliery Explosions

The explosions at the Lick Branch mine, Ennis, W. Va., Dec. 29 and Jan. 12, whereby 51 and 65 men were killed, and at the Leiter mine, Ziegler, Ill., Jan. 10, whereby 25 men were killed, occurring at this noteworthy period of earth disturbance, direct attention once more to the frequent close correspondence between these phenomena. Perhaps the most singular phase is that the correspondence is not local, but often occurs in widely distant parts of the globe. The earthquake in Italy was preceded by seismic disturbances in Montana, beginning Dec. 21 and continuing to Dec. 27. On Dec. 23 there were gas explosions in mines in Colorado. In November last the Marianna explosion was preceded by a few hours only by severe earthquake shocks in Boston. The Maypole disaster in England, Aug. 18, was likewise preceded by a few hours only by severe earthquake shocks at Eureka, Cal. It will be acknowledged by any candid mind that while a dangerous condition may exist in mines following seismic disturbances, local or otherwise, a mine explosion does not necessarily follow, since the ignition of the gas is necessary to produce an explosion. Also the ignition of gas in well regulated mines does not in most cases result in a mine explosion. However, it is obvious that, if there be any real connection between seismic disturbances and release of gas, a time like the present is one that should cause operators to be particularly on guard.

Further progress in the use of mine timber, chemically treated in order to prevent decay, is being made. An anthracite coal mining company of Pennsylvania was the first to introduce this practice. Its lead is being followed by the Miami Copper Company, of Globe, Ariz., and by two lead-mining companies of the Cœur d'Alene. It has been aptly pointed out that if it be economical to preserve railway ties, which are not only cheap in first cost, but also are cheap to replace, it will be far more economical to treat mine timber which is dear in first cost and also in the labor expense for renewal.

Statements as to the amount of copper in stock in this country, that have been much discussed this week, are undoubtedly far in excess of the actual condition.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Testing Placer Ground

A good deal has appeared in the columns of the JOURNAL and elsewhere lately, regarding the testing of placer ground for dredging purposes by hand or steam drills, and I have personally spent a good many thousand dollars in this same manner for people who were anxious to obtain such ground. These articles have covered the subject in an exhaustive way and have been most excellent, so far as they go, but it seems to me a few words more might be added which would tend to make dredging examinations far less costly affairs in the aggregate.

We all know that placer ground suitable for dredging purposes is one of the most difficult things in the world to find; it is almost as scarce as are hen's teeth. At the same time, there undoubtedly is much unexplored territory in the world today, which would pay to prospect for this purpose, provided there is a reasonable chance of finding it worth the effort and not an absolute waste of money. My own experience in this line has led me to offer a few suggestions to the mining fraternity, as well as to the intending investor.

EXPENSE OF DRILLING

To drill a piece of ground of any size, and at all thoroughly, is very apt to entail an expense of from $5000 to $10,000; and if such work is done in the tropics of South America, or in other foreign countries, it may amount to very much more than that. Often the ground is proved to be entirely unsuitable for dredging purposes, and this money is practically thrown away on a worthless proposition, with the result that the investor feels disgusted. Such properties are occasionally brought to the attention of capitalists by men who are themselves satisfied that the ground carries sufficient gold and is otherwise suitable for this purpose, before the area has been drilled at all. These men have usually arrived at their conclusions honestly, by panning the surface in a casual manner, or by actually seeing some natives or local miners sluicing out "stakes" upon various parts of the property. I do not mean that dredging ground is always presented in this way, because sometimes it has already been partly drilled, but in that case the owners themselves or someone else has had to take this gamble in the beginning. It then resolves itself into a question of whether they have done the work correctly or not, which I do not wish to touch upon here.

I have seen properties in South America, which were known to contain placer gold tested in a most superficial manner by desultory panning of the surface. With this information alone a company has been formed and an expensive dredge installed to work the ground, with most shocking results to everyone concerned. Of course, the ground should have been properly drilled in the first place; but the owners argued that their panning results apparently warranted them in going ahead without such a heavy expense as thorough drilling entailed. I am not trying to defend this argument for a moment, but I do think there is a method which might have been followed and which would probably have shown that the ground was either entirely unfit for dredging, or that it would warrant the expense of drilling.

TESTING BY PITS

In most placer ground the water level is found several feet below the surface, and sometimes it is possible to sink pits to bedrock with the aid of buckets or small pumps to keep the water out. But even if it is not possible to sink all the way down, a trained and expert panman in this class of work, which a placer engineer should be, can flag the ground at suitable distances, and, by squaring up small pits at these points, pan the material for each foot in depth separately. By taking a sufficient number of pans from each foot and uniting the gold so found for weighing, he can obtain a surprisingly close approximation of what the ground is worth to the depth he is able to sink conveniently. His experience in other fields will often tell him what to expect below the water level, where he cannot get.

Of course, this method of making a preliminary examination is perfectly obvious to every engineer, but to many promoters and investors it is not, and they might be slow to think that a property, turned down by a man using this method had been given a fair chance. That primarily depends upon the man who does the work. Unless he is a trained engineer deductions of this sort may be well founded; for the average promoter or investor, who undertakes to do this himself, be he ever so honest, is not apt to be cold-blooded, exact, or methodical in his work, leaving aside altogether the question of experience and lifelong training.

The expense of such a preliminary examination is trifling as compared with that of drilling the ground, and it may only show that the ground should be drilled anyway. A large piece of dredging ground can stand this extra cost; and if it is unsuitable for the purpose, the heavy expense of an examination by any kind of a drill has been saved. The total equipment necessary is a small pair of scales, costing about $15, some acid and mercury, test tubes, annealing cups, an alcohol lamp, and a pan, together with the necessary digging tools which can be obtained anywhere. The engineer does all the work himself, with perhaps one or two ordinary laborers as helpers.

A. P. ROGERS.

New York, Dec. 17, 1908.

Alumina in Copper Blast Furnace Slags

In recent issues of the JOURNAL I have noted Charles F. Shelby's quotations of Carl Henrich's articles relating his experience in New Zealand at the Champion mines in May, 1886, also Harley E. Hooper's criticism of Mr. Henrich's results in the issue of Dec. 5 and Mr. Shelby's reply in the JOURNAL of Dec. 26, 1908.

When Mr. Henrich's articles appeared in the JOURNAL of July 17 and Aug. 28, 1886, I fastened to them as containing the only practical information on the subject "Is Alumina an Acid or a Base?" at which everyone was having a whack about that time. I have carefully kept them ever since. I afterward gained some first-hand information concerning this work, which may prove interesting now. My own connection with the matter was through samples of ore sent to the Mt. Lyell works for treatment and for advice, and also afterward from negotiations in regard to my taking up the work provided a new company could be formed.

In conversation with the only surviving director of the old company, who came to the Mt. Lyell works to see the ore sampled, I mentioned the existence of those articles. He was greatly surprised, and when I showed them to him he remarked: "Why, we only ran twice, about three or four days altogether, when the bank shut us up." This, with the following facts, shattered my faith in the articles in question.

The total amount of ore smelted was small; Mr. Hooper says the whole dump contained about 100 tons. Mr. Henrich's

report to the company starts off, "There have been smelted during the last run a total of 119,416 lb. copper ore——," about 60 tons. The furnace was a 30-ton round copper furnace built by Fraser & Chalmers, of Chicago.

With the ore samples sent, which, by the way, contained 4.51 per cent. alumina, there was a sample of the old slag and one of the old matte. The old slag sample, which showed pieces of free matte scattered through it, gave the following result: Silica, 30 per cent.; iron, 37.9; lime, 9.5; magnesia, 12.42; alumina, 5.67; and copper, 1.22 per cent. This confirms Mr. Hooper's analysis.

Mr. Hooper's statement that practically no lime was given is not quite correct. In his samples Nos. 1 to 4, 1.5 per cent. is the highest lime given, but in samples Nos. 5 to 9, the lowest is 5.1 per cent., and the highest 15 per cent., with an average of 9 per cent.

I think with Mr. Hooper that the deductions of Mr. Henrich in this particular case are based on insufficient and inaccurate data and are, therefore, misleading. Mr. Henrich's difficulties were great; his isolation complete so far as men and material were concerned; pure chemicals were almost impossible to get, and his chances for accurate work were reduced to a minimum in many ways. Twenty-two years ago rule-o'-thumb and cut-and-try were still helpful methods with a lot of us. Mr Henrich's work, however, represented advanced thought and was very acceptable.

G. F. Beardsley.

Fruit Vale, Cal., Jan. 4, 1909.

Discipline in Mines

The question of discipline in the management of mines will be of much greater importance in the future than has ever been attempted in the past. In my opinion it will be a vital factor in the safer operation of dangerous mines.

The fact that rigid discipline is maintained in European collieries is one of the open secrets of their steadily decreasing death rate from mine accidents. Yet despite this, the continental mines labor under more dangerous natural conditions than we have; their workings are deeper and more gaseous. For instance, England, France, Belgium, Nova Scotia and British Columbia mine coal in gaseous seams, on a scale as extensive as our own, and under conditions where they are surrounded with the maximum of danger; however, their statistics show a gradually decreasing percentage in the death rate; ours a shocking increase. This, more than any other argument, says something radically is wrong with our methods or management, or both.

We have often criticized our British cousins for their methodical ways, but the writer is under the impression that it would be greatly to the general good of all concerned if we adopted a little more method and system in our work. We are altogether too restless, too experimental in our mining as in many other things. The child is ever unmindful to profit by the pitfalls encountered and overcome by the parent.

Result of Foreign Experts' Visit

Not long ago the reader will recall the visitation of a committee of foreign mine experts, come hither at the solicitation of our Government, to look into mining conditions here with a view to offering suggestions for betterment. Their report was anything but startling. They told us but little we did not already know. The bulk of the commission's report is already embodied in many of our State mining laws. Some things they advised we do not at all approve. They suggested 650 volts of electricity as the limit in mines using that power, yet many of us have found to our regret that 250 volts is high enough considering the fatalities which have occurred from this source when men have come in contact with it. Taken as a whole, the commission simply told us that which we already knew, and left it to us to either change, or continue, as we saw fit, anything which in our system was contrary to their finding; this confirms our opinion that it is up to us to adopt a system based on the best mining knowledge, and experience with actualities, and then strictly adhere to it.

The Laws Must Be Enforced

Rigid discipline will be one of the chief essentials in the new methods which will undoubtedly be adopted. In the first place it will be necessary to have every employer and employee fear the law, insofar as violating it is concerned. It must be made financially easier for the employer, and less painful for the employee to obey the law than to ignore it. Employers of men must be taught by the sternest measures, that they must not expect an employee to be fire-boss and shot-firer, where one duty is enough to take all his time, and run chances of what may happen because of his inability to complete his contract. Employees must be taught in turn that they will have—even assuming no explosion follows their act—more time for their own pleasure if they get tamping clay by a little trouble, rather than use the more readily procured coal dust. Trivial things both, but what of the result? It does not seem so trivial according to Inspector Loutitt's testimony at a recent inquest.

Punishment Should Be Severe

I can speak from personal experience when I say emphatically that the law is misconstrued purposely every day in many of our most gaseous mines, and even boldly violated without fear of punishment. I have also found that the average miner has no fear, and seldom even respects the law as it relates to mining. This is a matter of vital importance to the safe working of our mines. Compare such a condition with the feeling that exists in other mining countries, England, for instance, where if a man leaves a ventilating door open, it means three months at hard labor without the option of a fine. And he gets it! Justice is meted out quickly and hard, whereas in this country the case would probably hang fire three months before being taken up by the court. I have spent a week of valuable time, with my work at the mine going by default, endeavoring to bring a case to argument where a miner had deliberately disobeyed the law. It is an experience which makes any mine official hesitate about enforcing the legal provisions governing his operation.

If we are to profit by any law, present or future, it must be enforced quickly, positively, and in such a way as will create a lasting impression; when this is done, mine managers will deem our laws a help, rather than a hindrance.

Sim Reynolds,
Superintendent Raven Coal Company.
Wheeling, W. Va.

January 6, 1909.

Speed of Hoisting at British Collieries

The speed of hoisting in British collieries is, according to an editorial note in the *South African Mining Journal*, Aug. 8, 1908, at the Dowlais Cardiff, 2220 ft. in 52 sec., an average winding speed of 2562 ft. per min.; Ashton Moss, 2850 ft. in 1 min. 25 sec., or 2010 ft. per min.; Lady Windsor, 1500 ft. in 35 sec., or 2571 ft. per min.; Bolsover, 1116 ft. in 28 sec., or 2388 ft. per min.; Denaby and Cadeby, 2289 ft. in 55 sec., or 2497 ft. per min.; Rhodes Rotherham, 1650 ft. in 45 min., or 2358 ft. per min.; while at the Rosebridge mine a maximum hoisting speed of 5100 ft. per min. has been recorded; but this is excessive, as, for considerations of safety, it should not exceed 4000 ft. per min. From the foregoing data, and taking into consideration the needs of a regular output, an average hoisting speed of 3000 ft. per min. may be assumed to represent the best modern practice.

In timbered drifts the track should not be spiked directly to the sill timbers of the sets, as then it is difficult to lower the track if that becomes necessary in order to level it.

In mine tracks fish plates should always be used to join the rails, and the ends on both sides of the joint should be securely spiked.

Loading Blast Holes and Driving Small Drifts

By George C. McFarlane*

Contributors to recent issues of the Journal appear to hold widely divergent views as to the proper method of loading up the drill holes. As to the proper place for the detonating cap, I am certain that Mr. Adkinson is correct in stating that a hole shows more shattering in the vicinity of the detonating cap; this is no reason, however, for placing the cap in the bottom of the hole.

As everyone knows, dynamite is detonated from a solid into a gas by pressure. When the detonating cap lets go it compresses about 2 cu.in. of the surrounding mass of dynamite sufficiently to cause dissociation; the transition from solid to gas must occupy a definite interval of time, about one-twenty thousandth of a second. The initial explosion of one or two cubic inches of dynamite in the immediate vicinity of the cap would generate sufficient force to compress the entire charge to the dissociating pressure.

Detonation of a mass of black powder is effected by a uniformly expanding zone of flame starting from a spark. With dynamite detonation is accomplished with a succession of jolts separated by imperceptible but definite intervals of time. This explains why a strong cap and a well packed charge give definitely better results. The strong cap detonates enough of the surrounding charge to make a strong primary explosion. When the charge is well tamped the primary explosion would compress two or three feet of powder to the pressure of dissociation. With a weak cap and poorly compacted dynamite, it is conceivable that it might take three or four jolts to explode the whole charge.

The reason the ground around the primer is badly shattered is that the primary explosion of an ounce or so of dynamite hasn't power enough to spring the rock burdened on the hole, and as the tamping is tightly up against the explosive, the pressure crushes and shatters. In the interval that precedes the detonation of the main portion of the charge the gas from the primary explosion blows the tamping back an inch or so and cushions the main explosion to a certain extent. For these reasons I believe a cap should be in the top of a charge, because it is evident that the main or secondary explosion tears the rock out. With a cap on top a small part of the upper end of the charge is rendered useless for rock breaking purposes; with the cap in the bottom a small part of the bottom of the charge is consumed in shattering the bottom of the hole. With a lifter or back hole it wouldn't make a particle of difference, as far as breaking ground went, where the cap was; with a cut hole, where the power is needed on the toe of the hole, a cap on top of the charge will tend to put the locus of the principal concussion a fraction of an inch nearer the bottom of the hole.

Tamping

In breaking rocks with mud-caps, I find it makes a very material difference whether or not the detonating cap is placed on top of the dynamite. The most effective way to break a rock is to pick out a little depression and form a wall around it with plastic clay; fill this crater with dynamite, lay the cap on the center and cover the whole with soft clay. If the cap is shoved down into the dynamite the breaking power of the mud cap is lessened. The only possible explanation of this phenomenon is that when the detonator is near the bottom of the dynamite, the detonation lifts a portion of the explosive bodily from the rock before it bursts into gas. High explosives must have a good contact with rock which it is desired to break. When a mud cap is placed on top of a stone, the explosive is usually plastered down tight against it, and the stone is broken into several fragments; if the same quantity of explosive were poked under the stone it would have poor contact and do very little execution. This is the reason why dynamite is supposed to strike down.

In regard to tamping a hole, I think that ordinarily 8 or 10 in. of clay tamping is enough. Strong cut holes require more tamping to get the full power of the explosive. Take the case of a 6-ft. incut hole in the face of a drift, the hole being 1¾ in. in diameter and loaded with 32 in. of 60-per cent. explosive. The center of the charge would be burdened 4 ft. and in hard granite or trap it would take one two-thousandth of a second for the concussion to travel from the explosion to the free face. This means that for a period of one two-thousandth of a second the gases of the explosion must be confined. At the end of the period, the momentum imparted to the rock tears it away from the solid. During this period the tamping will be subjected to a pressure of 450,000 lb., sufficient to force 18 in. of clay or 3 ft. of water tamping 6 in. This shows that 18 in. of clay tamping is none too much. A 6-ft. hole burdened 30 in. would kick 8 in. of clay tamping back 6 in. before the rock cleaved from the solid.

A quick way to tamp up a round of holes is to have one of the muckers make a candle box full of clay slugs 1½ in. in diameter and 4 or 5 in. long. In loading twist a piece of paper around one end of the slug and they are easily shoved in and rammed home with the loading stick. I think the best results are obtained by putting in 18 in. of tamping for the incut holes and 14 in. for the other holes. Using a 2 in. time interval on the fuses, the fire in the fuse will be several inches in the tamping before an adjacent hole goes off. It is no uncommon thing for a hole to kick off 2 or 3 ft. of another hole; as long as the fuse was burned down into the tamping and firmly bedded in a foot or so of clay, the spent fuse would break in case a collar blew off; otherwise the fuse might be pulled out of the hole. I noted a case in which one hole cut another hole off in the middle of the powder charge; the hole had pulled back to a slip and the dynamite was cut so smoothly that there was no sign of a hole on the slip until one of the men stuck his pick into it.

This cutting off of holes is a prolific source of accident. If the holes are overloaded as they often are, powder is thrown in the muck. Of course, there is no method of blasting that will eliminate accidents altogether, because things are liable to happen in blasting a round of holes that no man can foresee.

Drifting and Crosscutting

In driving drifts and crosscuts where there are no good slips or floors to break to, the "V" or pyramid incut will be found to be the most satisfactory. In narrow drifts four holes will be enough and they should be drilled so that the points nearly or quite intersect. In drifting, I think the double-screw column is much handier than a cross-bar, although it takes longer to rig up on a column than it does on a bar. In uneven ground, the machine often runs up or down on a hole; with a column and arm it is possible quickly to adjust the machine for alinement and often prevent the steel from fitchering and running tight. In very tight, hard ground, it pays to set the column as close to the face as the machine will work; drill the holes about 5½ ft., and give them as much lift as possible. Of course, when the cut holes are drilled with the machine close in, the column has to be rigged back about 18 in. to drill the back holes and lifters.

If the ground is only moderately hard it pays to drill the cut holes so as to bottom 1¾ in.; then four pounds of 60- or 75-per cent. dynamite can be put in the bottom 30 in. of each hole. If the ground is extremely hard, time can be made by drilling the holes smaller, bottoming them 1¼ or 1⅜ in. Not only do small steels cut faster and hold their gage better, but it is also far easier to collar a hole on a slanting face with a small starter.

When small holes are used it will be necessary to spring the four cut holes with about four 1¼-in. sticks of 60-per cent., then blow them out well with a blowpipe; this will chamber the holes so that they will take enough powder to throw out the incut. It takes about 40 min. to spring four holes, (15 min. to tamp up, 15 min. to get the smoke out of the drift, and 10 min. with the blowpipe to clean and cool the holes.)

Order of Fire and Misfires

In most cases it is a decided advantage to blast the incut with a battery, although it takes more time than if the holes are

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all loaded and fired in one round. When fired with a battery the cut generally kicks the collars off a few of the surrounding holes, so that after the incut round there isn't the same danger of holes cutting one another off and causing misfires and scattering powder in the muck. Again if the cut does not come out well the bottoms can be reloaded and spit with the squaring holes. When the incut is blasted separately, there isn't much danger of the machinemen lighting holes out of their proper order and perhaps spoiling the whole round.

If a hole that is solidly tamped with about a foot or so of clay tamping misses fire, it is certainly no joke to dig the tamping out. If the caps are always soaped, and waterproof fuse is used, such mishaps are bound to be extremely rare. One method of drawing tamping that is a little safer than picking it out with a scraper, is to burn it out by repeatedly loading up whatever collar there is to the hole; after two or three shots the concussion will jar through the tamping and set off the main charge. Another method, which I believe is safer, is to make a little tank by capping both ends of a 6- or 8-in. pipe about 3 ft. long, tapping in a couple of inch nipples on opposite sides of the pipe. This tank would hold two or three pails of water. To blow tamping use a small tip on the blowpipe, wedge a plank or board across the drift, and after inserting the blowpipe in the hole, lash it fast to the board so that it cannot kick back. Now run the blowpipe hose to the water tank and run the machine hose from the air pipe to the upper nipple of the tank. Use a valve two or three hundred feet back from the face for turning on the air pressure. This method works well in an upper or flat hole; it will often wash out a foot of tamping without shifting the blowpipe.

Indiana Mine Legislation

Special Correspondence

The indications point to considerable legislation relating to mines and miners in Indiana during the present session. At first opportunity, three bills were introduced. Senator Bland presented a bill to regulate the width of entrances to coal mines. Senator Royse introduced a bill which provides for the careful supervision of men who work in the coal mines of the State. This measure provides for the creation of a miners' examining board in each county where mining is carried on. Said board is to consist of three members appointed by the circuit judges of the different counties who shall hold examinations monthly, keep a record of the mining certificates issued and make stated reports to the circuit judges, and to the mines inspectors of their respective districts. No man will be entitled to work in the mines, who has not had two years' experience in such work, and all who have been in the work two years will be entitled to certificates without examination.

There is nothing in the bill which will prevent men from working under the direction of skilled miners in order that they may learn the business. The measure calls for a fine of from $100 to $500, or a sentence in the county jail from 30 days to six months for violation of any of the provisions of the act.

Coal Miners' Convention

Special Correspondence

A large number of the 1100 delegates due to attend the International Convention of the Mine Workers of America, in Indianapolis, Indiana, beginning Jan. 19, were on hand the day before the convention opened. Already there are hints among the delegates and at headquarters of exciting times ahead, and even President Lewis intimates that he will not be at all surprised if the convention is the stormiest ever held.

Much interest centers in the outcome of the election for president, and a few anti-Lewis men are saying that, in the event Lewis carries the day, several districts are almost certain to secede.

The friends of President Lewis contend with some show of reason that he has not had a "fair shake," and assert openly that a systematic effort has been made to cripple his administration. They point to the fact that he succeeded in reviving the joint conference after it had become, to all intents and purposes, dead; that he secured a two-year wage scale during a panic, which continued in force the "prosperity" scale of wages for 285,000 mine workers, a thing unprecedented in the history of joint conferences; that in reviving the joint conference he practically saved the organization from dissolution, as all well-informed union men assert, that without the presence of the employers at a convention there is no one to negotiate with.

On the other hand his opponents say he has lost every strike and abandoned districts in trouble until several vice-presidents have refused to longer serve as national officers.

To those who stood at the cradle of the organization and risked much to make it the most powerful trades union in the world, the situation is particularly distressing. They are hopeful some course will be pursued that will avert the threatened rupture, for they say it is idle to deny that the organization now faces the most critical period in its history; that it is divided into factions which are arrayed against one another with undisguised hostility.

The anthracite situation does not present a roseate appearance, from the organization's point of view. The fact is the union is in a moribund condition with a pitiful sum in the three district treasuries, compared to what should be there to meet what will be a most serious situation in April, when the three-year contract will expire by limitation. The outlook, therefore, for a successful struggle with the anthracite operators does not seem particularly hopeful to even the most sanguine.

Other matters known to be antagonistic to the Lewis administration are to come up, which will tax the conservative members heavily to prevent continued dissention and strife during the convention.

Mining Legislation at Washington

Special Correspondence

The bill for the relief of applicants for mineral surveys (H. R., 25,396) introduced on Jan. 8 by Representative J. C. Needham and referred to the House Committee on Mines and Mining was favorably reported on Jan. 14. A few amendments were incorporated and the measure now reads as follows:

"That the Secretary of the Treasury be, and he is hereby, authorized and directed to pay, out of the moneys *heretofore or hereafter* covered into the Treasury from deposits made by individuals to cover cost of work performed and to be performed in the offices of the United States surveyors-general in connection with the survey of mineral lands, any excess in the amount deposited over and above the actual cost of the work performed, including all expenses incident thereto for which the deposits were severally made *or the whole of any unused deposit; and such sums, as the several cases may be, shall be deemed to be annually and permanently appropriated for that purpose.* Such repayments shall be made to the person or persons who made the several deposits, or to his or their legal representatives, after the completion or abandonment of the work for which the deposits were made, and upon an account certified by the surveyor-general of the district in which the mineral land surveyed or sought to be surveyed is situated and approved by the Commissioner of the General Land Office."

The amendments are of importance because they make the bill apply for the future as well as to past transactions, while the appropriation is made annual and permanent with this purpose in view. The changes were introduced in consequence of a letter from First Assistant Secretary of the Interior Frank Pierce to Mr. Needham, in which Mr Pierce pointed out that the proposed legislation was urgently needed, as the sums which

accumulate in consequence of these deposits are neither funds of and available to the United States, nor, under present conditions, repayable to those rightfully entitled to them. He went on to note that the Comptroller of the Treasury disagreed with the conclusion reached by the department (36 Land Dec., 561) in a case of an application for such repayment, upon the ground that while Section 2402, Revised Statutes, directs repayment of "any excess in such sums over and above the actual cost of the surveys," it does not in terms appropriate them to that purpose, which appears to be a strict rule of interpretation in his office. The effect of the bill as now drafted will be to bring about the regular repayment of unused deposits and the excess of deposits made by individuals to cover the cost of work in the offices of surveyors-general and covered into the Treasury in connection with mineral surveys.

Tariff Hearings at Washington

SPECIAL CORRESPONDENCE

It has become apparent within the past few days that the Ways and Means Committee is making a serious study of the question of duties on iron ore, and is inclining to the idea of removing them entirely, or at least making a large cut in the present rates. Chairman Payne has carried on considerable correspondence with reference to the metallic content of various ores and has written to some of the producers to ask the character and fine content of their product. In addition he has written to the Geological Survey asking for a tabulated statement showing the content of a number of domestic and foreign ores. This has been furnished him, the answer giving, including Lake, Alabama, Cuban, Spanish and Newfoundland ores. Chairman Payne has particularly written to some of the iron-ore interests who appeared before the committee some time ago in order to get their views. A poll of the Republican members of the committee has shown that they are nearly evenly divided on the subject of removing the tariff on iron ores and that evidence one way or the other that would suffice to turn a single vote might alter the whole outcome on this topic and with it change the general range of duties which will be assessed upon iron and steel products. Among the marked developments in this connection during the past few days has been the definite alinement of the Pacific Coast interests both northern and southern in favor of the total removal of the duty on pig iron, iron ore and coke, strong demands being filed with the committee from Pacific Coast sources, including the United Metal Trades Association of Portland and the Founders' and Employers' Association of Los Angeles. Severe pressure from New England consumers of scrap iron has also developed a request that the tariff be removed, or else cut to not over $1 in place of the present rate of $4 per ton.

ZINC ORE

Along with the iron-ore question the Ways and Means Committee is seriously considering the tariff treatment of zinc ore. The question of duties on the ore is among the most hotly contested that has yet been presented to the committee, and a large number of briefs has been filed on both sides of the question. The opposition to the proposed duties has become exceptionally strong within the past 10 days and is being voiced both by consumers and the smelting interests.

The position of the smelting industry is that there is a constantly increasing shortage of the raw material, and if domestic consumption of spelter is to increase in the same ratio the next 10 years as it has in the past 10, the whole industry will be confronted with a disastrous condition if deprived of foreign ores. Instead of these ores coming to the United States under a duty, it is alleged that they would go to foreign countries, and the users of spelter would be compelled to supply a part of their requirements with the foreign article. It is argued that the domestic production of zinc has increased within the last 10 years 100 per cent., whereas the Joplin district has only been able to increase its output a scant 10 per cent. during this time. The zinc-smelting industry is said to be facing a shortage of raw material, even with the ores of Mexico and British Columbia. Some interests urge that it would be better to reduce duties on spelter than see a duty placed on raw material, and 1c. a pound on finished spelter is said by them to be ample to give the American miner and smelter all the protection they are entitled to. It is pointed out that the difference in the average price in London and the average price in New York during the past 10 years has been less than 0.75c. a pound.

The Cape Copper Company

SPECIAL CORRESPONDENCE

The Cape Copper Company, Ltd., has issued a report for the year ended Aug. 31, 1908. The net profit amounted to £144,366, which is a long way below that earned in the previous year. This large decrease is principally to be attributed to the lower prices that have ruled for copper during the year under review. The decrease in profit has reduced the dividend on the ordinary shares from 19s. per share in 1907 to 6s. 6d. per share in 1908. The company dates from 1888 and is a reconstruction of the Cape Copper Mining Company, Ltd., registered in 1803, which paid dividends amounting to £1,324,375 between 1864 and 1888, or £67 13s. 9d. per original £10 share, on which £8 per share were paid. The present company has distributed between 1889 and 1908 £2,666,250 to the ordinary shareholders and £336,150 to the preference shareholders. The operations of the company are not confined to South Africa; it is also interested in the Tilt Cove Copper Company in Newfoundland, as well as in copper mines in India and America. In the two latter countries, however, the operations are of an experimental character.

In South Africa the principal mines are the O'okiep and Nababeep mines, the output from which has been practically the same as that returned in the preceding year. From the O'okiep mine 14,812 dry tons of 15.02 per cent. copper were mined, while from the Nababeep mine the output was 54,974 dry tons of 4.78 per cent. copper. The reserves of ore at the O'okiep mine are estimated at 10,000 tons of 20 per cent. copper ore and at Nababeep 150,000 tons of 5 per cent. ore. From the Nababeep North mine 5069 tons of 5.83 per cent. copper contents were mined. The company owns smelting works both in the Cape Colony and at Britonferry, in England.

At the O'okiep smelting works 25,586 tons of ore were treated, the matte produced averaging 51.2 per cent. copper. At the Nababeep works 51,872 tons were smelted, the matte obtained averaging 49.7 per cent. copper. No details are given in the report about the operations at the smelting works at Britonferry, the only information given being that results have been satisfactory, and that further improvements to the plant have been carried out during the year.

In Newfoundland the Tilt Cove establishment made a profit for the year ending Dec. 31, 1907 of £51,034, one-half of which was paid to the Tilt Cove Copper Company and the other half was credited to the profit and loss account of the Cape Copper Company. The output from the East mine was 27,062 tons of 3.3-per cent. copper, wet assay. The South Lode returned 12,961 tons of 3.53-per cent. copper. The ore reserves at the East mine and the South Lode are given as 45,756 tons.

The director's report is supplemented by several detailed departmental reports.

As regards the South African interests there are no less than 11 separate reports, namely those of the superintendent, the chief mine agent, the mines mechanical engineer, the railway engineer, the traffic manager, the smelting works manager, the port and shipping manager, of two medical officers and of two chaplains. These reports are eloquent of good organization and show that the company pays attention to the well-being of its employees.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. E. Spurr is at Matehuala, San Luis Potosi, Mexico.

J. M. Callow, of Salt Lake City, Utah, has been at Ely, Nevada.

H. W. Turner, of San Francisco, is engaged on professional work at Jean, Nevada.

Charles W. McPherson, inspector of surveys in the Canadian Yukon, is on his way to Scotland.

A. Kunkle has been appointed superintendent of the Iowa-Tiger mines, near Silverton, Colorado.

R. Alvin Weiss, of New York, mining engineer, has been called to Montana on professional business.

We shall be obliged if H. B. Pulsifer, formerly of Kansas City, Mo., will advise us as to his present address.

Joseph Jacobson, manager of the Columbus Consolidated mines, Utah, has been a visitor at Houghton, Michigan.

M. M. Johnson, of Salt Lake City, engineer for the Newhouse interests, has been examining claims at Seven Troughs, Nevada.

H. F. Seymour, of Cleveland, O., has taken charge of the Great Southern Mica Company, with headquarters at Asheville, North Carolina.

Dr. Henry Froehling, of Richmond, Va., has been examining the Catawba gold mine, near Kings Mountain, N. C., for Richmond buyers.

Duncan McVichie, of Salt Lake City, recently examined the Prince Consolidated and Ohio-Kentucky mines at Pioche, Nev. He went from there to Tonopah.

Mark B. Kerr, of San Francisco, has been appointed consulting engineer for the Pittsburg-Gold Flat Mines Company in the Grass Valley district, Nevada county, California.

Elton W. Walker has resigned his position as superintendent of the Tombstone Consolidated Mines Company in Arizona, to take effect Feb. 1, and will open an office in Detroit, Mich., as consulting engineer.

The firm of Harvey & Wilbraham, consulting mining engineers, London, England, has been formed by F. O. Harvey, of London, and A. G. B. Wilbraham, late manager of the mining department of Mason & Barry, Ltd., in Portugal.

Edward H. Taylor, Harry W. Weeks, W. D. Stuckenberg and B. G. Maynes have established an office as consulting fuel engineers and chemists, in the Old Colony building, Chicago. The business will be conducted under the name of the Commercial Testing and Engineering Company.

Charles F. Huber has been appointed vice-president and general manager of the Lehigh & Wilkes-Barre Coal Company, with office at Wilkes-Barre, Penn. He has been with the company for 21 years, acting successively as division engineer at Audenried, as chief mining engineer and as general superintendent.

Last winter J. B. Tyrrell, of Toronto, Ont., offered a prize of $100 for the best collection of minerals to be made in the Province of Ontario during the summer of 1908. Professor Nicol, of Kingston, and Professor Walker, of Toronto, examined the collections and awarded the prize to W. F. Battersby, a third-year student in the School of Mines, Kingston, Ont., who collected most of his minerals in the Montreal River district in Ontario.

Obituary

B. Franklin Jones, superintendent of the Westmoreland Coal Company in Pennsylvania, died Jan. 15, at Atlantic City, N. J., where he had gone for his health. He was 45 years old. He was formerly with the H. C. Frick Coke Company, rising to the position of division superintendent at Uniontown. In 1903 he left that place to take charge of the Westmoreland Company's mines. He was an active member and president of the Coal Mining Institute of America.

Alexander McDonald, a pioneer of the Yukon, died suddenly of heart failure at Celar Creek, Yukon Territory, on Jan. 6, at the age of 52 years. Mr. McDonald was a native of Nova Scotia and reached Dawson in 1896, taking up claims in the Klondike. He speedily amassed a fortune estimated at $5,000,000. He was considered the richest man in the Territory and was also heavily interested in Alberta coal lands. The body was taken to Vancouver for interment.

Alexander Thomas, secretary of the Crucible Steel Company, of America, died Jan. 8, aged 59 years, at Hamburg, Germany. He went to Germany last August in the interest of the company. For more than 30 years Mr. Thomas was identified with the crucible steel industry, having been connected with the Park Steel Company prior to its amalgamation with the Crucible Steel Company of America. Two years ago he visited Japan and did much to introduce American steel in the Orient.

Almarin B. Paul, one of the oldest pioneer miners of California, died in San Francisco on Jan. 12 at the ripe age of 85 years. Mr. Paul had been in active mining ever since he arrived in California in 1849. He built the first quartz mill in the State and was also one of the first to take up the cyanide process on the Pacific coast. He began early to investigate the values to be found in the black sands of the ocean beaches and of the hydraulic mines. For a great number of years he contributed largely to the local technical press on the subject of saving fine gold in the quartz and placer workings, and became an enthusiast on the subject. He was one of the earlier miners on the Comstock lode in Nevada, having gone there at once on the discovery of gold, but eventually returned to California. In earlier days he visited all the mining excitements on the coast and in this way acquired a great amount of practical knowledge and a wide acquaintance. He was a constant investigator of metallurgical processes connected with gold and silver mining. For the past 10 years or more he had confined his attention to his mining interests in the quartz properties in Shasta county. Mr. Paul was an enthusiastic advocate of the mining industry of California and was well known all over the State.

Societies and Technical Schools

Institution of Mining Engineers of Great Britain—The office and headquarters have been transferred from Newcastle-upon-Tyne, England, to 39 Victoria street, London.

Massachusetts Institute of Technology—The electrical engineering courses are now attended by a number of graduate students, who are pursuing the advanced courses offered. The electrical department needs larger quarters, and it is hoped that they will soon be provided.

Iowa Engineering Society—This society held its 21st annual convention at Waterloo, Iowa, Jan. 13 and 14. The following are the officers for the ensuing year: President, C. T. Wilson, Waterloo; vice-president, T. R. Warriner, Cedar Rapids; secretary and treasurer, A. H. Ford, Iowa City; directors, L. H. Stone, Cedar Rapids and C. P. Chase, Clinton.

Indiana Engineering Society — The twenty-ninth annual convention of the Indiana Engineering Society was held in Indianapolis, Jan. 14, 15 and 16. Professor W. K. Hatl, of Purdue University, is president and Charles Brossman, of Indianapolis, secretary. The program for the present convention was unusually full of interesting subjects, which were discussed by prominent men. The committee on mining consists of C. J. Colgan, Linton; Frank A. Kaffman, Brazil; P. B. Breneman, West Lafayette. Mr. Colgan made a report on conditions of the Indiana mines and mine engineering, Jan. 15. A report on "Comparative Tests of Indiana Coal" was made by Prof. C. A. Young, of Lafayette. George W. Munroe gave an illustrated lecture on "Producer Gas from Indiana Coal." The meeting closed with a banquet and other social features were introduced.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Goldfield, Salt Lake City and Denver

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 11—The Natomas Consolidated, of California, the new corporation which has acquired extensive dredging interests both at Folsom and Oroville, intends utilizing all the rock piles thrown up by the numerous dredges by crushing the cobbles into road-making material. After removing the cobbles the land left is suitable for agricultural operations, and thus one of the objections to the dredging industry may be removed. The company owns certain valuable water rights, and has obtained options on about 50,000 acres of land which is to be brought under irrigation and sold to settlers. This land has been more or less subject to overflows, and will be reclaimed and made fit for cultivation. The water used for power purposes can be later used for irrigating this large tract of land in Sacramento county.

The Anti-Débris Association has also succeeded in bringing the dredge miners into line in some measure. A committee was appointed to visit the Oroville dredging field and determine whether suit could be commenced against the dredge owners. The Dredge Miners' Association has now written to this Anti-Débris Association committee, agreeing to comply with all the demands and promising that no material should be allowed to reach the Feather river. The Anti-Débris Association has usually whipped the miners in any litigation, and doubtless the dredge miners want to avoid litigation if it is a possible thing.

The current at the Big Bend plant of the Great Western Power Company has been turned on for the first time. At the start some 50,000 h.p. will be generated, to be increased later on to 100,000 h.p. The lines have been carried complete from Big Bend in Butte county as far as Oakland, on the bay shore.

A new schedule of rates on ore will be adopted on the Tonopah & Tidewater railroad on Jan. 24, which will have a marked effect on mining affairs both in this State and Nevada. The reduction will admit of handling ores which are at present of little or no value, as they cannot be shipped to smelters. A better profit can also be made by the miners on ores of the character now being shipped. The new freight tariff will also probably have the effect of sending more ores to the smelting plant at Needles, San Bernardino county, and somewhat less to the smelters on San Francisco bay. The new tariff shows an entire readjustment on rates of varied grades of ore. The Tecopa district in Inyo county, where much lead ore is being mined, pays a flat rate now of $8.89 per ton on ore from $50 to $100 in value. Under the new rate $60 ore will pay $4.95; $70 ore, $6.45; and $100 ore will pay but $8.20. On the lower grades from Tecopa district the rate on $15 ore is reduced from $2.61 to $2; and on $40 ore from $3.98 to $3.25, and the intermediate grades in proportion. The new rates from Goldfield cut the charges from $2.60 on $40 ore to $2.75 on $15 ore. The rates from Rhyolite and Beatty districts are cut also, and are from 50c. to $1 less than from Goldfield. These rates should change shipments from Salt Lake and San Francisco to Needles and will benefit the different mining camps along the line of the road.

In this connection it may be stated that merchants and manufacturers and others in this city are making a determined fight against the proposed higher east- and west-bound freights on the transcontinental railroads. An organization has been perfected and the shipping community is pulling together.

The second furnace of the new copper-smelting plant at Coram, in Shasta county, has been blown in, and the converter plant will be ready for operation in a few days.

The Leona Chemical Company has issued bonds to the amount of $1,000,000, and will now greatly enlarge its chemical manufacture plant at Melrose on San Leandro bay. The company will manufacture industrial chemicals from raw materials taken from its own mines. The pyrites deposit at Laundry Farm will give the materials for extensive sulphuric-acid making, and the barytes mine in Mariposa county will furnish the ore for making paint materials. A number of minor products will also be turned out. Roland L. Oliver, of Oakland, is general manager, and F. M. Smith is largely interested.

Goldfield, Nevada

Jan. 12—At the annual meeting of the Goldfield Consolidated held yesterday at Evanston, Wyo., several changes were made in the directorate of the company, which now stands as follows: Senator George Nixon, president; George Wingfield, vice-president; W. C. Ralston, of San Francisco, treasurer; J. M. Mac Kenzie, manager, Charles Hayden, of Boston, J. H. Cartwright and J. D. Hubbard, directors. John S. Cook, James R. Davis and J. M. Fenwick are the retiring directors; the latter to act as private secretary for George Wingfield. Dividends of 30c. per quarter are to be resumed on March 1; this will mean a quarterly distribution of $1,080,000.

Davis & Loftus, who have taken over the property of the Bullfrog Gold Bar Mining Company, have submitted to the stockholders a plan of reorganization and are desirous of obtaining the name and address of every stockholder in the company that they may present to every one the outline of this plan.

While little is heard of the Gold Mountain district, there is a large amount of development work being carried on. The Bonnie Clare Mining Company which is prospecting the May Day lode by an adit is meeting with encouraging results. This property was closed down a year ago due to dissention among the principal stockholders, who allowed the company to go into the hands of a receiver; the receivership has since been dissolved. A large amount of supplies have lately been shipped into the old Oriental mine in that district, and extensive development work is to be carried on. It will be remembered that some of the finest specimens of gold ore ever exhibited came from this property; this ore is now in the museum of the Smithsonian Institute at Washington.

Unfortunately, this district has suffered in the past by poor management of its properties and the greediness of mining promoters, but with good economical management and better milling facilities, many of the properties now idle can be made paying propositions.

A contract is to be let shortly for the construction of a telephone line from Tonopah to Helena, the new town near the Broken Hills mine, and about 40 miles east of Tonopah.

The Champion traction engine, built to haul 20 tons of ore from the Great Western mine at Hornsilver to its shipping point, Cuprite on the Tonopah & Tidewater railroad broke down on its initial trip last week. New parts were ordered, and mule teams are being used until these parts arrive.

L. J. Cohn, register at the Carson City land office, reports that during the month of December 125 final mineral entries were made on mining claims, involving payments of nearly $30,000 by the claimants.

The Western Ore Purchasing Company, whose plant was destroyed by fire at Hazen last week, has purchased the old

Scott & Amann sampler at that place and will use it while a new plant is being erected. The sampler of the Western Ore Purchasing Company at Hazen, Nev., was totally destroyed by fire Jan. 3, the loss being in the neighborhood of $60,000, partially covered by insurance. At the time of the fire there was about 1500 tons of ore stored in the bins, which will be shipped to Salt Lake City for sampling. The plant will be rebuilt at once on a larger scale.

The Nevada Bay State Oil Company, which has been drilling for oil in the salt marsh northwest of Goldfield but was compelled to stop operations due to the cable's breaking, has received a specially designed fishing apparatus from Los Angeles, and will endeavor to recover the cable. The well is 500 ft. deep.

The sulphur mine at Cuprite, 15 miles south of Goldfield, shipped four carloads last week, and it is reported that this amount will be shipped to Los Angeles each week.

The old camp of Candelaria, in the northern part of Esmeralda county has taken its place again on the shipping list. Last week the Potosi Mining Company made a shipment of 175 tons of ore to the smelter at Bingham Junction, Utah.

Owing to the financial depression during the past year, a number of mining companies and many individual claim holders neglected performing the annual labor prescribed by law on their lode claims, which technically amounts to abandoning the same. As a result on Jan. 1 a great many re-locations were made throughout the State.

By means of an injunction Horton and Aldrich, of Chicago, have secured a postponement of the annual meeting of the Little Florence until Jan. 20. The meeting will no doubt be a lively one as the feeling between the two factions is very bitter, and sensational charges have been made by both sides.

Salt Lake City

Jan. 15—Twenty-two cars of machinery for the Ohio Copper Company's mill arrived at Lark during the week. The jigs are already in place, but the slimers and tables have not arrived. The last shipment consists mainly of transmission machinery—transformers, shafting, pulleys, belting, etc. The raise from the Mascotte tunnel to connect with the shaft of the Ohio Copper Company is progressing rapidly so that connection should be made by the end of February.

At Garfield the Fink furnace is said to be meeting with considerable success in making high-grade matte, but owing to trouble with the furnace lining as yet no attempt has been made to make blister copper directly from the ore. An automatic feeder is being installed, and it is said that as soon as that is in place the attempt to make blister copper will be made. Samuel Newhouse is so greatly pleased with the Fink experiments that he has announced that the Cactus mine will be equipped with a 300-ton Fink smelter even if the furnace fails to make blister copper.

It has been demonstrated that the plant can make matte carrying as high as 70 to 80 per cent. copper successfully and rapidly, and it is claimed that within a short time the furnace will be turning out blister copper with the same ease with which it is now producing matte. The plant consists of two revolving cylinders which smelt and roast alternately, the smelting cylinder generating gases which are utilized as fuel in the roasting cylinder. In starting the process some coal is required, but once in operation the sulphur gases do the roasting. Both the roasting and the smelting of the concentrates is accomplished with a single fuel charge, and the cooling of the calcines is avoided. Furthermore the fumes are caught and do not enter the stacks. When the concentrates have been converted into matte the slag is drawn off and a charge of silica added in order to reduce the ferrous oxide. The matte is kept agitated by the revolving cylinder and by forcing air into it converted into blister copper. The plant is very inexpensive compared with the ordinary smelting plant, and is extremely simple.

Butte

Jan. 14—The continued cold weather which has prevailed throughout the State for the past two weeks has seriously affected the output of the Butte mines. For the past week the Boston & Montana smelter at Great Falls has been operating at about one-third its normal capacity. This is due partly to the diminished water power caused by freezing of pipes, but chiefly to the fact that the ore in cars shipped from Butte is frozen solid during the journey and the only way to get it out is to mine it over again. The greater part of the Great Northern railway's ore cars are now at Great Falls loaded with ore which it is impossible to remove. As a consequence there is a car shortage in and around Butte, and the mines of the Boston & Montana company, which ship to the Great Falls smelter, have been closed down since last Friday. Owing to the peculiar cause of the shutdown it is not known just when shipping will be resumed. At the Washoe smelter at Anaconda no trouble has been experienced with frozen ore. This is because of the shorter haul for the ore and also because at the Washoe plant the cars are immediately run into drying sheds, where a sufficiently high temperature dries out the ore and loosens it.

At the annual meeting of the Montana Society of Engineers, held at Great Falls last week, C. H. Bowman, of Butte, president of the Montana State School of Mines, was elected president of the society for the ensuing year. Steps were taken toward obtaining favorable legislation for the proper supervision of the county roads, a committee being appointed to confer with the members of the legislature on the subject.

The British-Butte Mining Company has instituted action against the owners of adjoining claims for the purpose of obtaining the right to run ditches so that the company's new gold dredge may be operated. The company alleges in its complaint that it has erected a gold dredge upon its property at a cost of $80,000, and that unless it can obtain the right to run the ditches the new dredge will be valueless.

Denver

Jan. 16—The most lively topic of discussion in mining circles at the present time is the anticipated advent of the new independent smelting company into the mining districts of the West. This company, with $50,000,000 capital, is said to be backed by the Standard Oil, Amalgamated, Ryan-Cole, and allied interests. It is confidently expected to commence the erection of a large copper plant near Salt Lake City at an early date.

Now comes the resignation of Dennis Sheedy from the board of directors of the American Smelting and Refining Company, and a strong rumor that he is going on the board of the new competitive company, with the further inference that the new company is going into the lead-smelting business in this State, in active competition with the American company at the latter's own exclusive game.

The mineowners are, of course, pleased to learn of the entry of another "Richmond in the field," with the possibility of a sanguinary struggle, and slashing of treatment rates right and left.

Such, then, are the points of active discussion in mining circles at the present time. To people conversant with the mining and smelting situation in Colorado the question arises, "Where will the ore be obtained?" and particularly lead and fluxing ores, on which the American Smelting Company has for some time yet exclusive call. Colorado is a great mining State, and with the material lowering of treatment charges, the output of low- and medium-grade ores will be greatly stimulated, and there is a strong possibility that the new company, starting in the smelting business with ample capital and modern works, carrying only the actual cost of construction, paying nothing for good will of a former business, and not saturated with water, will find an ample and profitable field in this State, to the great advantage of the mining community as a whole.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

GRAHAM COUNTY

Arizona Copper—A loss of about $200,000 was caused by fire at the smelter due to a runaway slag train. Concentrator No. 2 is a total wreck, while the engine room, smelter, ore and coke bins, were badly damaged.

Kentucky—A strike of copper glance is reported at a depth of 225 feet.

New York-Arizona—During the past two years $24,000 has been spent in development work. Most of the work is being done in the Lillian tunnel which is 1000 ft. long, and has attained a depth of 300 ft. Four hundred feet more work in this tunnel will tap shafts from which ore shipments have been made. A compressor is being installed. The water supply is from the pipe line of the Morenci Water Company.

Gold Belt—About $18,000 worth of copper ore was shipped during 1908. Operations will be resumed at once.

Morenci Water Company—A steel bridge has been built across Eagle creek. It is a one-span trestle 187 ft. long and 14 ft. above the river bed, and is for the purpose of holding the heavy 10-in. pipe line out of danger of high water during the flood season. Heretofore the pipe line was under the ground, but this was very unsatisfactory as the floods invariably broke and injured the pipes.

PINAL COUNTY

Ray Consolidated—Plans are being drawn for a large reduction plant, work on which will begin about the middle of this year. Eleven prospecting drills are at work and ten acres have been prospected during the past month, proving low-grade copper deposits.

California

AMADOR COUNTY

Central Eureka—The shaft has been retimbered to below the 2000-ft. level, but bad air has given some trouble.

South Eureka—Another assessment has been levied on the stock of this company. The stockholders are persistent, for they have been paying assessments off and on for about 20 years with only an occasional profitable orebody.

CALAVERAS COUNTY

Eastland-Gray—This gravel mine has been sold to S. R. Fox who intends working it by some dredging system. The mine is near San Andreas and operations have been resumed.

Vinich—Active work has been commenced on this Angels Camp mine. A body of ore on the 600 level is to be worked.

EL DORADO COUNTY

Garden Valley District—A. R. Seymour has leased, with the privilege of purchase, 20 acres of mining ground in this district and has begun operations upon it.

INYO COUNTY

Monster—The first shipment of ore under the new management has been made by this mine to the smelter at Keeler. The ore runs high in lead with considerable silver. A. A. Stanton, of Los Angeles, is manager.

KERN COUNTY

Fairview—The quartz mill of this mine near Rosamond is nearly ready to be started.

MARIPOSA COUNTY

Hornitos—A new mill, quartz crusher, etc., for this camp is now being hauled in from the railroad. Considerable prospecting is going on in that locality.

NEVADA COUNTY

Bear River—Arrangements are being made by the owners to bond this mine to Eastern men. They have been working the tunnel for two years and while a 2-ft. ledge has been found, there is no pay ore as yet.

PLACER COUNTY

Long Beach Asbestos Company—This company, of Long Beach, Los Angeles county, intended to manufacture helmets and coats for firemen and other articles from the asbestos found near Towle. Thos. E. Morgan, of Dutch Flat, however, on the last day of the year relocated the asbestos claim on the ground that work had not been done on them in accordance with the law.

PLUMAS COUNTY

Rose Quartz Mining and Milling Company—This new company intends working the group of seven claims owned by F. H. Kelley on Poormans creek, in Onion Valley district. The claims are only partly developed. F. H. Kelley and O. C. Pratt, of Quincy, are among the incorporators.

SIERRA COUNTY

Dead Broke—The White Bear Mining Company is about to reopen the old tunnel on this mine. The ledge carries large quantities of sulphurets which were laid aside in early-day mining but are now valuable.

SISKIYOU COUNTY

Hardscrabble—This company at China Gulch has purchased a gasolene engine for power purposes.

Quartz—A new company has taken hold of the group of quartz mines owned by Foster & Mackintosh at Nigger Creek, near Callahan.

TRINITY COUNTY

West Point—Mark Manley for this company has bonded the Leas and Nicholson mines which adjoin the Brown Bear property at Deadwood. There are five claims.

TUOLUMNE COUNTY

Harvard—Fifty of the 60 stamps of the mill at this mine are dropping and the other 10 will be put in use as soon as the concentrators are installed.

Tarantula—This mine near Chinese has been sold to C. F. Crawford representing English capitalists, by Joseph Russell; an air compressor and machine drill have been ordered.

Colorado

BOULDER COUNTY

Alton—Kansas City and Chicago men are interested, and they will get plans for the erection of a milling plant. W. R. Burke, Boulder, Colo., is manager.

Mount Audubon Power Company—This company is going to build a hydroelectric plant at its property, expecting to generate about 1500 h.p., the estimated cost of the complete plant to be $75,000. J. E. Haggard, Ward, Colo., is manager.

Rip Van Dam—Denver people have purchased one-half interest with William Brown at Springdale, Colo., and heavy developments are being mapped.

CLEAR CREEK COUNTY

Linn Consolidated—An air compressor is being installed at the property near Georgetown.

Pioneer & Monitor Group—P. W. McCaffrey, of New York, has purchased these groups near Dumont, the consideration being reported at $150,000, on which

a cash payment of $25,000 was made. New and heavier machinery is to be installed and an electrochemical process will be tried in the mill.

Santiago—It is reported that in the spring this company will arrange for the erection of an aërial tramway from the mine to its mill at Georgetown, a distance of three miles.

Snowdrift—Nashville, Tenn., people are interested in the purchase of this group, and they will develop their holdings through the tunnel, near Georgetown, as the Snowdrift Mining Company.

Vidler Tunnel—After an idleness of over a year a contract has been given to F. A. Goetz, of Georgetown, for the driving of 200 ft. on this tunnel in the Argentine district.

Lake County—Leadville

Banker Tunnel—This tunnel, Winfield, is in 4000 ft., and for several hundred feet has been driven through a mass of low-grade ore. A few days ago a streak of ore came into the low-grade body which runs high in gold, silver, copper and lead. This ore is being sacked. The manager of the property is at present East consulting with the stockholders as to erecting a mill in the spring to treat the low-grade ore. The principal stockholders are in Philadelphia, with Doctor Horner, of that city, as president of the company.

Cleveland—Sinking has started on this mine, South Evans gulch, and the shaft will be sent down another 100 ft.; good progress is being made with the work, as there is little water to handle, not over 25 gal. a minute.

Gallagher—The new shaft on this property, to the north of the original shaft, has opened ore carrying some gold and silver and a large percentage of lead. Ore is being shipped from the old shaft steadily.

Helena—The station at the 700-ft. level, Iowa gulch, has been cut and a new pump is being installed; it is large enough to handle the flow of water easily, so that the next 100 ft. of sinking will be easily accomplished. With every foot of sinking the formation changes and the management looks for the orebody before the contract is completed.

Progressive—The body of ore recently opened in this mine, North Fryer hill, is now 9 ft. high and 7 ft. wide, with top and bottom not reached. Shipments are going out steadily.

Vinnie—High-grade gold ore is being taken from this claim, Breece hill. The streak of this rich matter is in a body of medium grade ore. The vein runs into the Ibex ground about the tenth level.

Young America—The owners of this mine, Granite, state they have on the dump 15,000 tons of ore that will average $10 per ton, and on account of the heavy transportation charges they are unable to ship it. To overcome this they will erect a mill in the spring to treat the ore. The mill will be a custom one as well, as there are a number of dumps in the neighborhood that can be treated.

Teller County—Cripple Creek

The Cripple Creek district enters upon the new year with bright prospects. A large amount of mining is being done, both by the companies and leasers. All is quiet in labor circles and the relations between the employer and the miner are cordial. The Mine Owners' Association is in control, and the card system is being enforced the same as it was a year ago. The drainage tunnel is being pushed steadily along. The milling situation is about the same as last year, with the exception of a little higher rate on some of the ores where there is no contract with the mill. There is a general tendency toward more reasonable royalties than in former years. A large amount of leasing is being done both by companies and by individuals in a small way.

Blue Bird—Connection has been made between the bottom level of this property and one of the Portland drifts, thus giving good air. The Blue Bird is under lease to the Humphreys-Thompson people, of Denver, and is said to be doing well. H. D. Thompson, of Cripple Creek, is in charge of the property.

El Paso Consolidated—A change has been made in the control of this company. Four of the old directors, S. S. Bernard, J. M. Beatty, George Bernard and E. J. Eaton have resigned and new directors have been put in. The present board consists of A. L. Burris, A. J. Styber, A. L. Doud, William Bainbridge, A. Kemple and J. H. Avery. Mr. Burris will be president and general manager and Mr. Bainbridge, who was formerly superintendent of the property, will be consulting engineer. For the past year there has been a struggle between the Bernard factions and that headed by Burris for the control of the company, and it was expected that there would be a fight at the annual meeting which occurs in March, but matters were precipitated by the calling of a special meeting. The property of the company is at present being operated under lease by a number of leasers. Mr. Burris lives in Colorado Springs.

Half Moon—The shaft-house on this property has been totally destroyed by fire. The property is controlled by the Stratton estate and is at present under lease to Charles Harrison and associates, of Cripple Creek. This property at one time produced a very large amount of ore.

Indiana

Pike County

Solomon Deeble & Co., coal operators, of Carlisle, have leased several hundred acres of coal land north of Petersburg, near the Evansville & Indianapolis railroad. The company will begin sinking a shaft at once. There are two veins of coal underlying this land—one a 4-ft. vein and the other a 7-ft. vein. Both will be worked, giving employment to several hundred men. The mines at Blackburn, Little Rodgers, Massey, Ayrshire, Fortwell and Winslow are operating from three to six days a week, and the railroad is now running from two to three extra coal trains a day. The Worley mines, owned by Arthur Jordon, of Indianapolis, which have been idle for two years, will be opened in a short time. The vein in the Killians mine has been found to be 13 ft. thick, and the coal is said to be of very good quality.

Louisiana

Petroleum production in Louisiana in December was 358,600 bbl. Shipments by rail were 203,128 bbl.; pipe line, 112,639; total, 315,767 bbl. During December 15 wells were completed, 12 being in oil and three dry. There were 44 wells drilling at the end of the month.

Michigan

Copper

New Baltic Exploratory Company—Exploratory work has begun on the lands of this company which lie to the east of the Franklin, Jr., in view of opening the northern extension of the Baltic lode. Operations will be confined to trenching and drilling.

Superior—This company is accumulating rock preparatory to putting through another mill test. The first mill run consisting of about 900 tons yielded nearly 38 lb. of copper per ton. The rock is coming from the drifts of the four lower levels.

Atlantic—The crosscut from the 19th level of this company's shaft has struck the lode, but it has not yet been extended far enough to ascertain its conditions. The crosscut driven from the 15th level has encountered a lode at a distance of nearly 400 ft. from the shaft; its identity has not as yet been definitely decided and results of its further opening will be awaited with interest, as it may have a bearing on the future development of the property.

Calumet & Hecla—The first quarter of this company's large regrinding mill has gone into commission and is treating the tailings from the Calumet mill. The ultimate capacity of this plant will be about 10,000 tons daily, and it is to contain 48 Chilean mills and 200 Wilfley tables. The Chilean mills with their quota of tables are arranged in multiples of six, each set driven by a 250-h.p. 2300-volt induction motor.

Michigan—Construction work on this

company's stamp mill is going on in a limited way and the trestle approach to the building is being erected. Conditions are improving at depth in the mine. "A" shaft is sinking close to the 17th level and "B" shaft is down to the 14th level; the drift extended from this level is entering into a good copper-bearing formation after passing through practically barren ground for a considerable distance.

King Phillips—No. 1 shaft of this company has opened the lode by means of crosscuts to the 10th level, and the lower workings are yielding a good grade of rock which is being accumulated in a stock pile. No. 2 shaft is crosscutting to the lode at the sixth level. The recently installed electric hoisting equipment is working satisfactorily.

Wyandot—Drifting continues on the amygdaloid lode that this company cut with its crosscut from the bottom of the exploratory shaft, and the copper showing is being maintained. This is the most important showing yet made on this property.

Tamarack—No. 1 shaft of this property is being put into shape to handle all the mine water from this tract, and a large concrete tank is being erected to store the water preparatory to its being hoisted.

Mass—This company has started to drive two crosscuts from "A" shaft to intercept the lode that was opened by a drill hole. One is being driven from the 15th level and the other from the 17th level.

Allouez—No. 2 shaft is down to the 13th level; the shaft is being turned so as to conform with the pitch of the formation which is expected to be cut within the next two levels.

Copper Range—This company will in all probability give up its option on the Globe tract upon its expiration in April. A shaft has been sunk to a depth of 1000 ft., and at that depth much prospecting has been done without finding anything of commercial value, or even any indications that would warrant further prospecting. One of the drills operating on the lands adjoining the old Atlantic property is down about 650 ft. and the other nearly 600 ft. Results from these holes are being awaited with interest as it is maintained that the northern lodes of the section extend across Portage lake and in proximity to these lands.

Winona—The directors will take action shortly regarding another assessment; this will probably be $1 per share. The last assessment was $2, of which $1 was paid in the fall of 1907, and the balance in February, 1908. The need of additional funds at this time is due to the fact that the extensive development work which was carried on during 1908 and which cost between $140,000 and $150,000, has practically exhausted the working capital. The Winona discontinued rock shipments in November, 1907, at the time of the break in the price of copper. It is proposed to resume shipments this spring. A much larger output is expected than heretofore. In 1907 the Winona shipped 102,100 tons of rock to the Adventure mill. The yield was 2,231,445 lb. of mass and mineral, or 1,285,863 lb. of refined copper, being 12.59 tons of refined copper per ton of rock shipped. By a more careful selection the management expects the yield can be brought up to 14 pounds or better without a material increase in cost.

Missouri

Zinc-lead District

The natural-gas supply proved inadequate during the recent cold weather causing many of the mines and mills using gas to shut down.

Apache Maid—Barr, Gloniger & Walsh have let the contract for the erection of a 300-ton mill on their lease of this mine on the Troupe land south of Webb City.

Holdout—This company, composed of Chicago and Webb City parties, has been incorporated for $32,000. Frank Forlow, of Webb City is attorney.

Knights—Several rich drill strikes on the Sampson land near Knights station bid fair to make this a producing camp.

Kathleen—This company has been incorporated with a capital stock of $50,000, to operate at Belleville. W. F. Hilles, Dallas, Texas, J. Wise Brown, E. A. C. Elliott and F. B. Wilcox, of Joplin are the stockholders.

Transylvania Royalty Company—J. P. Newell, of Carthage, and New York parties have incorporated this company with $100,000 of capital stock.

Montana

Butte District

Amy Silversmith Mining Company—Several new leasers have lately begun work. The work is for the most part confined to the 300-ft. level.

Butte & Superior—The shaft has reached the 1400-ft. level where a large station is being cut and a pump installed. It is reported that more copper ore has been encountered on the 1200-ft. level where development work is now being carried on.

Davis-Daly—The Colorado shaft has reached a depth of 1400 ft Below the 900, the shaft has three compartments; above this point it has but two. Ground is now being stoped out, from the 900 up, which will make the entire shaft three compartments.

Butte-Montana — The company has shipped three 50-ton cars of ore from its Alec Scott mine to the Washoe smelter this week.

Butte Central Copper Company—This company has been recently organized under the laws of Delaware. The company is capitalized at $2,500,000, with 250,000 shares of the par value of $10. When the old Butte Central & Boston Copper Corporation has been discharged from bankruptcy and its affairs untangled, the new company will assume control of the Ophir mine and begin operations. Freeman I. Davidson, largely interested in the old corporation, is instrumental in the formation of the new company.

Surprise Eagle Company—At a recent meeting of the directors it was decided to levy an assessment of one cent per share on all outstanding stock for the purpose of providing a working capital.

Fergus County

Barnes-King—President Gillie has recently published his anual report to the stockholders. The report covers the period for the past 14 months, and contains reports of General Manager McGee and Treasurer Swinhorne. It is stated that under the new management the monthly deficits of 1907 were changed into monthly profits in 1908, and that the cost of mining and development has been reduced from $4.18 per ton to $2.53. The treasurer's report states that on Nov. 30, 1908, there was a balance in the treasury of $225,113.41, but that it will be some time before a dividend can be declared.

Jefferson County

Corbin Copper Company—At the first meeting of stockholders the following directors were elected: Stephen R. Dow, Alvin R. Bailey, Noah W. Jordan, George E. Learnard, David E. Dow and Richard M. Edwards. Stephen R. Dow is president and Alvin R. Bailey, secretary and treasurer.

Kelly Smelting and Refining Company—At a meeting of stockholders held in New York the name of the company was changed to the Alta Montana Copper Company. The company owns the Alta group near Corbin.

Nevada

Esmeralda County—Goldfield

Goldfield Consolidated—The Clermont shaft, which will be the main working shaft of the company, is now 920 ft. deep. The Mohawk vein was intersected at 856 ft., 20 ft. lower than the bottom of the old Mohawk shaft. On passing through the hanging wall, quartz of a milling grade was entered, which showed for 60 ft. in the shaft; the barren spot which was then cut, still shows in the bottom of the shaft. Construction on the shaft house has already started, and the 200-h.p. hoist, which will be operated by compressed air, is daily expected.

Red Top—Drifts are being extended north and south on the lower level; an advance of 150 ft. was made last month.

Florence Goldfield—The new Florence mill commenced operations Jan. 9 with 10 of its 40 stamps dropping; the number will be gradually increased to the full capacity. In the Florence property large bodies of ore have been blocked out by the various leasers. This ore will be treated before much more development work is done. No new leases are being granted nor will extensions be given to any of the present leasers.

Florence Gem Lease High grade ore was struck a few days ago; two wagon-loads of ore a day are being sent to the sampler.

Atlanta—Eight sets of lessees are working on this property; while small seams of good grade ore have been opened in several places, nothing of sufficient size to warrant shipping has been developed.

Goldfield C. O. D.—In a winze from the 250-ft. level 15 in. of high-grade ore was recently opened. Work is still progressing in the winze, and the drift on the 300-ft. level is being pushed to catch this oreshoot. The company has a large tonnage of milling ore developed.

Consolidated Red Top Lease—While the management will not give out definite figures, it is generally known that the face in the oreshoot found between the 225- and 300-ft. levels, is showing richer than ever before. The drift on the 300-ft. level is being extended south to catch the oreshoot on its downward pitch, and, as ore assaying $30 per ton now shows in the breast, it should be close to the shoot.

Esmeralda County—Stimler

Cottonwood Mine—Returns from a 20-ton shipment from this property gave $62 in gold and $51 in silver per ton. In the bottom drift, where the dike was cut, the orebody is 40 ft. wide. The property is equipped with a 20-h.p. hoist. Considerable development work is being done.

Nye County—Bullfrog

Smith Brothers' Mill—It is reported that Smith Brothers have made arrangements which will enable them to resume operations on their custom mill at Beatty, and that work will be rushed from now on to completion. With the exception of the cyanide tanks, the material is now on the ground. This is a ten-stamp mill; the batteries were furnished by the Hendrie Bolthoff Company. The mill will be run by electric power obtained from the Nevada-California Electric Power Company.

Shoshone—The returns as given by the State bullion-tax collector credit the Shoshone with a production of $535,763 for the first nine months of 1908. The "glory hole" is nearly 150 ft. long by 100 ft. wide by 200 ft. deep at the west end; over 10,000 tons of ore are now broken in the glory hole. The ore goes through chutes to the 200-ft. level whence it is hoisted to surface.

Gold Bullfrog Mining and Milling Company—A 25-h.p. gasolene hoist has been installed on this property and sinking will be resumed; the shaft is now 150 ft. deep.

Mayflower—The buildings for the new five-stamp mill have been completed and are now ready for the machinery, nearly all of which is on the ground. A station has been cut at the 500-ft. level; water for the mill will be pumped from that level. There is sufficient ore on the surface to supply the mill for two months; this, together with ore blocked out on the 200-ft. and 300-ft. levels will supply the mill until lower levels are ready for production.

Nye County—Springdale

Newcomer Mill—The 50-ton custom mill being built by Scott Newcomer at Springdale is nearly completed and is expected to be in operation by the end of the month. Should the treatment, which consists of roasting before cyaniding, prove a success, the Pioneer mine will furnish the mill with all the ore that it can treat.

Nye County—Bullfrog

Bullfrog Mining Company—A 10-ton shipment to the Western Ore Purchasing Company from the Stewart & McVicar lease on Ladd mountain gave returns of $86 per ton.

Pioneer—This property is still the center of attraction. The drift from the sub-winze shows 15 ft. of ore that assays more than $100 per ton as it is broken.

Nye County—Tonopah

Belmont—Extensive development work is being done on the 1100-ft. level, the deepest point at which ore has been found in Tonopah. In the raise from the 1100-ft. level the company is working on the largest body of ore yet developed in this mine. This is the same body of ore in which the big winze from the 1000-ft level was sunk, and which was exposed on that level by a drift for a distance of 200 ft. Owing to the divergence of the two faults which terminate this oreshoot on the 1000-ft. level, it should be exposed for a distance of more than 400 ft. on the 1100-ft. level.

Nye County—Manhattan

Moore Lease No. 5—In a test at the Vieth mill 18 tons of ore from this lease on the Manhattan Earle property yielded 61 oz. of amalgam, which it is estimated will make an average of $45 gold per ton of ore. The ore was all taken from the working shaft now 90 ft. deep. The company intends to install a gasolene hoist.

Nye County—Round Mountain

Jefferson Mine—Charles Kanrahat, who recently sold this property to the McBeth syndicate, of New York, is authority for the statement that there is now $43,000 worth of machinery on the ground and that $30,000 additional will have to be spent to properly equip the mill and mine.

Humboldt County—Seven Troughs

Sandifer Lease—This lease recently broke into a fair sized body of high-grade ore on the 250-ft. level.

Humboldt County—Winnemucca

Intermountain Mine—Work is to be resumed on this property, which lies close to the town of Winnemucca. W. G. Adamson, superintendent of the company, states that the shaft, now 250 ft. deep, will be sunk to a depth of 400 ft., at which point it is expected to cut the Pride of the Mountain vein. This property was one of the early producers of the State and is credited with a production of more than $400,000.

Golden Eagle Mine—This property started work last week with Hasal Power as manager. For the present the ore will be concentrated at the company's mill and the product shipped. Later the company will erect a cyanide plant. The property is about 30 miles west of Winnemucca, and three miles from the Western Pacific at the old camp of Central.

North Carolina

Iredell County

A deposit of asbestos is being opened near Statesville by Charles Lambert, of Pittsburg, Penn. The asbestos so far found is said to be of good quality.

Oklahoma

The production of petroleum in December is reported by the *Oil Investors' Journal* at 2,796,600 bbl.; deliveries, 3,112,018 bbl. Added to stocks, 684,542 bbl. Total stocks on Dec. 31 were 52,097,200 bbl., as estimated. During December 297 wells were completed, of which 271 were oil producers, 8 gas producers and 18 dry. There were 286 wells drilling at the end of the month.

Ottawa County

Several drills are at work prospecting near Afton, and some strikes of zinc and lead ore are reported

Oregon

Lane County

Much development work is being done in the Bohemia district, which lies partly in Lane and partly in Douglas county. This work is of a character that denotes permanency, as it consists of road building, the shipping in of machinery, tunnel work, etc The miners of this camp have overcome the habit of doing only assessment work each year and are now expending all their available money on development work.

Vesuvius—The 10-stamp mill on this property near Bohemia postoffice is now running. The returns are said to be very satisfactory, but no details can be learned. Mr. Hand, who is manager of the Vesuvius mine, is also doing extensive work on the Oregon-Colorado and River side properties.

Combination Mines Company—This company was recently organized under the laws of Oregon, and has taken over the Combination mines owned by Clark Brothers. The officers of this company are R. H. Clark, of Milwaukee, Wis., president and treasurer; W. T. Clark, of Wenatchee, Wash., vice-president; J. W. Disch, of Milwaukee, Wis., secretary. The capital stock consists of 450,000 shares, par value $1; 200,000 shares are held in the treasury. This company has a high-grade concentrating property and is now installing machinery with which to work it. The Eastern office is at Milwaukee.

Martin Creek Mining Company—Good ore carrying gold and silver is being mined at this property near the Combination mines.

Mayflower Mines—Considerable development work is being done; machinery for a 100-ton mill is on the ground. The recent heavy fall of snow has caused a suspension of surface work, but it will be resumed as soon as the snow is gone. W. P. Ely is manager.

Twin Rocks Company—At the annual meeting of this company, recently held at Cottage Grove, the following officers were elected: President, Lewis Hartley, Cottage Grove, Ore.; vice-president, Geo. B. Spitler, Mt. Zion, Ill.; secretary-treasurer, W. B. Hartley, Cottage Grove, Ore. A block of 50,000 shares of stock was voted to be sold so as to raise additional money for development and machinery.

West Coast Mines Company—Several men are at work on this property and more will be put to work soon. It is the intention of the management to put the mill in working order and to commence dropping stamps as soon as enough ore is broken to assure a steady run for the 30 stamps.

Sweepstakes—A vein of solid quartz 16 ft. wide and rich in gold has been found at this property. S. J. Brund is owner.

Black Butte—This quicksilver mine about 12 miles south of Cottage Grove is now a paying proposition. For the last ten years money has been spent in development, and over four miles of drifts have been run to open up this large body of cinnabar ore. The furnace invented by Mr. Dennis, manager of the property, is in successful operation and considerable refined quicksilver is being shipped. This property is owned by New York men.

Pennsylvania

Anthracite Coal

Penn Coal Company—The district court has issued a peremptory order directing this company to take measures at once to extinguish the fire which has been burning in its colliery at Carbondale for more than a year. The order was issued in a suit brought by residents of the town, who complained of the gases escaping from the mine, and also of the danger of surface caves, as the coal below was burned out. The company has given notice of an appeal to the Supreme Court.

South Dakota

Lawrence County

American Eagle—Before the mill can be operated a water supply must be secured. The company will in the spring run a crosscut from rimrock to rimrock, build concrete dams and pump the water to the mill. The mine will be developed all winter.

Branch Mint Operating Company—Manager Hecht, of New York, is dropping 60 stamps daily in the mill which is running on the old Richmond dump.

Homestake—Preparations are being made to erect a power plant on Spearfish creek that will use 100 cu.ft. of water per second. The plant will require 1½ years and $1,000,000 to build. Advertising the water right and ground has been commenced by the company.

Pennington County

Fairview—Jerry Harrington is opening up this claim near Mystic, and has found a ledge of free-milling gold ore, 2 ft. in width, which will be treated in the old Cuttysark stamp mill that has been moved over to the property.

Forest City—This property, formerly the Clara Belle, at Oreville, is about to resume under the management of the Cleveland interests. A new shaft will probably be sunk.

Texas

The field reports from the southeast districts of Texas show 57 wells completed, 44 being oil producers and 13 dry holes. There were 71 wells under the drill on Dec. 31. The production of petroleum in December was 949,730 bbl. Shipments by rail were 618,722 bbl.; by sea, 147,512; total, 766,234 bbl. It is estimated that 150,000 bbl. were consumed in refineries and 75,000 bbl. in field operations.

Utah

Salt Lake County—Bingham

Utah Copper—The seventh steam shovel is now in operation; there is still another shovel being assembled. Five steam shovels are stripping overburden and two working on ore. The mine is shipping, as nearly as the railroad facilities will permit, the full tonnage that can be handled by the mill.

Utah-Bingham—Since last fall the mine has been equipped with machinery, air drills, etc. The main vein has been developed for 900 ft. along its strike by three adits and raises connecting them. Considerable ore is developed, but owing to the condition of the roads shipping has been stopped until next spring.

Boston Consolidated—A serious cave has occurred in the Ben Hur adit.

Tooele County

Shipments—During the week ending Jan. 1, the Sioux Consolidated shipped 11 carloads; Iron Blossom, 3; Eureka Hill, 3; May Day, 2; May Day concentrates, 2; Centennial Eureka, 24; Yankee, 2, Uncle Sam, 4; Gemini, 3; Eagle & Blue Bell, 1; Bullion Beck, 2; Colorado, 33; Dragon Iron, 10; Black Jack, 1; Swansea, 5; Lower Mammoth, 2; Brooklyn, 3 carloads. All these were 30-ton cars except those from the Colorado, Dragon Iron and Swansea mines, which were 20-ton cars. Six thousand five hundred bars of bullion were shipped from the smelter during the past week, bringing the total for the month of December up to 29,484 bars.

Shipments from the Tintic mines for the week ending Jan. 8 were as follows: Sioux Consolidated, 12 cars; Iron Blossom, 3; Consolidated Eureka, 44; Eureka Hill (leases), 6; Uncle Sam, 8; May Day, 4; Yankee, 3; Bullion Beck, 2; Ajax, 2; Colorado, 47; Dragon Iron, 23; Black Jack, 7; Brooklyn, 1; total, 162 cars. All these were 30-ton cars except the 20-ton cars from the Colorado, Dragon Iron, and Black Jack mines.

Lower Mammoth—About 300 ft. of the main shaft has been retimbered; it will require 90 days to complete the work to the 1200-ft. level. The assessment period will probably continue until fall. The officers of the company are John Dern, president; A. J. Stewart, vice-president; W. S. McCornick, treasurer. The other directors are D. L. Wertheimer, E. C. Coffin, A. T. Moon and M. P. Braffet. A. Reeves is secretary.

Little Chief—New machinery has been installed. The placing of guides for the counterbalance for the new hoist will require another week, as 1400 ft. of guides must be put in place. Drifting will then begin on the 1000-ft. and 1400-ft. levels.

Honerine Extension—At this mine at Stockton a blind lode has been found in a drift driven east on the Honorine vein from the Honerine company's old 600-ft. level tunnel. This is 600 ft. below the Honorine Extension tunnel. The orebody has been drifted on for 20 ft. and the ore is still good in the face. The width of the find is unknown, but the whole drift is in ore. The ore assays 25 per cent. lead, 14 oz. silver and $0.00 gold per ton. The

cross-fissure at which this ore is found was barren in the level above; the next cross-fissure is 125 ft. distant. As the find is in ground thought by many to be unmineralized, it promises to give new life to Stockton.

West Virginia

FAYETTE COUNTY

Nuttallburg Collieries Company—This new company, recently organized with $200,000 capital stock, has taken over the property of the Nuttallburg Coal and Coke Company, comprising 4160 acres of coal land, of which about 3000 acres are undeveloped; arrangements have been made for making several additional openings, and it is expected to double the present output. Dr. H. L. Kirkpatrick, Macdonald, W. Va., is president; John M. Alderson, Alderson, W. Va., vice-president; Angus McDonald, Charleston, W. Va., secretary; Lee Long, Charleston, W. Va., general manager and treasurer.

Wyoming

The principal producer of copper in this State continued to be the Penn-Wyoming Copper Company, of the Encampment district. During 1908 the smeltery of this company operated only 119 days, producing 2,384,356 lb. of copper from ore yielding 125.6 lb. per ton. The company is now operating a new and enlarged smeltery.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended Jan. 9 were: Buffalo, 44,020 lb.; Coniagas, 35,630; Cobalt Central, 40,000; Chambers-Ferland, 80,000; La Rose, 193,560; McKinley-Darragh, 44,020; Nipissing 127,500; Nancy Helen, 40,000; Temiskaming & Hudson Bay, 80,000; Muggley Concentrator, 72,900; total, 777,850 pounds.

Crown Reserve, Cobalt—The annual meeting held at Montreal Jan. 12 was attended by about 200 shareholders. The statement submitted showed that after payment of dividend due Jan. 15, amounting to $283,210, the company would carry forward a surplus of $317,117. During the year ore was taken out to the value of $910,350. President John Carson estimated the value of the output for 1909 at $1,200,000 which, allowing $200,000 for operating expenses, would leave $1,000,000 available for dividends. The intention of the directors is to pay dividends quarterly at the rate of 24 per cent. per annum and such bonuses as may be justified by earnings.

Hargraves—The main shaft of this mine, Cobalt, is going down at the rate of 2 ft. per day, and has reached a depth of 90 ft. A crosscut will be run to tap the Jacobs vein at depth and will be continued 100 ft. beyond it to strike a strong parallel vein.

Nipissing—During 1908 this mine produced 7,062,527 lb. of ore yielding 2,897,446 oz. silver of a net value, f.o.b. Cobalt, of $1,384,447. The ore averaged 19c. per pound. Sinking continues at the Fourth of July shaft, which is now down 121 ft. At the Meyer vein the west drift has been prepared for stoping. The vein shows a width of from 2 to 8 in. averaging 3500 oz. silver to the ton, over a distance of 40 ft. At the Kendall shaft drifting is proceeding both ways on the new cross-vein. The north vein, which averaged 4 in. wide and assayed 2000 oz., has faulted. On the south end of the vein it has split into 3 stringers each about 1 in. wide and running from 1500 to 2500 oz. silver to the ton. The middle vein is being followed up.

White Silver—At this mine, on the Temagami reserve, a shaft is down 30 ft. on a vein carrying high silver contents. About $50,000 has been spent on machinery and development and a quantity of ore is awaiting shipment.

ONTARIO—KENORA DIVISION

Kenora Prospectors' and Mine-Owners' Association—The first general meeting of this association was held at Kenora, Jan. 12. The following officers were elected: Honorary president, Capt. H. A. C. Machin; president Major J. E. P. Vereker; vice-president, Thomas Walsh; executive committee, Mayor Rideout, John Nash, H. D. Alston, J. Beck, W. G. Cameron, J. A. Whitney and A. Stevenson. Committees were appointed to draft resolutions for presentation to the provincial government asking that the timber on lands patented by miners should become the property of the patentee, and that State aid should be given for the development of the mining resources of the district.

Mexico

CHIHUAHUA

Batopilas—A shipment of 200 bars of silver bullion was made from this old property in the western part of the State early in January. Production is increasing owing to recent important discoveries of high-grade ore.

Parral Output—The production of the Parral camp for the month of November was 34,485 tons, and for the month of December, 28,889 tons. For the last week of December it was 7815 tons, and for the first week of January, 7840 tons.

Las Cuadras—These old properties in the Santa Barbara camp are again active under the direction of Charles M. Dobson. Shipments are in progress.

San Antander—This mine in the Santa Eulalia camp is now outputting at the rate of one carload a day; the ore goes to the Chihuahua plant of the American Smelting and Refining Company. C. O. Calahan is the owner.

Rio Tinto Copper Company—This company's new 300-ton copper smeltery in the Terrazas camp is scheduled for blowing in not later than Jan. 20. The company is purchasing out-of-the-district ores, especially copper sulphide and silicious ores.

Minas Tecoletes y Anexas—The mill at this Santa Barbara property operated by the American Smelters Securities Company, is treating approximately 800 tons of ore daily. Since its remodeling the plant is operating more efficiently. The average value of the ores milled is given as 20 grams silver, 3 grams gold, 7 per cent. lead, and 8 per cent. zinc. Wet concentration is practiced. It is reported that the company has in view the early erection of a zinc plant for the treatment of a large tonnage of accumulated middlings and tailings. W. M. Drury is the manager in charge.

Palmor Mining Company—This company, operating in the Parral camp, is said to have lately opened up ore of minable grade, and is contemplating the installation of heavier hoisting machinery.

El Tesoro Mining Company—This St. Louis company is successfully operating several properties in this State, as well as in Sinaloa. Its more important mines are in the vicinity of Guadalupe y Calvo and Choix. W. C. Harlan and A. W. Warwick are directing operations. The mill at El Tesoro mine is in operation.

Concheño—Corrigan, McKinney & Co., of Cleveland, Ohio, have taken back this mine as the Greene Gold-Silver Company forfeited over a year ago upon its second payment after having paid $500,000 on the purchase price of $1,250,000.

JALISCO

Cinco Minas—At this mine in the Hostotipaquillo district which is being developed by the Marcus' Daly estate under the direction of H. E. Crawford, a new body of ore has been found. It now appears certain that the Daly estate will complete the purchase of this property.

New Railroads—Considerable railroad building is going on in western Mexico. The Southern Pacific is building from Guaymas to Guadalajara as fast as it can. It is understood that the intention is finally to connect this road with the Pan-American at San Geronimo on the Isthmus of Tehuantepec. The Pan-American is now completed as far as the Guatamala border. The Mexican Central has its branch from Guadalajara to Manzanillo on the Pacific in operation

SONORA

Greene-Cananea—Six furnaces are now in operation. The production of copper for the past 17 months was 58,180,856 lb. The company employs 4000 men.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Jan. 20—In the Seaboard bituminous-coal trade dullness prevails as it has for some time past. A revival in the demand for steam coal was expected in some quarters in January, but these prophets are now postponing the good times for 60 days longer. The fact is that manufacturers are not buying with any degree of freedom in the East, and seem to be satisfied with enough to meet their immediate needs. Talk of season contracts is heard, but nobody seems disposed to start the business, and little or nothing will be done on this line for a month or more to come.

The anthracite trade is quiet. Some of the large companies are cutting off one or two days' work a week from the working time at the collieries; others are running full time, but not pushing work. Shipments continue and it is still evident that a good deal of coal is being stored.

In the West there are more signs of revival, though business in steam coal continues rather slow. There has been cold weather throughout the week, however, and from most consuming centers a better demand for household coal is reported. In Indiana mining time has been increased and many mines are running four days per week, with a few full time. In Illinois short time seems to be the rule. There is rather less complaint heard at the distributing centers of overshipments, notwithstanding the usual tendency of operators to load up the sidings at the large cities.

Coke business shows more hopeful signs than any other branch of the trade. Production in the Connellsville region is increasing from week to week, and the Pennsylvania Railroad reports larger shipments of coke than for a year past.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Jan. 11, 1908, and Jan. 9, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	123,320	63,216	D. 60,104
Bituminous	985,266	784,448	D. 200,818
Coke	193,973	253,625	I. 59,652
Total	1,302,559	1,101,289	D. 201,270

The total tonnages give daily averages of 118,415 tons in 1908, and 122,365 tons this year.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, 11 months ended Nov. 30, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	20,535,661	2,771,487	23,307,148
Buff., Roch. & Pitts.	4,982,888	300,353	5,283,241
Buff. & Susquch'na	1,059,525	185,847	1,245,372
Penn. lines, N. Y. C.	6,170,610	65,414	6,236,024
Pitts. & L. Erie	7,562,114	2,702,832	10,264,946
Norfolk & Western	10,194,955	1,752,261	11,947,216
Total	50,445,753	7,778,194	58,223,947
Total, 1907	61,795,402	13,092,432	74,887,834

The total decrease this year was 16,663,887 tons, or 22.3 per cent. In addition to the above, the Baltimore & Ohio carried 941,612 tons anthracite in 1907, and 719,681 in 1908; decrease, 221,931 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, 11 months ended Nov. 30, short tons:

	1907.	1908.	Changes
Hocking Valley	3,826,978	3,033,023	D. 793,955
Toledo & Ohio Cent.	1,688,748	1,473,228	D. 215,520
Baltimore & Ohio	2,100,377	1,319,549	D. 780,828
Wheeling & L. Erie	3,213,825	2,493,773	D. 720,052
Cleve., Lorain & Wh.	2,736,986	2,217,064	D. 519,922
Zanesville & Western	1,455,471	1,180,104	D. 275,367
Toledo Div., Pen. Co.	2,081,111	1,410,128	D. 670,983
L. Erie, Alliance & Wh.	1,149,587	986,756	D. 162,831
Marietta, Col. & Clev.	34,752	50,791	I. 16,039
Total	18,287,835	14,164,416	D. 4,123,419

The total decrease shown in 1908 was 22.5 per cent.

Coastwise shipments of coal from chief Atlantic ports, 11 months ended Nov. 30, long tons:

	Anthracite.	Bitum.	Total.	Per't.
New York	13,698,715	9,244,744	22,943,459	62.6
Philadelphia	1,951,031	4,254,843	6,205,874	16.9
Baltimore	228,206	3,337,890	3,566,096	9.7
Newp't News	.....	2,480,609	2,480,609	6.8
Norfolk	.....	1,471,884	1,471,884	4.0
Total	15,877,952	20,789,970	36,667,922	100.0
Total, 1907	17,747,371	22,524,791	40,272,162	.....

Total decrease in 1908 was 3,604,240 tons, or 8.9 per cent. New York includes all the New York harbor shipping points.

Shipments of coal by water from Seattle and Tacoma, Wash., 11 months ended Nov. 30, were 657,334 tons in 1907, and 454,784 in 1908; a decrease of 202,550 tons. These shipments are chiefly to California and Alaska ports.

Coal receipts at St. Louis 11 months ended Nov. 30 were 7,413,151 short tons in 1907, and 6,268,039 in 1908; decrease, 1,145,112 tons.

The coal shipments reported by the Southwestern Interstate Coal Operators' Association for the year 1908 are, in short tons:

Missouri	2,416,201
Kansas	5,178,933
Arkansas	1,887,328
[illegible]	2,686,808
Total	12,169,270

[illegible] in 1907 was 14,656,338 tons, showing a decrease in 1908 of 2,487,068 [illegible] r 17 per cent.

New York

Anthracite

Jan. 20—The hard-coal market must still be reported very dull. The sharp cold weather which came with the opening of this week has not lasted long enough to have any marked influence on the trade. Domestic sizes are selling slowly. In steam sizes there is a little more activity, but nothing beyond the usual demand. All sizes are in good supply.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal market is dull, no new demand for steam coal having developed. The far East is taking no coal and along the Sound deliveries are light with no new orders, or at least very few. New York harbor business is extremely dull and prices are nominal at $2.45@2.65 New York harbor for good grade Clearfield. Off grades are offered lower. All-rail business is slow and the snow and ice storm of this week has interfered a little with transportation.

In the Coastwise trade there is nothing doing. Freight rates are nominal at about the same as last week. The stormy weather has interfered with this trade and vessels are not anxious to clear just now.

Birmingham

Jan. 18—There is need for more coal, and the output has been steadily improving since the first of the year. The railroads are handling coal promptly. In addition to the increasing needs of some of the larger consumers, the coke production is being pushed. The coke supplies are now somewhat better than the demand, but several furnaces are to be blown in soon, while foundries and machine shops are starting up that will require all the coke that can be furnished.

Chicago

Jan. 18—Owing to cold weather the market for domestic coals remains good, and steam coals show no weakening. Western coal has moved steadily as fast as it has been received, leaving little ground for complaint about demurrage

charges, although on some consignments these charges have cut prices to the extent of 10 or 25c. on Illinois lump. Fine coals are firmer in tone, and the whole market shows improvement for products of Western mines. Eastern coals in general share in the improvement, but smokeless continues depressed because of large receipts that force low prices.

Illinois and Indiana coals bring $2@2.65 for lump and egg, $1.65@1.75 for run-of-mine, and $1.30@1.65 for screenings. On smokeless lump and egg quotations run $3.15@3.65 for Pocahontas and New River lump and egg, and $2.75@3.15 on run-of-mine, with lower grade smokeless $3.05@3.55 for lump and $2.75@2.95 for run-of-mine. Hocking holds up well to the $3.15 list price. Youghiogheny is quiet at $3.15 for ¾-in. gas. Pittsburg No. 8 is in somewhat large supply and brings $2.70@2.85 per ton.

Anthracite is in good demand in city and country, with practically no shading of prices for independent coal, and with no trouble about supplies.

Cleveland

Jan. 19—Receipts at Cleveland by rail in December included 87,411 tons anthracite, 266,326 tons bituminous coal and 76,173 tons coke. Practically none of the anthracite or coke was forwarded, but during the first days of the month 49,972 tons of bituminous coal were reshipped by Lake.

Steam trade is quiet, and the recent demand for slack seems now to be about over. Cold weather has started up a better demand for domestic coals. The market as a whole, however, must be called quiet, almost dull.

Indianapolis

Jan 18—Here and there are signs of improvement in the coal trade. This is partly due to the coming of severe cold weather, starting domestic demand up with a rush. In Sullivan county, for instance, news comes of the adoption of a five-day weekly schedule for a number of mines and the lengthening of the schedules in others. The mines are now in better condition, financially, than any time since the spring of 1908. Mines that have been running only one and two days in the week are now running three and four days. A few are operating six days.

Pittsburg

Jan. 19—The rivers reached a coal-boat stage on Saturday and Sunday and nearly 2,000,000 bu. were shipped to St. Louis and New Orleans. There is still a barge stage but little coal is going out. A good rise is expected later in the week, when efforts will be made to get out all the coal loaded in the pools and harbors. Many empty barges arrived and were immediately sent to the mine tipples in the upper pools of the Monongahela river. As a result all the idle mines along the river resumed operations yesterday. The railroad mines are being operated at around 60 per cent. The demand is not strong, but prices remain firm on the basis of $1.15 a ton for mine-run coal at mine. There is some slight shading of this rate by small independent concerns, but the large operators are determined to maintain the price. A start has been made at the Marianna mine of the Pittsburg-Buffalo Company where the serious explosion occurred last month. About 50 men are working in each shift, and it is proposed to increase the number gradually.

Connellsville Coke—A decided slump in spot furnace coke prices is noted and sales have been made as low as $1.50; it is reported that one sale was at $1.35 a ton at ovens. Large producers are holding firmly for $1.75 for spot and $1.90@2 on contract for the first half. Foundry coke has not dropped materially and for spot shipment it will be difficult to do less than $2.10. On contract, quotations continue at $2.25@2.40 a ton at ovens. The *Courier* gives the production at 265,158 tons. Shipments were 9179 cars as follows: To Pittsburg district, 3406; to points west of Pittsburg, 5101; to points east of Connellsville, 672 cars.

Foreign Coal Trade

German Coal Production—Coal production of the German Empire, 11 months ended Nov. 30, metric tons:

	1907.	1908.	Changes.
Coal	131,393,100	136,729,987	I. 5,336,887
Brown coal	56,853,293	60,934,889	I. 4,081,596
Total mined	188,246,393	197,664,876	I. 9,418,483
Coke made	20,025,165	19,537,382	D. 487,783
Briquets made	15,043,430	16,813,871	I. 1,770,441

Of the briquets made in 1908 there were 13,101,439 tons, or 77.9 per cent. of the total, made from brown coal, or lignite.

German Coal Trade—Imports and exports of fuel in Germany, 11 months ended Nov. 30, metric tons:

Imports:	1907.	1908.	Changes.
Coal	12,549,210	10,745,167	D. 1,804,043
Brown coal	8,163,446	7,920,938	D. 242,508
Total coal	20,712,656	18,666,105	D. 2,046,551
Coke	538,739	518,588	D. 20,151
Briquets	175,030	176,923	I. 1,893
Exports:			
Coal	18,115,184	19,192,539	I. 1,077,355
Brown coal	20,039	25,449	I. 5,410
Total coal	18,135,223	19,217,988	I. 1,082,765
Coke	3,471,671	3,315,691	D. 155,980
Briquets	1,126,539	1,381,559	I. 255,020

The coke exports in 1908 included 25,075 tons to the United States.

Welsh Coal Prices—Messrs. Hull, Blyth & Co. London and Cardiff, report current prices of coal as follows, on Jan 8: Best Welsh steam, $3.48; second, $3.36; thirds, $3.24; dry coals, $3.60; best Mormouthshire, $3.18; seconds, $3.06; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Jan. 20—The iron and steel markets in general, while they show no signs of the widespread activity which was predicted for January, are nevertheless improving a little. The advance, however, is very slow.

In pig iron the inquiry is better and orders are reported to be coming in. They are mostly small, however, indicating that the foundry people are still satisfied to supply their immediate needs and have not in sight as yet business enough to warrant them in placing large contracts. Forge iron is dull, and basic pig is only in moderate demand. Prices of pig generally are rather uncertain. Some furnaces have talked of advances, but find that the only result is to check orders.

In finished material—with the exception of structural steel—business is also generally on a small scale. Orders do not come in with any degree of freedom except for moderate quantities. The railroads are still out of the market so far as rails are concerned, though they are placing some orders for bridge work. In structural steel more is doing than in any other branch. In the Eastern cities orders for buildings are being placed, some of them of fair size. The whole makes a very good aggregate tonnage. It is observed that the large fabricating companies in New York and elsewhere are taking contracts which would seem to imply the purchase of steel from the mills at 1.25 or 1.30c. if a profit is to be figured on. This is from 0.40 to 0.50c. below the tidewater prices of beams and other structural material.

Shipments of iron ore from the Lake Erie docks to furnaces are still reported as slow. The docks are generally congested, and unless there is a very considerable movement between now and May 1 they will not be ready to receive shipments from the upper Lake ports.

Baltimore

Jan. 19—The only exports noted for the week, besides copper, were 536,250 lb. scrap tin to Rotterdam.

Birmingham

Jan. 18—While the activity that is desired has not yet asserted itself, Southern pig-iron producers are selling iron right along and the aggregate is showing up well. One or two orders of some proportion have been booked in the Birmingham district recently, while numerous small orders, early delivery, are noted. The quotations hold strong at $13 per ton, No. 2 foundry. The furnace companies which have been sounding a 50c. advance do not report any business transacted. Some of the larger melters have again started an inquiry as to iron.

There is a large consumption of iron right in the Birmingham district. The

big steel plant of the Tennessee company is now on full in every department. The Bessemer rolling mill, belonging to the same concern is turning out finished iron and steel again. The cast-iron pipe concerns are all active, while foundries and machine shops show further improvement.

By Telegraph

Birmingham, Jan. 20—The Sloss-Sheffield Company sold today 20,000 tons of foundry iron to a leading cast-iron pipe plant on a basis of $13 per ton, first-half delivery. It is rumored here that the Alabama Consolidated Coal and Iron Company has bought the large plant of the Dimmick Pipe Company.

Chicago

Jan. 18—There is little activity in iron of any sort. Users of pig iron continue to buy in small quantities and for needs of the immediate future chiefly. Both buyers and sellers seem to have come to the conclusion to abandon contracts reaching any considerable distance ahead for deliveries, and inquiries are neither numerous nor for large tonnage. Despite this quietness the market has no indications of weakening, consumption being apparently well matched by production.

For the small lots that are being sold $13@13.50 Birmingham ($17.35@17.85 Chicago) for Southern and $17.50@18 for Northern are standard prices. Any considerable order could probably shade these quotations. Business is gradually resuming its normal tone following the holiday season, and the changes of the first of the year, and in sales of iron and steel products there are signs of increasing strength. Coke is somewhat stronger, with the best Connellsville in good demand at $4.00@5 Chicago.

Philadelphia

Jan. 20—Local consumers are making no effort to cover second quarter requirements for pig iron. There is no increase in shop or foundry work at present. Eastern furnace interests are not soliciting orders and a few makers have refused to sell at less than December prices. Inquiries have fallen off, except in a few instances for basic pig. Buyers claim that pig iron has not touched bottom and refer to the drop in Southern pig quotations during the past few days. At present an accumulation is in progress but makers express confidence in a heavy compensating demand which they think is liable to break out any time. Pipe works are ready to extend their orders but are insisting on lower prices. Some central Pennsylvania furnaces are again making very low offers for early delivery. Some special brands of Lehigh Valley iron are advanced 50c. nominally, but no sales have been made yet.

Steel Billets—Contracts of some magnitude have been closed for billets [illegible] days delivery. Prices continue on the basis of former contracts.

Bars—All bar mills are doing a little more business and there is a gradual return to normal conditions. A few good sized orders have been placed this week but at a shading from current prices.

Scrap—The sales of scrap have been unimportant. Foundries are buying a little. Heavy melting steel scrap is pretty well cleaned up. Consumers are fairly well supplied. Prices are weak. Dealers are on the war path for heavy scrap to hold.

Pittsburg

Jan. 19—There has been no material improvement in the iron and steel trade. Tinplate leads the finished lines and production is being increased. The American Sheet and Tin Plate Company has started its American works, a 28-mill tinplate plant at Elwood, Ind., and last week was operating 160 mills, or about 75 per cent. of capacity. This was increased yesterday when several more mills at different plants were put on the active list. Most of the independent tinplate mills are running practically to capacity. When the spring trade opens it is certain production will be about normal. The same may be said of the wire trade. At present the American Steel and Wire Company is operating at around 80 per cent. of capacity and is booking many small orders. The Carnegie Steel Company yesterday started its Edgar Thomson rail plant in full, as in addition to receiving specifications on the Pennsylvania railroad order it has booked some foreign business. It is figured that the railroads will place orders for fully 3,000,000 tons, but of this there is no certainty. The structural steel trade continues dull, but there are some important contracts in sight which are being delayed on account of the talk of a probable reduction in prices. Every consumer that enters the market is determined to get the lowest possible price and usually succeeds, the shading, however, being done entirely by independent mills.

Pig Iron—A number of important transactions in different grades of pig iron have been closed within the past two weeks, but for certain reasons the buyers insisted that no publicity be given to the contracts. One concern in the past 10 days sold over 10,000 tons of iron of various grades and at different prices. Another sold several lots of malleable bessemer, which is apparently the strongest grade. One lot calls for 1200 tons and is for early delivery and the price was $15.75. This price could not be duplicated for second-quarter delivery. A sale of 600 tons of No. 2 foundry for prompt delivery at $15.50 was made yesterday and another lot is under negotiation and may go at a lower price. Basic [illegible] as strong as at the opening of the year, when $15.75 was named for first quarter, as a sale of several hundred tons was made within the past few days at $15.50. It is said that this price cannot be shaded. Standard bessemer is weak. The effort to hold first-half iron at $17 failed and now $16.50 is the quotation made by large producers. However, a sale of 600 tons was closed last week at $16.40. Gray forge is not in demand and is quoted nominally at $14.50. All prices are f.o.b. Valley furnaces.

Steel—In the crude-steel market most of the business is on old contracts. The price of $25, Pittsburg, is being firmly held for both bessemer and open-hearth billets. The announced price on plates continues at 1.60c., but there is still considerable shading. Merchant-steel bars remain firm at 1.40c.

Sheets—The sheet market shows improvement and production is being increased. Prices are firm, black sheets remaining at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—There is no demand, but prices are firm at $46@46.50, Pittsburg.

Foreign Iron

Scotch Iron Production—The Scottish Ironmasters' Association has issued the following statement for the full years given, in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1	90,548	96,043	I. 5,495
Make of pig	1,403,447	1,230,191	D. 173,256
Total	1,493,995	1,326,234	D. 167,761
Consumption	997,692	827,627	D. 170,065
Exports	400,260	312,562	D. 87,698
Total used	1,397,952	1,140,189	D. 257,763
Stocks, Dec. 31	96,043	186,045	I. 90,002

Of the exports in 1908, there were 142,830 tons to foreign countries and 169,732 to England and Wales.

Metal Market

New York, Jan. 20—The metal markets generally have been quiet, and no active revival of business is manifest as yet.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold			
Dec. 1908	$ 7,358,707	$ 5,122,538	Exp. $2,235,169
" 1907	1,004,441	44,448,515	Imp. 43,444,074
Year 1908	71,215,456	50,246,099	Exp. 30,969,357
" 1907	55,215,681	143,398,072	Imp. 88,182,391
Silver			
Dec. 1908	4,726,289	4,382,290	Exp. 343,999
" 1907	4,413,698	4,222,036	" 191,662
Year 1908	51,837,671	42,196,966	" 9,640,705
" 1907	61,625,866	45,912,360	" 15,713,506

Exports from the port of New York, week ended Jan. 16: Gold, $5,930,000, chiefly to France; silver, $1,010,000, chiefly to London. Imports: Gold, $237,526; silver, $169,014, from the West Indies, Mexico and South America.

Foreign commerce of the United States, year ended Dec. 31, reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1907.	1908.
Exports	$1,923,426,205	$1,753,307,931
Imports	1,423,169,820	1,116,402,243
Excess, exports	$ 500,256,385	$ 636,905,688
Add excess of exports, silver		9,640,705
Add excess of exports, gold		30,969,357
Total export balance		$ 677,515,750

The gold and silver movement in detail is found in the table at the head of this column.

Gold—The price of gold in the open market in London fell off early in the week, but recovered later, 77s. 10⅝d. per oz. being paid for bar gold and 76s. 5⅝d. for American eagles. The Bank of France took most of the gold arriving from the Transvaal; but a total of $3,100,000 was shipped to Argentina. A shipment of $500,000 was also made to Argentina from New York.

Platinum—Prices still hold at $23.50@24.50 for refined ingot, $26.25 for hard and $20@21 for scrap, depending upon the quality. The refiners seem to be waiting for something to turn up. They are evidently uneasy as to what may happen in the future, and are inclined to push prices as high as they possibly can, with little buying in sight just now. Our last report from St. Petersburg is also to the effect that dealers there are holding back in expectation of higher prices. This appears to be over-optimistic, in view of the fact that there is not at present enough buying to keep the market stiff. In some well-informed quarters it is thought likely that the price will decline before making any further advance.

Silver—Silver advanced to 24⅜d. in London on Jan. 18 on active buying for the Indian bazaars, but closes at 23 15/16d. with a lower tendency. Selling by China banks caused the fall, and the market is quoted dull at the decline.

SILVER AND STERLING EXCHANGE.

Jan.	14	15	16	18	19	20
New York	52⅛	52⅜	52⅝	52⅞	52⅜	52
London	24	24⅛	24 5/16	24⅜	24⅛	23 15/16
Sterling Ex.	4.8745	4.8740	4.8740	4.8750	4.8740	4.8740

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Jan. 7, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India	£ 207,500	£ 66,110	D. £ 141,390
China	61,000	.....	D. 61,000
Straits	.....	.....	.....
Total	£ 268,500	£ 66,110	D. £ 202,390

Receipts for the week were £4000 from Chile and £170,000 from New York; £174,000 in all.

Copper, Tin, Lead and Zinc

Jan.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
14	14⅛ @14⅜	13⅞ @14⅛	61⅞	28½	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
16	14⅛ @14⅜	13¾ @14	61⅜	27¾	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
16	14⅛ @14⅜	13¾ @14	....	27¾	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
18	14 @14¼	13¾ @13⅞	60⅛	27¾	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
19	14 @14¼	13⅝ @13⅞	60⅜	27¾	4.15 @4.20	5.12½ @5.17½	4.97½ @5.02½
20	14 @14¼	13⅝ @13⅞	60⅜	28	4.15 @4.20	5.12½ @5.16	4.97½ @5.00

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Liquidation in the London market of some of the large speculative accounts, many of them originating from this side, to which we have previously referred, caused a break in the market for Standard. It has all along been feared that something of this kind would happen, and the situation is now clearer because of the liquidation of these accounts, which appears to have been inspired by the reports of large stocks of refined copper accumulated in this country, although some of these reports are greatly exaggerated. The lower prices established at London were immediately reflected in the quotations at which electrolytic copper was offered to domestic consumers. Though concessions have been made from day to day, such business as has been forthcoming either from Europe or from the home trade, has been only of a retail character. The market closes very unsettled at 14@14¼c. for Lake copper and 13⅝@13⅞c. for electrolytic. Casting is nominally 13⅜@13⅝ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled 19c. per lb., base. Copper wire, 15¾c. base, carload lots at mill.

The London market broke sharply every day of the week, until Tuesday morning, when £59 12s. 6d. for spot and £60 10s. for three months was touched. From this point there was a feeble rally, and the close is easy at £60 7s. 6d. for spot and £61 5s. for three months.

Refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@76.

The disparity between the New York and London markets was such on Monday last that cathodes could be bought in London out of storehouse and be delivered in New York at 13½c. per lb., while the price here was 13¾c. However, it is improbable that any such return movement will occur, the chances being that the disparity will be removed by a rise in the London price, or a fall in that of New York.

Exports from New York and Philadelphia for the week are reported at 4213 long tons copper. Our special correspondent gives the exports from Baltimore at 801 long tons.

Imports and exports of copper in Germany, 11 months ended Nov. 30, metric tons:

	1907.	1908.	Changes.
Imports	120,753	147,114	I. 26,361
Exports	9,813	8,034	D. 1,779
Net imports	110,940	139,080	I. 28,140

The increase in net imports in 1908 was 25.3 per cent.

Tin—The firmer tone which London reported middle of last week was not maintained, and the market relapsed into dullness. Transactions were of small volume at declining prices. At the close, quotations reacted somewhat and are cabled at £126 15s. for spot and £128 12s. 6d. for three months.

Consumers in this market are attracted by the lower prices and are showing some interest. So far, large transactions, however, have not taken place. The market is quoted at about 28 cents.

Arrivals of Bolivian tin ores and concentrates—chiefly concentrates—in Europe for the 12 months ended Dec. 31 are reported 15,394 long tons in 1907, and 17,632 tons in 1908; an increase of 2238 tons.

Lead—There has been no change in the market, quotations being easy at 4.15@4.20c., New York.

The London market presents no new features and closes unchanged at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—There is a little more pressure to sell, and as the demand is of small proportions prices have eased off somewhat, and close at 5.12½@5.15c., New York, and 4.97½@5c., St. Louis.

The London market is also somewhat lower, and quotations are cabled at £21 2s. 6d. for good ordinaries, £21 7s. 6d. for specials.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market is quiet, with little doing in the way of sales. Quotations are a shade lower, at 8⅛@8¼c. for Cookson's; 8@8½c. for Hallett's; 7½@7⅝c. for ordinary brands.

Aluminum—There is no change in the condition of the market. The European situation is still demoralized, prices being down to the cost of production. Foreign

aluminum has been sold in New York at 21½c. per lb. for ingots. The Aluminum Company still quotes 24c. base for No. 1 ingots and 33@34c. base for sheets.

Some large bids have recently been made for aluminum wire in electrical work. A contract for transmission wire for a Manitoba power company which would require 1,350,000 lb. of copper wire has been taken by the Aluminum people at a price not made public. Deliveries on this contract will extend over some time. Another contract in Massachusetts, which would take 450,000 lb. of copper wire, has also been taken by the Aluminum people.

Quicksilver—The market is quiet. New York quotations are $45@46 per flask of 75 lb., showing no change. San Francisco prices are $45@46 for domestic orders, and $43@44 for export. London quotation is £8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, 12 months ended Dec. 31, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.
Copper	166,348	68,866	Imp. 97,482
Copper, 1907	129,061	66,375	Imp. 62,686
Tin	47,730	42,096	Imp. 5,634
Tin, 1907	43,794	35,435	Imp. 8,359
Lead	237,518	49,464	Imp. 188,054
Lead, 1907	204,695	43,372	Imp. 161,323
Spelter	108,519	8,417	Imp. 100,102
Spelter, 1907	109,172	6,553	Imp. 102,619
Quicksilver, lb.	3,270,412	1,676,167	Imp. 1,594,245
Quicksilver, '07	2,958,603	2,209,439	Imp. 748,664
Ores.			
Tin ore and con.	25,013	.....	Imp. 25,013
Tin ore, 1907	20,871	.....	Imp. 20,871
Pyrites	759,910	.....	Imp. 759,910
Pyrites, 1907	769,141	.....	Imp. 769,141

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1908 the United States furnished 7068 tons copper matte, 56,138 tons fine copper and 36,443 tons lead.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 16—The base price paid for zinc ore this week was $41@42.50 per ton of 60 per cent. zinc; no premium price is reported. For 80 per cent. lead ore $50 per ton was paid.

The shipment was largely reduced the past two weeks by temporary shutdowns for repairs by a number of the larger producers.

Hazel Green failed to report. There is included in the week's shipments 28,000 lb. from Mineral Point, 63,000 from Harker, 101,910 from Linden and 116,100 from Highland; in all 309,010 lb. zinc ore shipped in the previous week, but not then reported.

SHIPMENTS, WEEK ENDED JAN. 16

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	543,730	.....	151,700
Linden	346,150	.....	.....
Harker	338,450	.....	.....
Cuba City	177,250	.....	.....
Benton	163,290	60,000	.....
Strawbridge	88,000	.....	.....
Days Siding	83,000	.....	.....
Livingston	80,000	.....	.....
Mineral Point	28,000	.....	.....
Highland	175,700	.....	.....
Total	2,023,570	60,000	151,700
Year to Jan. 16	6,472,996	60,000	552,900

Shipped this week to the Platteville Separating Company, 367,650 lb.; to the Joplin Separator Works, from Rewey, 108,600 lb. zinc ore.

Joplin, Mo., Jan. 16—The highest price for zinc ore was $46, the base price being $44 and $43 for the bulk of the ore sold, with a few small bins sold at $42 per ton of 60 per cent. zinc, for sulphide ore. Silicate ore sold on a base of $19 per ton of 40 per cent. zinc, with sales as high as $24, on a flat bid. The average price, all grades, was $39.78. Lead advanced this week to $54.50 per ton, an increase of $2.

SHIPMENTS, WEEK ENDED JAN. 16

	Zinc, lb.	Lead, lb.	Value.
Webb City Carterville	2,479,990	355,050	$61,310
Joplin	599,340	79,680	15,681
Galena	517,230	62,920	12,498
Aurora	294,710	.....	9,881
Alba-Neck	395,180	49,310	9,579
Granby	528,160	1,700	8,998
Badger	314,760	.....	6,610
Quapaw	269,000	.....	5,111
Duenweg	213,190	10,060	4,736
Prosperity	159,480	16,850	3,787
Miami	296,050	.....	3,503
Spurgeon	100,580	61,780	3,275
Carl Junction	88,340	5,370	2,083
Cave Springs	76,520	.....	1,645
Carthage	65,980	.....	1,384
Sarcoxie	55,670	.....	1,197
Zincite	58,560	.....	1,171
Totals	6,822,740	642,720	$152,449

Three weeks	29,119,840	3,251,520	$648,105
Zinc value, the week, $135,746;		3 weeks,	$565,618
Lead value, the week,	16,703;	3 weeks,	83,487

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1907.	1908.	Zinc Ore. All Ores. 1907.	1908.	Lead Ore. All Ores. 1907.	1908.
January	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February	48.30	36.63	47.11	34.92	84.58	49.72
March	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	58.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60.34
September	41.00	37.63	40.11	34.44	53.52	54.50
October	41.75	35.95	39.83	33.28	51.40	52.63
November	38.60	39.13	35.19	35.02	43.40	54.53
December	31.50	42.75	30.87	39.63	37.71	49.68
Year	$44.36	$36.63	$43.68	$34.31	$68.90	$53.93

Note.—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

The average price, all grades, was $51.96 per ton.

A snowfall of 12 in. last Monday, with 7 deg. below zero on Tuesday put a large number of mines out of business for the greater part of the week, and it is estimated that the output was only approximately 30 per cent. of normal. The shipment is the smallest in years. A number of producers declined to sell under a base price of $45, and the buyers seemed equally determined not to pay this price. This, with the heavy snow, made the shipment light. A large proportion of the ore shipped is from purchases of the previous week.

Chemicals

New York, Jan. 20—The market in general is steady with no changes of importance. Stock-taking is hardly completed yet, and buyers do not seem ready yet to do business beyond their immediate needs.

Copper Sulphate—Demand is fair and no shading is reported, there being little outside stuff on the market. Quotations are steady at $4.75 per 100 lb. for carload lots and up to $5 per 100 lb. for smaller parcels.

Arsenic—The market is dull, only a few small sales being reported. Quotations are 3½c. per lb. for white arsenic.

Nitrate of Soda—Comparatively little is doing in this article. Current quotations are 2.17½c. for spot and 2.12½c. for futures.

Mining Stocks

New York, Jan. 20—The general stock markets have been largely professional in their character, with outside dealing not at all heavy. Fluctuations have been moderate, the only considerable decline having been in Amalgamated Copper. This stock rallied a little at the close. There was nothing of importance to affect the course of the market seriously in either direction, and it was not specially interesting.

On the Curb there was a fair amount of trading in copper stocks, Cumberland-Ely being the leader. While prices were not strong, they held up better than might have been expected. In the first part of the week Standard Oil was forced down, but it rallied toward the close. The Cobalt stocks were in fair demand, and prices held well, with a good volume of trading. The Nevada stocks were not specially active.

Boston, Jan. 19—It has been a dull and monotonous market, and outside of a few exceptions price changes have been unimportant. The weakness of copper metal has had to do with this state of affairs, which, to say the least, is discouraging for the moment.

A slight upward movement occurred in some of the Lake Superior mines on reports of daily conferences between the Calumet & Hecla and Bigelow, or Osceola people. However, they came to naught and prices lost pretty much all the advance. Isle Royale, for instance, rose $2 to $26.50, but is back close to $25, and Osceola rose $4 to $134, losing all but $1 of it. Calumet & Hecla went off $10 to $660. Superior Copper had another bulge and crossed $40, with subsequent reaction to $39. Tamarack rose $4 to $84, losing part of the advance.

The Osceola Consolidated annual meeting has been further adjourned to Feb. 17, pending a decision by Judge Knappen. Copper Range is off $1.62½ for the week to $77.62½, and North Butte $1.50 to $79.50. Arizona Commercial fell from $37 to $35.62½; Butte Coalition from $26.25 to $24.75; Lake from $22.62½ to $21, and Utah Consolidated from $45.25 to $44. Wyandot touched $4, the highest price for some time. The talk of contest for control of the Daly-West mine has had no effect on the stock. National Mining stockholders have been assessed 40c. a share to pay off its indebtedness.

A factor of some importance is the demand for memberships in the Stock Exchange. Two transfers have been made lately and at record prices, namely, $37,000 and $38,000

The Curb has been fairly active, but without any important feature. Several new mining securities have made their appearance there.

STOCK QUOTATIONS

NEW YORK Jan. 19	
Name of Comp.	Clg.
Alaska Mine	⅜
Amalgamated	79¼
Anaconda	47½
Balaklala	12 1/16
British Col. Cop.	8
Buffalo Mines	3¾
Butte Coalition	24⅞
Colonial Silver	7/16
Cum. Ely Mining	8¾
Davis Daly	2¾
Dominion Cop.	7/16
Douglas Copper	1¾
El Rayo	3½
Florence	4⅞
Foster Cobalt	.56
Furnace Creek	.11
Giroux	8
Gold Hill	5/16
Goldfield Con.	8
Granby	104½
Greene Gold	⅛
Greene G. & S.	7
Greenw'r & D.Val.	‡.75
Guanajuato	2
Guggen. Exp.	180
Hanapah	.15
McKinley Dar.	.95
Miami Copper	14
Miemac	2
Mines Co. of Am.	1
Mitchell Mining	⅛
Mont. Sho. C.	1
Nev. Utah M. & S.	2 1/16
Newhouse M. & S.	5¼
Nipissing Mines	10⅝
Old Hundred	⅛
Silver Queen	.98
Stewart	1/16
Tennessee Cop'r	44½
Tri-Bullion	7/16
Union Copper	1/16
Utah Apex	6
Utah Copper	44½
Yukon Gold	4¼

BOSTON Jan. 19	
Name of Comp.	Clg.
Adventure	9
Allouez	‡35
Am. Zinc	24¼
Arcadian	3
Arizona Com	36
Atlantic	16¼
Boston Con	15
Calumet & Ariz.	114
Calumet & Hecla	‡665
Centennial	31¾
Con. Mercur	.31
Copper Range	77⅛
Daly-West	10
East Butte	7⅝
Franklin	15¼
Greene-Can.	11⅞
Isle Royal	25¼
La Salle	14⅞
Mass.	5⅛
Michigan	12⅛
Mohawk*	66
Nevada	18½
North Butte	79¾
Old Colony	‡.60
Old Dominion	55¼
Osceola	131
Parrot	28½
Quincy	93
Rhode Island	5
Santa Fe	12¾
Shannon	16¼
Superior	39
Superior & Pitts.	16⅛
Tamarack	‡78
Trinity	15⅛
United Cop., com.	‡14⅛
U. S. Oil	28¼
U. S. Smg. & Ref.	44
U.S.Sm. & Ro.,pd.	46½
Utah Con	44
Victoria	4⅞
Winona	5
Wolverine	150
Wyandotte	3½

*Ex. Div. ‡Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38⅝
Am. Smelt. & Ref.	85⅝
Am. Sm. & Ref. pf.	102
Colo. Fuel & Iron	41
Federal M. & S.,pf.	‡84
National Lead	77¾
National Lead, pf.	107
Pittsburg Coal	‡13¼
Republic I. & S.	25¼
Republic I.& S.,pf.	86¼
Sloss-Sheffield	78
Standard Oil	658½
U. S. Steel	52⅛
U. S. Steel, pf.	113¾
Va. Car. Chem.	45⅝

BOSTON CURB	
Ahmeek	141
Black Mt.	3⅛
Chemung	19
Globe Con	6¼
Hancock	12
Helvetia	3¾
Keweenaw	4¾
North Lake	‡7⅝
Ojibway	14
Superior & Bost.	15¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Jan. 16		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	2.00	1.50
Cent. C. & C.	78.00	76.00
C.C. & C. pd.	81.00	79.00
Cent. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	21.00	19.00
Doe Run	125.00	110.00
Gra. Bimet.	.25	.20
St. Joe	14.00	12.50

LONDON Jan. 20			
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton's Islnd.	0	3	3
Camp Bird	0	15	3
Esperanza	3	2	6
Tomboy	0	18	9
El Oro	1	2	6
Oroville	0	9	0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Jan. 20
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.10
Belcher	.63	St. Ives	.18
Best & Belcher	.75	Triangle	.03
Caledonia	.38	BULLFROG STOCKS	
Chollar	.28	Gibraltar	.03
Comstock	.29	Homestake King	.08
Con. Cal. & Va.	.98	Mont. Shoshone C.	1.00
Crown Point	.85	Tramp Cons	.09
Exchequer	.55	MISCELLANEOUS	
Gould & Curry	.29	Bonnie Clare	.06
Hale & Norcross	.45	Lee Gold Grotto	...
Mexican	1.30	Nevada Hills	1.50
Ophir	2.00	Nevada Smelting	1.25
Overman	.37	Nevada Wonder	.35
Potosi	.40	Nevada-Utah	2.87½
Savage	.54	Penn-Wyoming	.08
Sierra Nevada	.50	Pittsburgh S. Pk.	.80
Union	.69	Rawhide Coal	.60
Utah	.10	Round Mt. Sphinx	.15
Yellow Jacket	1.37		
TONOPAH STOCKS			
Belmont	.90		
Extension	.50		
Golden Anchor	.01		
Jim Butler	.16		
MacNamara	.37		
Midway	.24		
Montana	.70		
North Star	.03		
Tono'h Mine of N.	5.87½		
West End Con	.36		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.15½		
Booth	.26		
Columbia Mt.	.17		
Comb. Frac	1.17		
Con. Red Top	.12½		
Cracker Jack	.04		
Dia'dfield B. B. C.	.09		
Goldfield Belmont	.06		
Goldfield Daisy	.68		
Great Bend	.19		
Jumbo Extension	.18		
Kendall	.08		
Lone Star	.06		
May Queen	.04		
N. Y. C. O. D.	.07		
Ore	.11		
Red Hill	.15		
Roanoke	...		
Sandstorm	.17		

COLO. SPRINGS Jan. 8	
Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con	3½
Dante	6
Doctor Jack Pot	8½
Elkton	70½
El Paso	50¼
Findlay	15¾
Gold Dollar	9¼
Gold Sovereign	3⅛
Isabella	24
Index	....
Jennie Sample	5
Jerry Johnson	‡4⅛
Mary McKinney	38½
Pharmacist	‡3⅛
Portland	1.01
Un. Gold Mines	4½
Vindicator	80
Work	6¾

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev.	Feb. 2	Feb. 23	$0.05
Andes, Nev.	Jan. 8	Feb. 2	0.10
Caledonia, Nev.	Jan. 8	Jan. 29	0.05
Chollar, Nev.	Jan. 11	Feb. 3	0.10
Con. Imperial, Nev.	Jan. 11	Feb. 3	0.01
Copper King, Ida.	Dec. 10	Jan. 15	0.01
Exchequer, Nev.	Dec. 30	Jan. 20	0.05
Federal-Ely, Utah	Jan. 9	Feb. 1	0.01
Iowa, Utah	Jan. 5	Feb. 2	0.02
Savage, Nev.	Jan. 6	Jan. 28	0.10
Sierra Nevada, Nev.	Feb. 12	Mar. 6	0.10
Silver King Con., Utah	Jan. 6	Jan. 26	0.10
Wabash, Utah	Jan. 7	Jan. 30	0.10
Yellow Jacket, Nev.	Dec. 28	Feb. 3	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1907.	New York. 1908.	London. 1907.	London. 1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.619	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.514
August	68.745	51.683	31.637	23.858
September	67.792	51.720	31.318	23.877
October	62.435	51.431	28.863	23.725
November	58.577	49.647	27.154	22.933
December	54.565	48.759	25.362	22.493
Year	65.327	52.864	30.188	24.402

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1907.	Electrolytic 1908.	Lake. 1907.	Lake. 1908.	LONDON. 1907.	LONDON. 1908.
January	24.404	13.726	24.525	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	21.565	12.675	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	60.500
September	15.565	13.388	16.047	13.600	68.375	60.338
October	13.169	13.354	13.551	13.646	60.717	60.139
November	13.391	14.130	13.870	14.386	61.226	63.417
December	13.163	14.111	13.393	14.411	59.113	62.943
Year	20.004	13.208	20.661	13.424	87.007	59.902

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September	38.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.925	29.144
			Av. year	38.160	29.465

Prices are in cents per pound.

LEAD

Month.	New York. 1907.	New York. 1908.	London. 1907.	London. 1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	5.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.880	19.063	13.875
September	4.813	4.515	19.775	13.125
October	4.750	4.351	18.531	13.375
November	4.376	4.330	17.281	13.538
December	3.658	4.213	14.600	13.156
Year	5.325	4.200	19.034	13.439

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1907.	New York. 1908.	St. Louis. 1907.	St. Louis. 1908.	London. 1907.	London. 1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20.875
December	4.254	5.137	4.104	4.987	20.076	20.625
Year	5.962	4.726	5.812	4.578	23.771	20.163

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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Electric Shot-Firing in Coal Mines

Discussion of a System Installed in Utah, Where All Shots Are Fired from the Surface after the Workings Are Clear of Men

BY D. HARRINGTON*

Fully as beneficial as the arrangement for spraying is the electric shot-firing system, which, by causing all shots to be exploded after every man, including shot-firer, is out of the mine, thus prevents the numerous accidents due to blowout, or windy-shots, falling roof, or coal, caused by successive concussions from shots which are fired when men are in the mine; this plan also insures the safety of all human lives in case of a general explosion which may be caused by such concussion, or windy-shot.

CRUSHER, TIPPLE AND TRESTLE AT THE SUNNYSIDE MINE OF THE UTAH FUEL COMPANY, IN UTAH

Shot-Firing System at the Castle Gate Mine

A successful system of electric shot-firing is installed in the Castle Gate mine of the Utah Fuel Company. Considerable gas has been encountered in the development of this property. The shot-firing scheme here inaugurated has been a working success for more than a decade. The same method is also a working success in the Sunnyside No. 1 mine, where gas has always caused much annoyance. From the central power plant containing the electric generator, to the mouth of the return air course, the feed wires of No. 6 rubber-covered or weather-proof wire, are strung on ordinary pine or cedar poles, 16 to 18 ft. long and equipped with short cross arms.

From the mouth of the manway or any opening in which the wires are not likely to be disturbed by haulage devices, falling roof, etc., these two feed wires are carried through some opening which approximately divides the mine into halves, or which will at any rate allow of practically uniform length of auxiliary lines in order to insure symmetrical distribution of current. These auxiliary lines are of No. 12 rubber-covered wire and are run from the main feed wires through the main haulage entries to the mouth of the rooms, thence No. 14 rubber-covered wire to the working faces. These wires should be taken through any opening which is likely to be well kept up. In most cases, haulageways are well preserved, and in such entries the wires should be strung as far as possible from the track and close to the roof. The main, or No. 6 feed wires should be supported on posts wedged between roof and floor and spaced about 30 ft. apart; the actual fastening of the wires to the post should be a small iron bracket and glass insulator. The Nos. 12 and 14 wires may be fastened by means of 3-wire porcelain cleats, placing the wires in the two outside grooves; these cleats are fastened to props, legs, caps of timber, or to wooden plugs driven into holes previously drilled into roof or rib, such supports being placed 25 or 30 ft. apart or sufficiently close to insure that wires will not touch each other if the insulation should wear or rot off.

Arrangement of Wires Before Shooting

The coal is either undermined or overcut by hand, and giant powder, about 40 per cent. nitroglycerin, is used to bring down the coal; less than 1/10 lb. of powder is used per ton at Sunnyside, and less than 1/5 lb. at Castle Gate; the Castle Gate coal is hard and is used largely as domestic fuel, therefore the market for this coal demands a minimum of fines, while the Sunnyside coal, not so hard, is used for coking purposes, and consequently, the slack can be utilized to advantage. "Reliable" exploders are used, these being provided with two insulated wires each 6 to 8 ft. long. These exploder wires, bared of insulating material, are attached to the No. 14 rubber covered room wires, before mentioned, by the miner just previous to leaving his working place for home, the connections are made in parallel to insure the firing of at

NOTE—A sketch of the Sunnyside mine in Utah, showing the plan of wiring for the shot-firing system here described, was published on page 193 of THE ENGINEERING AND MINING JOURNAL of Jan. 23.

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least part of the round of shots in case an exploder may be defective while if connected in series, one defective exploder would prevent the firing of the entire round. In making wire connections, loops should not be allowed; all wires should be bared and twisting resorted to, several turns being made to insure good contact.

The Shooting Switch

Switches should be placed so no shot can be fired without previously throwing three switches into contact, all switches should be placed in locked boxes with key in possession of shot-firer. At the power plant, the engineer in charge of the generator is in charge of one locked switch, this latter being out of contact until after all men are out of the workings. This same locked switch is thrown out again as soon as the shots have been fired. The main shooting switch is placed in a small cabin near the mouth of the mine, but removed from direct line of all openings in order to insure safety of shot-firer in case of explosion; this cabin is used for no other purpose than the housing of this switch; it is substantially built and is kept locked, with access to no one except the shot-firer.

There is also a switch controlling each auxiliary No. 12 wire line, this switch being placed in a locked box located near the point where the connection of auxiliary line is made to feed line. Each of these switches controls a shooting district, and is kept locked with a key in the hands of a shot-firer. All switches in connection with this system are of the knife variety, with knife or lever dropped down out of contact, in order to prevent any possibility of accidental closing of the switch by jarring, etc.; this latter detail may seem trivial, but is most important in possible results.

Current is supplied from the central power plant in each camp; at both Castle Gate and Sunnyside, a 500-volt continuous current is used. The generators in both places were installed for haulage purposes before shot-firing by electricity was contemplated; the additional power required for shooting is trivial, being only used for a few seconds daily after haulage operations have been suspended.

The Shot-firer's Duties

In operation, the services of the following are required: A checkman, a man who acts as wireman and shot-firer, and the fire-bosses or inspectors; the checkman and the shot-firer may be charged totally to the shot-firing system, while the services of the inspectors, or fire-bosses are merely incidental to their ordinary duties.

The checkman's duties are physically light, hence for the purpose, an employee who has been injured in the company's service will answer, provided he can be thoroughly trusted. The checkman should be at the powder distribution house shortly after 6 a.m., and have instructions to give out only a certain amount of explosive to each man (6¼ lb. per man is the maximum amount which can be kept in the mine in one place by provision of the State law). As 6¼ lb. will bring down at the Sunnyside mine more than 80 tons, the actual amount here allowed per man is but one or two pounds. After giving out powder, the checkman goes to the check cabin which is situated close to the mouth of the manway, and if possible close to the mine ventilating fan; his position should be such that he will have a view of the mouth of the main haulageway and tipple, but always out of direct line of any mine opening. To this check cabin, the fire-bosses, or gas inspectors, also come to make their report of the morning's inspection, which is always done before any employee may enter the mine. To this cabin, also, all employees must report to get assurance from the inspector as to the safety of their individual working places.

THE CLEAR CREEK STORE AND HOUSES OF THE UTAH FUEL COMPANY

Upon receiving such assurance, the employee, day hand, or miner, will, before entering the mine, deposit his check or tag with the checkman; this check bears the miner's number, which must correspond with the number of that man on the company's books at the mine office, and to the number on the check which the miner places on the car of coal loaded out by him to establish ownership to that car. Failure to deposit this check will subject the offender to dismissal, and failure on the part of any day hand may also cost him his day's pay, as the checkman keeps the time of the day hands from checks deposited with him; when no check is deposited, no time is credited.

These checks are placed on a board having corresponding numbers, and kept in the check house under the care of the checkman, who remains in the vicinity of the check house throughout the day. As each man leaves the mine, he receives from the checkman his check, thus accounting for all employees at all periods of the shift. The checkman occupies his time during the day by performing numerous physically light, but important and useful duties; he keeps a book having the name and number of each miner together with his working place, nationality, regularity of attendance at mine, etc., from which the mine officials may obtain much timely information. The checkman can also oil and otherwise look after the fan, if the latter is located near the check house; he can clean and fill safety lamps where used, keep a record of barometer and thermometer readings, etc.

The fire-bosses, or gas inspectors, perform the usual duties as underground inspectors, and each employee must report to the fire-boss before entering the mine for his day's work. If during the underground inspection the fire-boss has found any missed shots, he is required to bar entrance to the place with a notice warning all persons to keep out; on coming to the surface he will not permit the miners in that particular place to go to work, at the same time informing the shot-firer of the location of the missed shot. The shot-firer will, during the day, inspect this place, and upon discovering the trouble, will make the shots ready to be fired with the regular round that night; if they fail a second time, it is the duty of the fire-boss to investigate and inspect the holes after all shots are fired; a third failure of the shots renders it necessary for both shot-firer and inspector to remain after shot-firing on the third night until these shots in question are put off.

The Cause of Missed Shots

Unless shots or wires are tampered with maliciously, failure twice in succession is rare. The usual cause of a missed shot

is generally due to failure on the part of the miner to correctly connect the exploder wires to the No. 14 room wire, or to a fall of roof breaking the wires. Since failure of shots means loss of the next day's work to the miner, even the most ignorant will scarcely repeat such error after having been shown the correct method, and as there is a lapse of not more than an hour between the departure of the miner and the firing of shots, roof falls are not at all likely to cause much trouble.

Loading the Holes

The fire-boss' connection with firing ceases from the time the men enter the mine in the morning until in the afternoon when he carries a supply of caps, or exploders, to each working place; the miners have previously drilled the holes and otherwise prepared for the loading of same with minimum delay for the fire-boss. The latter makes certain that the holes are free of dust, are not deeper than the undermining, are not too close to roof, or rib, etc., and proceeds to load the holes by first throwing into the back of the hole a handful of wet wood pulp which has been procured by the miner from the company supply, placed in barrels and located at convenient points underground. The cost of this pulp is about $25 per ton. The fire-boss next takes powder from the miner, attaches the exploder, or cap, which is accomplished by tying the powder with a half hitch of the wires with which the exploder is provided; he then places powder and cap in the hole and proceeds to tamp a few handfuls of wet wood pulp upon the powder; this process is repeated for each hole, leaving the miner to complete the tamping.

The inspector thus has complete supervision over the loading of each and every hole, being final judge as to the amount of powder to be used, giving out only as many caps as there are holes, etc.; he may also refuse to shoot any hole which he deems in any manner dangerous. Wet wood pulp is used in tamping because a State law prohibits the withdrawal or re-opening of a missed shot unless *"such holes are tamped with wet wood pulp,"* and while it is necessary to open but few shots, still when such a case occurs, it is not well to defy the law.

Any tampering with the loading after the departure of the inspector will, of course, subject the offender to dismissal if apprehended; the exploder wires are not connected to the No. 14 room wire by the miner until he is ready to leave for home, and knowing his next day's work depends on the correctness of this connection, very few missed shots are traceable to the miner's carelessness. Below is a copy of the shooting regulations as posted at the Castle Gate mine:

Shooting Regulations in Utah

(1) The mining must extend at least 6 in. beyond back of holes in all cases, and 12 in. at all places beyond and toward the right side of the holes.

(2) All holes must be at least 2½ ft. in length. No shorter holes will be fired.

(3) All coal dust must be extracted from holes before they are fired.

(4) No holes must be charged with more than 5 sticks of powder. (1¼ lb.)

(5) No material whatever except the wet wood pulp furnished by the company must be used in tamping holes.

(6) No shots will be fired unless all places within 30 yd. of the hole are in a wet condition, so that dust cannot be raised by a windy-shot.

(7) Standing holes or parts of standing holes will not be recharged.

(8) The hole in a "tight" corner must be at least 1 ft. from rib at back of hole.

(9) In solid faces, holes must not be more than 5 ft. apart horizontally and not less than two such holes will be fired.

(10) In coal over 6 ft. high, no hole must be more than 5 ft. in hight above the floor at back of hole, in shooting bottom bench.

(11) In high coal, bottom bench must be shot down before shots are fired in the top bench.

(12) The object of the above rules is to prevent and remove the danger from blow-out or windy-shots and it should be the duty of all firemen in addition to the above rules, to refuse to shoot any holes which in their judgment may be dangerous, whether the circumstances are fully covered by the rules or not. The firemen are expected to always be on the safe side.

The shot-firer, who is also wireman, must go into the mine sufficiently early in the morning, to throw out of contact all switches which were thrown into contact for the firing of the previous night's round; when all switches are thrown out of contact and containing boxes are securely locked with the only existing key in the possession of the shot-firer, all precautions have then been taken to prevent the accidental discharge of any shots which may for any reason happen to be connected at the face; the switch at the power house is in contact only for a few minutes per day and then only when all men are out of the mine; the switch by which final connection is made at the shooting cabin is likewise in contact only a few seconds daily, and the switches controlling various auxiliary circuits in the mine, which have been in contact over night, are thrown out before any men are allowed to go into the mine.

During the day, the shot-firer becomes wireman, and goes through the mine carrying various materials for extension or repairs where needed; when the time arrives by which the men should be out of the mine, he throws all underground switches into contact for all circuits where holes are to be shot. The shot-firer next goes to the check cabin to ascertain from the checkman whether all men are actually out of the mine. If the checkman's board is bare, he knows the "coast is clear," and proceeds to the shooting cabin, which is located in a safe place; here he throws the main switch making the final closing of the circuit. After leaving the switch in contact for two or three seconds, the circuit is again broken *not to be again closed until the next night*, the cabin is securely locked and the shot-firer goes home. The engineer at the power house knowing from his ammeter that the shots have been fired, opens his switch and the entire shooting system is totally devoid of current for another day.

If, however, on coming out of the mine, the shot-firer is informed that men are yet underground, and that no known emergency exists for their being there, he gets from the checkman the location of their working place, goes into the mine and on locating them, fires the shots as soon as they are out. If his search in the mine is vain, a search through the camp is instituted and when the men are found and *not until then*, shots are fired.

GENERAL VIEW OF THE CASTLE GATE TIPPLE AND COKE OVENS

THE WINTER QUARTERS MINE AND SIDINGS

It is important that both checkman and shot-firer are sober, conscientious men, neither position being one to be filled by boys or irresponsible relatives or personal friends of mine officials; the checkman need not be physically perfect, but the wireman should be a wide-awake conscientious man, preferably of middle age, with great power of endurance and incapable of shirking. The position should be well paid and appointment to it should be solely as a reward of merit.

Cost of Installation

The cost of installing a shot-firing system is much less than the expense incurred in completing a spraying system. At the Sunnyside No. 1 mine, with an annual production of about 300,000 tons, the installation of a complete shooting plant, excluding source of power was $1250, of which $850 was for material, which comprised 6000 ft. of No. 6 rubber-covered wire, 26,000 ft. of No. 12 rubber-covered wire, 30,000 ft. of No. 14 rubber-covered wire, 10 switches with locked boxes for same, 16-ft. poles, cross-arms and insulators for 1200 ft. of surplus line, shooting cabin on surface, and brackets, insulators, porcelain cleats, etc., for 30,000 ft. of underground line. The line to No. 2 mine at Sunnyside, cost but $640, the low cost being due to the fact that no poles, etc., were necessary for the main feed line; the feed wires were strung on poles already in place and carrying power into the mine for electric hoists and electric locomotives; the installation of a separate line, however, is generally advisable, so as to remove shooting wires from the danger of being charged by possible accidents to other power lines which carry current during working hours.

The $1250 expenditure for the No. 1 mine installation, if paid by one year's output of that mine, 300,000 tons, would add but 2/5c. per ton to the cost. In operation for the same sized mine, producing 300,000 tons annually with 275 days worked, there would be a checkman at $75 per month amounting to $900, and a shot-firer or wireman, 275 days at $3.25 per day, amounting to $893.75, a total yearly labor operating cost of $1793.75; add to this $100 for material, which would be ample, and $1900 will cover the entire charge of this system against 300,000 tons, or an addition to the cost sheet of less than ⅔c. per ton, certainly not an item that any mine operator should fear.

Objections to the System

Objections to the shot-firing system have been advanced as follows: Output must necessarily be restricted through missed shots; the concerted action of so many shots must have harmful effect on roof causing excessive expense to keep roof up and to keep haulageways clear; ventilation must be disarranged by falling roof and by heavy concussion, and lastly, the presence of explosive gas would prevent successful use of such a system.

As to a decrease of output, experience has shown that on the installation in a mine with a daily output of over 1000 tons, after the newness has worn away and miners understand the correct method of connecting exploder wires to shooting wires, the percentage of missed shots is but 1 per cent.; on an annual output of 300,000 tons, 1 per cent. is 3000 tons and if the coal company clears one dollar per ton, the shooting system should be charged with $3000 annually, *not lost* but the receipt of which is deferred; if money is worth 6 per cent., we have here an actual charge against the shooting method of $180 yearly.

The general belief is that the resulting concussion caused by the firing of 200 or 300 shots simultaneously is at least approximately 200 or 300 times as great as that of one shot; this is, however, erroneous as the resultant concussion is less than the aggregate of the three of four shots which constitute a round at each working face. These working faces are 50, 75 or 100 ft. apart and the waves sent through all surrounding territory by the different concussions, radiate in all directions; these waves meet each other and are partially neutralized.

No inspection of underground conditions is made from the time of firing shots, which is about 5 p.m., until 3 or 4 a.m., a lapse of 10 or 11 hours; the fire-bosses seldom report any derangement of ventilation devices, such as open doors, etc., nor is there excessive falls of roof on haulage tracks during this time. The fact that there is but one concussion per day, rather than a continual succession of jars, tends to prevent the shaking loose of the roof, and for this reason, the system is really more applicable to mines with clay roof than to workings with a hard sandstone roof like that at Castle Gate and Sunnyside.

The System Can be Used in Gaseous Mines

The presence of explosive gas is the most serious objection to the installation of such a system; however, the plan has for years been successfully operated in the most gaseous mines of Utah, one of which has at times been worked with safety lamps exclusively. In the gaseous mine at Sunnyside, absolute and unqualified success has attended the operation of the system; it is true that a violent explosion occurred at Castle Gate after the shot-firing scheme had been inaugurated there; however, this very fact only emphasizes the correctness of its principle, for not a single human life was sacrificed, and the good name of the mine was preserved. It has been stated that this explosion was the result of the bad judgment of the shot-firer in throwing his lever a *second* time into contact after having made a first contact; however, whether the explosion was caused by the first contact or by throwing the lever a second time cannot be definitely stated.

There is but Small Loss of Time

It is also advanced that labor trouble may be precipitated because of lost time from missed shots, which latter prevent the miner whose shots failed, from working the following day. Where installed correctly and carefully operated, the missed shots aggregate only about 1 per cent., and as most of these are the fault of the miner himself, successive misses are rare. Moreover, when the miner becomes accustomed to the system, and realizes that it renders him absolutely safe from blowout or windy-shots and their attendant dangers, also that he can go into the mine in the morning breathing air free from head-splitting powder smoke, and come out at night without having so much as had a whiff of that arch enemy of all miners, he is indeed an obdurate individual who cannot look with equanimity on the occasional loss of a day's labor.

The installation of well devised spraying systems in the mines of Utah has rendered most of these operations practically nonexplosive; also the installation of both the spraying system and the electric shot-firing system in the gaseous mines has freed the underground employee as well as the mine official from many of the ordinary anxieties which always accompany underground colliery work.

When the commission of foreign colliery experts who came to the United States to investigate our methods, presumably to instruct us how to improve them, had inspected the Utah mines, they were enthusiastic in their praises of the life-preserving systems here installed, and while they roundly condemned the dangerous dustiness of Western mines, they carefully excluded Utah mines from this excoriation. The Utah coal operators have had abundant proof that instead of being "out of pocket" to the extent of 1, 2, or 3c. per ton produced, they are in fact the gainer to the extent of several thousand dollars annually, and possibly to a much greater extent in disasters prevented.

The cause of the so-called burning of dynamite is obscure. E. A. Mann, chief inspector of explosives for Western Australia (*Journ. Chamber Mines, West Australia*, July 31, 1908), states that it is doubtful whether the explosive frequently, if ever, actually catches fire in the hole. It seems probable to Mr. Mann that the formation of fumes is due to the fact that the initial impact of the detonator is insufficient to penetrate to the extreme limits of the charge.

Mineral Production of British Columbia in 1908

Returns Show an Estimated Decrease of $2,025,000 in Total Value with an Increase in Lode Gold, Copper, Silver and Zinc

BY E. JACOBS*

The mineral production of British Columbia for 1908 shows an estimated decrease of $2,025,000 in total value as compared with that of 1907. In quantities of individual minerals produced, though, there are in several instances increases, the exceptions being in placer gold, lead and coal, respectively. On the other hand, lode gold made an increase of approximately 60,000 oz.; silver of 291,500 oz.; copper of 3,053,000 lb.; zinc of 8,000 tons; and coke of 25,000 tons, while building materials, etc., are estimated at $50,000 higher in total value. Of the total decrease shown, $146,000 is in placer gold, $1,730,000 in lode metals, and $149,000 in non-metalliferous minerals.

Revised returns will probably show several changes, among these in copper which would appear to be shown at less than the actual production. However, the estimate which follows has been based upon information obtained chiefly direct from the larger mines of the province, and so far as many of the small silver-lead mines are concerned, from production statistics published in local newspapers. These latter are always difficult to obtain unofficially, so that information is generally incomplete until after the owners and lessees of small mines have sent in to the provincial Bureau of Mines returns which admit of the actual production of various districts being ascertained and made public.

The figures showing the production of coal and coke may be taken as approximately correct, since they have been obtained from the companies making the greater portion of the production of the province in these minerals. Unimportant changes will probably result when several new companies that have been producing on a small scale have sent in their returns for the year.

In regard to the total production of individual districts, the Boundary district (which is included in that officially known as Yale) has maintained its lead over West Kootenay, though not to so great an extent as in the years 1906 and 1907, respectively. It will be observed by reference to one of the accompanying tables that while West Kootenay made an increase in 1908 as compared with 1907 of $917,700, figures for the Boundary show a decrease of $1,360,000. This decrease, though, is attributable entirely to the fall in the price of copper, which notwithstanding that the production of that metal in the Boundary was increased by about 4,500,000 lb., the value of the year's product was lessened by $1,552,000 by the reduction of the average market value for the year of copper in New York to the extent of practically one-third as compared with that of 1907. The Coast was third on the list in 1908, decreases in both copper and coal production being accountable for its having given place to West Kootenay for second place. East Kootenay, which in 1907 was third in point of total value of mineral products, took fourth place for 1908. Here, too, there is a particular reason; namely, a reduction by about one fourth in the average price of lead for the year, which caused the suspension early in the year of one lead mine and a reduced production at another, the latter being the largest producer of this metal in the province.

Apart from the fall in prices of metals, there was little to retard progress during the year, the chief exception having been labor troubles for a few weeks at Crow's Nest Pass coal mines in East Kootenay. At all the metalliferous mines and smelting works that were operated, wage questions were settled either at the close of the previous year or in the early part of that under review, and no fresh difficulties were experienced during the remainder of the latter period.

Following the method of calculation used by the British Columbia Bureau of Mines, the average prices for the year of silver, lead and electrolytic copper in the New York metal market, as near as practicable, have been taken as a basis, less deductions of 5 per cent. off silver and 10 per cent. off lead. The several prices used are as follows: Gold, placer, $20 per oz.; gold, lode, $20.67 per oz.; silver, 50c. per oz.; lead, 3.78c. per lb.; copper, 13.2c. per lb.; coal, $3.50 per ton (2240 lb.); and coke, $6 per long ton.

Gold

The production of placer gold in 1908 was still more disappointing than in 1907, which in turn gave the smallest production up to that time of any year since 1898. In like manner it must now be said of 1908 that its total of this metal was the lowest since the earlier year mentioned. The greater part of the decrease was in Cassiar district, the estimated shortage from Atlin division of that district having been $183,000, and of the Liard and Stikine divisions $25,000. Individual miners produce comparatively little gold in Atlin camp now, and for one reason or another the hydraulicking companies recovered much less gold last year than in several previous years. There is, though, much gold-bearing gravel still available on three or four of the Atlin creeks, so it is to be expected that with an adequate water supply, which has recently been provided for by one or two of the larger producers of the camp, a much better result will be obtained next season. The three divisions of the Cariboo district are each credited with an increase, as shown in the last of the tables, their mineral production being entirely placer gold. The Similkameen division of Yale district appears to have increased its yield by $9000, but Lillooet shows $7000 less than in 1907. The figures for the Kootenay districts and the Coast do not exhibit any changes of production of placer gold, in comparison with that of the year immediately preceding.

The decrease shown against Cassiar district is partly the result of the transfer of a portion of Skeena mining division to the coast district, while that of Lillooet is the result of a temporary stoppage of dredging on that part of the Fraser river.

In lode gold the largest proportion of

ESTIMATED VALUE OF MINERAL PRODUCTION, BRITISH COLUMBIA, 1908.

	1908.	Changes.
Gold, placer	$682,000	D. $146,000
Gold, lode	5,291,520	I. 1,236,500
Total gold	$5,973,520	I. $1,090,500
Silver	1,610,000	D. 93,825
Lead	1,654,695	D. 636,763
Copper	5,792,820	D 2,373,724
Zinc and iron	280,000	I. 229,400
Total	$15,219,535	D. $1,875,912
Coal	$5,950,000	D. $350,235
Coke	1,488,000	I. 150,522
Building materials, etc	1,200,000	I. 50,600
Total	$8,638,000	D. $149,113
Summary:		
Metalliferous	$15,219,535	D. $1,875,912
Non-metalliferous	8,638,000	D. 149,113
Total mineral production	$23,857,535	D. $2,025,025

MINERAL PRODUCTION, BRITISH COLUMBIA, 1907–1908.

	1907.	1908	Changes.
Gold, placer, oz.	41,450	34,100	D. 7,350
Gold, lode, oz.	196,179	256,000	I. 59,821
Total gold	237,629	290,100	I. 52,471
Silver, oz.	2,745,448	3,037,000	I. 291,552
Lead, lb.	47,738,703	43,775,000	D. 3,963,703
Copper, lb.	40,832,720	43,885,000	I. 3,052,280
Coal, long tons	1,800,067	1,700,000	D. 100,067
Coke, long tons	222,913	248,000	I. 25,087

*Editor, British Columbia *Mining Record*, Victoria, B. C.

the increase was made in Trail Creek division, in which three mines at Rossland each produced more gold than in 1907, their total increase having been rather more than 48,000 oz. In Yale district the Boundary mines yielded about 12,800 oz. more, this having been gold occurring in association with copper. Nelson division contributed 800 oz. to the total increase, and a small addition was reported from a mine in the Lardeau section of West Kootenay. The decreases were in the Coast district, chiefly from the copper-gold mines having a greatly reduced production consequent upon a suspension of work during quite half of the year. To the total of 256,000 oz., Rossland mines contributed about 142,000 oz.; Boundary mines and Hedley camp of Osoyoos division together about 94,000 oz.; Nelson (mostly from Sheep Creek camp), rather more than 14,000 oz.; the Coast (chiefly the Marble Bay mine, Texada Island), about 4000 oz., and the remainder from the Lardeau. Of the two larger gold mines of the province, the Ymite in Nelson division, and the Nickel Plate near Hedley, the latter is understood to have maintained its production on a similar scale to that of several recent years, but the former was practically a non-producer. The development of several small gold mines in Sheep Creek camp, was one of the features of progress in the year.

MINERAL PRODUCTION OF BRITISH COLUMBIA BY DISTRICTS AND DIVISIONS, 1907–1908.

Name.	Divisions.		Districts.	
	1907.	1908.	1907.	1908.
Cariboo District			$360,500	$420,000
Cariboo	$306,500	$350,000		
Quesnel	44,000	50,000		
Omineca	10,000	20,000		
Cassiar District			572,809	225,000
East Kootenay District			5,548,880	4,873,100
West Kootenay District			4,792,976	5,770,550
Ainsworth	364,868	624,000		
Nelson	614,395	414,984		
Slocan	619,842	779,740		
Trail Creek	3,049,702	3,725,142		
Other parts	144,169	166,824		
Lillooet District			15,721	5,000
Yale District			8,444,326	7,160,245
Osoyoos, Grand Forks and Greenwood	8,354,995	6,994,925		
Similkameen	56,564	135,000		
Yale	32,767	30,320		
Coast Districts			6,147,348	5,610,540
Totals			$25,882,560	$23,857,535

* The districts are shown in the order followed in the official reports of the provincial Bureau of Mines. Similarly, Rossland is included in the Trail Creek, and Greenwood and Grand Forks mining divisions, which constitute the district generally known in the province as the Boundary, are shown as in the Yale district, as is customary in the official publications.

Silver

The production of silver was larger in 1908 than in either 1906 or 1907. For the three years the several totals were: 1906, 2,990,000 oz.; 1907, 2,745,000 oz.; 1908, 3,037,000 oz. West Kootenay continues to hold its lead among the districts of the province producing silver, but since it includes a much larger extent of mining country than East Kootenay, which comes second, the comparison is hardly a fair one. Further, by far the greater portion of the silver produced in East Kootenay last year came from one mine—the St. Eugene with two others contributing 50,000 oz. each, while in West Kootenay a dozen or more of the larger mines and a score or so of the smaller ones combined to make up the greater part of the production of the district. West Kootenay's production was from the following localities: Slocan, 953,000 oz.; Ainsworth division (which includes part of the district generally known as the Slocan), 330-000 oz.; Lardeau, 206,000 oz.; Rossland, 156,000 oz., and Nelson, 72,000 oz., together 1,742,000 oz. East Kootenay produced 675,000 oz., from St. Eugene, North Star and Sullivan mines. The Boundary district's proportion was 596,000 oz., chiefly from the copper mines of the Granby and British Columbia copper companies. The Coast district yielded 49,000 oz., nearly two-thirds of which was from the Marble Bay mine, Texada island, and a little less than one-third from the Ikeda mine on Moresby island of the Queen Charlotte group.

The very satisfactory increase made by the Slocan district, namely, of about 61 per cent., 953,000 oz. in 1908 as against 591,000 oz. in 1907, was contributed to in considerable degree by the Rambler-Cariboo, Richmond-Eureka, Ruth, Reco, Vancouver (now being operated by the Van-Roi Mining Company, organized in London early in the year), Standard, Hewitt, and Westmont mines. Ainsworth mining division made an increase of about 17 per cent., largely from the Whitewater and Whitewater Deep mines, in Whitewater camp, and in less degree from the Canadian Metal Company's Blue Bell mine, on Kootenay lake, at which a modern concentrating mill was completed last summer.

Silver from Rossland and Boundary district mines is chiefly obtained from ores also having copper as an important marketable metal content. More than three-fourths of that from the Lardeau last year was from the Silver Cup mine, with the True Fissure contributing nearly all the remainder from that district. In Nelson division the La Plata, and Silver King mines produced most of the silver from that division.

Lead

The gradual decrease in quantity of lead produced in the province during three immediately preceding years was continued last year. The production for several years, as shown in the Annual Report of the Minister of Mines for British Columbia, was in round figures as follows: In 1905, 56,581,000 lb.; in 1906, 52,408,000 lb.; in 1907, 47,739,000 lb. Now comes a further decrease, for the estimated ouput for 1908 is but 43,775,000 lb., this being the lowest total since 1904, in which year it was about 37,000,000 lb. In the production of this metal East Kootenay leads with an output of 30,200,000 lb., or rather more than 69 per cent. of the whole, and this nearly all from the St. Eugene mine, of which, by the way, it may be mentioned that reporting last August the managing director of the Consolidated Mining and Smelting Company of Canada, Ltd., which owns this mine among others, advised the directors that "the probable ore reserves of the St. Eugene group are nearly 50 per cent. greater than a year ago. Ore 50 per cent. better in grade than last year's average has been found between the 600- and 800-ft. levels, on the main vein above the 1500-ft. level, and between the 1900- and 2000-ft. levels. In the report of last year it was mentioned that the 2000-ft. level did not promise to yield as much tonnage as the 1900-ft. level, but present indications are that the former will produce more ore than the latter, or any other level in the mine. The grade of the ore is, however, lower than that produced from the upper workings. Some bodies of low-grade material have been found on the 2100-ft. level, and a raise from this level shows ore of workable grade. Drifting and crosscutting on the 2200-ft. level are progressing, and one or two low-grade orebodies have been found. It will, however, require work for six months or a year to determine the amount of ore on this level." The ore concentrated last year in the St. Eugene mill averaged lower in lead and in silver than that in former years; it required 6.3 tons of ore to make one ton of concentrate. The aggregate of production of the St. Eugene mine for all years to June 30, 1908, was 684,311 tons of ore from which 138,878 tons of concentrate were made, which contained 3,951,141 oz. of silver, and 162,905,421 lb. of lead. The production for the calendar year 1908 was about 23,300 tons of concentrate and 2400 tons of ore shipped crude. The St. Eugene is the largest lead mine in Canada.

The approximate lead production of West Kootenay was as follows: From mines in Slocan and Ainsworth districts, 12,000,000 lb.; Nelson, 650,000 lb.; Lardeau, 900,000 lb., and Boundary, 25,000 lb. The chief producers in Slocan were in order of quantity, the Standard, Rambler-Cariboo, Richmond-Eureka, Ruth, Vancouver, Reco, Slocan Star, and Sunset; in Ainsworth division, the Blue Bell, and Whitewater (the product of the Whitewater and Whitewater Deep mines combined); in Nelson division, the Emerald and La Plata; and in the Lardeau, the Silver Cup (Ferguson Mines, Ltd.).

The term for which the Lead Bounty Act of 1903 was operative expired on June 30, 1908. The amount of bounty paid by the Dominion of Canada government under its provisions was $712,000, leaving of the amount originally provided for (namely, $2,500,000) an unexpended balance of $1,788,000. During last year's session the Parliament of Canada passed legislation authorizing a continuance of payment of the bounty for another term of five years until June 30, 1913. The new act differs from the old in that the full rate of bounty (75c. per 100 lb. of lead), is payable until the price of pig lead in London reaches £14, 10s. per ton of 2240 lb., instead of £12, 10s. as under the old act, when the amount of bounty is diminished proportionately to the excess in price above the former amount mentioned. The old act was intended to guarantee the producer of lead in Canada a steady price of £16 per ton, equal to about $2.50 per 100 lb. of lead. The new act practically raises the price £2 per ton, equal to about 43c. per 100 lb. The new act does not otherwise differ from the old. The full rate of bounty has been continuously payable since the coming into force, on July 1, 1908, of the new act, and the amount of bounty earned by lead producers under it has been about $30,000 per month to the close of the year. G. O. Buchanan, of Kaslo, B. C., Dominion supervisor of lead bounties, is authority for this information concerning the lead bounty.

In connection with the production of lead it may be added that while the lead smelter of the Hall Mining and Smelting Company at Nelson, remained closed all the year, and that of the Sullivan Group Company at Marysville, East Kootenay, was closed in February and has not since been operated, the Consolidated Mining and Smelting Company of Canada has increased both the smelting and refining capacity of its lead reduction works at Trail, which are being regularly operated. Two more Huntington-Heberlein roasting furnaces (making six in all) have been installed, a new anode plant put in, and the refinery enlarged to a capacity of about 75 tons of refined lead per day. The company has also made a number of changes and improvements at its concentrating mill at the St. Eugene mine, whereby an increased saving has been made.

A concentrating mill embodying the latest methods for the separation of lead and zinc from the iron and other gangue of the ore was erected and fully equipped at the Blue Bell mine, Kootenay lake, this mill having been designed by S. S. Fowler, of Nelson, general manager for the Canadian Metal Company, which also owns the Blue Bell mine. In this connection it may be stated that there now being in that mine a sufficient tonnage available and probable to justify expenditure which will insure stability of the plant, this has been provided for by making the foundations of the mill of concrete and its frame of heavy timbers. The general arrangement of the plant is such as to permit of large increase of capacity at relatively small expense. In detail the planning of the mill has not involved any radical departures from well established lines of ore dressing, although there have been introduced a number of minor innovations. As a corollary, the general scheme of development of the mine adopted has been such as to make practicable its exploitation at low cost, thereby insuring the extraction of the ore under conditions especially favorable to profit-earning results.

Copper

The year's production of copper, estimated at 43,885,000 lb., is the largest by nearly 1,000,000 lb., of any year since copper mining was commenced in the province, that of 1906 (42,990,000 lb.) having previously been the maximum production for one year. Of the total for 1908, Boundary district mines produced about 36,000,000 lb.; those of Rossland came next with 5,300,000 lb., and the Coast mines with about 2,500,000 lb. The production of other parts of the province was insignificant.

The progress of copper mining in the Boundary will be evident from the following figures of annual production, those in parentheses being for the whole of British Columbia: In 1904, 22,066,000 lb. (35,710,000 lb.); 1905, 27,670,000 lb. (37,692,000 lb.); 1906, 32,227,000 lb. (42,990,000 lb.); 1907, 31,521,000 lb. (40,833,000 lb.); 1908, 36,000,000 lb. (43,855,000 lb.). Assays of copper ores of the district, based upon copper recovered in 1907, averaged 1.34 per cent. copper. As there is not a very great difference in the general copper content of the respective ores from the several large mines of the district, an idea of the quantity of copper produced by each company is obtainable from the following figures showing tonnage of ore mined and smelted last year: Granby Company, 1,023,000 tons; British Columbia Copper Company, 358,000 tons; Consolidated Mining and Smelting Company, 41,000 tons; Dominion Copper Company, 22,000 tons (the last mentioned company operated its smelter only a few weeks, going into liquidation last summer). This gives a total of 1,444,000 tons of copper ore mined and smelted in the Boundary last year.

Improvements made at the Granby Company's smelting works at Grand Forks were extensive, these including the construction of additional ore and coke storage bunkers of a capacity, respectively, of 7000 and 4000 tons; a steel dust chamber at the back of the blast furnaces to replace the brick chamber formerly used; enlargement of the brick dust settling chamber near the smoke stack; substitution of a steel and brick building of larger size, and having cement floors, for the old wood structure used as a blowing-engine room; installation of two Connersville rotary blowers, each 30,000 cu.ft. per min. capacity and each having two 150-h.p. induction motors; lengthening of the copper-converter department, preparatory to installing three 7x10 ft. 6-in. converters to have a total capacity of 36,000,000 lb. of copper a year and to be electrically operated, in place of those heretofore in use; installation of a two-cylinder 40x40x42-in. Nordberg blowing engine of latest type, capacity 10,000 cu.ft. per min. at 12 lb. pressure, and driven by electric power; and numerous improvements to electric plant, water-supply service, etc. The lengthening of the eight 18-ft.x44-in. blast furnaces to 22 ft. each has been commenced, and when this work has been completed, probably by June next, the treatment capacity of the works will be 4000 tons of ore per day instead of 3000 tons, as at present. The total quantity of ore treated at these works in 1908 was 1,037,000 tons, and the copper produced amounted to 23,535,000 lb., which is the largest production yet made here in any one year.

No important new construction work was done at the Granby mines in 1908, they having been previously equipped for a daily production up to 5000 tons of ore. On an adjoining group of claims the Consolidated Company opened up what promises to prove to be a large body of ore of workable grade. The B. C. Copper Company doubled the air compressor capacity at its Mother Lode mine, installing a Canadian Rand 35-drill engine, electrically driven by a 700-h.p. induction motor and a rope drive. At its Oro Denoro mine the same company installed an ore-crushing and conveying plant, and a plant for similar purposes at its smelter sampling works at Greenwood. Numerous less important improvements and installations were also made at its several mines and its smelting works. Recently the company issued a circular showing that during six months ended Nov. 30, last, it had produced about 5,548,000 lb. of copper which, together

with the gold and silver also recovered, was of a total value at the time of shipment of $1,038,085, and from which there would be a total profit estimated at $226,700.

Rossland mines are estimated to have produced a total of 5,300,000 lb. of copper in 1908, in the following proportions: Centre Star, 2,606,000 lb.; Le Roi, 1,705,000; and Le Roi No. 2, 928,000 lb. The ores of all these mines contain gold and silver as well as copper, Le Roi No. 2 being especially favored in recovering an average gold value fully twice that from the other mines. Extensive developments and, at the Centre Star, substantial improvements as well, were made at the mines, but particulars were not supplied, except that the Le Roi expended $108,000 in development work consisting of 6000 ft. of drifting, raising, crosscutting, etc., and between 4000 and 5000 ft. of diamond drilling. The most important results achieved during the year were the finding of bodies of ore of good grade in the deeper levels of all three mines, in the Le Roi on the 1650-ft. level, in the Centre Star down to about 2000 ft., on the incline, and in the Le Roi No. 2 on the 700-ft. level, and deeper in a diamond-drill bore.

In the Coast district the copper production to be noted is that of the Marble Bay mine, Texada island, which shipped 10,000 to 13,000 tons of ore containing up to 5 per cent. copper; of the Britannia Mining and Smelting Company, which last June resumed operations on a small scale at the Britannia mine, Howe sound, and shipped to the smelter about 16,800 tons of ore and concentrate, containing approximately 646,000 lb. of copper, besides gold and silver; of the Tyee Copper Company, which shipped several thousand tons of good-grade ore from the Indian Chief group on the west coast of Vancouver island; and the Awaya, Ikeda Company, which sent to the Tyee smelter from its mine on one of the Queen Charlotte islands about 5400 tons of ore containing about 500,000 lb. of copper and fair amounts of gold and silver as well. The Hidden Creek Mining Company opened up a very large body of ore on Observatory inlet, Portland canal, along a distance of about 2000 ft., ranging in copper from 2 to 10 per cent. but did not ship any to the smelter.

The Britannia company's copper-smelting works on Vancouver island were not operated in 1908. At the Tyee Copper Company's smelter, Ladysmith, Vancouver island, many improvements were made. A wharf was constructed in Oyster Harbor and a trestle built to connect with the smelting works. On the wharf ore bunkers provided with mechanical equipment for expeditiously unloading ore from vessels, were built, and machinery, both steam and electric, was installed to facilitate handling the ore. All plant and machinery requisite for doubling the treatment capacity of the works was purchased and received before the year closed.

Zinc and Iron

Although the zinc smelter built at Frank, Alberta, has not yet been made suitable for smelting zinc ores, there has been in British Columbia in 1908 some production of zinc concentrate, to an extent of between 9000 and 10,000 tons. About 8000 tons were shipped from the Whitewater and Whitewater Deep mines, of which 3000 tons had been held over from 1907 and the remainder made in 1908. This product averaged about 44 or 45 per cent. zinc and also carried silver. The Ruth mine at Sandon, Slocan, sent to Kaslo nearly 1000 tons of zinc concentrate, the grade of which was raised to about 50 per cent. zinc at the Kootenay Ore Company's sampling works and 250 tons of the product shipped, leaving about 650 tons on hand. The Vancouver mine shipped 1036 tons of concentrate averaging 45 per cent. zinc and 40 oz. silver per ton. The remaining production was in smaller lots.

The works built at Nelson for the treatment of lead-zinc ores by the Snyder electric process were in successful operation during the closing weeks of the year. It is claimed that metallurgically the process is distinctly successful, but that mechanical difficulties occasionally occur, the overcoming of which will be a matter of time and experience in the practical working of the plant.

Last summer a laboratory Elmore vacuum plant was taken to the Hewitt mine, Slocan, where tests were continued over two weeks. Experiments in cleaning iron out of the concentrate, instead of using a magnetic separation process were successful on a concentrate carrying about 40 oz. silver per ton, 20 per cent. zinc and 18 per cent. iron in the form of siderite. The Elmore process made a concentrate of 48 to 50 per cent. zinc, and carrying 80 to 120 oz. of silver per ton. The proportion of iron left in the concentrate was only 6 per cent. The extraction was from 88 up to 96 per cent. of zinc from the original feed, and the silver extraction was equally good.

At the Blue Bell concentrating mill the zinc-separation plant is not yet in full operation. The ore here contains about 30 per cent. pyrrhotite which, with the zinc blende also in the ore, leaves the Wilfley tables and finer jigs and, after dewatering, is conveyed to a drying furnace, cooled, and elevated to a magnetic separator. It is expected to make a product of 40 to 45 per cent. zinc, but while the price of spelter continues low experiments with the plant will be extended over a longer period than might otherwise be deemed profitable.

Iron mining is practically non-existent in the province at the present time. The product of iron in 1908 was of absolutely no importance. The full report of Einar Lindeman, who in 1907 was sent to the British Columbia coast by the Dominion Department of Mines to examine occurrences of iron ore is being awaited. Meanwhile there is no production of this metal, even from properties which in past years have made shipments to a small iron furnace on Puget sound.

Coal and Coke

The year's net production of about 1,700,000 long tons, which was less by 100,067 tons than that of 1907, was chiefly from Vancouver island collieries, of which the Wellington Colliery Company produced about 740,000 tons, and the Western Fuel Company 393,000 tons. On the mainland of the province, the Crow's Nest Coal Company produced 522,000 tons and the Nicola Valley Coal and Coke Company, with recently opened mines in the Nicola district, about 30,000 tons. Coke production was 13,000 tons at the Wellington Colliery Company's ovens at Union, Vancouver island, and 235,000 tons at the Crow's Nest Pass Company's ovens at Fernie and Michel. Among a number of substantial improvements and additions to equipment the latter company is making is the installation of the Greene superposed track system self-dumping car haul at its Michel colliery to eventually have a capacity for handling 6000 tons of coal daily. A Canadian Rand four-stage, high-pressure air compressor, having a capacity of 3000 cu.ft. of free air per min., is also being put in at this colliery. It is noteworthy that the larger companies mining coal in the Crow's Nest Pass region are substituting the most economical type of Corliss condensing engines for the simple slide-valve engine with its excessive steam consumption.

On December 18, the Hosmer Mines, Ltd., commenced the shipment of coal from its newly opened colliery at Hosmer, on the Crow's Nest branch of the Canadian Pacific Railway. This company's property consists of six sections of coal lands and two sections of surface, on which the town of Hosmer, and improvements connected with the colliery plant are located. There are 13 coal seams on the property varying in thickness from 4 to 30 ft. The mine buildings, tipple, trackage, machinery and plant for ventilation, haulage, power, and all other requisite purposes, are extensive, modern and complete, and everything about the colliery is planned with the object of developing here a large and important coal-mining and coke-making industry. Beehive coke ovens, 240 in number, have been erected, sufficient to give an initial output of about 300 tons per day, while the putting in of Belgian ovens, with by-

product recovery, and distilling plant, are included in the plans for the future. Additional ovens will be built as required. This enterprise has been established under the immediate supervision of Lewis Stockett, who was also associated with the Bankhead colliery, at Banff, Alberta, which, like the Hosmer mines, is an industry connected with the Canadian Pacific Railway Company.

Another coal-mining industry established last year is that of the Corbin Coal Company, which has lately opened a mine in the Crow's Nest district and connected it by a 17-mile railway with the Canadian Pacific Company's Crow's Nest branch. In addition there are several other coal companies which are preparing for mining coal but they are not yet in a position to regularly maintain an output.

The South Wellington Coal Mines, Ltd., has opened a coal mine on Vancouver island and, during the course of development work has taken out about 15,000 tons of coal. It is now installing a tipple of 1000 tons daily capacity, constructing a tramway seven miles to tide water, and building bunkers and a loading plant at the shipping point. This company expects to have its preparatory work completed by next May.

Seward Peninsula in 1908

By John Power Hutchins*

The gold production of Seward Peninsula, of which Nome is the largest town, was about $5,000,000. The following tabulation shows the gold production since 1900.

GOLD PRODUCTION OF SEWARD PENINSULA.

1900	$4,000,000
1901	4,500,000
1902	5,050,000
1903	4,437,000
1904	4,878,000
1905	4,600,000
1906	7,000,000
1907	6,500,000
1908 (estimated)	5,000,000

The summer of 1908 was very dry and this caused reduced output. The freeze-up came about September 20 and was earlier than usual. The placers of Seward Peninsula are scattered over a considerable area and discoveries and developments will continue for several years with an annual increase in gold production in normal years.

Discoveries and developments of importance were made on the old beach lines back of Nome, and it is entirely probable that these will continue for a number of years. Considerable gravel containing as much as $100 per cu. yd. was extracted.

There were no labor difficulties as in 1907, and the supply of men was ample at all times. Wages are high, 40c. per hour and board, and 30c. per hour and board, being the respective rates for skilled and unskilled labor. Open-cut mining with hand methods begins about June 15, and continues until about October.

The amount of gold produced by drift mining was a greater proportion of the whole than in normal years. This kind of mining is not seriously affected by drought. Probably more than two-thirds of all the gold was produced by this method. It is applied almost exclusively at present for mining the old beach lines back of Nome.

The Old Beaches

These old beaches are interesting for both economic and geologic reasons. They are probably areas where gold-bearing material transported by streams was concentrated by wave action during considerable periods of stability, the region back of Nome being successively elevated. There are several of these beaches and the material in the areas between them is also said to be gold-bearing.

It is locally believed that the old beaches and the intervening areas will be worked by floating dredges. Much of the ground is frozen, and as yet it is uncertain whether it can be thawed cheaply enough to allow of operating with profit. Considerable has been written of frozen ground during the last year, and it is considered by some to be merely a "bugaboo."

Dredging

Gold dredging was carried on about as usual. A new dredge with 9-cu.ft. buckets began operations, and after numerous accidents sank; it is now a wreck. Bad design, construction, and management combined with difficult conditions to produce this result. Similar terms may be applied to almost every other dredge that has been installed on Seward Peninsula. In South America the same proportion of disasters prevails. Many of the failures occurred where there probably is considerable gold.

Hydraulic Mining

Hydraulic mining suffered most by reason of the dry weather. Some of the large ditches were practically dry during more than half of the working season. The summer was one of the dryest ever known.

There is not much open-cut mining with hand labor on Seward Peninsula. The water supply is generally better than that of the interior of Alaska and some form of hydraulic mining can generally be applied. There are stream beds that can not be mined by open cutting with hand labor because of unfrozen ground which results in a heavy inflow of water; the streams are generally of considerable size, and are, therefore, difficult to turn from their beds and to control during freshets.

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The Milling Situation at Cripple Creek

Special Correspondence

Immediately after the Golden Cycle mill went into active operation, the Mill Trust withdrew the excessive treatment rates to conform to the more moderate prices charged by the Golden Cycle for the treatment of Cripple Creek ores. The shippers of the district had, however, considered themselves long-suffering under the exactions of the Trust, and at anything like equal rates favored the competitive mill. The Mill Trust then established an open rate, effective also on all existing contracts, through which the treatment rates were reduced $1@2 per ton, and a low mark of $3.50 was established for the treatment of ores below $8 valuation.

Things then proceeded mildly for a period of about six months, the papers of the district being rendered somewhat lively and humorous by the facetious advertisements of the rival mills. The next move in the game was the restoration of the old rate by the Mill Trust on Oct. 15. This brought no response from the Golden Cycle people, but the amenities and frivolities in the advertisements in the local papers gradually disappeared, and the shrewd miner became suspicious of an understanding being arrived at between the two.

Now comes a feeler from the Golden Cycle company, in which the general manager intimates that the stockholders at the coming meeting of the company may decide to raise the treatment charges, inasmuch as the mill has now been in operation for something over a year, and the officers of the company, having obtained their experience in the only practical school, have at last ascertained the cost of treating a ton of Cripple Creek ore.

In this connection we call attention to the speech of the president of the Golden Cycle Mining Company at the banquet of last year, in which he stated that he knew the tailings loss was about 80c. per ton, and the cost of working a ton of ore a trifle over double that amount. Meanwhile the Mill Trust, having obtained its second wind, since the late advance in treatment charges, has announced as a Christmas offering to the mineowners a reduction in treatment charges on low-grade ore effective Dec. 26. The new rates are: On ore up to 0.5 oz., freight and treatment, $4.50—old rate, $5.25; to 0.75 oz., $5.25—old, $6.50; 1 oz., $6—old, $6.75 per ton.

Silver and copper amalgamation plates, according to Henry Louis, should be coated with silver amalgam until each square foot contains ¼ oz. of silver; W. A. Caldecott states that much less silver can be used with good results.

Methods of Mining the Granby Orebodies

The Large Uniform Deposits Require Little Timbering, and Electric Power Is Used for Haulage and Operating Air Compressors and Pumps

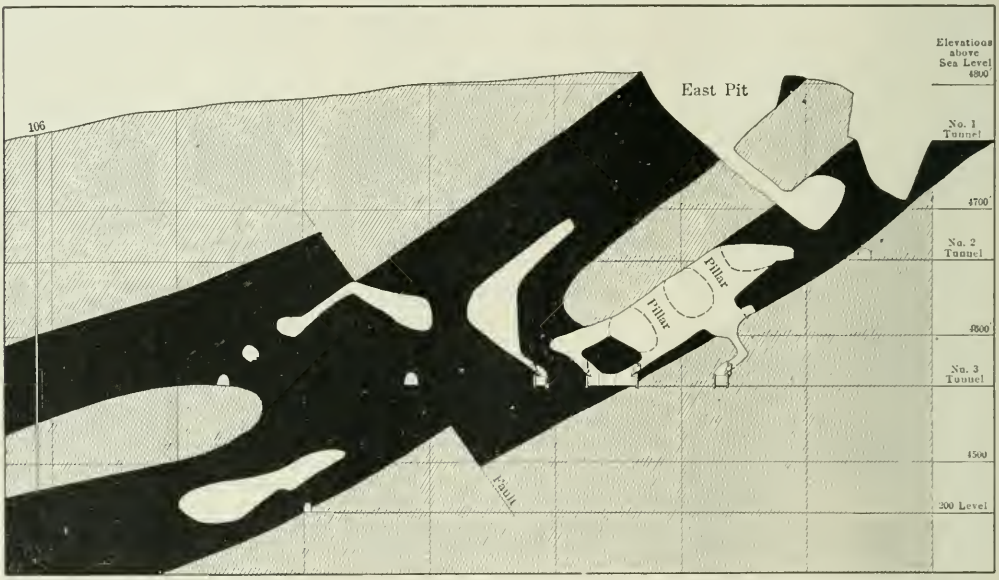
BY C. M. CAMPBELL*

The Granby company is at present operating in Phœnix what appears to be two distinct groups of orebodies. The oldest workings are in the deposits which outcrop on the Knob Hill and Old Ironsides claims, while the later workings are about half a mile to the east and are almost entirely on the Gold Drop claim. The Knob Hill-Ironsides deposit has been opened up, at 100-ft. intervals, by several levels. The upper one of these, No. 1 tunnel, was originally a shipping level and from the stopes above this level and from the open cuts in which a steam shovel worked, nearly a million tons have been shipped. When the crusher at the mouth of this tunnel was destroyed by fire, it was rebuilt at the mouth of the next lower level known as No. 2 tunnel. No. 1 tunnel then became nothing more than an intermediate level, all the ore above No. 2 tunnel being handled through that outlet.

After being crushed this ore falls directly into Canadian Pacific railroad cars, or if none are at hand it is diverted into a pocket which is reached by a cross-cut from the next lower level known as No. 3 tunnel. The No. 3 tunnel equipment handles all the ore between this level and No. 2 tunnel and its terminals are on the Great Northern railway. In descending order the remaining main levels are known as the 200-ft., 300-ft. and 400-ft., and the tonnage from all these levels is hoisted through the Victoria shaft. The bins connected with this shaft are served by both the Canadian Pacific and Great Northern railways. The Knob Hill-Ironsides mine is thus divided into three distinct units known as No. 2 tunnel, No. 3 tunnel, and Victoria shaft. These have a distinct and complete equipment of rolling stock, crushers and bins and are manned by separate crews under separate shift bosses.

The Gold Drop is equipped like the others and forms a fourth unit. The output from this mine is handled by the Canadian Pacific. In case one railway is unable to operate, the shipments from at least three outlets can be handled by the other road. Also, if one or more of the units happen to be out of commission, each of the others can be pushed toward its maximum capacity of 150 tons per hour and the day's shipment made up.

The methods of underground mining are largely the result of evolution. The first few years of work showed that the ore was of decidedly low grade. On the other hand it also showed the orebodies to be of vast size with value uniformly distributed. The nature of the ground was also found to be such that timbering could be almost dispensed with. As a result of this, sorting was abandoned; the square set method gave place to open stopes with the roof supported by rock pillars; cheap electric power was introduced to operate air compressors, for pumping and for haulage; cars up to 10 tons capacity and running on a 3-ft. gage took the place of the small mine cars previously in use, and, as stated above, the different outlets were equipped with up-to-date shipping facilities. All these improvements have had the end in view of giving the mine a large, uninterrupted, daily tonnage.



TRANSVERSE VERTICAL SECTION THROUGH THE OREBODY. THE AREA SHOWN IN BLACK IS BLOCKED IN 100-FT. SQUARES

Nature of the Deposit

A transverse vertical section taken about the middle of the orebody is shown in an accompanying illustration. At this point it shows up to, perhaps, the best advantage. The section shows two orebodies. As a rule the area between these orebodies is absolutely barren. Some drill holes, how-

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NOTE—From advance sheets of the *Journ.*, Can. Min. Inst., Vol. XI.

ever, have shown it to contain a few tenths in copper and in this section part of the area is mineralized sufficiently to place it in the shipping class. At the place where this section is taken a crosscut could be started in ore at the footwall and driven more than 600 ft. before again encountering waste rock.

The orebody is cut by several faults. The only one which seems to throw the orebody to any extent is shown in the section. This has been traced from one end of the deposit to the other and shows a throw of from nothing to one hundred feet. This fault plane dips to the west at an angle of about 55 deg. Several other fault planes occur dipping at various angles to the east, but none of these affect the continuity of the ore. In some cases they apparently do so. This is due to the fact that the strike and dip of these slips are much the same as those of the orebody, and when a slip occurs close to the hanging wall of the deposit it may act as such for a hundred or two hundred feet. Beyond this the mineralization will either break through and ore be found on each side of the slip or it will fall away from the slip and waste will replace the ore. When a clean slip occurs as a hanging wall, few pillars are needed and a large stope can be made with a safe roof. In most parts of the mine the division between ore and waste is more gradual. Sometimes it may be a few inches; it is seldom more than a few feet and can usually be recognized without any sampling.

Scheme of Operations

In opening up a level, parallel drifts, usually about 75 ft. apart, are started in the direction of the strike of the deposit. At intervals of about 45 ft. along the drifts raises are begun. An 18-hole round is drilled and blasted. Before the muck is cleared away the bar is again set up and another round drilled and blasted. The third round is then drilled, but the cut holes only are blasted. All the rock is then shoveled up and the chute is built. The remaining holes of the last round are then blasted, and as these throw the rock to the sides of the raise the timbers of the chute are uninjured. The raise is then carried ahead at an angle of about 45 deg. This allows the muck to run and also enables the men to get about without the aid of timbering.

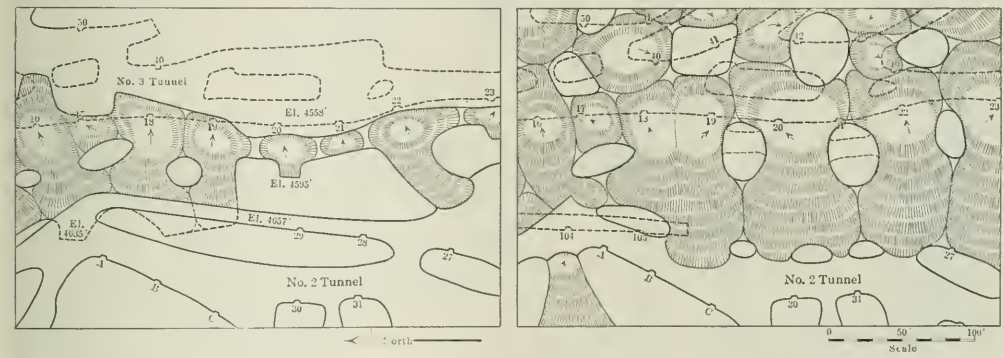
For ventilation purposes the first raise of a series is usually carried through to the level above or some other convenient opening. In the case of the highest level the most convenient opening is the surface. When the face of No. 2 raise is about 30 ft. above the sill floor, stoping is commenced and it is widened out until it connects with No. 1 raise. The same thing is done at an elevation of about 60 ft. In this way the raises are carried ahead, connecting with each other at hights of 30 ft. and 60 ft., and breaking through into the next level at 100 ft. The only small work is in the first 30 ft. This is charged to development, the remaining excavations being placed in the stoping account. In this way a network of pillars is left throughout the stope. So far a column only has been used. As soon as the sill floor above has been reached, tripods and long steel can be used to advantage. In this way a glory hole is started and the opening can be widened out until the sides of the glory hole get too flat for the ore to run. Machines are also put to work where the connections between the raises have been made and at other advantageous places. The stope may thus be turned back to meet the hanging wall and the pillars reduced in size, or where the nature of the ground permits, a pillar may be eliminated altogether.

One series of raises is seldom sufficient to tap all the ore. If the footwall is flat, a parallel drift in waste with accompanying raises will have to be driven. There will also be several drifts between the foot and the hanging wall. At one place on No. 3-tunnel level there are five parallel drifts now operating and at least another will be required. In this case the pillars in the stopes are left nearly vertical instead of at an angle as when the deposit is steeper. It is often advisable when breaking a raise through from a lower level to make the connection at the back of the chute timbers. The timbers can be taken out and a glory hole started. At the same time the raise can be carried ahead as a stope 10 to 15 ft. beneath the foot of the old stope. While stoping ahead, upper holes are drilled into the undercut rock. In this way the back is always within reach. In fact it is rarely necessary to work in a stope at any great distance from the roof.

When raising in waste no connections are made until the ore is reached. If the ore is at any considerable distance the raises are put in less frequently and are branched so as to tap the ore at two or three places. After the ore is blasted the large blocks that can be reached are bulldozed. No blockholing is attempted. It has been found cheaper to buy more powder than bother with hand or air-hammer drilling. When the raises are in ore, there are always convenient temporarily abandoned chutes, which have been cleaned out, through which access is had to the broken ore in the raises. In the case of raises through waste, where no connections have previously been made, it is necessary to drive manways. To do this a staging is constructed midway between two chutes and about 8 ft. above the track, high enough to allow the trolley wire to pass under. The planks at the center of the staging, over the cars, are movable. A miner with an air-hammer drill or a small, ordinary drill starts a raise at about 60 deg. and continues for about 25 ft., when he branches and drifts until he connects with the raises on each side. The waste with a little help is run into the cars without interfering with traffic.

Chutes and Timbering

The abandonment of timbering in the stopes has already been referred to. The only other timbering required is for chutes, tunnel sets and occasional posts and caps on the sill floor where needed.



MARCH, 1905 MAP OF STOPES BETWEEN NO. 2 AND NO. 3 TUNNEL LEVELS MARCH, 1908

The details of a chute are shown in an accompanying illustration. In building this a temporary staging is constructed, hitches are cut for the posts, a sprag is wedged between the hanging and footwall of the raise, a block and tackle attached thereto and the stulls raised and wedged in position. The stulls are then lagged up inside. A space is left unlagged for the chute proper, and at the sides of this space and inside are placed posts surmounted by a heavy cap. The chute is built in, the gate placed in position, a permanent platform built for the chutemen and the work is completed. The chute opening is about 3 ft. square, and anything that can go through the chute can go through the cars and be handled by the crusher.

When the muck is drawn through the chute from the raise the lagging and inside posts are pretty well protected by broken rock. The cap, however, suffers more or less from blasting and in course of time is replaced if necessary. If convenient, heavy railroad iron covered with lagging may be used instead of a wooden cap. Chutes have been built lined with tank plates, and the inside timbers armorplated. This, however, is seldom done, as the life of an ordinary chute is usually long enough to handle all the ore from that part of the stope of which it is the outlet.

The chute gate is a solid piece of sheet iron, and is operated by a lever. It is shown in section in the drawing of a chute. In case a car is loaded and the gate is prevented from closing by a large rock, a plank or two is moved along the staging against the mouth of the chute thus preventing any loose rock from running over. Tunnel sets are rarely needed. The main haulage way on the 40-ft. level, a straight run of about 1000 ft., has no timbers other than those necessary to carry the electric light and trolley wires. This is the usual experience. In No. 3 tunnel there is a double-tracked stretch of 900 ft. of which 300 ft. is timbered with sets and top lagging.

Sill Floor Work

On the sill floors the haulage tunnels are always being driven ahead. On the levels where the big cars run these are about 9x11 ft. in size. For a drift of this size a 20-hole round is used. This is made up of four lifters, four cuts, eight breast holes in two rows and four back holes. All the rock broken on the sill floor is hand shoveled. For handling the ore different types of cars are in use. On the No. 3-tunnel level 10-ton, steel, hopper-bottom, and 7-ton, wooden, gable bottom cars are operated. These run on a 3-ft. gage and are operated by an electric locomotive. Owing to the 6-ft. hight of the steel cars, they could not be used for shoveling into from the sill floor and for this reason the lower wooden cars were built. They are not adapted for loading from chutes as on account of their low hight the muck is liable to shoot over. In order to deliver the large tonnage required of this level these cars were an absolute necessity. There are 15 of the steel ones and five wooden ones on this level, and since their introduction three years ago they have handled close to a million tons of coarse ore besides a large amount of waste. They are all still in use and in good working condition. They have, however, their defects. The steel cars are a little too long to receive a full load without being moved. The bottom gates do not always close tightly, and men have to be kept shoveling off the track In unloading, the large rocks often arch over in the car and when they cannot be dislodged with a pinch bar, dynamite has to be used. As this is hard on the rolling stock there is usually a car or two in the repair shop.

Underground the ore loading is in the hands of a mucker boss who is responsible to a shift boss and who oversees the shovelers and chutemen. A chuteman, working with a helper, loads the ore from the chutes. In case a chute gets blocked he does the blasting necessary to clear it. The train crew consists of a motorman and a head and back brakeman. The head brakeman is in charge of the train and does whatever is necessary in the cars.

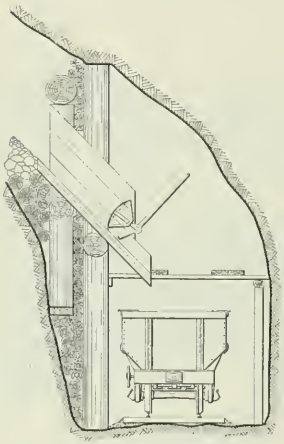
On the No. 2 tunnel level the working and equipment is practically the same except that a steam locomotive takes the place of the electric one.

In order to overcome the defects of the cars in use and those available, a special steel car was designed at the works. This is used on the 400-ft. level. This car, shown in section in an accompanying illustration is 5 ft. high and can be used for sill-floor shoveling as well as for loading from the chutes. The box has a 5-ton capacity, and has an automatic side-dumping arrangement. When a train comes to the unloading pocket, the motor goes ahead with slackened speed and a side wheel attached to the box runs up an inclined plane, the box tips, dumps its load and closes again. Since its installation in January, 1908, this arrangement has given excellent satisfaction.

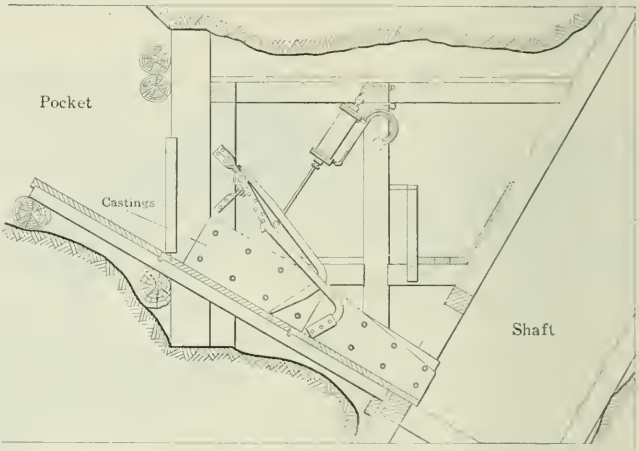
At the Gold Drop mine the entire output is dropped down a raise 300 ft. long to the Curlew tunnel. From the chutes at the bottom of the raise to the crusher bins, a distance of 800 ft. the ore is hauled in 3-ton, side-dump, wooden cars by an electric locomotive. An air lift is used to dump the cars.

The Victoria Shaft

The lower levels were originally worked by shafts Nos. 1 and 2. These were vertical, of small size and capacity and were worked to their limit. Besides, they were not centrally located for future workings.



CONSTRUCTION OF CHUTE



SKIP-LOADING DEVICE AT VICTORIA SHAFT POCKETS

In order materially to increase the output from below, the Victoria Shaft was constructed in 1905. This shaft cuts the upper orebody where that deposit crosses the 400-ft. level. The shaft is on a 60-deg. incline and connects with large storage pockets below the 400-ft. level. These pockets, ore and waste, are connected with the 300-ft. level by raises, thus materially increasing their capacity. The 200-ft. level will eventually be connected in the same way, or separate pockets may be cut out below that level.

The skip-loading device is shown in one of the illustrations. The finger gates shown in the drawing is supplemented by an extra gate made out of a piece of sheet iron. By this means the fines which would naturally slip through the fingers of the main gate are caught and prevented from going down the shaft. This type of finger gate, the sheet-iron attachment being omitted, is in general use at all crushers except that at No. 3 tunnel bins. In the case of the No. 3-tunnel crusher 4x4-in. square steel bars running in guides and worked by an air lift are used as shown. These do as good work as the finger gates, but no better, while they need more head room to install and have a greater initial cost.

A classification of the underground force employed at two different periods will show the expansion and development along new lines of the company's operations. The figures refer to the Knob Hill-Ironsides mine only, the Gold Drop being left out of consideration. In March, 1902, the average 24-hour crew consisted of one foreman, five shift bosses, one timber boss, 92 miners, 26 timbermen, 139 muckers, one pumpman, four nippers, two trackmen, two samplers, four blasters and two cage tenders. This makes a total of 280 and during this time the shipments averaged about 1000 tons per day. In March, 1908, this crew was made up as follows: One day foreman, one night foreman, seven shift bosses, one timber boss, six mucker bosses, 160 miners, nine timbermen, six timbermen's helpers, 46 chutemen, 84 muckers and chutemen's helpers, 12 nippers, six blasters, 10 barmen, three trackmen, three trackmen's helpers, three pumpmen and pipemen, one ditcher, six motormen, two locomotive engineers, eight head brakemen, six back brakemen, two car repairers, two oilers and two skip tenders, a total of 387. During this month the shipments went slightly over 3000 tons per day.

Diamond Drilling

Since starting operations more than 30,000 ft. of holes have been drilled. Almost all of this has been of small size and no holes have been deeper than 600 ft. All work is done by contract, the company furnishing power and water. The mineralized portion of the core is sampled and the results are found to agree remarkably well with those of the orebody when opened up. From several holes the cuttings were collected every few feet and analyzed. As the values were away high, this method was abandoned. The location of all drill holes is surveyed and the coordinates and elevation above sea level of the collar of every hole noted. If the hole varies from the vertical the course and dip are also kept. Drill holes can then be plotted independently of all other information. These figures are kept in a separate set of books together with all other facts regarding this work. Several holes which have been cut underground at distances of about 300 ft. below the collar have been found to be from 2 to 4 ft. from the vertical at that depth.

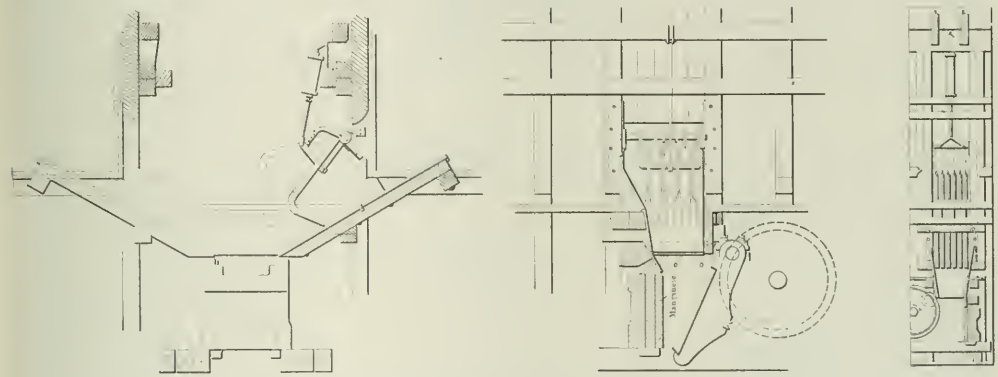
Surveying and Mapping

When the conditions are the same the surveying operations are, I think, much like those in other British Columbian mines. The coordinates of all important stations are kept on different sheets in loose-leaf ledgers. Depending on the importance of a piece of work the notes may be plotted by coordinates, by tangents or with a small protractor. It has been found necessary to keep a considerable number of maps on file. A general map showing the bulk of the company's land, buildings and underground workings is made to a scale of 100 ft. to the inch. Combined sill-floor plans on a scale of 40 ft. to the inch are made of the Knob Hill-Ironsides and Gold Drop mines. Brownprint copies of these are placed in the shift bosses' offices. It has also been found necessary to keep the stopes above each level on a separate map and separate maps are made of each level showing the geological features, especially the ore boundaries.

Transverse vertical sections are made every 200 ft. These last two series of maps are used in calculating the ore in sight. The permanent features such as shafts, side lines, drill holes, etc., are put on in ink, but as the geography of a level changes so rapidly the rest of the workings are indicated in lead pencil. From all these maps a set of brownprints is made at intervals. From the sill-floor plans a glass model of the Knob Hill-Ironsides is kept uptodate. This consists of sheets of glass running in slides in a plate-glass frame. On the glass sheets are outlined the different levels, areas of the orebodies, faults, etc., and as the space between the glasses corresponds to the space between the levels a better idea of the ground can be obtained than when all the plans are in the one plane. This arrangement does not need to be referred to often, but when it is needed it is found to be of very considerable help. It is the intention to supplement this with another similar arrangement having vertical glasses instead of horizontal ones. These will have the transverse vertical sections marked on them.

Stope Maps

The method of mining employed, whatever other advantages it may have, certainly does not tend toward simplicity in the stope maps. These are necessary to show the relation of the pillars to the



ARRANGEMENT OF GATES AT VICTORIA CRUSHERS

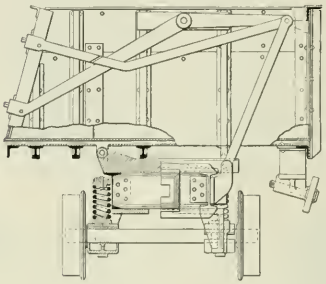
level below and the level above. The vertical sections are also constructed from these maps. As the stopes consist of a series of raises and glory holes with all the intermediate stages and with the pillars standing at different angles due to different dips of the orebody, it is not a simple matter to make a map which will show all these features to advantage. After considerable experiment it was decided to adopt, and adapt somewhat, what is known as the "hachure" method of map construction as used in topography. As the appearance of a stope soon changes, no attempt is made to go into unnecessary detail. In surveying, a setup is made in as commanding a position as possible, sights are taken to the governing points on the pillars and the ridges between the glory holes. These points are plotted and when the tracing is made, contour lines, afterward erased, are drawn in pencil on the tracing, approximately at 10-ft. intervals. The hachure lines are then inked in, their extremities being at right angles to the adjacent contour lines. Thus when the contour lines are not parallel the hachuring has a radiating appearance. When it is advisable to know the exact hight of any part of a stope the elevation above sea level is marked on the map at that place.

Ore in sight, ore developed, ore blocked out, or whatever term may be preferred, is calculated independently from the sill-floor plans and from the transverse vertical sections. The mean of these estimates, which do not vary to any considerable extent, is then taken. The horizontal area of each orebody as it crosses a level has been pretty well defined by drifts, crosscuts and drill holes. The average of this area and the area on the level above is multiplied by the vertical distance and from this product the tonnage is calculated. Each block of ground is figured out separately, and from the total the ore shipped is deducted, the balance being ore in sight. The ore extracted between shipping levels is also kept track of and the ore in sight in different blocks of ground can thus be estimated.

Brownprints

As a number of technical men who have visited us during the last few years have found this process to be a novelty, a few remarks regarding it may be excusable. The process is used chiefly for the reproduction of mine maps, blueprints being used for mechanical drawings. A tracing is first made from which a negative on thin, brownprint paper is obtained. Using paper of a heavier grade a positive consisting of very dark brown, practically black, lines on white background is produced. The different levels, which are superimposed in part, can then be colored and the map rendered intelligible to others besides the draftsman. There are also other advantages. When a tracing has to be brought uptodate it may happen that some pillars have been removed, drifts widened, etc. No erasures are made on the linen, but the extra lines needed are inked in and the lines not needed are simply inked out on the negative.

Another advantage is that the title, and other important lettering, has only to be made once and traced once. On subsequent tracings it is omitted. The original negative is, however, kept, and in future negatives it is only necessary to cut a hole where required and attach the negative of the title or whatever it has not been advisable to alter. There are other minor advantages which will show themselves after the process has been used for a little while.



SECTION OF MINE CAR, 400-FT. LEVEL

The National Engineering School of Mexico *

By Arthur R. Townsend†

The National Engineering School of Mexico is the foremost institution of its kind in the country. It is supported by the Government, the cost of maintenance and operation being, in 1896, $72,041 Mexican money. It is the oldest mining institution on this continent, having been founded in 1792, by royal decree in response to a petition of the miners' guild, that part of the tax levied on silver bullion might be applied to this purpose.

It is housed in a building completed in 1813, which is larger than the school demands, being 290x265 ft. The Government employs the unoccupied portions for official purposes. Originally intended as a school for miners, its scope has been enlarged to include all the branches of engineering as well as architecture. The school has influenced the industrial progress of Mexico since its enlargement, and there are several features in which it differs from, yet compares favorably with, our similar institutions.

Since 1792 the total number of graduates is 522; of late years, the average has been 14 per year. By graduates are meant only those to whom diplomas are granted. This is conditional in most courses on the performance of a year's practical work in the engineering profession of the course followed. The requirements for entrance are the courses of the national preparatory school. The courses taught in the National Engineering School are mining engineering, civil engineering, geographic engineering, electrical engineering, topography, hydrography and metallurgy, the time varying from five years' instruction for mining engineering to one and one-half years' instruction in metallurgy. The tuition is free and anyone complying with the scholastic requirements can enter the school.

The work is well systematized, and the records of attendance and scholarship are thorough. The studies pursued are like those of our technical schools, save that ours are more broad and thorough. Of the textbooks used, but four are in Spanish, eight being in French and 12 in English. The recitations partake of the nature of discussions in which the instructors join. Of the students enrolled, many are disqualified from entering the examinations; of those that do, only 80 per cent. pass, which is about 45 per cent. of those enrolled.

The school is well equipped in instruments for surveying and for testing materials, but poorly so in regard to physics. Its weakest feature is the pay of the faculty. This is very small, and the members of the faculty are all engaged in other occupations and give up to the school only the few hours a week required for the recitations. From this there is lacking the influence of the older men on the students, one of the best features of our smaller schools. The students are not distinctive or organized as a body in the way that is so common here. There is none of the effort on the part of the faculty to push a backward student, watch over him and see that he graduates, as is done here. It is the reverse condition from ours. With us only the most stupid fail; with them only the bright ones succeed. This accounts for the small number of graduates and insures their being of a relatively higher standard than in our schools.

The director who is the head of the school, his assistants and all the professors are appointed by the president of the republic. All the professors must be Mexican citizens and graduates of the courses in which they instruct. Graduates of foreign institutions can obtain the degree by passing the examinations of the school; without it, no responsible position can be held on work conducted by the Government.

*Abstract of an article by Mansfield Merriman in the *Engineering News* of Sept. 19.

†114 Liberty street, New York City.

The Rare Metals VIII—Uranium

By Charles Baskerville*

Uranium minerals occur most frequently in granites and pegmatites. The metal uranium is much less abundantly diffused than vanadium; however, it is found in a large number of rare minerals, many of which are of secondary origin.

URANIUM MINERALS.

	Oxide Content.
Uraninite, a uranate of uranyl, lead, etc.	75–85% UO_2 and UO_3
Gummite, an alteration-product of uraninite	61–75% UO_3
Thorogummite, a hydrous thoriferous gummite	22% UO_3
Yttrogummite, probably decomposed cleveite	
Uranosphaerite, hydrous bismuth uranate	50% UO_3
Autunite, a hydrous phosphate of uranium and calcium	55–62% UO_3
Torbernite, a hydrous phosphate of uranium and copper	56–62% UO_3
Zeunerite, an arsenate of copper and uranium	56% UO_3
Uranospinite, an arsenate of uranium and calcium	59% UO_3
Uranocircite, a phosphate of barium and uranium	57% UO_3
Phosphuranylite, hydrous uranium phosphate	71–78% UO_3
Trögerite, a hydrous uranium arsenate	64% UO_3
Walpurgite, a basic arsenate of bismuth and uranium	20% UO_3
Uranopilite, a hydrous calcium uranium sulphate	77% UO_3
Uranochalcite, an uncertain uranium sulphate	36% U_3O_4
Medjidite, a hydrous uranium calcium sulphate	
Zippeite, a basic uranium sulphate	13–17 U_3O_4
Voglianite, a basic uranium sulphate	12% U_3O_4
Uraconite, an uncertain uranium sulphate	66–71% U_3O_4
Johannite, a hydrous sulphate of uranium and copper	67% UO_3
Mackintoshite, a hydrous silicate of uranyium and thorium	22% UO_3
Samarskite, a tantalo-columbate of the cerium and yttrium metals	10–14% UO_3
Nohlite, a variety of samarskite	14% UO
Vietinghofite, a ferruginous variety of samarskite	9% U_2O_5
Annerödite, a pyro-niobate of uranium and yttrium	16% UO
Hielmite, a stanno-tantalate of yttrium, etc	2–5% UO_2
Bröggerite, a variety of uraninite	76–79% U_3O_8
Cleveite, a variety of uraninite	66% U_3O_8
Nivenite, a variety of uraninite	67% U_3O_8
Carnotite, a vanadate of uranium and potassium	62–65% U_2O_3
Uranothallite, a hydrous calcium uranium carbonate	35–37% UO_2
Liebigite, a hydrous calcium uranium carbonate	38% UO_3
Voglite, a hydrous carbonate of uranium, calcium and copper	37% UO
Schröckingerite, a hydrous oxycarbonate of uranium	
Randite, a hydrous carbonate of calcium and uranium	32% U_3O_8
Thorite, anhydrous thorium silicate	1–10% U_3O_8
Rowlandite, an yttrium silicate	0.4% UO_3
Uranophane, a hydrous silicate of uranium and calcium	53–67% UO_3
Hatchettolite, a tantalo-niobate of uranium	16% UO_3
Fergusonite, a metaniobate of yttrium, uranium, etc	1–8% UO_2
Tyrite, a variety of fergusonite	
Bragite, a variety of fegusonite	
Kochelite, a variety of fergusonite	0.43% UO_3
Sipylite, a niobate of cerium, etc	3% UO
Yttrotantalite, a tantalo-niobate of yttrium, erbium, etc	0.8–1–5% UO_2
Euxenite, a niobate and titanate of yttrium, etc	4–12% UO_2
Polycrase, a niobate and titanate of yttrium, etc	0.5–20% UO_2
Arrhenite, a heterogeneous decomposition-product	
Blomstrandite, a tantalo-niobate of uranium, etc	23% UO
Xenotime, yttrium phosphate	4% UO_3

*Professor of chemistry, College of the City of New York.

Note—These analyses are given in the nomenclature of the chemists at the time they were made.

The important uranium minerals are uraninite, bröggerite, gummite, thorogummite, uranosphaerite, autunite, torbernite, samarskite, and carnotite. Uraninite, or pitchblende, and carnotite are uraniferous minerals of commercial importance.

Metallic uranium and its carbide are employed in metallurgy to improve the toughness, hardness, and elongation of steel and iron. Uranium steel is used for manufacturing gun metal, armor plate, etc. However, as a steel-hardening metal, uranium is subordinate to vanadium, chromium, nickel and tungsten. Uranium is now employed in the manufacture of incandescent gas mantles, where its presence is found to improve the properties of thorium, cerium and zirconium salts. Uranium oxide has the property of imparting to a glass a beautiful fluorescence of a greenish-yellow color, and a fine velvet-black to porcelain, when heated in the enameling fire. Uranium salts are also employed in the laboratory. Uranium carbide is utilized for manufacturing filaments in incandescent electric lamps. Uranium minerals are treated for the extraction of radium salts. A convenient test for uranium minerals is to place a piece upon the black or orange paper envelop in which photographic plates are kept. The sensitive side of the plate should be next the mineral. After remaining in a dark room several days, the plate will show an outline of the mineral.

Uraninite

Uraninite occurs in granite rocks and in metallic veins. It often contains the metals of the lanthanum and yttrium groups, calcium, and iron. The largest deposits in this country are in Connecticut, North Carolina, South Carolina, Llano county, Texas, Colorado, especially near Central City, and in the Black Hills, South Dakota. In Gilpin county, Colo., uraninite occurs with auriferous sulphide ores; it is exported to Germany. This is the same as "pitchblende," found in Austria, from which practically all the radium salts are extracted.

Uraninite is a black, massive mineral of botryoidal or granular structure. The structure is sometimes columnar or lamellar, and the appearance is usually greasy or pitch-like. It is a brittle mineral, and the color is of a black shade—grayish, greenish, brownish, or velvet-black. The hardness is 5.5, and the specific gravity is from 6.4-9.7. The streak is brownish black, grayish, or olive-green.

Before the blowpipe, uraninite is infusible, or only slightly rounded on the edges, and sometimes colors the flame green from copper present. With soda on charcoal it gives a coating of lead oxide, and sometimes the odor of arsenic. Reactions for sulphur and arsenic may be obtained in the open tube, etc. With borax and salt of phosphorus, uraninite gives a yellow bead in the oxidizing flame; this bead assumes a green color in the reducing flame. It is soluble in nitric acid, forming a yellow liquid from which ammonia throws down a yellow precipitate. It is not attracted by the magnet.

The bead tests for uraninite are characteristic for uranium oxide, and the appearance and streak are important for distinguishing uraninite from similar species.

Cleveite and Nivenite

Cleveite and nivenite contain UO_2 in larger amount, and are characterized by containing 10 per cent. of the yttrium earths. Nivenite occurs massive, and its color is velvet-black. It is more soluble than any other varieties of uraninite, being completely decomposed by the action of dilute sulphuric acid at 100° in an hour. Nivenite is found in Llano county, Texas. Bröggerite occurs in octahedral crystals, having a specific gravity of 9.03.

Gummite

This mineral is fairly abundant in Mitchell county, North Carolina. It is found in rounded or flattened pieces, which resemble gum in appearance. The luster is greasy, and the color is reddish yellow to an orange- or hyacinth-red. The streak is yellow. Its hardness is 2.5-3, and the specific gravity is 3.9-4.2. Gummite is an alteration product of uraninite.

Before the blowpipe gummite yields much water and a bituminous odor. With salt of phosphorus in the oxidizing flame, it yields a yellow bead, which becomes green in the reducing flame, leaving an undissolved skeleton of silica.

Thorogummite

Thorogummite occurs with fergusonite, cyrtolite, etc., at the gadolinite locality in Llano county, Texas. It is found usually massive, but sometimes in groups of crystals resembling zircon in form. The hardness is 4-4.5, and the specific gravity is 4.43-4.54. Its color is dull yellowish brown, but after ignition, it becomes of a dull greenish hue.

Thorogummite is easily soluble in nitric acid, and responds to tests for uranium (see uraninite) and for thorium (see *Thorium*, thorite).

Uranosphaerite

This mineral occurs with other uranium minerals near Schneeberg, Saxony. It is found in half-globular aggregated forms, having a dull or slightly lustrous surface. The luster is greasy, and the color is orange-yellow or brick-red. Its hardness is 2.3, and its specific gravity is 6.36. The streak is yellow.

Uranosphaerite decrepitates on heating, and a mass of crystalline needles results. These needles possess a silky luster and brown color

Autunite

Autunite is found in thin, tabular crys-

tals of a bright yellow color and pearly luster, and also in aggregates with a micaceous structure. It occurs in Connecticut, Massachusetts, Pennsylvania, North Carolina, South Carolina, South Dakota, and Utah. It is usually associated with albite, columbite, gneiss, or mica.

Autunite laminæ are brittle, and the luster is pearly on the base. The hardness is 2-2.5, and the specific gravity is 3.05-3.19. Its color is lemon- to sulphur-yellow, and the streak is pale yellow.

Autunite fuses on charcoal to a black crystalline globule. With salt of phosphorus or borax, it yields a green bead in the reducing flame. With soda, a yellow, unfused slag results. The nitric acid solution is yellow.

Torbernite

This material occurs in thin, square tables of a bright green color and pearly luster. Sometimes it is found in the pyramidal or foliated, micaceous form. The hardness is 2-2.5, and the specific gravity is 3.5. It is brittle, and the streak is pale green.

Torbernite fuses easily before the blowpipe to a black mass and colors the flame green. With borax it gives a green glass in the oxidizing flame; this glass assumes a red color in the reducing flame. With salt of phosphorus it yields a green bead, which becomes red after being treated with tin on charcoal. With soda it gives a globule of metallic copper. The copper button is often whitened by arsenic. It is soluble in nitric acid, forming a yellowish green solution.

Uranophane

This mineral occurs in minute acicular crystals, and also in the massive form with a fibrous structure. The variety from Mitchell county, N. C., is a yellow colored mineral, having a hardness of 2-3, and a specific gravity of 3.834. The luster is vitreous.

Uranophane yields alkaline water in the matrass, and is rusty-brown colored on cooling. When heated in an open tube, it becomes almost orange colored. Before the blowpipe, it fuses to a black glass and colors the flame a slight green. With the fluxes it shows silica and uranium reactions. It dissolves in hydrochloric acid with the separation of silica in flakes.

Other Uranium Minerals

Phosphuranylite occurs as a pulverulent incrustation, having a pearly luster and yellow color, with other uranium minerals in Mitchell county, N. C. It yields water in a closed tube, and assumes a brownish yellow color on cooling. It is easily soluble in nitric acid.

Trögerite is found in thin, tabular crystals, having a pearly luster and lemon-yellow color, in the Black Hills, North Dakota. It is associated with uraninite. It yields considerable water in a closed tube and grows darker. It fuses easily, giving a pale blue flame. On charcoal it gives an arsenic odor, and shows characteristic uranium reactions with the glass fluxes.

Randite occurs as a canary-yellow incrustation on granite near Philadelphia, Penn.

Samarskite is described under the tantaliferous minerals.

Carnotite is described under the vanadiferous minerals. Test for uranium as in uraninite.

New Aneroid Barometer

The accompanying illustration shows a new aneroid barometer, invented and patented by J. C. Asten, of Upper Norwood, S. E., England. The instrument, which is made in large watch size, has a 2½-in. dial, and is capable of noting differences of elevation of 10 ft. up to 10,000 ft. The usefulness of such an instrument to engineers and others is plainly apparent.

ASTEN'S NEW ANEROID

A Large Dredging Company

Special Correspondence

Some additional facts have now been learned relating to the new corporation known as the Natoma Consolidated, of California, which was referred to recently in the Journal. The object of the consolidation is to control all the gold-dredging operations on the American river near Folsom and Natoma, as well as the operation of the Feather River Development Company, of Oroville. By so doing the operating costs will be decreased and the combined net earnings increased. Moreover the life of the combined dredging operations will be extended from six to 10 years, to a period ranging from 17 to 20 years. The total area of prospected dredging land involved in the corporation's holdings is about 6000 acres. It is estimated that in this area there are 287,700,000 cu.yd. of gravel, etc., containing, gross about $29,724,000. In addition there are 3000 acres of unprospected or partly prospected dredging lands, the value of which has not been computed and is not included in the above statement.

The company takes in the ground, dredges, etc., of the Natoma Gold Dredging Company, the Folsom Development Company near Folsom and the Feather River Development Company's property and dredges at Oroville. The Ashburton Mining Company, of Folsom, is also expected to come into the combination. The Consolidated company will commence operations with 14 dredges and will, without delay, construct three more, one on the property of the Folsom Development Company, one on lands adjacent to the Natoma Development Company's ground, and one on the Feather River Development Company's land at Oroville. Later four additional dredges will be built on the ground of the Folsom Development Company.

The capital stock of the new company is $25,000,000. In addition to the dredging properties mentioned, the new corporation will own the Natoma Land and Mining Company's land, water and vineyard departments; the Sacramento & Folsom Railway Company; the Sacramento Water Company; the Folsom Rock Company and the Folsom Pipe Company. The present water supply of the Natoma Land and Mining Company will be largely increased by building storage reservoirs, so as to supply water to the dredges at all times. The American reclamation district, north of the Sacramento river and across the American river, will be laid out, developed and supplied with water. The combined flow of water will be some 8000 or 9000 miner's inches. Water will be sold to Sacramento and adjacent towns.

Eugene J. De Sabla will be president; Louis Sloss and Frank W. Griffin vice-presidents. Among other directors will be R. G. Hanford, W. P. Hammon, W. H. Crocker, J. C. Coleman, J. D. Grant and J. H. Follis. A. E. Boynton, secretary of the present Hammon companies, will be secretary of the new one. Offices are being prepared in the new Alaska Commercial building in San Francisco. It is expected that, among others, Francis Carolan, John Hays Hammond, Frank Drum and George Pope will become interested. It is expected also that the general management will rest in W. P. Hammon while the present general superintendent of one of the largest dredging companies in the State, will take a similar position with this company. All the persons mentioned are men of large means in this community and many of them have been for years connected with the mining industry of California.

Upon unwatering an old copper mine the water should be tested, and if found to contain much copper, should be precipitated by the well known method of passing it over scrap iron and old tin cans.

Rhodesia in 1908

By W. Fisher Wilkinson*

The gold production for the year 1908 may be expected to reach £2,525,000 in value, which is £346,114 in excess of the production of 1907 (£2,178,886), an increase of 15 per cent. The accompanying table, compiled by the Rhodesia Chamber of Mines, gives the total gold production from Southern Rhodesia to March 31, 1908. In the table the ounces are partly bullion ounces. It has been arranged for all declarations of gold from April, 1908, to be made in fine ounces; and the value of the ounce will be calculated as in the Transvaal at £4.24773.

GOLD PRODUCTION OF RHODESIA TO MARCH 31, 1908.

	Tons Milled.	Gold, Oz.	Value.	Value per Ton.
Prior to Sept. 1, 1898	*	6,471	£23,456	
Sept. 1, 1898, to June 30, 1899	81,841	48,847	177,072	43.26s.
July 1, 1899, to June 30, 1900	104,746	57,621	208,877	39.88
July 1, 1900, to March 31, 1901	140,716	89,258	320,457	45.54
Year ending March 31, 1902	249,667	180,910	640,661	51.32
Year ending March 31, 1903	338,156	201,107	709,461	41.96
Year ending March 31, 1904	516,747	234,693	845,359	32.71
Year ending March 31, 1905	787,936	309,516	1,113,068	28.25
Year ending March 31, 1906	1,100,609	435,019	1,556,741	28.28
Year ending March 31, 1790	1,417,723	560,750	2,012,543	28.39
Year ending March 31, 1908	1,652,019	624,764	2,289,452	27.71
	6,390,160	2,748,956	9,897,147	30 97

* No details available.

The output is largely made up of the returns from small mines or tributors working within the average five stamps. The September sheet, for instance, has 104 different names contributing to the total, of which only 14 have 20-stamp batteries or upward. At the close of 1907 the small workers were contributing about 35 per cent. of the output.

The principal mines are given in the accompanying list, compiled from the September returns. The total production of southern Rhodesia for that month was valued at £204,261 from 159,934 tons.

SEPTEMBER PRODUCTION SOUTHERN RHODESIAN GOLD MINES.

	Tons Milled.	Stamps.	Total Yield.
Matabeleland:			
Bell	1,128	10	£3,092
Bush Tick	6,115	25	5,266
Nelly	1,690	15	4,077
East Gwanda mines	9,848	70	12,207
Gaika	2,953	5	4,610
Globe and Phoenix	6,412	40	10,775
Selukwe	5,650	40	5,433
Surprise	2,586	20	4,305
Wanderer	15,252	100*	5,851
Mashonaland:			
Joker	447	4	4,429
Battlefields	1,680	10	3,537
Giant	6,252	15	2,733†
Ayrshire	8,231	60	3,289
Eldorado	5,123	20	10,271
Jumbo	2,215	30	6,647
Penhalonga	11,100	60	8,595
Rezende	3,100	25	4,525

*Dry crushing process.
† Owing to collapse of main shaft in August the yield is not normal. The average for January to July was £10,700 per month.

*Mining engineer, London, England.

Working Costs

In the presidential address delivered to the Chamber of Mines on May 20, the following average costs of 11 of the principal mines, omitting the Wanderer mine, which is a low-grade property, working under exceptional circumstances, are given: The 11 mines crushed 534,332 tons and treated 271,443 tons of sands and concentrates. The costs per ton milled were as follows:

	s.	d.
Mining	7.	10.51
Sorting, crushing and tramming	1.	5.01
Milling	4.	4.17
Cyaniding and concentrating	2.	3.98
General charges	1.	11.65
Development redemption	4.	2.55
	22.	1.87

The average recovery was 30s. 10.08d., leaving an average working profit of 8s. 8.21d. One of the mines was working at a loss.

Population and Labor

The native population on Dec. 31, 1907, was estimated at: Matabeleland, 217,470; Mashonaland, 445,316; total, 662,786. The number of natives employed at the mines during March, 1908, was 30,571, of which 38 per cent. were local natives, the balance coming from Portuguese East Africa, northwest and northeast Rhodesia, Nyassaland and other sources. The diet of a native has now been fixed by legislation as follows: Meal, 2½ lb., or rice, 1½ lb. per day; meat, 1 lb. per week; vegetables (potatoes, beans, etc.), 2 lb. per week; lard, 8 oz. per week, or monkey nuts; salt, ½ oz. per day. The white population of southern Rhodesia on Sept. 29, 1907, was, males, 9451; females, 4556; total, 14,007.

Gold Producers

One of the successful mines of Rhodesia is the Giant, which for the year ending June 30, 1908, milled 65,074 tons with a 15 stamp mill and one tube mill, obtaining a recovery of 36.8s. per ton milled. The working costs, including development, totaled 15.5s., or 18.5s. if depreciation and London expenditure is added. Owing to the caving in of the main shaft, the successful operations have recently been thrown back, and about six months will be required to sink a new shaft. The orebody has lately widened out considerably at the sixth and seventh levels, being more than 100 ft. wide and all in pay ore, a discovery which has greatly improved the future prospects. To meet the cost of the new shaft and to double the mill capacity (a policy which the new discovery of ore mentioned above has influenced) £50,000 is being raised by a debenture issue. The Giant is one of the dividend-paying mines, having paid £17,812 in 1905-6, £35,625 in 1906-7 and £41,562 in 1907-8 on a capital of £250,000.

Another dividend payer is the Globe & Phœnix, one of the oldest of the Rhodesian mines. The depth of the workings are now 2300 ft. For the six months ending June 30, 1908, the 40-stamp mill crushed 37,546 tons and obtained a gross profit of £28,475, excluding depreciation and London expenses, the yield and costs per ton being, respectively, 42s. 1d. and 26s. 11d. Battlefields is another dividend-paying mine. The Eldorado mine, working on a conglomerate or so-called banket ore, commenced crushing in September, 1907, and up to Oct. 31, 1908, treated 43,802 tons for a yield of £111,408. The estimated profit was £53,000.

The Wanderer is a low-grade mine or quarry which dealt with 190,377 tons during the year ending April 30, 1908. The yield per ton was 8s. 8.83d., and the working costs, 6s. 5.7d.

Other Minerals

In the eastern part of Rhodesia the copper mines of Umkondo and Edmundian are being developed. The Edmundian started smelting in October. The reduction plant consists of pneumatic stamps and Elmore vacuum oil concentrator, and the smelting plant of calciners and reverberatories. The matte produced is shipped. Power is obtained from a hydroelectrical power plant situated four miles from the mine.

In the Bembesi district several diamond pipes have been discovered. Some diamonds have been found. Further work is required to establish the value of this discovery. The dispute between the Chartered Company and the De Beers, which claim exclusive rights to all diamond mines in Rhodesia is to be fought in the British courts. The claims of the De Beers company are opposed by the Rhodesia Chamber of Mines.

The blanketing for use at the Giant mine, Rhodesia (*Journ.* Met. Chem. and Min. Soc., Nov., 1908), is 3 ft. wide and torn into strips 4½ ft. long. The canvas is hand-washed in tubs. The blankets are washed every half hour. Revolving tables for washing the blanketing were tried, but the blankets could not be cleaned of the fine heavy concentrates that way.

The slope given the walls of the open cut at the Broken Hill Proprietary mines, Australia, varies from ½ to 1 to ¾ to 1.

The Microstructure of a Complex Ore from the Frisco Mine, Idaho

By William Campbell*

Two specimens of "magnetic lead ore" were sent to me by W. R. Ingalls, with the information that he had obtained them at the Frisco mill, Gem, Idaho, where it was being separated as the *magnetic* product by a Dings machine, equipped with a horizontal, endless belt (instead of the usual shaking tray) and thus enabled to work with wet material. He reported that this lead ore was strongly magnetic, the pull on a piece held near the magnets being pronounced, and that the magnets lifted from the belt pieces weighing an ounce or more. The greater part of this magnetic lead ore was collected by the jigs along with blende as a lead-zinc middling, which was fed to the Dings machine, it making a magnetic lead product and a non-magnetic zinc product. According to Frederick Burbidge, general manager of the Frisco Mining Company, Limited, the lead concentrate thus obtained had approximately the following analysis: Lot of 35 tons—22.3 per cent. lead, 31.2 silica, 13.9 iron, 13.6 sulphur, 13.5 zinc, and 10.1 oz. silver. Lot of 75 tons—22.1 per cent. lead, 26 silica, 17.8 iron, 12.3 sulphur, 12.7 zinc and 9.8 oz. silver.

In the hand specimen the two pieces of ore were fine-grained, showing tiny faces of galena in the midst of a good deal of dark, dull material. Scratching with a knife gave a brownish streak, but the specimens were hard. Some of the ore was powdered, in which state the magnet picked up particles having a metallic luster and a black streak, very hard, probably magnetite.

The two specimens were next ground flat on a lap and carefully polished on various grades of French emery paper and finished on a rouge board.[2] Under the microscope they were seen to be a very intimate mixture of galena, blende, magnetite, calcite and other gangue as the following description will show: The smaller specimen showed bright, easily scratched galena which was evidently the last mineral to be deposited. Fig. 1 (magnified 40 diameter), shows this as the white groundmass. The dark well polished material is calcite, which on etching with weak nitric acid shows a very fine structure, as if it had been crushed. Very thin veins of galena cut it in all directions. The rough metallic mineral in irregular grains standing out in relief is seen embedded in the calcite and is evidently earlier. It has all the appearances of magnetite and on etching with concentrated hydrochloric acid however, has a dark metallic streak, and probably is magnetite. Fig. 2 is similar; shows a characteristic cross-hatched structure. It can be scratched with a needle, showing rough magnetite; calcite, black due to etching and vertical illumination, but with oblique light showing fine white grains or crystals; galena as the bright white groundmass as before. Fig. 3 shows the same rough magnetite and black calcite. The mass of bright galena is the largest patch in the specimen. The more common structure is seen in Fig. 4 a complex of galena and gangue in which some blende and magnetite occur. Fig. 5 shows an area with much rough magnetite in grains, set in a groundmass of galena in which small patches of gangue occur. In other parts of the specimen several grains of black greasy quartz in relief were seen.

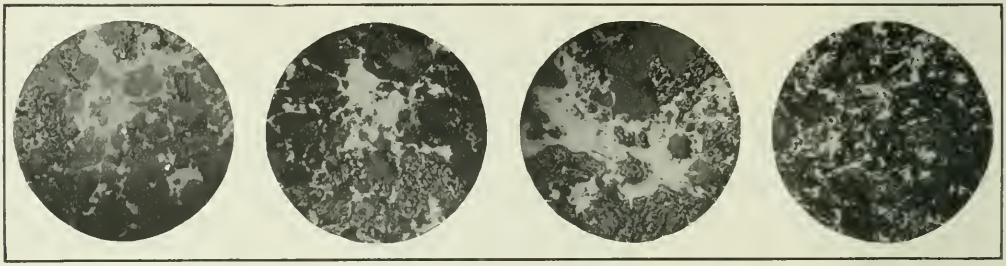


FIG. 1 FIG. 2 FIG. 3 FIG. 4

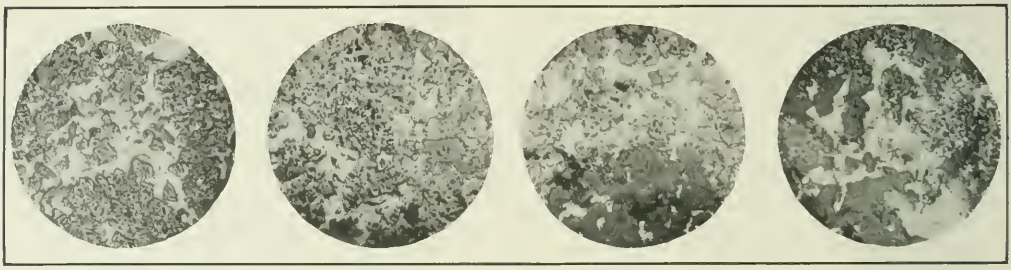


FIG. 5 FIG. 6 FIG. 7 FIG. 8

The larger specimen contains many large and small rounded grains of quartz which is apparently one of the oldest if not the oldest mineral present. Fig. 6 shows some of these small grains as intensely black spots. The rough grain in the center of the field is magnetite while the dark mineral, covering most of the ground, is blende. The interstitial spaces are filled with bright white galena, evidently the last constituent to form.

In Fig. 7 the black mass is quartz; the white groundmass is galena in which are set irregular grains of blende. Fig. 8 shows several dark grains of quartz, some rough magnetite and the usual white galena. The dark gangue in the lower part

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[2] "The Microscopic Examination of Opaque Minerals," *Economic Geology*. Vol. I, p. 751.

of the figure is probably barytes. It has a white streak, is soft and, with concentrated hydrochloric acid shows a well marked cleavage. There is a good deal of this mineral present in the specimen, forming a complex with blende, and in one place it includes a few small patches of chalcopyrite of later origin. The fine needles of gangue, seen in Fig. 8 embedded in the galena, are probably the same material.

Thus the very complex appearance of the specimens to the eye is explained by the microstructure which indicates the following order of deposition: quartz, magnetite, barytes (or some other gangue mineral), calcite and blende and, last of all, galena.

Federal Aid for State Mining Schools

SPECIAL CORRESPONDENCE

Representative Foster by instruction of the Committee on Mines and Mining on Jan. 16, reported to the House Senate bill 3764 passed by the Senate on May 15 last. This bill in different forms was simultaneously introduced in the two houses last spring and then provided for the appropriation of a portion of the proceeds of sales of public lands for the endowment of schools or departments of mines and mining in the various States. The House bill as now reported strikes out all after the enacting clause of the Senate measure and inserts a new draft nearly identical with the Foster bill of the last session (H. R. 20591). The measure provides that there shall be appropriated from the sale of public lands $5000 during the fiscal year beginning July 1, 1909, $10,000 for the fiscal year beginning July 1, 1910, $15,000 for the next fiscal year and so on up to $25,000 which is then made a permanent annual appropriation for each State and Territory for the establishment and maintenance under the control of the Secretary of the Interior of a school or department of instruction in mines and mining. Section 2 provides that if there be already established in any State or Territory a State school of mines and mining, or if there be a department of instruction in mining connected with any institution of learning controlled by a State the funds shall go to the already existing school or department. If there are two schools or departments of mines and mining the money appropriated is to be equally divided between them. In States where there is no such department of instruction and no agricultural college, some other State institution will be selected as the recipient, or in the event that there is no institution whatever controlled by the State, the Secretary of the Interior is to designate some accessible and convenient place where the school of mines and mining shall be located. The money appropriated is to be used only for "instruction, research and experiment (including the employment of instructors and experts, the purchasing of apparatus, supplies, and books, and the equipping of laboratories) in mining, mining machinery (with the application of electricity thereto) mining engineering, ore treatment, metallurgy, assaying, and chemistry and geology, so far as these sciences relate to minerals and mining, with a view to teaching a practical and scientific knowledge of the best and safest methods of mining and carrying on the business of mining and of producing gold, silver, coal, and other minerals, oil, gas, and medicinal waters, and also the concentrating, smelting, refining, and other preparation of the same for marketing, so far as the same may be necessary and appropriate to the mineral resources of the State or Territory in which said school or department of instruction in mines and mining shall be located, and especially for the study and prevention of explosions, fires and other dangers incident to the carrying on of mining and the mining industry, in order to secure the most intelligent conservation, use, and development of the mining and mineral resources of the country, to make the life of miners more safe, property in mines more secure, and to promote the general welfare of miners and operators of mines."

The head of each school or department of mining is to report annually to the governor of the State or Territory in which his school is located and a copy of the report is to be sent to the Secretary of the Interior. The money is to be disbursed upon warrant of the Secretary of the Interior to the State or Territorial treasurer who is to pay it over upon order of the board of trustees or other board of control of the institution.

In support of this bill the committee report calls attention to the growth of mine disasters and says: "We believe that the modest expenditure of the Government in the establishment of these schools of mines and mining where the correct principles of mining will be taught is of importance. We believe that the means of education which these schools will afford will, in time, reduce the loss of life and property to the minimum," besides affording other benefits.

In a letter to the President signed by Charles D. Walcott, which is also submitted, Mr. Walcott says: "There can be no question that the mining industry would be greatly benefited and extended by the more thorough training of men who are engaged in mineral production. At the present time a considerable number of mining engineers are graduates from out larger educational institutions, but the great mass of the mineral producers have not been thoroughly trained."

This bill contemplates only the appropriation of the proceeds of the sale of public lands outside of the "irrigation States." The following statement gives the amount available for the purposes of this bill from the sale of such public lands for the year ending June 30, 1908: Alabama, $23,334; Alaska, $18,373; Arkansas, $300,014; Florida, $64,250; Iowa, $117; Louisiana, $79,464; Michigan, $43,731; Minnesota, $424,415; Mississippi, $17,042; Missouri, $112,197; Wisconsin, $19,627; total, $1,103,165 for the year.

Drawback Regulations on Metals

SPECIAL CORRESPONDENCE

Treasury regulations of April 16, 1901, providing for the allowance of drawback on babbitt metal manufactured by Merchant & Company, of Philadelphia, in part with the use of imported lead and antimony, have been extended so far as applicable to cover the exportation of babbitt metal manufactured by the Frictionless Metal Company, at its factories at Chattanooga, Tenn., and Richmond, Va., with the use of imported lead and antimony. The drawback entry must show the total quantity of babbitt metal exported and the quantities and percentages of imported lead and antimony used in the manufacture. In liquidation the quantities of imported lead and antimony which may be taken as the basis for the allowance of drawback may equal those declared in the drawback entry provided they shall not exceed 83 lb. lead and 14 lb. of antimony for each 100 lb. of exported babbitt metal.

Treasury regulations of April 26, 1908, providing for the allowance of drawback on the exportation of iron tubes, pipes, flues and stays manufactured by the National Tube Company, wholly or in part from imported Swedish charcoal pig iron, have been extended so far as applicable to cover similar articles manufactured by the Reading Iron Company, of Reading, Penn., wholly or in part from the same imported material. The allowance shall not exceed 144 lb. of imported charcoal pig iron for each 100 lb. of exported product where the latter is manufactured wholly from imported material and a proper proportion of this amount when the exported tubes, pipes, etc., are manufactured partly from imported material.

A few years ago deep-level mining companies on the Rand, South Africa, were looked upon as questionable ventures, but now three deep-deep-level mines—the Robinson Deep, Simmer & Jack East and the Village Deep—are producing and the mining costs, which exclusive of development are, respectively, 12s. 10d., 16s. 8d. and 15s. 2d., are now lower at these mines than was the cost at most of the mines operating on the Rand at that time.

Water-tight Bulkhead Door

In many mines the water is confined either to the vein or to fractured zones in the country rock, while the rest of the ground is comparatively dry. Such conditions prevail at Eureka, Nevada, in the Richmond-Eureka mine, and also in the Pachuca and Real del Monte district in Mexico. Many mines have been drowned out through crosscutting unknown portions of the ground on old levels, or through driving new levels, without providing a water-tight bulkhead in the first solid ground near the mouth of the crosscut. Such a bulkhead keeps the sudden flow of water from drowning out the pumps, and at mines previously dry, if the ground between the shaft and the water-bearing zone is solid, this bulkhead will hold back the water until pumps can be installed. Indeed it seems as though ordinary prudence would dictate the building of a water-tight bulkhead near the mouth of such exploratory crosscuts.

In the later days of the bonanza period at Eureka, owing to failure to take this precaution, the Richmond-Eureka mine was lost when a heavy flow of water was unexpectedly struck in the fractured limestone on the bottom level of the Locan shaft. Since then the mine has been unwatered and a bulkhead closed by a door, constructed as is shown in an accompanying illustration, has been built. In the future at this mine when exploring the water-bearing zone a bulkhead will always be built for protection.

The bulkhead door that inspired the design illustrated in this article was used in the Real del Monte and Pachuca mines in Mexico; the redesigning to strengthen the door was done by C. F. Moore, chief engineer of the United States Smelting, Refining and Mining Company. This door is for use with concrete bulkheads.

In building the bulkhead, first a cross drift extending a few feet into the rock on each side of the crosscut or drift is driven at ankorage for the bulkhead. Bolts for fastening the door casing are placed in the concrete, and when the whole has become solid the casing is bolted in place on the side that faces the expected source of water. The door and casing are made of cast iron. While driving the drift the door is left open, especially at blasting time on account of concussion. If water is met with, the door can be closed even if there is a considerable flow of water coming out of the drift.

In using this door at the mines of different companies affiliated with the United States Smelting, Refining and Mining Company, it has been found that frequently there is leakage at the edges of the door. So to avoid that possibility a gasket, made out of old rubber belting, is hung from the casing. After closing the door, suitable lengths of railroad iron are put across the bulkhead, and bolts, with their T-ends hooked into recesses provided in the door and with their heads shouldering against the rail cross pieces, are used to bring the door home against the seat. This door is air-tight as well as water-tight, so that it can be used in isolating a level in case of fire. By means of the water gate, the flow of water can be regulated to the capacity of the pumps. The door has given great satisfaction wherever used, and has been found amply strong to withstand great pressures.

Peroxide Method for Determining Lead

W. S. Medell (*West. Chem. and Met.*, IV, pp. 152-156) has published some advance notes on a new method for the determination of lead. The proposed method is called the "peroxide method for the estimation of lead" and is said to be short, accurate and not affected by contaminating elements. The permanganate and iodometric titrations are about the most satisfactory volumetric methods in use. The new method consists of precipitating the lead from a caustic-soda solution as peroxide by bromine, reducing the peroxide with an excess of reducing agent and then titrating the excess with a permanganate solution.

At the beginning of the investigation oxalic acid was used as the reducing agent in a sulphuric-acid solution, but proved unsatisfactory. Phosphoric acid was substituted for the sulphuric acid with better results except for the time element. The substitution of ferrous ammonium sulphate for the oxalic acid and the use of the phosphoric-acid solution achieved the desired result.

The following reagents and standard solutions are used: Ortho-phosphoric acid; a 10-per cent. solution of caustic soda; a 5-per cent. solution of potassium bromide saturated with bromine; a standard solution of ferrous ammonium sulphate; and a standard solution of potassium permanganate. The ferrous ammonium-sulphate solution contains 18.958 grams of the pure salt per liter of water; 1 c.c. will reduce 0.005 gram of lead from PbO_2 to PbO. The permanganate solution contains 1.528 grams of the pure salt in a liter of water. The permanganate and the ferrous ammonium-sulphate solutions are standardized against each other.

Method of Analysis

Dissolve 0.5 gram of the ore in a 3¼ in. casserole with 10 c.c. of sulphuric acid (1:1) and 5 c.c. of nitric and hydrochloric acid; the proportion of these in the 5 c.c. varies with the ore. The solution is evaporated to white fumes and if manganese is present a crystal or two of sodium sulphite is added to reduce manganates that might be present. When cool, the solution is diluted with water to about 50 c.c., allowed to stand, then boiled, cooled and filtered by decantation, retaining as much as possible of the sulphate in the casserole. The residue is washed with sulphuric acid several times by decantation. A hot solution of caustic soda (10 c.c. of the 10-per cent. caustic solution to 20 c.c. of water) is poured, 15 c.c. at a time, through the filter and caught in the casserole containing the residue. The filter is then washed with about 100 c.c. of hot water and the washings and residue transferred to No. 3 beaker. The contents of the beaker are boiled until the lead sulphate is dissolved, then cooled to about 95 deg. C.; from 15 to 35 c.c. of the bromine water are added and the solution is stirred vigorously for a few seconds. The peroxide is at first yellow colored but soon darkens to the usual liver color. It is necessary to be sure of an excess of bromine and to heat the solution just below boiling for at least five minutes after its addition, but not long enough to drive off the excess of bromine. The solution is stirred while heating, and after removal from the hot plate is allowed to settle. The solution is filtered through a 11-cm. filter, retaining the bulk of the precipitate in the beaker, and filling up the filter with cold water as soon as the solution has passed through. The precipitate is washed by decantation with three successive portions of 25 c.c. of water each. The filter paper is then transferred to the beaker and 250 c.c. of cold water and 5 c.c. of phosphoric acid added. A measured amount of the standard ferrous ammonium-sulphate solution is added in excess to dissolve the peroxide, using a rubber policeman to break up the lumps of peroxide. The solution is then titrated with the permanganate solution.

The reactions of the process are:

$$PbSO_4 + 4NaOH = Na_2PbO_2 + Na_2SO_4.$$

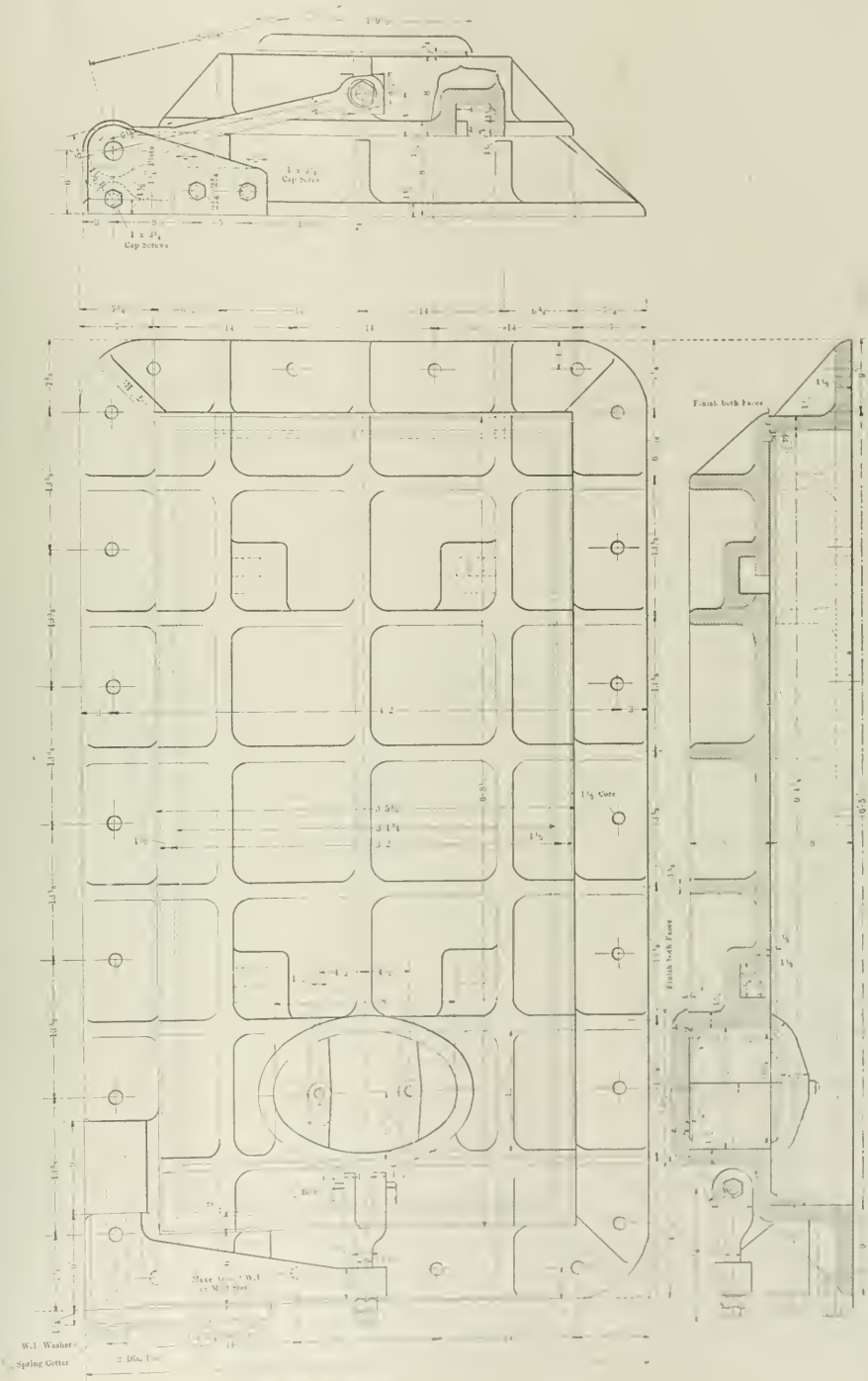
$$Na_2PbO_2 + 2Br = PbO_2 + 2NaBr.$$

$$PbO_2 + 2\ [FeSO_4 + (NH_4)_2SO_4 + 6H_2O] + 2H_3PO_4 = Fe_2(SO_4)_3 + PbSO_4 + 2(NH_4)_2HPO_4 + 14H_2O.$$

$$2KMnO_4 + 10\ [FeSO_4 + (NH_4)_2SO_4 + 6H_2O] + 8H_3PO_4 = 5Fe_2(SO_4)_3 + 2MnSO_4 + 2(NH_4)_2SO_4 + \ldots\ldots 8(NH_4)_2HPO_4 + 68H_2O.$$

The results obtained by this new method check well on the same sample, and check closely results obtained gravimetrically and by the molybdate method. Bismuth apparently does not interfere.

The total value of the metals and minerals raised in Tasmania during the quarter ending Sept. 30, 1908, according to the report of the Secretary for Mines, was £421,019, as compared with £365,703 for the period ending June 30, 1908. Blister copper, tin ore, silver-lead ore, gold and coal in the order named were the chief products.



[illegible] RICHMOND-EUREKA MINING COMPANY

Oroville Dredging, Limited

It has been decided to convert this from an American company into a British, exchanging each $5 share for one of £1. The market is in London rather than in America and F. W. Baker is perfectly frank in saying that the policy of a British management toward its stockholders is preferable to an American. At a recent informal meeting at London, W. P. Hammon made the following statements:

"The business as a whole is in good condition. The dredgers are working regularly with the exception of shortage of power occasioned by the very dry period in our country. The electric power of our company is generated by the streams from the mountains, and in an extraordinarily dry season like the last there is a shortage of water, and there was quite a loss of running time—perhaps 20 per cent. during September and October. That, however, does not occur frequently. Although we had considerable trouble during 1908, the demands for power in our country seem to be in advance of the supply. We are gradually overcoming that, and now there is sufficient power available to give us continuous running time. The results of the business in 1908 are not quite equal to those of the preceding year, for various reasons, to one of which I have referred. The life of the business based upon the amount of property worked to date at Oroville would give us a life of 10 years. On the Bear River we have been confronted with more or less difficulties, but we are working out of them gradually, and we have before us now a body of ground that promises good results, and our machinery is equal to it. We will, however, be obliged to eliminate a certain portion of ground that contains bodies of very heavy clay which it is impossible to wash or disintegrate by any appliances that we have been able to invent up to this time. The taking up other properties is, I think, a good business venture. We are well organized; we are as well equipped for that line of business, perhaps, as any operators in the field, and we have had as much experience in our business as any other company in existence. We have educated our men in the field, and they are practical. If we take over a property in any other country we shall equip it from those men who have received their training in the practical operations of the business. Working the Bear River with the one 7-ft. machine now at work, the life of the property would probably be 20 years. The life of the two properties, the Oroville and the Bear River, is about 14 years.

According to F. W. Baker, chairman of the company, owing to the financial situation which arose a year ago, certain holders in Boston sold out. The London market has absorbed since the company was organized about 220,000 shares, and today he knew of no big shareholders who were desirous of selling. On the contrary he was assured that they would not sell, at any rate, at anything like present prices. If the shares went to 20 or 25s., they might be tempted to sell, but at 8s. they looked upon the price as idiotic. Mr. Hammon holds about 50,000 shares, and he is not a seller.

The company is now examining a dredging property in Colombia, which is represented as comprising 25,000 acres, of which 300 acres are expected to give a profit of £600,000. The vendor of the property is to get one-fourth of the stock of any company to be organized and £7000 in cash.

Steel Corporation

The preliminary statement of the United States Steel Corporation for the quarter ending Dec. 31 shows results as follows:

Net earnings over expenses	$26,225,485
Sinking fund, depreciation, etc.	$ 5,213,822
Interest and sinking fund	7,311,963
Total charges	$12,525,785
Balance	$13,699,700
Dividends on stock	8,846,432
Balance	$ 4,853,268
Add adjustments	289,183
Surplus for the quarter	$ 5,142,451

The dividends declared were 1¾ per cent. on preferred—$6,304,919—and 0½ on common—$2,541,513.

These figures give the following statement for the year:

	1907.	1908.
Net earnings	$160,964,477	$91,826,520
All charges	$ 56,399,109	$45,942,857
Dividends	35,385,728	35,385,728
Appropriations for new w'k.	54,000,000	.....
Total	$145,784,837	$81,328,585
Surplus	$ 15,179,640	$10,497,935

The unfilled orders on hand Dec. 31 reached a total of 3,603,527 tons; an increase of 181,550 tons over Sept. 30, but a decrease of 1,039,026 tons from Dec. 31 of the previous year.

Mining Legislation at Washington

Special Correspondence

Representative Martin, of South Dakota, has introduced a bill (H. R. 26,477) for the establishment of mining experiment stations intended "to aid in the development of the mineral resources of the United States." The bill provides for the establishment of such stations "in each of the States and Territories which are known to contain natural deposits of the precious metals in paying quantities when in the judgment of the Secretary of Commerce and Labor it will subserve and promote the development of the mineral resources of the United States." At each station there is to be a geologist receiving $3000 per annum and a chemist at $2000, the outlay for establishing, equipping and maintaining each station to be $5000. The duties of these officers are described in Section 3 which reads:

"Sec. 3. That it shall be the duty of such geologist and chemist appointed under this act to receive for assay or analysis all rock, cement, clay, or other mineral-bearing substance that may be deposited with them by any citizen of the United States and make a proper classification or assay of each sample of rock, cement, clay, or other mineral-bearing substance, for the purpose of ascertaining the exact amount of gold, cinnabar, silver, copper, wolfram, tin, or any other mineral known for its value in the arts and sciences or used in commercial transactions, and to furnish, at a nominal charge to be regulated by the Secretary of Commerce and Labor to each depositor of rock, cement, clay, or other mineral-bearing substance, a full assay or analysis, showing the quantity and quality of each and every mineral found in said rock, cement, clay, or other mineral-bearing substance so examined by them.

"That the person depositing such sample as aforesaid shall, at the time of making such deposit, make oath before any person authorized by law to administer oaths stating the place from which such sample was taken and by whom taken, and in addition said chemist and geologist shall be each of them authorized and empowered to administer such oath; and the making of any false oath as to the facts set forth in said affidavit shall constitute perjury and be punished as a crime of perjury is punished under the laws of the State regulating the punishment of perjury."

Full records are to be kept and regular reports made to the Secretary of Commerce and Labor and whenever the geologist in charge of a station is not otherwise "necessarily" occupied he shall "personally explore and carefully examine the mineral regions within his jurisdiction, and especially at points of new and recent discovery and make full and careful report of such explorations and examinations at such times and in such manner as may be required and directed by the Secretary of Commerce and Labor, and he shall be allowed his actual and necessary expenses while so engaged."

Many superintendents do not use sufficient discretion in the selection of men to draw timbers when robbing work is being carried on. Only skilled men selected for their coolness, resource and courage should be employed to perform this work. These men should be paid good wages, and under no circumstances should they be put on piece work, for when this latter plan is followed, the men always take risks which otherwise would not be attempted.

Spelter Production of the World

The following estimate of the world's Harry R. Merton & Co., of London. The production of spelter is made by Messrs. figures are in long tons:

	1907.	1908.
Belgium	152,060	162,420
Rhine district	69,160	72,050
Holland	14,755	16,985
Great Britain	54,720	53,615
France and Spain	54,855	54,940
Silesia	136,260	141,410
Austria and Italy	11,180	14,000
Poland	9,585	9,600
Total Europe	502,575	525,020
Australia	980	1,070
United States	223,265	185,700
Total	726,820	711,790

The European producers show an increase of 4.6 per cent.; but there was a decrease of 16.8 per cent. in the United States. The result is a decrease of 15,030 tons, or 2.1 per cent., in the total production. These figures are preliminary, and subject to correction by complete returns; but they are a close approximation to the actual totals.

Leases of Phosphate Lands

SPECIAL CORRESPONDENCE

Senator Smoot, of Utah, has opened a campaign to compel the Secretary of the Interior to restore to entry after examination and classification by the Geological Survey the phosphate-bearing lands of the United States. His first step has been the introduction of a bill to this end (S. 8609), in which it is provided that the President shall appoint a commission of three members each to be paid $10 per day and expenses (unless already a Government employee), whose duty it shall be to clear the title of the lands, classified by the Geological Survey as phosphate lands, of all entries, claims, and locations invalid because of nondiscovery of mineral, failure to perform the annual labor and improvement required by law, or because of failure of entrymen, claimants, and locators, to perform any of the material acts required by law as a prerequisite to entry, claim, and location. The proposed commission is to have the power to administer oaths, to compel the attendance of witnesses, to visit the claims involved, and take judicial notice of all things observed, and to do what may be necessary to determine the facts in the most direct manner. The findings of this commission as to the validity of entries, locations, and other claims on lands not yet patented by the United States are, on approval of the Secretary of the Interior, to be conclusive.

The important feature of the bill is found in a proposed system whereby the Secretary of the Interior is empowered to issue leases or licenses to work the phosphate deposits belonging to the United States on such terms as he may deem best, or as may be directed by Congress; provided, that the leases and licenses shall be on such terms as to insure the proper development of the deposits and the utilization of the output in the United States. There is to be inserted in all future grants and patents a reservation of all deposits of phosphates, together with the right on the part of the Government, as well as of its licensees or lessees, to enter upon the lands and conduct mining operations under such rules and regulations, formulated by the Secretary of the Interior, as will insure the surface owners from loss or damage.

A Court of Patent Appeals

SPECIAL CORRESPONDENCE

In support of a plan to establish a United States Court of Patent Appeals, hearings were granted by the House Judiciary Committee Jan. 5 to a committee appointed by the American Bar Association on patents, trade-marks and patent law. This committee consists of Joseph R. Edson, R. S. Taylor, Arthur Stewart, Fred P. Fish and O. R. Barnett. The bill which it is desired to have Congress pass provides for a court with five justices, the chief justice to be appointed by the President and the associates by the chief justice of the Supreme Court of the United States, two sitting for three years and two for six years, terms of court to be held annually in Washington. The court would have jurisdiction to hear and determine appeals and writs of error from final judgments and decrees in the circuit courts of the United States in cases relating to patents for inventions; from final judgments and decrees in cases relating to patents for inventions rendered by any other court having jurisdiction under the laws of the United States to hear and decide such cases in the first instance; provided it shall have no jurisdiction in cases originating in the court of claims. After the proposed act shall take effect "no appeal or writ of error shall be taken from any circuit court or other court of the United States to any circuit court of appeals or other appellate court in any case to which an appeal or writ of error may be taken to the United States Court of Patent Appeals under the provisions of the act."

In support of the proposal it is agreed that owing to the present requirement that patent causes be heard in the first instance by United States circuit courts, and then on error or appeal finally (save in case of writs of *certiorari*) by the circuit courts of appeals, there are now practically nine supreme courts for patent cases in the country. The effect of this is the issue of many conflicting opinions as to patents, which prevents them from having the same force and effect throughout the United States and thus partially destroys their value. It is argued that a court created in the way now proposed would be superior in the decision of patent cases to any ever heretofore created. The bill has been indorsed by the chief patent bar associations of the United States and by the American Bar Association.

Washoe Smelter Case

Judge Hunt in the Federal Court on Jan. 25 handed down a decision in the so-called smoke case, wherein the farmers of Deer Lodge valley sought to have the smelter of the Anaconda Copper Mining Company at Anaconda, Mont., closed because the gases therefrom were ruinous to vegetation and live stock. In essence Judge Hunt denies the application for an injunction closing the smelter, and no damages are awarded to the complainants, with the exception of Fred G. Bliss, who is granted $450 a year for damages since 1904.

The Court found that there had been some damage from arsenic in the vicinity of the Washoe smelter, but no appreciable damage from sulphur.

The decision says: "Finally, in the last analysis when, in connection with the attitude of Mr. Bliss, direct and vicarious, we weigh the uncertainty of his proof as to the amount of past damage done to his land, or of future damage to be done to his pasture by the acts of these defendants, together with the fact that he has not resorted to a court of law to recover any damages at all, and balance these facts against the great injury that would be done to many interests, I hold that, under the evidence as he has submitted his case, discretion, wisely, imperatively guided by the spirit of justice, does not demand that the injunction as prayed for should issue."

The Court orders a further hearing in the matter on Feb. 15 to ascertain if there is not a possible means of so treating the flue dust as to reduce the quantities of arsenic now suffered to be released from the stack, and states that it may thereafter make any specific order such as may be equitable and right and that it will retain the bill in diligent effort to afford all the relief reasonably possible under its allegations.

A free-milling gold ore at the Giant mine, Rhodesia (*Journ.*, Chem., Met. and Min. Soc. of South Africa, Nov., 1908) is crushed coarse in stamps, fine-ground in tube mills, and then concentrated on blanket and canvas tables. By passing the battery pulp over amalgamation tables and treating the concentrates from the tables on amalgamation tables an extraction of 87.7 per cent. of the gold is obtained, 55 per cent. of the total gold being caught on the blanket tables.

Colliery Notes

One large coal company has adopted the plan of having sign boards in all parts of its underground workings; these notices point the way leading to the nearest exit.

The Reading Coal and Iron Company has completed plans for stripping a large coal deposit in the Heckscherville valley, north of Pottsville. It is estimated that this stripping will produce 10,000,000 tons of coal.

Discipline in the mines of Northumberland is enforced by fines and prosecutions. Discretion as to the amount of the fine is left to the judgment of the mine manager, so that the offending miner is not always taken before a magistrate and the offense made public.

Notice plates for coal or metal mines may be painted on glass and the whole covered with an elastic cement. The inscription is thus protected from air and moisture; the cement also aids in holding the fragments of glass together if the plate should be damaged.

Experiments have recently been carried on in England for the purpose of providing some method whereby the presence of small quantities of gas may be detected. The latest of these experiments has been worked with a double convex lens of blue glass, magnifying three to five times; it is stated that a very fine cap of gas can be seen through a lens of this description.

At a recent meeting of the North Staffordshire Institute of Mining and Mechanical Engineers the fact was brought out that in explosions due to gas alone the territory visited by the destructive agency is limited in area. The concensus of opinion was that it was only in explosions where coal dust had taken a part that the explosive force had passed through the entire mine.

In one district in Canada, the mine managers have found it advisable from the standpoint of economy, to have their ventilating fans so constructed that they can run them one way in summer and the reverse in winter. Reversible fans in all coal mines would not be a bad idea, for in the case of mine explosions, mine fires and other similar accidents, it is often best to reverse the system of ventilation.

To have two separate methods of shaft signaling from an underground landing to the engine house on the surface is a safety precaution that is most advisable, although many superintendents consider such practice as an exaggerated safety refinement. The electric signal with the single stroke bell, is, of course, the system to be generally used; in case of derangement in the electric system, the ordinary wire rope with rapper signal should be available.

The most modern screening plants recently constructed at different European collieries are entirely driven by electric power from a main generating station, each different unit being provided with separate motors, so that the break-down of any one part will not seriously affect the working of the plant as a whole. One special feature about these plants is that ample room has been allowed all around the various parts, with the result that all machinery is easily repaired; the plans also show that there are none of those cramped and dangerous passages usually met with on screening plants of considerable size.

James Ashworth gives it as his opinion, that 1 per cent. of firedamp in a mine is alone sufficient to carry a strong initiatory flame for a long distance. The same authority claims that with our present ordinary method of testing for gas, a fire-boss will not observe less than 3 to 3½ per cent.; he states that this condition is largely due to the fact that if the lamp's flame is lowered so far as to make a keen test, there is a great risk of its becoming extinguished. Mr. Ashworth further emphasizes the importance of practically testing every fire-boss at periodical intervals, as to his capability to see a firedamp cap of at least 2 per cent.

As a result of recent experiments conducted to determine stresses on winding ropes, it was found that the greatest stress on a winding rope does not occur at the beginning of a wind, as is the prevalent idea. In every case the application of the stresses to the winding rope (both ascending and descending) was shown to be very gradual. The greatest stresses on the winding rope were due to the vibrations of the cage. These vibrations in the first instance were caused by (1) the pulsations of the engine, in the case of an inferior type of machine; and (2) the sudden checking of speed by shutting off the steam, or by the application of the brakes.

Although subjected to influences which the average person would consider as injurious to health, the coal miner as an individual, is comparatively immune from disease. In discussing this question, members of the medical profession have advanced many theories as responsible for this condition. One doctor states that the miner works in a place absolutely free from germs, and that the poisons of the atmosphere never get to the miner while he is at work. It is also asserted that there is some atmospheric action of the sulphur or the coal dust with which the miner comes in daily contact. Sulphur is recognized as an active germicide. This same authority states that the wound a miner receives, no matter how severe, rarely suppurates or becomes inflamed.

The question has often been asked as to what connection there is between the explosibility of any particular coal dust and its percentage content of volatile matter. Recent experiments by a European commission seemed to show that the dust of certain coals having as low as 20 per cent. volatile matter, explodes even more readily than some dusts where the volatile matter averages from 30 to 40 per cent. It is probable we shall some day discover that the percentage of volatile hydrocarbon in a coal has no more connection with the degree of explosibility of the dust than it has with the coking qualities of a coal. The coking or non-coking qualities of a coal are now known to be largely due to its physical structure; this same condition may be the principal factor that causes one dust to explode more readily than another.

With reference to the provision of greater safety in our coal mines, many suggestions are made that are most unnecessary, if not impracticable. From an important source it was recently advised that legislation be enacted to require separate traveling-roads for the men working in coal mines. It seems that the number of accidents occurring on haulage-roads have been greatly exaggerated. Investigation shows that it is not as dangerous on an ordinary haulage-road in a coal mine as it is on the streets of our large cities. The alternative suggestion that haulage-roads be widened so as to leave room to walk on each side is also impracticable in many cases because of bad roofs. There are many important improvements that mine owners should be compelled to adopt, so there is no reason for loading them with any unnecessary burdens.

The Lehigh Valley Coal Company, as an experiment, has installed an oil-burning locomotive in one of its mines at Hazleton, Penn., and another at Seneca. The increasing length of hauls has caused the expense of underground transportation to grow rapidly in the last few years, and it is hoped that the oil-burner will bring about an economy in this branch of the industry. Of course, these motors can only be used in mines free from gas. The advantage of oil as a fuel, for use in the mine, is that its combustion creates no fumes to choke the gangways and interfere with the breathing of the miners. It is also true that smoke from these oil-burners is a negligible quantity. The new motor at Hazleton weighs 15,500 lb., is 15 ft. long and 5 ft. high. It has four driving wheels 24 in. in diameter, and runs on a track of 42-in. gage. It has been built to take up as little space as possible. The top of the smoke stack is even with the top of the boiler, and the cylinders lie close to the sides. The oil-burner at Seneca is practically the same, except that it runs on a 3-ft. track. Either of the two machines is capable of hauling from 12 to 15 loaded mine cars up a 3-per cent. grade, and is expected to do the work of ten mules.

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The Situation in Copper

The exaggerated reports about the accumulation of an immense stock of unsold copper, accompanied by the decline in the price for the metal, have put the ideas of the ill-informed at sixes and sevens. Some persons have the notion that the price for copper is on the road to 10c. per lb., whereas others are confident "that copper will sell above 16c. before it sells below 14c." The latter are evidently ignorant that the price is already below 14c. These wide differences of opinion are due to failure to take advantage of the accurate information that is available. Misinformation is greedily accepted when it bears out preconceived ideas or cherished wishes.

For example, one financial paper stated on Jan. 21, that electrolytic copper had been sold that day at 14⅛c., while another stated on the following day that it was being held at 14½c. As a matter of fact, electrolytic copper had been offered freely for a week previous at 13⅞c. by first hands, who would have been glad to dispose of some millions of pounds at that figure if the business had been forthcoming. By Jan. 18, the price in London had fallen to such a point that cathodes could be taken out of store, and delivered in New York at 13½c. Does anyone suppose that holders of large stocks in this country would not have been glad to let metal go at that figure, and replace it (if desired) by importation from England?

There is no great mystery as to the present situation in copper, which may be summarized as follows: Production in America is going on at the largest rate on record. Consumption is still below the normal. On Jan. 1 there was a considerable stock of unsold refined copper, but nowhere near so large as represented. However, the idea that there was no stock in this country was rather cultivated during the last quarter of 1908, and when speculators who had entered into large commitments in the London market awoke to the fact that the statistical situation was different from what they supposed, liquidation of their accounts ensued, causing the recent decline in prices. In the meanwhile, domestic manufacturers, pretty well conversant with the actual situation, have continued to refrain from buying, and production going on at undiminished rate, stocks have further accumulated since Jan. 1. The market is at present in a precarious condition, and will become more so as long as manufacturers hold aloof. It is the ultimate consumer who possesses the key to the situation. The world's stock of copper is not yet so big as to be a great drag on the market for a long time after consumption regains its normal rate. The question is simply how long we have got to wait for manufacturers to begin to buy.

The Lick Branch Colliery Explosions

The Lick Branch mine of the Pocahontas Consolidated Colliery Company was recently the scene of two disastrous explosions. The first, Dec. 29, resulted in a loss of 51 lives; the second, by which 65 men were killed, occurred at 8:30 a.m., Jan. 12.

After the first explosion a coroner's jury exonerated the company from all blame. On Jan. 18, another coroner's jury, investigating the second explosion, returned a verdict stating that it had been caused by an overcharged shot, which exploded in room 21; it was further stated that no blame should be attached to the Pocahontas Consolidated Company or to the Lick Branch colliery officials.

The investigations of these explosions were along customary lines, so there is small room for discussion. Some excitement has been caused by published statements over the signature of the president of the United Mine Workers of West Virginia, in which it is charged that the two explosions in the Lick Branch mine were due to flagrant violations of the mining laws; this official demands that the legislature order an immediate investigation. Among other charges brought against the company is a statement that many galleries in the mine have been driven from 175 to 178 ft. "ahead of the air." If this charge can be sustained it is a serious matter, since in that case the company would have acted in direct violation of the law.

From various other sources reports come that after the first explosion the coroner's jury pronounced the company blameless without giving an opinion as to what caused the disaster; further assertions are made that the mining department did not make a report during the interval between the first and second explosions.

We have stated so often that the coroner's investigations of coal-mine explosions are valueless, furnishing only a pretense that the law prevails, that a repetition of our views ought to be unnecessary. During recent years all such inquests have only entailed the useless expenditure of public money in the observance of a prescribed form. Solemnity has prevailed, but sincerity has been absent. There can be no fair trial without a prosecution.

The Rights of Stockholders

The well known gold mining company of California, Oroville Dredging, organized and originally owned by Americans, is being converted into a British corporation. English investors have lately become the largest stockholders in the company and the chief market for the stock is in London, which, of course, is a good reason for the conversion of the company. Another reason was stated with incisive frankness at a recent stockholders' meeting by F. W. Baker, the chairman, who remarked "I think our method—if I may put it so without any disrespect to our American friends, who are in the habit of running companies quite successfully—of giving more information to shareholders than the American companies generally do, is one which would receive the support of shareholders here, and I think also of the American shareholders. I met one shareholder—an American shareholder on the register—who said that for three years he had not had a single notice or any information. There is no shareholder on this side who has not had all the information we have had from the property, and in the future you will get more information, and that more frequently."

W. P. Hammon, general manager of the company, was thereupon inspired to remark as follows:" Speaking of the information given out by the company to the English shareholders, I think it may be well for me to state that it has been our custom from the operating end of the business to report fully—weekly, monthly, quarterly and annually—to the eastern offices. I am referring to Boston and New York. Our central office was in Boston until July of the past year, when it was moved to New York. Why you have not received full information regularly, I cannot say. I am not responsible for that, because we have made our reports regularly, and there is no reason why you should not have received them. If, as our chairman has stated, the property be transferred to an English company, no doubt you will receive information direct from the operating end of the business and have it regularly."

Here is the whole situation respecting the rights of stockholders to prompt and full information respecting their property boiled down in a most practical way. The directors of British companies recognize this right; the directors of American companies do not. (Of course, we are speaking generally, because there are some praiseworthy exceptions among American companies and condemnable exceptions among British.)

Several years ago there was a general awakening of conscience in London, inspired by the mining engineers. As the result of their efforts, British companies have acquired the habit not only of publishing full, frank and prompt reports, but also information as to cost of production, ore reserves, etc., which enables stockholders and investors to compute the actual value of their property. And, moreover, investors, with the aid of the reputable financial press, have learned how to do so. Sooner or later we shall come to this also in America. This subject is now under discussion by the Mining and Metallurgical Society of America. We have no doubt that good will result from its discussion.

The Zinc Ore Question

On Jan. 19 the U. S. Circuit Court of Appeals handed down an opinion affirming the judgment of the Circuit Court that imports of zinc ore into the United States are not dutiable under the terms of the Dingley act. This ought to settle the protracted litigation over this question. The first decision under the present tariff act was made in 1905. The Government did not appeal from this decision, but decided to start over again and make a new case. This has now been disposed of as stated above. Every decision, from first to last, has been in favor of the importers, and it seems fair that the Government should now announce that it is through litigating the matter. Instructions to collectors to observe the court decisions and to refund the duties levied and paid under protest are now in order.

The Incorporation of American Companies Operating in Mexico

The Mexican government has recently shown a desire that foreign companies operating in Mexico should incorporate under Mexican laws. In many cases this has already been partially accomplished by a double incorporation. On one hand a holding company is incorporated under the laws of the United States, the stock of which is distributed, and on the other hand the holding company owns 100 per cent. of the stock of a Mexican incorporation, the operating company, which carries forward the work of the organization in Mexico. In such a case the requirements of the Mexican government and the desire of the stockholders to possess American securities are both satisfied.

This double incorporation has some very decided advantages, but serious errors have also been made. In a recent case in northern Mexico the holding company, in order to borrow money, pledged the whole of the stock of its Mexican incorporation. It failed to repay the loan; foreclosure took place, and on investigation the American holders found that they owned nothing but some office furniture, and an insignificant amount of cash.

In a double incorporation of this kind it is desirable that the Mexican stock shall not be at the mercy of the directorate of the holding company, but that it shall only be subject to alienation by a substantial majority of the shareholders of the holding company, having full knowledge of the possible results of their course of action.

It is undesirable that the Mexican stock be in the names of any person or persons. The stock of the Mexican corporation should be nominative stock held by, and in the name of, the holding company with the exception of one share each of the stock issued to the directors and commissary to qualify them. These qualifying shares must necessarily be to bearer, and under the law must be deposited in the treasury of the Mexican company. By following these simple rules much risk and danger of loss is avoided.

The report of the United States Steel Corporation for the last quarter of 1908 shows no material changes from the earlier part of the year. Further comment on the year's results is reserved.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machine

Several years of experience with sellers and buyers of ore while in the public sampling business, and in several mining districts, and recently the reading of discussions in the technical journals have convinced me that much of the misunderstanding and criticism of existing sampling methods has been due to the failure on the part of many to realize two important facts: (1) That ore sampling on a large scale is not simply a theoretical problem which can be solved once for all, and for every locality, by mathematics alone; and (2) that it is a commercial enterprise calling for continual compromises between the theory of the subject and local requirements and conditions, and the allowable cost of plant and of operation.

The first object of all honest sampling methods is ultimately to take from a lot of ore a small amount which will contain in the same proportion all the elements of the original lot. This small amount must be so finely divided, i.e., crushed, that the assayer and chemist can weigh up from it, for assay and analysis, successive charges that will within reasonable limits maintain these same proportions. The second object is to accomplish this result at a reasonable rate of speed, and what is of equal importance, at a not excessive cost per ton of ore handled.

Mixing

The attainment of these objects may not seem difficult; but the many failures and disappointments prove that to obtain this result is anything but simple, although I think the great reason for the failures of many of the past and present methods is a total misunderstanding of the basic conditions and requirements of both hand and mechanical sampling. In most treatises and discussions of ore-sampling methods a great deal of weight is placed on the importance of *mixing* the ore before and during the sampling process. To my mind this *mixing* is impossible of attainment in large lots of ore as shipped from the mine, although its probability may increase with the finer condition or crushing of the ore. This ore frequently consists of particles varying from one foot to one one-hundredth inch in the greatest dimension, and may be almost dry or contain 20 per cent. or more moisture. Whenever such ore is dumped from a car, thrown into a cone, or piled up from a shovel from a barrow or from a spout, there is an immediate partial separation of the coarser from the finer particles, varying somewhat with the moisture of the ore, and constantly increasing with the size of the cone or pile. I have never seen any device which satisfactorily prevented such separation; ore passing through an inclined spout or through a revolving barrel will show it plainly; and even a nearly flat shaking tray will show the coarser particles riding the fines and traveling at a slightly greater speed.

If it were feasible to crush all the ore in a lot to 10, 50, 100, or even finer mesh, the probability of being able to mix these particles would increase with the fineness of the crushing, but the cost of this work, and the fact that the smelters desire the bulk of the ore to be as coarse as possible, prohibits such a method. Therefore, as I stated at the beginning, ore sampling, as with many enterprises, is a compromise between the theory of the subject and the commercial requirements.

Fractional Mixing

This compromise has resulted in what we might call a process of fractional mixing; i.e., instead of trying to prepare the ore so that we can ultimately mix the whole lot, we first crush as coarse as permissible, and then take a certain portion, as one-half from the carefully arranged pile in the coning or other hand methods, or take small amounts at regular intervals from the falling stream in mechanical methods. The small portion taken out of the stream by every revolution of the sampling machine is passed along for further crushing, after which it is again reduced in volume by a similar process and so passed along continually through from two to five machines until it reaches a temporary resting place in the sample bin.

Either no attempt, or at least but a crude attempt is made at mixing the several cuts taken by any one machine. The ore is frequently retarded in its course by the use of revolving barrels or shaking trays, but their influence on the correctness of the sample is a matter of unsettled discussion. Personally I think they have little or no influence in this direction. From the sample bins the further reduction in volume is usually made by coning and quartering, or preferably by riffling and regrinding, until there is finally obtained the 4 or 5 lb. of pulp, dried and crushed to 100 or 150 mesh, which goes to the assayer and chemist for valuation.

Plainly, the larger the proportion of the stream of ore taken for these successive cuts the greater the probability of accuracy; but here again expense and expediency are important factors. As an illustration: If each revolution of the machine took 90 per cent. of the stream, a 100,000-lb. lot would require approximately 95 successive sampling machines, with nearly as many recrushings to obtain the final 5-lb. sample. If 75 per cent. were taken there would be approximately 34 such sampling machines. It is hardly necessary to state that the cost of installation and operation of such a plant would be much greater than either the business or the necessity warrants.

Size of Cut

It is from a realization of these conditions as well as from numberless experiments and comparisons of actual work that sampling men have decided on certain proportions which combine reasonable cost and accuracy. Such proportions vary from the one-half of coning and quartering, through the one-half to one-fifth of shovel work, to the one-fifth to one-tenth, or even less, of mechanical sampling methods. This proportion depends on several other considerations which I will not take up now; but in general the nearer the ore approaches uniformity in character, i.e., the less difference there is between the value of the richest and the poorest particle, the smaller the proportion which may safely be taken, whereas, with the so-called "spotted" ores of the gold camps it may not be safe to consider less than one-fifth, and then only after crushing the ore much finer than is required with the ores from the silver-lead camps. On certain low-grade sulphide ores which were first crushed to roasting size, it was learned that a satisfactory sample could be obtained by taking a 5-per cent. cut at one stage of the work.

Present practice is so to construct the machines as to take a certain fixed percentage of the stream, and, when considered advisable, to vary the conditions by finer or coarser crushing. No hard and fast rule can be laid down for this matter unless it is assumed in all cases that every ore sample is, say, of the most spotted variety; but unless the shipper is willing to pay the necessarily higher sampling charge for the finer crushing, such an arbitrary arrangement is not feasible.

Different Conditions Require Different Methods

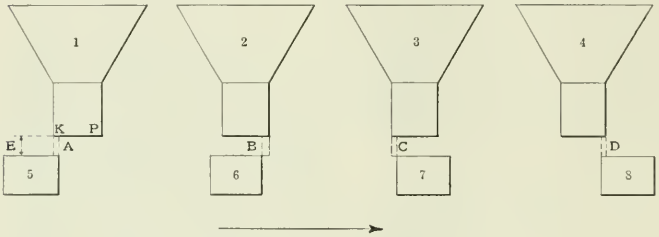
In many cases in which smelting companies or milling companies treat exclusively the ores from their own mines and particularly those of very low grade, this sampling is not of very great importance; for if the method employed gives a correct average valuation at the end of a month or possibly a year, it satisfies all requirements, and what error is made on an individual lot may be balanced in some following lot or lots. Hence such works do not require elaborate appliances for sampling, and can even permissibly sample merely every fifth or tenth car as shipped from the mine, and thus avoid costly mills and elaborate and expensive cleanups between lots. There are numberless sampling plants in use in this country built on this principle and satisfying all requirements.

With custom smelting, milling, or sampling plants, however, there exists an entirely different set of conditions; for, whereas the buying concern may be satisfied to take a chance on the correctness of the year's average sampling, the shipper of, say, 100 tons of $100 ore is not content with returns of $10 per ton *less* than this amount, merely because of the knowledge that the next shipper may have received $10 *more* per ton than this following ore was worth. That is why custom plants have necessarily been obliged to pay more attention to and to make more investigations of sampling methods than a company handling merely its own ores.

Disadvantages of Hand Sampling

Hand sampling of ore, containing particles varying greatly in value, has for years and years been known to give a splendid opportunity for profitable, though often unostentatious, manipulation by the buyer. No man has ever been able to so build a cone, dump a wheelbarrow, or transfer ore with a shovel in sampling without starting a separation of the finer and coarser particles. The very knowledge and recognition of this unavoidable condition prevented many shippers from realizing that this same separation was often used to the continual advantage of the buyer, who had probably studied the question very closely and had so laid out this work that even the position his men stood in and how they pushed the shovel into the pile was carefully planned, although details of his plan may have been unknown to the shoveler himself.

The first time I ran up against scientifically incorrect hand-sampling methods was in trying to account for large differences between what my company paid for the gold ores they were buying and what was reported by the concerns to whom we finally sold this ore. The details of these investigations may be of interest at a later time, but what I want to bring out now is that the investigations and tests proved so conclusively the unreliability of the hand methods, and the final outcry of the mine owner against them was so great that I doubt if, out of the million or so tons per month shipped from that camp, there is a pound of ore now being sampled by any but a mechanical system. And for the benefit of one contributor to this discussion I will add that this mechanical work is carried entirely through the bucking room even to the final division of the pulp over riffles and into the various sacks sent to the assayers.



POSITIONS OF SCOOPS IN PASSING SAMPLING MACHINE SPOUT

Selective Action of Scoops

This correspondent stated that he had found it possible to *eliminate entirely* the coarser particles from an ore by pouring it over an assayer's scoop. I can imagine no way for this to be done unless the ore is fed at a right angle to the sides of the scoop and from an inclined spout which would give the coarser a greater velocity than the fines. Then the position of the side of the scoop might be so raised or lowered as to allow the coarser to fall beyond and the fines to fall short of it. This would be incorrect practice, however, as the ore should be fed either vertically or in an inclined direction parallel with the scoop's sides.

In taking original and duplicate samples in the bucking room we pass the ore through riffles, taking one side for the original and the other for the duplicate. Some thousands of such comparative samples have shown no selection as above stated, either in value, in weight, or in separation of sizes as tested by screens. I wish to emphasize also that this mechanical division in the bucking room was in use by at least three sampling companies in 1896, and I could name many sampling mills which in the last 10 years have never used any other than the mechanical system at this stage.

It must be acknowledged that the mechanical systems adopted by some companies were fully as bad as the hand methods, and that some were so devised as to give a constant and pleasing percentage in favor of the buyer, and it is too much to expect that all such systems have been eliminated. As an instance, I know of a large mill using several machines in series, which, it is claimed, can be and are at times used in certain combinations which will take an excess of coarse, and at other times in other combinations an excess of fines. It is claimed that when the character of the ore is known, the superintendent of this plant *can* do the rest, that is, should he be *that kind* of a superintendent. But the fact remains that faults in construction and operation of a machine *can be located, proved* and *correction demanded* by any interested party, whereas, in *all* hand-sampling methods, the shoveler can continue one style of work, or can change it around with each shovelful, and although the onlooker may be positive that he has seen careless or crooked work, it is always a matter of dispute as to how this work really was done, as nothing less than a moving-picture machine can keep track of a man doing hand sampling.

Fundamental Requirements of Machine Samples

The discussions of sampling have shown a wide and surprising difference of opinion in regard to some of the fundamental facts and necessary requirements of mechanical sampling, and it would be well could these principles be thrashed out. Some of the statements in the Journal of Nov. 14 are entirely contrary to the facts, and show a fatal jumping to conclusions without proper investigation. For instance, the statement is made that all sampling machines are subject to a uniform error by the way the scoop passes under the stream of ore. To quote Mr. Church's statement exactly: "As the near side of the scoop passes under the area of the spout, ore of 2-in. size cannot fall into the sample until the edge of the scoop has passed 2 in. beyond the edge of the spout. This selective sampling is repeated as the scoop leaves the spout."

Let us refer to the accompanying sketches in which *1, 2, 3* and *4* represent the delivery spout and *5, 6, 7* and *8* the receiving sample spout of a mechanical sampler, which is moving in the direction of the arrow. Also let us assume that the greatest dimension of any piece passing through the spout is 2 in. Then as the distance *E*, in a properly constructed machine, is greater than the greatest dimen-

sion of the largest piece passing through the spout this 2-in. piece will fall into the sample spout even when the cutting edge has advanced 1 in. instead of 2 in., as claimed. But whether this is 1 in. or 2 in. is absolutely immaterial, as will appear later.

It is also claimed that on account of the positions *A* and *D* the sampler has a *selective* action and takes less of the coarser ore than it should. If this were the *whole* truth it would mean that the mechanical sampler invariably took a greater proportion of the fines than of the coarse presented to it, with rather terrifying results should there be great differences in value between the coarse and the fines. However, for the sake of argument let us grant the selection of positions *A* and *D*. Then it must also be acknowledged that in positions *B* and *C* the sampler selects a greater amount of the coarser ore, and that any error of *A* and *D* is corrected by *B* and *C*. It is unfortunate that this balancing was overlooked in the criticism referred to, for it may have led many readers, as it did one correspondent, to think that all sampling machines are built on an invariably incorrect principle.

The fact is, theoretically and actually, that *A* and *D* are balanced by *B* and *C*, and that the sampling would be just as correct were there a screen placed in the delivery spout and were the coarse and fines fed through different sides of the spout.

INDIVIDUAL LOTS AS ORIGINALLY SAMPLED.

	Weight, Wet.	Weight, Dry.	Gold.	Gold.	Lead.	Copper.	Silica.	Iron.	Sulphur.	Zinc.
	933	915	1 02	64.7	6.6	6.65	44.8	12.1	5.6	1.1
	3,154	3,120	0.81	39.7	6 4	9.1	48.4	4.5	2.4	1.0
	7,050	6,789		20.3	....	3.41	84.2	2.1	0.8	
	3,690	3,654	0.04	26.0	23.5	..	61.8	1.7	3.0	3.1
	3,845	3,765	0 48	22 5	9.0	6.85	30 4	18.2	15.7	3.5
	5,560	5,482	0.56	24 6	2.2	8.65	64.0	0.6	2.8	
	1,811	1,775	0.21	143.95	16.25	0.04	48.2	7.4	3.6	2.7
	3,646	3,598	3 04	15.0	14.6	....	7.2	28.2	16.0	2.8
	28,620	25,782	0.25	25.7	9.9	1 3	51.1	9.0	6.3	2.1
Average..	.....	.....	0 47	29 1	9.0	3.0	52.7	9.0	6.0	1.9
As sampled in mixture.			0 49	30.13	9.6	2 93	53.3	9.4	5.7	2.0
Variations, three assays...										
		(1)..	0.52	30 2	9 8	3.0	53.8	9.8	5.8	2.5
		(2)...	0.48	30.1	9.6	2.90	53.0	9.3	5.7	1.9
		(3) ..	0 47	30.1	9.4	2.90	53.0	9.2	5.5	1.6

INDIVIDUAL LOTS AS ORIGINALLY SAMPLED.

	Weight, Wet.	Weight, Dry.	Gold.	Silver.	Insoluble.	Iron.	Sulphur.
	11,620	10,388	0.065	108.9	78.5	6.6	0.8
	3,150	3,116	0.28	330.75	86.30	3.9	
	5,375	5,321	0.145	141.2	91.30	2.7	
	460	454	17.81	7.0	33 40	36.4	1.8
	6,075	6,045	6.035	6.36	94.8	2.1	
	2,734	2,707	1.77	5 45	90.7	2.7	1.0
	4,250	4,224	0.737	313 17	89 0	6.2	2.0
	1,710	1,692	8.705	44.35	70.1	9.9	10.2
	1,000	988	0.18	1,785.00	64.8	11.3	2 6
	1,244	1,222	0.06	94.55	95.2	2.1	
	9,340	9,116	6.705	1.55	58.0	3.0	0.7
	257	239	2.015	3,583 65	36.4	10.2	0.8
	4,880	4,788	1.465	5.4	60.6	19.5	1.4
Average..	...	.....	2.76	142.00	77.50	6.28	1.10
As sampled in mixture.			2.76	141.30	77.20	5.20	1.13
Assays. (1).....			2.84	141.7	77.2	5.7	1.30
(2).....			2.76	141.3	77.2	5.0	1.10
(3).....			2.68	140.9	77.1	4.8	1.09

Speed of Ore Stream

Again the amount of ore falling into the sample spout of any time-sampling machine depends entirely on the percentage of the whole time of revolution or oscillation that the sample spout is under the delivery spout. For instance, if in a Vezin sampler the cutting edges of the sample spout include an angle of 36 deg., it will take one-tenth, and if they include 90 deg., it will take one-fourth of the ore fed to it absolutely regardless of its speed of revolution. I would hesitate to mention such a truism, had I not been requested at times to increase the speed of the sampling machine in order to take a larger sample.

I also think it is the consensus of opinion that a rapidly moving machine takes a more accurate sample than the slower one. As sampling is a matter of averages, or as I have suggested, fractional mixing, it seems plain that taking 30 samples per minute will give a more representative result than taking one per minute. There are bound to be interruptions of the stream of ore in a mill, and the slower the machine moves the greater the liability of letting part of the stream get by without representation, or of getting into the sample all that does come by during a slow revolution.

Suppose a lot of ore were spread out into a ribbon 6 in. wide and 1000 ft. long. Which plan would give the most representative sample? That which took out every alternate 100-ft. stretch, or that which took out every alternate foot? There is a limit to this speed, of course, one consideration being that the ore must be allowed to fall through the machine freely and not be knocked wildly about by the sides of the spout. Vezin claimed that he overcame this by feeding the ore through a spout inclined toward the direction of motion of the machine and so regulating the inclination of the spout and the speed of the machine that the particles of ore and the top edge of the spout would have the same forward speed when they met. I have watched and tested for long periods the action of machines on a vertical falling stream of ore and taking 40 samples per minute, and am satisfied that danger of error from this source is negligible.

As a source of error the fact that the cutting edges and sides of a machine have actual dimensions, whereas, theory calls for mathematical lines and planes can also be neglected. Such a refinement is absurd in the face of the whole matter's being one of averages, and of adjustment between the desired accuracy and allowable cost of plant and operation.

Practical Results

I give in accompanying tables the details of two mixes, each of which is made up of 13 lots which were originally sampled during the last nine months. Owing to many of the samples being stored on an open platform, and having been sampled together during a heavy snowstorm, the dry weights do not check as closely as usual. In one lot in which the individual golds varied from 0.06 to 17.81 oz., and the silver from 1.55 to 3583.65 oz., the close checking of the average and actual assays of the mixture is very noticeable, although the *individual* assays for gold on the mixture pulp show large variations. These lots were all dumped indiscriminately into a hopper from which they were fed to a crusher and four sets of rolls. After each of the first three rolls the sample was reduced in volume by a Brunton oscillating time sampler taking approximately 20 per cent. The resulting sample was then halved by successive rifflings and grindings to the quantity needed for assaying, i.e., the sampling was mechanical throughout.

I do not wish to give the impression that I believe that the last word has been said in providing correct sampling methods. Baffling and unexplained differences will occasionally occur with everyone in the business; but in well conducted works the percentage of such cases is gratifyingly small. I have examined a large number of mills, and have had access to an almost nauseating number of comparative samplings and tests, and I am of the opinion that modern correct mechanical sampling is fully on a par with the assaying by which it is tested; that differ-

ences between successive samplings of a lot will generally be less than the variations of check assays on the individual pulps; and that the errors in sampling, or differences between samples and resamples, are almost entirely due to faulty design or construction of the machine, neglect in repairing the cutting edges and keeping them to the designed shape, machines not working continuously, loss of fines through leaks in spouts, etc., lack of thorough cleaning between lots, "sloppy" work in bucking room proper, and, very largely, *insufficient crushing* as the weight of the sample grows smaller.

T. R. WOODBRIDGE,
Vice-President, The Taylor & Brunton Ore Sampling Company.
Salt Lake City, Utah, Dec. 22, 1908.

Acetylene Lamps for Mines

BY A. CRESSY MORRISON*

For several years acetylene has been used in miners' lamps in France, Germany and Belgium to a large and steadily increasing extent, until at present it is used almost exclusively in more than 200 mines employing about 50,000 miners. The light is satisfactory, saves nearly 50 per cent. in cost and gives a better, brighter illumination than candles, or oil lamps. Mining engineers have been more or less familiar with this fact, but the introduction of acetylene into mines, up to the last two years, has been very slow in this country. Its use is now, however, commencing to be recognized as an important advance, and it promises in time to replace all other means of illumination, except in special cases.

Candles, which are largely used in Western mines, remove seven times and kerosene five times as much oxygen as does acetylene when furnishing the same candlepower. The products of combustion given off by candles are ten times and from kerosene nine times as much as that given off by acetylene. The difference is, therefore, enormous. While acetylene in a mine gives off no smoke whatever, every miner is familiar with the difficulty from the products of combustion given off by other illuminants. Acetylene, therefore, makes for the life and comfort of the miners, protects them from the degenerating effects of insufficient oxygen, and removes an important cause of lung and throat troubles. It has been found, in actual experience that in entries, which are 60 to 70 ft. ahead of the brattices or blower pipes, there is no smoke when an acetylene lamp is used and the entry is just as clear at the end of a shift as it is at the beginning.

An interesting thing about acetylene is the tenacity of the flame. It is not easily blown out; the rapid motion of the miner will not cause it to flicker badly; and it burns brilliantly in an atmosphere so foul that the candles fade and go out. In fact, acetylene will not deprive the miner of light until the atmosphere is so bad that it will not support life.

For underground surveying and mine inspection, the use of acetylene is of great importance. Maps and note books escape the usual accompaniment of grease and smudge, while the acetylene flame with its reflector makes a good background for the blumb-bob string when surveying.

A large acetylene lamp and a strong re-reflector are useful about mines for throwing light into inaccessible places so that high backs, stopes, dangerous from caving, or other inaccessible parts of the mine can be examined.

Acetylene is especially advantageous as a cap lamp for drivers, and it has been found where mules are used that they can see much better and are not nearly so liable to stumble.

The bad quality of oil for miners' use, which has in some States compelled the passing of laws establishing a standard quality (laws, by the way, which are frequently violated by a species of adulteration which almost defies detection), is becoming another powerful argument in favor of the substitution of some illuminant which cannot be adulterated.

In actual practice, it has been found that 8 oz. of calcium carbide at 4c. per lb., or 2c. worth of carbide, will give nearly 10 c.p. of light for 10 hours, while candles in many parts of the country, counting four candles to the 10-hour day, would cost 5c. per day. There seems, therefore, to be no reason why acetylene should not be introduced provided a proper lamp at an economical price can be devised. As a matter of fact, practical experience has demonstrated that some of the miners' lamps now upon the market meet all the necessary requirements both as to economy, lasting quality, and practicability in use.

Miners' acetylene lamps are now frequently found in mines throughout the country, especially in Pennsylvania, New Jersey, and Illinois. The New Jersey Zinc Company, of New York, which has adopted acetylene illumination for all its mines, has probably more lamps underground than any one concern. The number of miners' lamps in use in the mines of this company is about 3000, and it has been found, in practical use, that the saving is at least 2c. per day for every miner.

The whole method of using acetylene is so simple and the lamps now in practical use are so satisfactory that the subject of better illumination in mines is worthy the attention of every mine owner and engineer; in fact, the obtaining of better illumination at half the cost, with greater output, safety, comfort, and, above all, with better health, to the user is so vitally important that the subject must be investigated soon by all mine managers.

*Secretary-treasurer of the International Acetylene Association, 157 Michigan avenue, Chicago, Ill.

The Zinc Ore Tariff Question

The Government's appeal from the decision of the U. S. Circuit Court for the Southern District of Texas in the zinc-ore customs case was heard at New Orleans on Jan. 5 before the U. S. Circuit Court of Appeals for the Fifth Circuit (Judges Pardee, McCormick and Shelby, circuit judges). The Government's side of the case was argued by former Assistant Attorney-General James C. Reynolds, appointed for this case as special assistant to the Attorney-General. The importers were represented by W. Wickham Smith, of New York. On Jan. 19 the Circuit Court of Appeals handed down the following opinion:

"Under the facts in this case it is not necessary to decide whether the provision for lead-bearing ores in paragraph 181, Tariff Act of 1897, is exclusive.

"On the merits the Board of General Appraisers and the Circuit Court ruled correctly.

"The judgment of the Circuit Court is affirmed."

The Board of General Appraisers held that the term "calamine," as mentioned in paragraph 514 on the free list in the Tariff Act of 1897, included the carbonates and silicates of zinc, and that blende ore should be admitted free of duty under Section 614 of the Tariff Act of 1897 as crude minerals, subject to the provision that, when any of the ores, carbonate, silicate, or blende, contained lead, a duty of 1½c. per lb. on the lead contents only should be levied under Section 181. The Circuit Court affirmed in all respects the decision of the Board of General Appraisers, and this decision has now been again affirmed by the U. S. Circuit Court of Appeals.

The Treasury Department's estimate of the amount and kinds of money in the United States Jan. 1, 1909, is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 176,291,097	$ 612,317,841
Gold certificates	56,412,360	801,860,509
Silver dollars	4,219	72,443,593
Silver certificates	20,378,201	470,837,799
Subsidiary silver	18,162,747	135,063,365
Treasury notes of 1890	6,811	4,589,189
U. S. notes	10,258,047	336,422,969
Nat. bank notes	25,287,727	651,780,438
Total	$306,801,209	$3,092,315,703

Population of the United States Jan. 2, 1909, estimated at 88,209,000; circulation per capita, $35.06.

The total amount in circulation shows an increase of $13,326,405, as compared with Jan. 2 last year.

Northern Zambezia, South Africa, contains, according to Stephen J. Lett, in his pamphlet "More about Zambezia Minerals," many copper deposits and considerable gold; its coal deposits are extensive.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

MANUFACTURE—Improvements in or Relating to the Manufacture of Aluminum or Aluminum Alloys, and Silicides. Alf Sinding-Larsen, Christiania, Norway. (Brit. No. 25,408 of 1907.)

CALCIUM CARBIDE

PRODUCTION—Process of Smelting Metallic Compounds and Producing Carbides. Edgar F. Price, Niagara Falls, N. Y., assignor to Union Carbide Company, Niagara Falls, N. Y., a Corporation of Virginia. (U. S. No. 904,991; November 24, 1908.)

COAL AND COKE

COKE—Process for Treatment of Fuel-Coke. Harry L. Bruce, Portland, Ore. (U. S. No. 906,379; Dec. 8, 1908.)

FIREDAMP—Method of Preventing the Liberation of Firedamp. Albrecht von Gröling, Vienna, Austria-Hungary. (U. S. No. 906,872; December 15, 1908.)

RESPIRATORY APPARATUS for Use in Coal-Mines and Like Places. William E. Garforth, Normanton, England. (U. S. No. 908,239; Dec. 29, 1908.)

COPPER

BLAST-FURNACE PRACTICE—Apparatus for Handling Matte and Slag of Copper Blast-Furnaces. George K. Fischer, New Rochelle, N. Y. (U. S. No. 906,622; December 15, 1908.)

TUYERE—An Improved Construction of Copper Tuyere for Blast Furnace and Like Use. William J. Foster, Walsall, Staffordshire, Eng. (Brit. No. 3304 of 1908.)

GOLD AND SILVER

AMALGAMATOR and Concentrator for Ores and Tailings. John R. Harrison, Ballarat, Victoria, Australia, assignor of one-half to Hugh Victor McKay, Melbourne, Australia. (U. S. No. 909,293; Jan. 12, 1909.)

GOLD-DREDGE. Horace J. Clark, Chicago, Ill., assignor to Clark Dredge Manufacturing Company, Chicago, Ill., a Corporation of Maine. (U. S. No. 909,063; Jan. 5, 1909.)

PLACER-MINING MACHINE. Asa L. Corson, Pueblo, Colo. (U. S. No. 909,553; Jan. 12, 1909.)

TUBE-MILL. Harry W. Hardinge, New York, N. Y. (U. S. No. 909,292; Jan. 12, 1909.)

IRON AND STEEL

MANUFACTURING—Process of Manufacturing Steel. William R. Walker, Chicago, Ill. (U. S. No. 906,757; Dec. 15, 1908.)

SMELTING Method of Blast-Furnace Smelting. John W. Nesmith, Denver, Colo., assignor to Colorado Iron Works Company, Denver, Colo., a Corporation of Maine. (U. S. No. 910,480; Jan. 19, 1909.)

ZINC

EXTRACTION APPARATUS—Apparatus for Extracting Zinc. Edward H. Shortman, Bloxwich, England, assignor of one-half to the New Delaville Spelter Company, Limited, Spring Hill, Birmingham, England. (U. S. No. 907,416; Dec. 22, 1908.)

MINING—GENERAL

FUSE—Non-Explosive Fuse. Frank B. Cook, Chicago, Ill. (U. S. No. 905,503; Dec. 1, 1908.)

MINE SHAFTS—Improvements in Air Locks for Mine Shafts. Communicated from the Société Anonyme, John Cockerill, Seraing, Belgium. (Brit. No. 12,086 of 1908.)

MINE-TIMBER. Zachariah Z. Ansbach, Silver Creek, Penn. (U. S. No. 907,554; Dec. 22, 1908.)

MINING METHOD—Method of Mining. Martin Schwerin, Elizabeth, N. J. (U. S. No. 904,021; November 17, 1908.)

RIVER-BED DEPOSITS—Apparatus for Elevating Gold Bearing Deposits from River-Beds. Albert L. Eliel, San Francisco, Cal., and Oscar H. Eliel, La Salle, Ill., assignors of one-third to Lewis E. Aubury, San Francisco, Cal. (U. S. No. 910,277; Jan. 19, 1909.)

ROOF SUPPORTS—Improvements in Mine Roof Supports. Frederick C. Keighley, Uniontown, Penn. (Brit. No. 13,660 of 1908.)

ORE DRESSING

CONCENTRATION—Improvements in Apparatus for the Concentration of Pulverized Ore. Juan Guinea, Begona, Viscaya, Spain. (Brit. No. 11,762 of 1908.)

CONVEYERS — Improvements in Conveyers, Screens and the Like. Harry Bentley, Whitehaven, Cumberland, Eng. (Brit. No. 23,750 of 1907.)

CRUSHER—Cradle Crusher. Robert K. Donald, Victoria Road Loch, Victoria, Australia. (U. S. No. 909,562; Jan. 12, 1909.)

CRUSHERS — Hammer or Beater for Crushers and Pulverizers. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher and Pulverizer Company, St. Louis, Mo., a Corporation of Missouri. (U. S. No. 904,908; November 24, 1908.)

CRUSHING-ROLL. Thomas L. Sturtevant, Quincy, and Thomas J. Sturtevant, Wellesley, Mass., assignors to Sturtevant Mill Company, Portland, Me., a Corporation of Maine. (U. S. No. 907,300; Dec. 22, 1908.)

ORE-SEPARATOR. John G. Kirksey, Carthage, Mo. (U. S. No. 906,535; December 15, 1908.)

ORE SEPARATORS—Improvements in Centrifugal Ore Separators. Philip F. Peck, Chicago, Ill. (Brit. No. 3682 of 1908.)

STAMP MILLS—Improvements in Stamp Mills. Francis I. Mathews, Oakland, Cal. (Brit. No. 13,358 of 1908.)

METALLURGY—GENERAL

BLAST-FURNACE SLAG—Improvements in the Treatment of Blast-Furnace Slag. Henry K. G. Bamber, Greenhithe, Eng. (Brit. No. 2405 of 1908.)

DESULPHURIZING ORES—Process of Desulphurizing Ores. Robert Hübner, New York, N. Y. (U. S. No. 906,883; December 15, 1908.)

ELECTRIC-FURNACE PRACTICE — Improvements in, and Relating to Processes of Melting in Electric Furnaces and Their Application to the Extraction of Easily Volatilizable Metals. Henry Herrenschmidt, Paris. (Brit. No. 24,517 of 1907.)

FURNACE—Furnace for the Reduction of Ores. George F. Rendall, New York, N. Y., assignor to American Reduction Company, a Corporation of New Jersey. (U. S. No. 910,086; Jan. 19, 1909.)

SLIME TREATMENT—Method of Treating Electrolytic Slimes for the Recovery of Metals Therefrom. Alexander J. McNab, Trail, British Columbia, Canada, assignor of one-half to Walter H. Aldridge, Trail, British Columbia, Canada. (U. S. No. 908,603; Jan. 5, 1909.)

WELDING—Improvements in Electrodes for Electric Welding, Soldering or Brazing. Communicated from the Electric Railway Improvements Company, Cleveland, Ohio. (Brit. No. 5017 of 1908.)

MINING MACHINERY AND APPARATUS

BORE-HOLES—Apparatus for Ascertaining Strike and Dip of Veins or Seams in Bore-Holes. Franz Meine, Berlin, Germany. (U. S. No. 908,299; Dec. 29, 1908.)

BORING Earth-Boring Machine. Charles L. Beltz, Selma, Cal. (U. S. No. 910,451; Jan. 19, 1909.)

DUMP-CAR—Two-Way Dump-Car. Allen E. Ostrander, New York, N. Y., assignor to American Car and Foundry Company, St. Louis, Mo., a Corporation of New Jersey. (U. S. No. 909,209; Jan. 12, 1909.)

MINE CAGE SAFETY DEVICE—A New or Improved Safety Device for Mine Cages, Lifts and the Like. Hugo Pieron and Wilhelm Merkel, Remscheid, Germany. (Brit. No. 25,023 of 1907.)

MINE CAGES—Improvements in Automatically Operated Fences or Gates for Mine Cages, Hoists, Lifts and the Like Purposes. William Wilde and William Petrie, Thurnscoe, Rotherham, Yorkshire. (Brit. No. 26,869 of 1907.)

MINE-CAR COUPLING. Thomas C. Nation, Equality, Ill. (U. S. No. 908,880; Jan. 5, 1909.)

MINE-CAR STOP. Charles M. Henretta, Byesville, Ohio. (U. S. No. 907,350; Dec. 22, 1908.)

MINE-CAR WHEEL. John T. Parks and Madison T. Davis, Jr., Charleston, W. Va. (U. S. No. 909,112; Jan. 5, 1909.)

MINE-DOOR-OPERATING DEVICE. John M. Sausser, Osnaburg, Ohio. (U. S. No. 908,333; Dec. 29, 1908.)

ROCK-DRILLING ENGINE. John A. Traylor, Denver, Colo., assignor to the John A. Traylor Machinery Company, Denver, Colo., a Corporation of Colorado. (U. S. No. 909,259; Jan. 12, 1909.)

ROCK DRILLS—Improvements in Dust Collectors for Rock Drills. Gustave Jacques, Vielsalm, Belgium. (Brit. No. 9781 of 1908.)

SAFETY LAMPS—Safety Portable Manual Generator for Igniting Miners' Safety-Lamps. John C. Bowie and John H. Phelps, Cardiff, England, assignors to John Cunningham Bowie, Cardiff, England. (U. S. No. 908,386; Dec. 29, 1908.)

TUNNELING MACHINE. Joseph Retallack, Denver, Colo., assignor of one-half to John H. Redfield, Denver, Colo. (U. S. No. 906,741; Dec. 15, 1908.)

VALVE MECHANISM for Rock-Drills, etc. Joseph L. Mitchell, Denver, Colo. (U. S. No. 909,923; Jan. 19, 1909.)

WINDING-DRUM. Francis Donaldson, Pittsburg, Penn., assignor to Lidgerwood Manufacturing Company, New York, N. Y., a Corporation of New York. (U. S. No. 909,768; Jan. 12, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

CHARGING—Furnace-Charging Apparatus. Frank C. Roberts, Philadelphia, Penn. (U. S. No. 910,233; Jan. 19, 1909.)

CHARGING—Mechanism for Charging Furnaces. David Baker, Newton, Mass., assignor to the Brown Hoisting Machinery Company, a Corporation of Ohio. (U. S. No. 910,264; Jan. 19, 1909.)

CONCENTRATION Apparatus for Washing or Extracting Minerals. Reinhold Freygang, Hamburg, Germany. (U. S. No. 910,279; Jan. 19, 1909.)

CUPOLAS—Improvements in Spark Arresters for Cupolas and Like Furnaces for Melting Metals. Samuel Osborn and David Carnegie, Sheffield, Eng. (Brit. No. 1115 of 1908.)

FUEL—Fuel-Feeder for Furnaces. David F. Nisbet, Wilkinsburg, Penn. (U. S. No. 910,305; Jan. 19, 1909.)

FUME-CONDENSING APPARATUS. Louis C. Laurent, Denver, Colo. (U. S. No. 907,379; Dec. 22, 1908.)

FURNACES—Improvements in Furnaces. Alfred W. Bennis, Eccles, Eng. (Brit. No. 26,471 of 1907.)

GAS PRODUCERS—Apparatus for Regulating the Supply of Fuel to Gas Producers and Other Combustion Appliances. Friedrich W. Sandmann, Dortmund, Germany. (Brit. No. 23,953 of 1907.)

KILNS—Improvements in Kilns for Burning Limestone, Dolomite and the Like. Ernst Schmatolla, London, W. C. (Brit. No. 17,609 of 1908.)

ORE ROASTER. Cyrus Robinson, New York, N. Y. (U. S. No. 908,423; Dec. 29, 1908.)

INDUSTRIAL CHEMISTRY

SULPHURIC ACID—Manufacture of Sulphuric Acid. Hugo Petersen, Wilmersdorf, near Berlin, Germany. (U. S. No. 904,147; November 17, 1908.)

SULPHURIC ACID—Method of Making Sulphuric Acid. Hugo Petersen, Wilmersdorf, near Berlin, Germany. (U. S. No. 908,696; Jan. 5, 1909.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Walter Lewisohn has been chosen treasurer of the Tennessee Copper Company.

Robert N. Bell, of Boise, Idaho, is at Pioche, Nevada.

S. W. Mudd, of Los Angeles, Cal., is spending the winter in New York.

Willard S. Morse has resigned from the American Smelting and Refining Company.

James MacNaughton, general manager of the Calumet & Hecla company, is in New York.

Thomas Kiddie, manager of the smelter at Northport, Wash., was at Wallace, Idaho, recently.

Wm. Yolen Williams has returned to Spokane, Wash., after having spent several weeks in Nevada.

J. Parke Channing, it is understood, will soon retire from the presidency of the Tennessee Copper Company, but will remain a director.

Arthur Lakes, Jr., mining engineer, has moved his offices to Denver, Colo., where he will practice his profession.

R. M. Atwater, Jr., of New York, is making an extended examination of the Giroux copper mines at Ely, Nevada.

George E. Collins, manager of the Newhouse tunnel at Idaho Springs, Colo., has returned from a business visit to the East.

Dwight E. Woodbridge, of Duluth, Minn., consulting mining engineer, has been a visitor at the Lake Superior copper district.

Richard A. Parker, of Denver, Colo., has been examining mining property in the Nelson mining division of British Columbia.

A. H. Roller, manager of the Alice Development Company, at Idaho Springs, Colo., has returned from a business visit to the East.

William M. Gibson, assistant superintendent of the Calumet & Hecla, has left on a European tour and will be absent for about three months.

Superintendent Wilcox, of the Mass Consolidated Copper Company, is in the Wicks-Corbin district, of Montana, inspecting some mining claims.

S. S. Raymond, manager of the Britannia Smelting Company, at Crofton, Vancouver Island, B. C., left that place recently to visit New York.

A. B. W. Hodges, general superintendent for the Granby Consolidated, has returned to Grand Forks, B. C., from a two week's visit to Nevada.

H. S. Wierum, formerly with the American Smelting and Refining Company, has been appointed consulting engineer for the Lewisohn mining properties.

J. E. McAllister, general manager for the British Columbia Copper Company, Ltd., is to be in New York for a few days during the latter part of January.

H. Irving Jones, of Central City, Colo., has been appointed manager of the Hearne Gold and Copper Mining Company, operating in Gilpin county, Colorado.

W. A. Carlyle has left London, England, on a visit to Rossland, where, as consulting engineer, he will advise concerning the further development of the Le Roi mine.

Dr. James Douglas delivered an address before the mining students of the University of Wisconsin, Jan. 18, on "Some Metallurgical Recollections and Anticipations."

Dr. Malcolm Maclaren has left London for Kalgoorlie, Western Australia, to make, on behalf of leading companies, a detailed geological and economic examination of that field.

Frederick Burbidge has been appointed assistant manager of the Federal Mining and Smelting Company. He has been for some time manager of the Frisco Mining Company, Ltd.

Eustace M. Weston has resigned the management of the Rand Collieries, Ltd. (gold section), Brakpan, Transvaal, in order to enter upon the management of a large tin mine in Swazieland.

Edward Scallon has resigned his position as mining engineer with the Winona and King Phillip mines to accept one with the new Cole smelters soon to be erected in the Tooele valley, Utah.

H. P. Wherry recently returned from Mexico, and will be identified with the firm of Dickman & Mackenzie, of Chicago, as mining engineer. He has just gone to Magdalena, Sonora, to make some examinations.

H. L. Jene, who has been for three years with the Commonwealth Oil Corporation, Ltd., of New South Wales, has resigned his position. He was on the staff of the general manager as chief mine examiner and analyst.

A. A. Thomson, of London, who has been connected with the Steptoe Valley Smelting and Mining Company, at McGill, Nev., is now on his way to Katanga, Africa, whither he is going for the Tanganyika Concessions, Ltd.

Henry Snell, of Globe, Arizona, formerly superintendent of the Arizona Commercial, and now with the newly organized Superior & Globe Company, has been a visitor in the Lake Superior district, where he was called upon the death of his father.

Henry C. Schmidt has resigned the position of superintendent of mines with the Compania Metallurgia Nacional at Matchuala, Mexico, for the purpose of establishing an office at Monterey, Mexico, making a specialty of the operation and management of mining properties.

Hon. William Templeman will retain his position as Canadian Minister of Mines. A seat in Parliament has been found for him by the resignation of William Sloan, member for Comox-Atlin, B. C., and Mr. Templeman's return for that constituency is regarded as assured.

Samuel B. Sheldon, general superintendent of the Lackawanna Steel Company, Buffalo, N. Y., resigned Jan. 9, to accept the position of general superintendent of the Sancon works of the Bethehem Steel Company. George F. Downs, heretofore assistant general superintendent of the Lackawanna company, has been appointed general superintendent in his place, and Thomas H. Mathias has been advanced to the position vacated by Mr. Downs.

Obituary

J. Stanley James, the well known consulting mining engineer, of London, died suddenly Jan. 10, in that city.

William G. Park died suddenly at his residence in Pittsburg, Penn., Jan. 19. He was born in Allegheny, Penn., in 1849 and graduated from the Rensselaer Polytechnic Institute at Troy, N. Y. In 1873 he entered the firm of Park Brothers & Co., manufacturers of crucible steel, and after some years became the active manager of the works. The concern was reorganized as the Park Steel Company. In 1900 this company was the principal factor in the organization of the Crucible Steel Company, of America, and Mr. Park then retired; but in 1903 he was called into active service again and made chairman of the board, in which capacity he served until his death. He was thoroughly familiar with the manufacture of steel, and had much ability as an organizer and executive officer.

Societies and Technical Schools

Canadian Mining Institute—Preliminary notice has been issued of the eleventh annual general meeting, which will be held at Montreal, March 3, 4 and 5. Headquarters will be at the Windsor Hotel.

The provisional program of the meeting is as follows: Proceedings will be opened at 10 a.m., Wednesday by an address from the president. The Wednesday morning, and, if necessary, the afternoon session of that day will be devoted to the consideration of business submitted to the meeting, including the report of the council; the treasurer's statement; the proposed repeal of and amendments to the by-laws; and the election of council for the ensuing term. A selection of papers will be read and discussed on Wednesday evening, and at the Thursday and Friday sessions.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Goldfield, Salt Lake City and Denver

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 20—The continued heavy rains which have been falling for the past 10 days have caused great damage in the upper portion of the State and some portions of the valleys have been flooded. Numerous railroad bridges have been carried away so that railroad communication has been stopped with many places. Several large dams of the electric power companies have been washed out and this has caused shortage of power supply at certain mining points. Three large dredgers have been wrecked. Gold dredge No. 2 of the Natomas Consolidated near Fairoaks in the Folsom field turned turtle from the high winds. This machine cost about $125,000, but it can doubtless be repaired for about $20,000. The Indiana dredge at Oroville has also been wrecked and is supposed to be a complete loss. The National Gold Dredging Company's dredge on the middle fork of the American river has also been wrecked.

There was a heavy accumulation of snow in the high Sierra, especially near the summit where 12 ft. of snow had fallen. The miners hoped that continued cold weather would keep this as a storage supply for the streams and coming summer, but the very warm rains are melting this snow at the rate of 6 or 7 in. daily.

It is doubtless a fact that many of the débris dams of the hydraulic miners in the mountain and foothill region have been more or less damaged by the heavy flows of water in the cañons and smaller streams. Some of the slimes and tailings plants below quartz mines have been washed away entirely. Of course, great piles of tailings in similar situations have been carried away altogether.

In the action of the people against the Selby Smelting and Lead Company, the smelting company has filed a notice of appeal from the judgment entered against them on July 16. At that time the smelter was closed down by injunction owing to alleged damage to agricultural lands by smelter fumes.

Goldfield, Nevada

Jan. 19—It is rumored that the Clark road will shortly have a preliminary survey made for the proposed road connecting Stonewall (a station 15 miles south of Goldfield) with Hornsilver, Lida, Palmetto and Silver Peak. This would give life to a number of low-grade properties in those localities, that without railroad facilities could not be operated at a profit

The payroll at Tonopah for the month of December was more than $150,000; Tonopah Mining Company paid $100,000 of this; Montana Tonopah, $17,000; Jim Butler, $4000; West End, $5000; MacNamara, $5500; Tonopah Extension, $2500; Belmont, $15,000.

In his annual report to Governor Dickerson, the State bullion-tax collector on Jan. 15 points out many evasions of mining companies, and recommends the enactment of a penalty clause that can be enforced. The report states that expense bills are much out of proportion to the amount of ore produced, and that some companies have charged operating expenses of leases that were operating at a loss though such losses in no way affected the resources of the parent company. The total tax collected on an output of $10,113,959 for the first nine months of 1908 was $84,339.

Wallace, Idaho

Jan. 20—A suit for the recovery of $150,000 has been brought against the Frisco company by David H. Hyman, of New York. Mr. Hyman is president of the company, and the suit is primarily to foreclose a mortgage for the amount mentioned. It is claimed than on Oct. 1, 1907, the company borrowed from Mr. Hyman the sum of $150,000 on a promissory note bearing interest at the rate of 6 per cent. and payable Jan. 1, 1909. It is further alleged that no part of the note has been paid and Mr. Hyman petitions that the mortgage covering all of the company's property given in security of the note be foreclosed. If this is done it is believed in Wallace that both the mine and mill will be operated again on a large scale.

A movement has been started among the mining men of the Cœur d'Alene to take a space at the Alaska-Yukon-Pacific fair and to place on exhibition a large collection of ore samples taken from properties of the district. A representative of the commission in charge of the exhibits at the fair is expected to arrive in Wallace some time this month to complete arrangements.

The sheriff of Shoshone county has received for service on the Bunker Hill & Sullivan Mining Company an order directing that it remove all stakes and monuments on claims which have been so laid out that they conflict with those of the Federal Mining and Smelting and allied companies. On the failure of the Bunker Hill company to comply with this demand the Federal company states that it will use such force to remove the stakes and monuments as may be necessary.

Butte

Jan. 21—The mines of the Boston & Montana company resumed operations on Jan. 18 after a shutdown lasting 10 days. At the annual stockholders' meeting of the British-Butte Company held here on Jan. 20 the following were elected directors for the ensuing year: M. H. De Hora, J. N. Kirk, W. E. Ward, Sam Barker, Jr., John F. Davies, H. A. Frank and J. W. Murphy. The report of Colonel De Hora, president and general manager, was read and approved by the stockholders.

In the action of the Montana Hardware Company against the Butte-Continental Copper Company, two of the stockholders of the latter company have asked permission to intervene and protect the company's interests, stating that the president of the Continental company, G. E. Blackburn, refuses to defend the action.

The directors of the Pilot-Butte Copper Company have called a special stockholders' meeting for Jan. 28, at which time the problem of how to meet the option payments for the company's property will be discussed. In the notice of meeting it is stated that two payments, each of approximately $40,000, must be made during the present year or the option will be forfeited.

Salt Lake City

Jan. 22—Samuel Newhouse has pronounced the Fink smelter an unqualified commercial success, and is at present in New York organizing a company to exploit the new process. It is said that John Hays Hammond and European capitalists will become interested in the organization. The experiments were carried on at Garfield near the Boston Consolidated mill in the plant erected by Mr. Newhouse. This plant has a capacity of 100 tons per day, and cost about $13,000. It has been shown that the Fink smelter with 15 men on a shift and 25 h.p. and with less than two tons of fuel can smelt concentrates from the Boston Consolidated mill at the rate of 100 tons per day, turning out blister copper running from 95 to 98 per cent. On Jan. 17 blister copper was turned out in less than an hour after charging the concentrates into the furnace. This is the first furnace ever invented that will make blister copper direct from ore.

The annual meeting of the Daly-West Mining Company will be held at Denver, Feb. 15; a fight is being waged by certain stockholders of the company to remove the present management and prevent the company from being merged with the Daly and the Ontario companies. There are 180,000 shares outstanding.

At the Utah Copper Company's property, the ground is being worked for over a mile in length with seven steam shovels in operation. The two main pits are now being connected, and when this has been accomplished, in place of loading cars singly, an entire train can be loaded at once. From Pit *B* two and one-half million tons of copper ore have already been mined. At the edge of this pit is a face of ore 230 ft. high. A little blasting at the foot of this cliff breaks down large quantities of ore. The orebody is 2000 ft. wide, and at present in furnishing the mills with 6000 tons of ore per day. The present mining cost is said to be less than 20c. per ton. In addition to the enormous surface development, considerable underground work is under way. C. M. MacNeill, president, J. R. Babbitt, general counsel, and J. D. Hawkins, general manager, of the United States Refining and Reduction Company, of Colorado, and C. C. Hamlin, a prominent Colorado lawyer and politician, have been visiting the property of the Utah Copper Company at Bingham and Garfield. A report is now being compiled by the officials of the company.

The Sioux Consolidated Company has posted a dividend payable Jan. 20, of 8c. per share on the 745,389 shares issued, or a total of $59,631. At the recent annual meeting it was shown that there was $73,000 in the treasury with considerable ore unsettled for. This property paid its first dividend last October; dividends were also paid in November and December, so that during 1908 this company paid 17c. per share, or $126,716. Many people question the ability of the mine to keep up this rate of production.

The Uncle Sam Consolidated Company, another Tintic producer, has passed the January dividend, and it may be several months before dividends are resumed. This is due to the fact that the mining at present is in one of the lean streaks characteristic of Tintic. John Dern, before going to Nebraska, stated that while the mine did not have as much shipping ore as usual "in sight," that the vein was as strong as ever. Development work is being pushed, as the company has considerable money in the treasury.

The Tintic smeltery is smelting again at full capacity, as No. 3 lead furnace is in operation. The copper furnace has been held back considerably by slow delivery of structural steel, but it will be ready for operation soon. The recent delay was due to the breaking of the pump that fed the water jackets of one of the furnaces and was not due to the breaking of the station pump at the Swansea mine. The smeltery is now taking power from the Telluride Power Company. Shippers have been notified to resume shipments to the smelter as everything is running smoothly.

Denver

Jan. 23—In the Breckenridge gold-placer district, Ben. S. Revett, manager of the Reliance Mining Company, has remodeled his steam dredge, and altered it to use electricity, getting his power at present from the Central Colorado Power Company; but it will eventually be furnished by the Consolidated Mining and Electric Company (the old Gold Pan power plant) from Spruce creek, on the upper Blue river. The dredge's capacity is about 2500 cu.yd. per day, and it is believed by those who know that it will make a success. The Colorado Gold Dredging Company, with two dredges, the first that have achieved a marked success in this district, has been dredging during the season at a cost of 8c. per yd., everything included; and as nearly as can be ascertained, the average saving is from 12 to 14c. The capacity is 3000 cu.yd. in 24 hours. A fourth dredge has been moved from Clear creek, near Golden, into this district, and is a 5-ft. close-connected bucket type, with a capacity of about 2500 cu.yd. per diem.

A gold dredge of 2000 yd. capacity was installed last fall on Green river, close to the Colorado-Utah line, and near the projected line of the Moffat road. A trial run was made before winter closed in, and it is stated that the saving was from 30 to 40c. per yd. The owners have 1190 acres of placer claims, besides two power sites.

A 300-bbl oil well has been struck at Boulder by the Inland Oil Company, and a good deal of excitement prevails, leases having been taken for 8 to 10 miles around. Refined oil is being shipped from Boulder at the rate of 360 cars monthly.

The Eastern Colorado Power Company, a subsidiary concern to the Central Colorado Power Company, has let a contract to the Karns Rotary Tunnel Machine Company, for 600 ft. of tunnel through granite between the Power company's intake and outlet near Magnolia, on Boulder creek. The machine cuts a 6-ft. diameter bore. The same company has also announced in the daily press that a contract has been let to the MacArthur Construction Company, of New York, to build a dam in Boulder county to cost $600,000. It is designed to impound 500,000,000 cu.ft. of water, and will be built of concrete. The lines from the first section of the Shoshone plant, near Glenwood Springs (18,000 h.p. capacity) will connect at Denver with the line from the Boulder plant (21,000 h.p.), thus supplying a large amount of power for the needs of the city of Denver.

The diamond-drill hole from the breast of the Yak tunnel, at Leadville, tapped the Resurrection mine this week, and the water from this immense property is now being rapidly drained through the tunnel. The Resurrection was leased by the owner, D. H. Moffat, to the Yak company, and will be operated by it through its tunnel.

Professor George, of the University of Colorado, at Boulder, and director of the State Geological Survey, has issued a report of the progress of his survey during the past two years. This includes the survey and mapping of 110 sq.m. in the Hahns Peak region, and about 90 sq.m. of the Boulder county tungsten belt; and 22 sq.m. of the Montezuma area in Summit county have been mapped topographically and geologically. A complete topographic and geological map of the State is also nearing completion.

Toronto

Jan. 23—The rush to Gowganda, in spite of the season, continues undiminished, and considerable hardship has resulted owing to the lack of accommodation and the crowding in of numbers ill prepared to encounter inclement weather. Three prospectors were recently found frozen to death in a tent near Gowganda, and others have undergone much suffering. The mining recorder at Elk Lake has been so overwhelmed with business that there has necessarily been much delay in recording applications. The Government recently sent several assistants to enable him to overtake the work. Building is going forward rapidly and material and provisions are being sent in as fast as possible. The provincial government has set aside a tract of land of about 1000 acres at the north end of Gowganda lake as a townsite. Squatters have been warned off and as soon as plans can be made the lots will be sold by tender.

Frank Law, the Toronto broker charged with conspiracy to defraud in connection with the flotation of the Highland Mary and several other mining companies, whose case has been repeatedly postponed, was brought to trial last week and found guilty. Law's counsel gave notice of appeal on the ground that Law had been promised immunity. Sentence was suspended until the appeal is decided.

Paul Neuman, of the Apex Underwriters Syndicate, pleaded guilty yesterday to technical violations of the clauses of the Ontario Companies Act regarding prospectuses and was fined $200 on the first charge, and $10 on the second. Mr. Neuman stated that he had no intention of violating the law, and had submitted the advertisements complained of to a legal expert on company law who assured him that they were not illegal.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Modern Copper—It is reported that this property was sold last week to the Boston-Bisbee company.

GILA COUNTY

Globe—In accordance with a notice signed by Superintendent R. B. Hegardt and posted Jan. 24, all the mines of the Old Dominion Company closed down at two o'clock Sunday morning, to remain closed indefinitely. The Globe Consolidated, Arizona Commercial, Superior & Boston, Miami and other companies sustained the Old Dominion Company's action by also suspending work yesterday. A few agitators in the union have been stirring up discord for some time, but the decision of the Old Dominion Company to close its mines was caused by offensive acts of walking delegates.

GRAHAM COUNTY

Clifton-Morenci District—The Shannon Copper Company recently secured a controlling interest in the Clifton-Northern railroad and will operate it in the future. The company is laying a three-rail track to the New England ore bins in North Clifton. The greater portion of the New England and Copper King ore is being shipped to the company's smelter. The company has also purchased valuable limestone claims up the San Francisco river. The local management of the company has received instructions to begin work on the Shannon-Arizona railroad, which will be built from the Shannon smelter to the mines at Metcalf. The road will be built high in order to avoid the annual Chase creek floods. It is proposed to extend the road to the Garfield district, where the company owns property.

PINAL COUNTY

Kelvin-Calumet—At a meeting of parties interested held in New York City, the control of the Kelvin-Calumet was sold to the Lewisohns, J. Parke Channing and the General Development Company. The property will be acquired by a new company, to be known as the Ray Consolidated Copper Company, which will have a capital of 1,000,000 shares of the par value of $5 each, and $2,000,000 6-per cent. convertible bonds.

California

CALAVERAS COUNTY

The warm rains have helped out the water supply of the mines in this county, the previous shortage having been due to the cold weather, which froze up the ditches. The Utica mine at Angels, after several weeks idleness, has started operations again.

Reiner—At this mine, San Andreas, crude petroleum applied on the green wood in use has enabled them to produce abundant steam without change in the furnaces. The blue gravel channel has been reached. Machinery is being hauled in and the mill will soon be ready for operation.

EL DORADO COUNTY

Independence—Owen, Hill & Schafsky are putting up a two-stamp mill on this mine where they recently uncovered a very rich pocket. The vein is small but the rock is exceptionally rich.

Patterson—Work has been resumed on this mine at Indian Diggings by Fred and John James.

MARIPOSA COUNTY

Egenhoff—This group in the Merced river cañon on the line of the Yosemite road a mile from the old Hite mine, is now the property of A. B. McKee, of Chicago. There are seven claims in the group, four of which are being worked. There is a 10-stamp mill and other necessary equipment on the property. The capacity of the mill is to be increased and the mine worked on a larger scale than formerly.

Green Mountain—This copper mine, owned by Capt. Sydney, will hereafter ship its ores to the Globe smelter. New machinery is to be installed.

NEVADA COUNTY

Blue Lead—This famous old gravel mine at Relief Hill has been bonded by James Graham, of Modesto and J. V. Snyder, of Nevada City, and operations will shortly be resumed. The bedrock tunnel tapping the gravel channel is 2700 ft. long. The men at present are working in an upraise.

Midas—At this mine near Rough & Ready district, Herbert James superintendent, a good strike has been made. This is one of the newer mines of the county, having been discovered two years ago.

PLUMAS COUNTY

John Salsbery, of Tonopah and J. E. Hall have bought the Hobson, Dewey and Blackjack properties from Wm. Stampfli, and the Soda Creek placer from Wm. Hall. They have also acquired the Plumas National mine.

SHASTA COUNTY

Balaklala—The smelter is treating about 1200 tons daily of Balaklala ore and about 150 tons of Trinity ore, and is producing upward of 1,500,000 lb. of copper per month. The ore is said to be yielding 48 lb. of copper per ton. The smelter has four MacDougal roasting furnaces, three blast furnaces and one reverberatory.

SIERRA COUNTY

Telegraph—There are now 30 men at work in this mine taking out gravel to be washed when there is sufficient water supply.

SISKIYOU COUNTY

Hogan—At this mine on Taylor creek a vein of very high-grade ore has been found near the surface and specimens are being sacked.

TRINITY COUNTY

Yellow Jacket District—Seven of the groups of mining claims in this district will be worked all winter, something it is not customary to do.

TUOLUMNE COUNTY

Jupiter—In this mine near Jacksonville, owned by E. R. Bolton, a wide ledge has been met carrying free gold and a high percentage of valuable sulphurets.

YUBA COUNTY

Blue Point—Superintendent E. W. Tarr reports that considerable machinery for this mine is being made and that as soon as certain changes have been made in the machine for building the ditch, excavation work will be resumed.

Colorado

TELLER COUNTY—CRIPPLE CREEK

Drainage Tunnel—Good progress is being made on this tunnel from the portal heading; it has reached a point nearly 4700 ft. in. A considerable flow of water was recently encountered, which checked the progress of the work slightly for a few days, but at the present writing the watercourse has been passed and the tunnel is comparatively dry once more beyond it. The workmen on the tunnel are after a record for tunnel driving this month. No work will be done in the headings of the

intermediate shaft until a new compressor can be installed. The work on the tunnel is being done under contract by A. E. Carleton, of Cripple Creek. James McIlwee, also of Cripple Creek, has charge of the work at the tunnel.

Cripple Creek Mine Owners' and Operators' Association—The annual meeting of this association was held in Colorado Springs last week and all of the old board were reëlected to serve for the ensuing year. These are as follows: Sam McDonald, superintendent of the Strong mine; E. H. Beebe, superintendent of United Gold Mines; R. P. Windsor superintendent, of Elkton; E. J. Trevarrow, superintendent, of Vindicator, and G. E. Copeland, general manager of Copeland Sampling Company. It is understood that an effort will be made to have a bill passed the legislature making it a felony to buy stolen ore.

Golden Cycle—This company will install a large new hoisting plant on the main shaft of the Cycle workings, thus enabling the mine to make a much greater production. The new hoist will be of the direct-connected type, and is manufactured by Webster, Camp & Lane, of Akron, Ohio. The hoist will be good for 3000 ft. depth. In the meantime the mine is making a steady production. H. McGarry, of Colorado Springs, is general manager, and J. T. Milliken, who was formerly consulting engineer of the mill at Colorado City, is now to be consulting engineer of all the Golden Cycle interests, including the mine, mill and coal lands.

Portland—A new roaster has been installed in the mill of this company at Colorado City, increasing the capacity to such an extent that it is able to do some custom milling, and is in the market for ores from this district. A small plant has been erected at the mine in the district to experiment on the treatment of the low-grade dump ores, of which there is a large quantity. The regular quarterly dividend of 4c. per share was declared this week.

Gilpin County

Anchor—A controlling interest in this property has been sold to William H. Hearne, of Wheeling, W. Va., who has assumed the presidency of the Hearne Gold and Copper Mining Company. About 50 tons of ore per day are being shipped since the tramway made connections to the mines.

Aztec Mines Company—Arrangements are being made for the installation of an 80-h.p. boiler and also for a larger hoisting plant, with intention of sinking the shaft several hundred feet. H. Irving Jones, Central City, is manager.

German Uranium Mining Company—Philadelphia people are interested in a lease and bond on the German and Leontine properties, and they are installing a plant of machinery and will put in an air compressor at an early date. W. Knutzen, Bald Mountain, Colo., is manager.

Gilpin-Boulder Consolidated Mines Company—A new shaft building is being erected on the Poole claim, and a steam plant is to be installed. E. H. Crabtree, Central City, Colo., is manager.

Gilpin County Land and Mines Company—This company has purchased for a reported consideration of $10,000 the Colorado lode in Russell district, and it is reported that it is arranging for its transfer along with adjoining property to Eastern buyers.

Rockford—This mine in Russell district has been sold to Henry P. Lowe, of Denver, and S. T. Harris, of Russell Gulch, Colo. Milling ore 8 ft. wide and of a good grade has been opened up in sinking and machinery is to be installed. S. T. Harris, Russell Gulch, Colo., is in charge.

Rome-Gardner—Rome, N. Y., people are interested in this claim, and they are having an examination made. Leasers are taking out some good ore, but it is expected that the company will arrange for heavy developments and will require heavier machinery. A. Watters, Bald Mountain, Colo., is manager.

Senator—Chicago people have become interested in this mine near Black Hawk; a company is being organized and arrangements are being made for development. Company office is at 121 La Salle street, Chicago.

Lake County—Leadville

Ball Mountain Tunnel—The management states that within 30 days this tunnel will reach the Sunday vein, 2300 ft. from the portal; the tunnel is being driven at the rate of 9 ft. per day.

Big Six—Prospecting is being carried on in new territory on Breece hill to the northeast from the 750-ft. level with some success. The ore found runs well in gold, but so far it is only in patches. Sufficient ore is being taken out to pay the running expenses, and as long as this continues prospecting will be continued in the new territory.

Yak Tunnel—The water in Resurrection shaft No. 1 has been tapped and is being lowered at the rate of 1 ft. per day. No chances were taken with tapping this large body of water; drill holes were driven to it 50 ft. in advance of the tunnel and into one of the drifts, which is 35 ft. below the level of the tunnel. The water is now being forced through the holes. The tunnel is being driven ahead at the rate of 12 ft. per day.

Illinois

Illinois Coal Operators' Association—At the annual meeting last week, the following officers were chosen: President A. J. Moorshead, Madison Coal Company; vice-president, F. W. Lukens, O'Gara Coal Company; secretary and treasurer, E. T. Bent, Oglesly Coal Company. The selection of a commissioner to succeed the late Herman Justi will be made by the executive committee.

Idaho

Shoshone County

Merrimac—A strike of 13 in. of clean shipping galena ore has been made at a depth of about 50 feet.

Carney Copper—A report of the company's affairs has been issued showing that during 1908 about 650 ft. of work was done. About 122,000 shares of treasury stock was disposed of netting the company $13,287, while the total receipts aggregated $17,748. Altogether the company disbursed $18,391, leaving a small indebtedness.

Temple Mining Company—At a meeting of the directors held in Wallace this week it was decided to levy an assessment of five mills a share with which to prosecute development work.

Wallace M. M. & R. Company—At the annual meeting of stockholders held in Wallace, the following officers were elected for the ensuing year: President, L. Dols; vice-president, George Evans; treasurer, Herman J. Rossi; secretary, Gary C. Burke; directors, J. W. Evirs, J. F. Gilson and William Fagan. The secretary's report shows that about 250 ft. of work was done during 1908. A resumption of work at the mine will not be made until the spring.

King of Pine Creek—The strike recently made in this property has now widened out to about 7 ft. of ore of a concentrating quality. Development work will be pushed throughout the winter.

Kentucky

Henderson County

Southern Coal and Transportation Company—This company, which recently bought 8000 acres of coal lands, has begun work opening a mine, and has let contracts for machinery to handle an output of 2500 tons daily. J. W. Miller, Robard, Ky., is manager.

Montana

Butte District

Butte & London—At the regular annual meeting of stockholders held on the 10th, the following were elected directors for the ensuing year: Frederick W. Baker, James Talbott, James H. Lynch, A. V. McMillan, Fred Whiteside, Charles J. Kelly, F. J. Anderson, W. W. McDowell, Guy W. Stapleton, T. H. Emery and W. E. Reynolds.

Butte & Ely—At the regular annual meeting of stockholders the following were elected directors for the present year: R. M. Hodgens, J. C. Adams, B.

E. Calkins, Dr. T. B. Moore and A. L. Longley. At the directors' meeting held immediately afterward R. M. Hodgens was elected president, B. E. Calkins vice-president, and A. L. Longley treasurer.

Butte & Yerington—At the regular annual meeting of stockholders the following were elected directors for the present year: W. C. Siderfin, J. N. Kirk, J. C. Adams, J. H. Case, Dr. T. B. Moore, W. E. Right and B. E. Calkins. At the directors' meeting officers were elected as follows: W. C. Siderfin, president, T. B. Moore vice-president, W. E. Wright secretary and treasurer.

Copper Eagle—The management states that favorable results have been met with in the development work now being carried on at the 350-ft. level, the work showing the same three orebodies which were opened up on the 250-ft. level. Manager Corry states that in sinking the shaft an independant shoot of heavy sulphide ore was encountered, which showed 1.5 per cent. copper, 281 oz. silver, $3 gold per ton.

BUTTE DISTRICT

Butte Coalition—Present production is 2,500,000 lb. per month. The 16th level crosscut, Tramway shaft, has cut the extension of the main orebody of the Minnie Healey mine.

Michigan

COPPER

Ahmeek—The rock now being milled is yielding 24 lb. of copper per ton. When the two new shafts are completed a year hence the whole stretch of the company's holdings on the Kearsarge lode will be commanded, and an output of 14,000,000 lb. of copper per annum is eventually expected.

Hancock—Sinking continues at No. 2 shaft of this company at the rate of nearly 100 ft. per month, several lodes traversing the tract. It is calculated the Hancock lode will be intercepted at 2200 ft., and the main workings of the Quincy at 3600 ft. The shaft is below the 14th level. The main working crosscut at the 13th level to connect with No. 1 shaft will be holed through in a short time. This crosscut will handle all the rock from the working of No. 1 shaft.

Quincy—The new Pontiac shaft of this company is down 200 ft. with copper in evidence all the way. A rock house is to be erected in the near future.

Ojibway—No. 1 shaft of this company has reached the 650-ft. level and a station is being cut preparatory to crosscutting. The lode was opened near the shaft at the 500-ft. level. The crosscut from this same level of No. 2 shaft is at the point of intersecting the lode.

Challenge—This company has concluded all development at the exploratory shaft with the exception of one diamond drill, which is operating in the eastern crosscut. Nothing of any commercial value has been found in developing.

Superior—Sinking has been resumed in No. 1 shaft below the 10th level, where it was bottomed when sinking was temporarily suspended while a portion of the shaft was widened to accommodate the two skip roads. The new hoisting engine and compressor have gone into commission and the smaller engine moved to the site of No. 2 shaft.

Wyandot—This company has done about 125 ft. of drifting on its newly opened amygdaloid lode and the same copper-bearing formation continues.

Copper Range—This company has started its third diamond drill on the land it has under option from the St. Mary's Mineral Land Company. Two parallel cross-sections will be made of the tract. At the Globe tract a crosscut has been drawn to the lode 356 ft. from the surface but the same unsatisfactory conditions exist as at the 1000-ft. station.

Mohawk—Sinking continues in all five shafts. Underground conditions are up to the average with plenty of ground opened to keep the mill running to its capacity. Nos. 1 and 2 shafts are down to the 16th level; No. 3 to the 11th; No. 4 to the 12th; and No. 5, the newest of the openings, below the 8th level. It is planned to start a new shaft No. 6, in the spring about midway between No. 5 shaft and the southern boundary of the property.

Wolverine—This company has installed electric pumps in its two shafts. At the stamp-mill the Jackson sand-conveying system will soon be ready to run. This system will deposit the tailings at a distance of about 800 ft. from the mill.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Red Top Consolidated—A 64-ton shipment, having an estimated value of $7000, was made to the Western Ore Purchasing Company Jan. 15. Eight carloads have been shipped since Jan. 1, all but one of which returned over 5 oz. gold per ton; that one carried 4.8 oz. gold per ton.

Butterfly Group—The five claims in this group on Knickerbocker mountain, about four miles east of Goldfield, was purchased last week by J. O. Buckley, of Milwaukee, for the Nevada & Eastern Mining Company. As yet no development work except the annual assessment work has been done on the property.

Simmerone—It is reported that work will be resumed on company account. Three years ago the property created quite an excitement by shipping high-grade ore to the extent of $15,000. But the shoot was lost at a shallow depth; and although the shaft was continued to a depth of 250 ft., and considerable crosscutting done, the oreshoot was not found again.

Combination Fraction—The lower portion of the shaft has been retimbered and a cage put in to take the place of the bucket and crosshead formerly used; a large pump is also being installed. With these improvements and the large ore reserves now blocked out, a steady production is promised.

Commonwealth—The Commonwealth Mining and Leasing Company on Jan. 14 made its first shipment; this amounted to 18 tons. The property is two miles east of Goldfield, and should returns from this lot be favorable and regular shipments be made, development in that portion of the district will be encouraged.

Hazel Goldfield—As work advances to the south a steady improvement is noticed both in the width and the value of the ore. Shipping ore is now exposed in every heading, the better values being next to the hanging wall in a streak from 6 to 20 in. wide; the rest of the vein is of milling grade. As a large amount of water has been struck, a pump will be installed.

Five Friends Lease—This lease which adjoins the Hazel on the north, in crosscutting for the Red Top vein from the 250-ft. level, has recently cut a high-grade orebody.

Nancy Donaldson—As returns from several small trial shipments of medium-grade ore, taken from shallow shafts sunk on this property, were favorable, three miners are now prospecting the ground to determine the best location for a deep shaft. On determining the best point for it, three shifts will be employed and a gasolene hoist installed to expedite sinking.

Kansas City Velvet Lease—A shipment of nine tons was made from this property Jan. 16. This ore occurs in small lenses; the main shoot has not yet been found.

ESMERALDA COUNTY—HORNSILVER

Great Western—This property is shipping to Cuprite by wagon 12 tons per day. The drift on the 300-ft. level is being extended east to cut the oreshoot worked on the upper levels. In the west drift on the 200-ft. level ore has been found carrying over 2 oz. gold per ton.

ESMERALDA COUNTY—SILVER PEAK

Pittsburg Silver Peak—From March 1 1908, to Jan. 1, 1909, the mill ran at nearly full capacity with an average monthly output of 10,000 tons showing a value of $10 per ton; the extraction is 93 per cent About 200 men are employed at the mine and mill; the average wage is $5 per day The ore is transported to the mill by an aërial tram; an automatic weighing machine is now being installed at the mine. Many surface improvements are under way, including a two-story bunk house at the mine; the lower floor of this is to be fitted as a club house for the miners.

ESMERALDA COUNTY—LONE MOUNTAIN

Teton Group—Rogers and Tedford, the owners of this property on the east slope of Lone mountain, have sent to the mine a wagon train of supplies and will sink the shaft, now 40 ft. deep, to a depth of 200 feet.

NYE COUNTY—BULLFROG

Homestake-King—This property on Jan. 10 shipped the December clean-up, $10,000 in gold bullion, to the Mint. The management states that the property produced more than $40,000 in 1908.

Pioneer Mine—A carload of ore was shipped to Salt Lake City Jan. 7. Stoping on the high-grade ore is progressing in the sub winze with no change in the value of the ore. The shaft is now 200 ft. deep; a station will be cut at a depth of 210 ft. and a level run to develop the orebody.

Shoshone—A third shift has been put on in the crushing department of the mill which is now running to full capacity. Fourteen bars of bullion, valued at between $30,000 and $35,000, were shipped Jan. 14; these represent the December clean-up from the zinc boxes. The concentrates in the future will be reground and cyanided so that only bullion will be shipped.

NYE COUNTY—TONOPAH

During the week ending Jan. 9 the Tonopah Mining Company mined 3050 tons; Belmont, 600 tons; Jim Butler, 300 tons; Midway, 100 tons; West End, 150 tons; MacNamara, 250 tons; and Montana Tonopah, 720 tons of ore.

Belmont—On the 1100-ft. level a large tonnage of fine ore has been blocked out. A raise from the west drift of the 1100-ft. level shows a vein 10 ft. wide in which occur streaks and bunches of high-grade ore; 70 ft. east of this, a raise from the east drift has exposed 5 ft. of ore of good milling grade. This ore has been proved to the 1000-ft. level. In the west drift on the 1000-ft. level a winze was sunk and a drift run to the east which shows 5 ft. of milling ore in the face; this is 275 ft. west of the raise from the west drift on 1100-ft. level. Whether these orebodies are in the same vein or not has yet to be proved.

Montana-Tonopah—Two important strikes were made in this property last week, both finds being in the rhyolite-dacite formation. The first was made on the 465-ft. level where a continuation on its dip of the Triangle vein was cut in the west crosscut at a point 300 ft. west of the shaft. The orebody is 2½ ft. wide and is of good milling grade. The second strike was made in a crosscut on the 515-ft. level and shows 8 ft. of milling ore, this also is in the Triangle vein.

MacNamara—On the 200-ft. level in the drift which was turned so as to run south in order to find the vein which was faulted in the drift, ore was found after driving 60 ft. south. The vein is 8 ft. wide showing 2 ft. of milling ore on both hanging and footwall with low-grade quartz between. The west drift on the 275-ft. level cut into ore last week; the face shows 5 ft. of milling ore.

Tonopah Mining Company—The mill reported an average of 92 stamps dropping continuously last week; 2950 tons of rock assaying $25.25 per ton were crushed; 58 bars of bullion valued at $795 a bar and 46,000 lb. of concentrates were shipped, making a total production of $57,495 for the week.

NYE COUNTY—HANAPAH

Silver Glance—The Conrad & Lain lease on this property, 18 miles east of Tonopah, recently shipped 36 tons which returned very close to $100 per ton. Ore for a second shipment is now being hauled to Tonopah.

WHITE PINE COUNTY

Nevada Consolidated—The Steptoe Valley works now consists of three units of 1333 tons capacity each. Two of these are being increased by 20 per cent., and a fourth is being added, all of which is for treatment of Nevada Consolidated ore. When completed (next April) the works will be of 6000 tons daily capacity, of which 2000 will be for Cumberland-Ely and 4000 for Nevada Consolidated. This should give the latter capacity for producing about 50,000,000 lb. of copper per annum. Nevada Consolidated is already producing its copper at a low cost, and is expected eventually to produce at 7c. per lb. for operating charges, or say 8½c., including amortization and all charges.

Giroux—The affairs of this company will hereafter be directed from the Duluth office of Thomas F. Cole, although Joseph L. Giroux will retain the presidency. Mr. Cole is said to agree with Mr. Giroux in belief as to the possibilities of the Alpha shaft. The property will now have a more vigorous development.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—This company's statement for November and the five months of its fiscal year from July 1 to Nov. 30 is as follows:

	November.	Five Mos.
Earnings	$3,657,764	$13,761,803
Expenses	3,385,928	13,005,877
Net earnings	$ 271,836	$ 755,926

For the five months there were decreases of $3,501,759 in earnings; of $2,803,113 in expenses; and of $698,646 in net earnings.

BITUMINOUS COAL

Union Connellsville Coke Company—This company, of Uniontown, has awarded a contract for the construction of a coking plant of 75 ovens at the Simpson shaft recently completed. It is the intention of the company to have them completed and in operation as early as practicable. W. H. Wilkey, of Uniontown, will erect the ovens.

Oliver & Snyder—The Oliver & Snyder Steel Company has adopted the new mine roof support recently patented by Fred. C. Keighley, general superintendent of the company's three coking works near Uniontown. The installation of this support has been begun in the mine at Oliver No. 2. Thirty sets, covering a distance of 100 ft. are being put in as a beginning. Mr. Keighley states that the old roof supports will be replaced with the new kind as rapidly as they require replacement and the entire workings of the company will eventually use this equipment.

Kennerly Coal Company—Negotiations are in progress for the sale of this company's coal lands to persons understood to represent the United Coal Company, of Pittsburg. The Kennerly company has its headquarters at Johnstown; it owns about 4000 acres of land in the Bens Creek valley in Somerset county.

United Coal Company—An explosion in the Merchants' mine of this company at Boswell, Somerset county, on Jan. 26, killed five men, including Superintendent J. G. Logan, and injured several others.

South Dakota

LAWRENCE COUNTY

Custer Peak—The company is preparing to sink another 100 ft. Superintendent O'Brien reports that the copper showing is now 3 per cent. at the 200-ft. level, the width of the ledge being 85 ft. A five-stamp gold mill will also be erected.

Hercules—Grading for the 200-ton mill has commenced and the orebody is being prepared by Superintendent Englehardt for a steady ore supply.

Homestake—The company is preparing to install a new cage to operate between the 1200-ft. and 1750-ft. levels.

Two Bears—Work will be recommenced when the weather permits. E. H. Harriman of New York, is one of the principal owners of this property.

CUSTER COUNTY

Saginaw—Free gold was encountered by Manager Herber, of Custer, in the shaft at a depth of 34 ft. at the face of the incline. The vein will be followed up.

Texas

JACK COUNTY

Lost Valley Coal Company—This company has begun work on the development

of its coal lands near Jacksboro, and has let contracts for the necessary machinery. J. J. Jermyn, of Scranton, Penn., is in charge of the work.

Utah

Beaver County

Utah Gold and Copper Mines Company—The fissure cut by the main tunnel a short time ago has been drifted on for 60 ft., and from 2 to 4 ft. of lead-silver ore of stoping grade has been found.

Honerine Extension—A drift at this mine has been driven in ore for 42 ft., and ore still shows in the face. Considerable trouble has been caused by water, but a small electric pump is to be installed.

Peacock Consolidated Copper Company—At this property adjoining the King David group a drift has been run west of one of the fissures disclosed in the crosscut; this drift has cut a crossvein, the ore in which carries about 45 per cent. lead, some gold and considerable silver. In this district the ore makes at intervals in large caves in the limestone; the management feels confident that a large body of rich ore will soon be found.

Salt Lake County

Rainbow Mining Company—The tunnel has cut a body of molybdenum ore about 250 ft. below the surface. The surface ore on this vein averaged 17 per cent. molybdenum.

Big Mitt—In this property between Big and Little Cottonwood cañons a vein, 8 in. wide and assaying high in gold and copper, has been opened up.

Ohio Copper Company—The stock of this company has been listed upon the Salt Lake exchange. The capitalization is 1,500,000 shares having a par value of $10. The treasury contains 380,650 shares and $76,452 in cash. The bonds outstanding amount to $877,000. The company owns 15 patented claims at Bingham, in which 1385 ft. of shaft has been sunk and 10,682 ft. of other underground work has been done. The ore in sight is estimated at 7,000,000 tons, while the possible ore between the Mascotte tunnel and the 500-ft. level is 6,400,000 tons. The average value of the orebody on the upper levels is said to be 1.66 per cent. copper. The 2400-ton concentrating plant will soon be completed. In the lower tunnel vein, which has a depth of approximately 2000 ft., ore averaging 1.75 per cent. copper has been found. Up to date this is the best average grade that has been found in the property. The management believes that it is approaching the main orebody, and expects to find in it a higher grade of ore than it did nearer the surface.

Bingham Amalgamated Company—A deal is said to be in progress by which this company disposes of 330,000 shares of treasury stock at about 40c. per share. While it is uncertain who is after this stock, the Utah Copper Company and the Ohio Copper Company, both of which are neighbors, have been mentioned. The Bingham Amalgamated adjoins some of the largest Bingham properties, and has a good showing.

Summit County

Little Bell—On the 300-ft. level two veins are being drifted upon; it is expected that when the contact is reached high-grade bodies will be found.

Wisconsin

Zinc-lead District

Beloit-Elmo—This company is rebuilding the 75-ton mill moved from the Hazel Patch, at Mineral Point.

Cuba City—A big increase in shipments will be made from this camp within the next few weeks. The Baxter, Board of Trade, Best, Henrietta, Meekers Grove and Dall are producing again. The Dall is now prepared to double its former daily production of 25 tons of concentrates; the new shaft has been connected up with 1000 ft. of tramway and a new power equipment installed. The company has just declared its fifth regular monthly dividend of 5 per cent. on $60,000 capitalization.

Raisbeck—Milwaukee parties, represented by P. R. Grey, are unwatering the old Raisbeck mine, under option to buy.

West Virginia

Monongalia County

D. R. Davidson Coal and Coke Company—This company has bought 300 acres of coal land near Morgantown, and has begun work opening a coal mine. Preparations are also being made to erect a number of coke ovens. The company is controlled by D. R. Davidson and others, of Beaver Falls, Penn., owners of the Union Drawn Steel Company.

Canada

British Columbia

Weather conditions during the early part of January were so severe that for several days there was a practical suspension of mining and smelting operations in West Kootenay and Boundary districts, consequent chiefly upon much ice in Kootenay river having prevented the operation of the hydro-electric power plant at Bonnington falls. The difficulty was overcome by the middle of the month and work was at once resumed at the larger mines in Rossland, Phœnix and Greenwood camps, and at the several smelters treating ores from them.

British Columbia—Crow's Nest Pass

Crow's Nest Pass Coal Company, Ltd.—A new entry is being opened to one of the larger coal mines at this company's Coal Creek Colliery, that in use for 10 to 12 years having become unsafe. Operations have been resumed at the company's Carbonado colliery with about 150 men employed.

British Columbia—Boundary District

British Columbia Copper Company, Ltd.—In addition to operating several producing mines and a smelter, this company is developing a new property, in Wellington camp, with encouraging results, a promising orebody having been opened on it recently.

Consolidated Mining and Smelting Company, Ltd.—Besides regularly maintaining ore production at the Snowshoe mine, in Phoenix camp, this company is developing a neighboring group of claims, known as the Phoenix Amalgamated, on which a large body of ore of shipping grade has been proved to occur.

British Columbia—Nelson Mining Division

Ymir Mines, Ltd.—This company is prospecting with a diamond drill in the Ymir mine.

Sheep Creek—Several mines are producing lode gold in this camp—the Queen with a 20-stamp mill, and the Kootenay Belle and Nugget each with a smaller mill. While production is not yet large it is increasing.

British Columbia—Slocan

Whitewater—A contract for driving a 1500-ft. crosscut tunnel has been let by the Deep Mines, Ltd., the operations of which are being directed by J. L. Retallack, of Kaslo. The purpose of this work is to explore the vein at the extreme depth at which development by means of tunneling is practicable. During 1908 about 8500 tons of hand-sorted lead ore, 12,500 tons of lead concentrates, and 8000 tons of zinc concentrates were shipped from the associated Whitewater and Whitewater Deep mines.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ending Jan. 16 were as follows: Crown Reserve, 120,000 lb.; La Rose 336,890; McKinley-Darragh, 61,560; Nova Scotia, 360,000; Nipissing, 85,262; O'Brien, 63,840; Trethewey, 60,000; total 1,087,552 pounds.

Badger—A new plant is being installed comprising two 100-h.p. boilers and a 10-drill compressor, with dynamo for electric lighting, hoists, etc., which will be in operation about the middle of February, when development will be undertaken on a large scale. The main shaft is down 223

ft. with about 300 ft. of drifting on the 100- and 200-ft. levels, on a vein yielding high-grade ore. No. 5 shaft is down 160 ft. with 150 ft. of drifting at the 150-ft. level, on a vein which so far is low in silver. It will be tested at depth by a diamond drill.

Columbus—The main shaft is down 250 ft., where a station is being cut, and development will be carried on extensively at this level. A crosscut will be run to cut No. 2 vein lying about 68 ft. east, and at this point diamond drilling will be undertaken to cut a big vein at a depth of 300 feet.

Foster—Drifting is being done on a vein running under Glen lake, which is between 2 and 3 in. wide and is yielding good ore.

La Rose—A body of high-grade ore has been added to the reserves of this company. So far nearly all the ore shipped has been taken from or above the 110-ft. level. A good deal of development work has been accomplished at the 200-ft. level, but little ore has been taken out. In running a winze to connect the two levels recently the main vein was encountered showing an average width of 11 in. and carrying about 4000 oz. to the ton. This increases the depth of the ore reserves by 90 feet.

Trethewey—The report for the annual shareholders' meeting to be held Jan. 27, covering the period of 16 months ending Dec. 30 shows a total revenue of $357,970, with an expenditure of $147,446, leaving profits of $210,524. Of this amount dividends at 15 per cent., or $141,817, have been paid, leaving a balance of $68,706 at the credit of the revenue account. This with the balance carried forward from the previous year gives a balance of $113,108.

ONTARIO—MONTREAL RIVER DISTRICT

Otisse-Carrie—This is the first of the Montreal River mines to make shipments of ore. It is now hauling high-grade ore to Charlton where an ore and freight shed is being built for the company beside the railway track. A carload will shortly be sent to the smelter.

Mexico

CHIHUAHUA

Palmilla—This mine in the Parral camp, operated under bond and lease by Shepherd & McQuatters, is now producing at the rate of about 35 tons daily. Excellent progress is made in the driving of the transportation-drainage tunnel.

La Reina de Plata—Another pocket of high-grade lead-silver ore was lately opened up at this Santa Eulalia mine, of which Capt Lindsay Brown is manager; 30-oz. silver ore is shipped.

Greene Concession—While no official announcement has been posted regarding the termination of the immense mineral rights to lands in Chihuahua and Sonora, and in spite of the fact that the Minister de Fomento has recently refused to grant locations made within the tract, it is nevertheless believed that neither Col. W. C. Greene nor his authorized representatives have taken the required steps toward the postponement of the expiration date, Jan. 12. It is likely that definite announcement of some sort will shortly come from government officials at Mexico City. Recent reports are to the effect that W. C. Greene's mineral concession, embracing large areas in the districts of Guerrero and Rayon of this State and in the Sahurita district of Sonora, expired on Jan. 12. In any event it is not known that either Colonel Greene or his representatives have made any decided move toward its extension. If this is correct it is probable that many denouncements will be shortly recorded and that work will begin immediately in a number of places.

Batopilas—A recent shipment of bullion from this old mine consisted of 199 bars valued at 102,000 pesos.

Ronceesvalles—E. F. Armstrong and London associates have lately resumed developments at the Pinos Altos property.

Parral Output—The Parral camp produced for the week ending Jan. 14 a total of 8820 tons, of which 5840 tons were locally milled and the balance sent to out-of-the-district smelters.

Rio Tinto Copper Company—This company started up its new 300-ton copper smeltery at Terrazas on Jan. 15. The company's mines furnish the bulk of the ores, but some custom tonnage is received.

Fortuna—This property in the Calabacillas gold section accessible from the Mexican Central railway, is under bond to G. B. Jacobs and associates, who are doing development work.

Chihuahua Copper Mining Company—This company operating in the Chorreros mountains east of Chihuahua has temporarily suspended milling operations on account of water difficulties in the mine. The manager, Ross D. McCausland, is now in the United States for the purpose of purchasing more power and pumping machinery.

Los Angeles—This property in the Minas de Oro section of the Guadalupe y Calvo district is being operated by Stallforth Brothers, of Parral. The mill is running on a good grade of ore.

Santa Rosalia Smelter—The long-built smelting plant of the Encinallas company was blown in about a month ago, and is reported in satisfactory commission. Custom ores are received, although the company is operating several mines of its own which supply a large tonnage. J. L. Saint-Dizier is the general manager.

COAHUILA

Torreon Smelting Works—Reports from Boston state positively that this plant has been bought by the new International Smelting Company, the recently formed competitor of the American Smelting and Refining Company.

DURANGO

La Libertad—It is reported that this old mine in the San Diego district is to be reopened. The mine is opened by an adit more than 1000 ft. long. The ore will be shipped to Torreon.

GUANAJUATO

Shipments—The value of the ore and bullion shipped from the Guanajuato district during the week ending Jan. 18 amounted to $254,800. Of this total bullion sent chiefly to Mexico with a small amount to New York made up $167,500, the remainder being ores and concentrates.

San Cayetano—The work of unwatering the old workings is progressing rapidly. The drift is now near the point where the several million tons of water will be tapped. The work will also drain two other mines.

Mariquita—This silver mine in the Zacualpan district, which has been closed for the last few months, is to resume operations with two shifts.

MICHOACAN

Dos Estrellas—This company has declared a dividend of $1 per share, representing a disbursement of $300,000.

SONORA

Greene-Cananea—According to a preliminary report, Dec. 31, 1908, the production in 1908 was 19,128,000 lb copper; average price 13.745c.; gross receipts, $2,622,143; estimated cost, 10½c. per lb. In addition to the copper there was produced 449,246 oz. silver, and 3046 oz. gold. The Capote mine is yielding 250 to 300 tons of ore per day; the Oversight, 800 tons. Since the smelter resumed operations in July, the copper recovery has been 47 to 50 lb. per ton of ore.

New Caledonia

Exports of minerals from New Caledonia for October and the 10 months ended Oct. 31 are reported by the *Bulletin du Commerce*, of Noumea, as follows, in metric tons:

	October.	Ten Mos.
Nickel ore	12,680	109,299
Cobalt ore	263	3,286
Copper ore	.....	10
Iron ore	11	44
Chrome ore	3,052	40,227

Exports of metals for the 10 months included 5 tons of lead and 5150 kg. silver.

The boring for petroleum at Anse-Vata, near Mount Ouen-Toro, has reached a depth of 125 meters. At this depth there are strong indications of the existence of oil.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Jan. 27—The coal trade in the West has been rather disappointing. In steam coal, progress is still exceedingly slow, and from some consuming centers a falling off is reported this week instead of an advance. The weather over the greater part of the West continues mild and the demand for domestic coal has been comparatively light. The coal operators are attributing the slow trade in steam coals to all sorts of causes, but no two of them agree except in the fact that business is dull. Most mines are running on short time. Prices at the principal markets have not suffered as much as might be expected, since shipments have been kept down, and at Chicago, Cleveland and other leading points there is very little demurrage coal forced for sale.

The Seaboard bituminous trade is quiet and sales are reported light. Business in the interior cities in the East is rather better than on the Seaboard, but there is not much to boast about.

Anthracite trade is dull and shipments from the mines to consumers are slow. A good deal of coal is still being stored to provide against contingencies.

It is understood that at a recent meeting of representatives of the larger coal companies in the Pittsburg district, it was decided to appeal to the Interstate Commerce Commission with regard to the rates on coal to Lake Erie ports. It is claimed that, the relative distances being considered, the present rates discriminate against Pittsburg shipments and in favor of West Virginia and Ohio coals.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Jan. 18, 1908, and Jan. 16, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	247,484	182,974	D. 64,610
Bituminous	1,704,452	1,462,326	D. 242,126
Coke	325,385	441,833	I. 116,448
Total	2,277,321	2,087,133	D. 190,188

Average daily tonnage, 126,518 in 1908, and 130,446 in 1909; increase, 3928 tons.

The anthracite-coal shipments, by regions, or districts, for the full year were, in long tons:

	1907.		1908.	
	Tons.	Per Ct.	Tons.	Per Ct.
Schuylkill	20,141,288	30.0	18,006,468	27.9
Lehigh	8,329,959	12.4	7,786,265	12.0
Wyoming	38,638,146	67.6	38,872,201	60.1
Total	67,109,393	100.0	64,665,014	100.0

Allowing the usual percentage for coal used and sold at mines, the production of anthracite in 1908 was approximately 73,720,000 long tons, equivalent to 82,566,400 short tons.

Coal report of Monongahela River Consolidated Company, fiscal year ended Oct. 31:

	1907.	1908.	Changes.
Pittsburg district	7,321,961	5,985,486	D. 1,336,475
Kentucky	132,196	110,624	D. 21,572
Total mined	7,454,157	6,096,110	D. 1,358,047
Coal sold	8,339,114	6,044,307	D. 2,294,807

Decrease in coal mined, 18.2 per cent.; in coal sold and delivered, 27.5 per cent.

Coal receipts at Boston, year ended Dec. 31, reported by Chamber of Commerce:

	1907.	1908.	Changes.
Anthracite	2,053,328	1,776,401	D. 276,927
Bituminous	3,184,964	3,302,929	I. 117,965
Total domestic	5,238,292	5,079,330	D. 158,962
Foreign	545,652	370,709	D. 174,943
Total	5,783,944	5,450,039	D. 333,905

The foreign coal reported is chiefly from Nova Scotia, though some comes from Great Britain.

Coal passed through the locks on the Monongahela river above Pittsburg for the year was 10,743,317 short tons in 1907, and 8,563,909 in 1908: a decrease of 2,179,408 tons, or 20.3 per cent. The decrease was largely due to the long period of low water, which prevented shipments of coal down the Ohio.

New York

Anthracite

Jan. 27—The hard-coal market continues quiet. It is still mainly a weather market, with all sizes in good supply. Several of the large companies are running only part time this week, some of them three and some four days. From present appearances this will continue to be the rule for some time.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

Business in soft coal is very slack. What little is doing goes by fits and starts, orders coming in for a day or two and then being entirely absent for several days at a time. This applies to the far East, to the Sound and to New York harbor. At the same time there is no pressure to sell coal, as most of the companies are shipping only on orders and there is little stock at tidewater.

All-rail trade is a little better than the tidewater business. There is a general feeling that consumers' stocks must be extremely low and that pretty soon they will have to put in more coal.

In New York harbor good grades of steam coal can be bought at $2.40@2.50 and gas coal at $2.25 for run-of-mine. A little incident of the week has been a demand for gas slack, which is selling at 65@70c. at mine, or higher than run-of-mine. This is due to the fact that sales of screened coal have been small, and in consequence production of slack has been cut down until it is below the demand.

Cars are abundant but transportation is rather slow, coal taking nine or 10 days to come through.

In the Coastwise trade there is little doing. Vessel owners appear to have fixed a minimum at 75c. from Philadelphia to all points beyond Cape Cod, and no boats are offering below that price.

Birmingham

Jan. 25—Coal producers in this State report the trade quiet. There is, however, a heavier output at the mines than has been noted for some time in the past. The shipment of coal into the Louisiana market has been stopped, the receipt of a large tonnage of coal from Pennsylvania down the river there affecting this territory. Coke making is being held up to its top notch, there being a good demand on all sides. The accumulated stock is being kept up, and any improvement in iron making will be met easily.

Chicago

Jan. 25—Mild weather again over Chicago territory has weakened the demand for coal generally and especially for domestic supplies. The consequence has been considerable selling of Illinois lump at discounts of 10@25c. from the current market prices and a weakening of the market for anthracite, free coal becoming more in evidence and having a better chance of sales. Smokeless continues in large supply and high-grade smokeless has suffered from extensive advertising of a large purchase by a leading firm in city trade. The market is now closely responsive to weather conditions and will continue to be dull unless supplies are greatly restricted or much colder weather comes.

Illinois and Indiana coal brings $1.85@2.65 for lump and egg, $1.60@1.75 for run-of-mine, and $1.30@1.60 for screenings. Smokeless run-of-mine has brought in some cases 80@90c. at mines, or $2.85@2.95 Chicago, although Pocahontas and New River have sold up to $3.15. Hocking Valley has fallen off in sales with the mild weather and is sluggish at $3. Youghiogheny is quiet at $3.15 for ¾-in. gas and Pittsburg No. 8 is dull at $2.65@2.75. Anthracite has become in light demand again with the weather and shows little prospect of activity until freezing temperatures return.

Indianapolis

Jan. 26—The disturbing factors in business are still apparent, and the demand for steam coal is small. The operators, however, are not discouraged, but remain hopeful that disturbing factors will soon be settled.

There is a report that the Frick Coke Company will build ovens on a tract of 200 acres of land at Indiana harbor on lake Michigan, not far from the plant of the Indiana Steel Company at Gary.

Pittsburg

Jan. 26—The rivers were navigable all week and fully 6,000,000 bu. of coal were shipped to lower ports. A large proportion was loaded in coal boats which hold 25,000 bu. each and went to the New Orleans market. A number of empty coal boats and barges returned on the rise, and all the river mines are in full operation. Conditions in the rail trade are not so encouraging, and this week it is estimated less than 25 per cent. of the railroad mines are running. The large operators are adhering strictly to the old prices, based on $1.15 per ton for mine-run coal at mine; slack is held firmly at around 75c. Some small independent interests are cutting these prices, and it is possible to buy a limited tonnage on the basis of $1 per ton for mine-run coal.

Connellsville Coke—The coke trade continues in bad shape, and sales of prompt coke are still being made at low prices. The large producers, however, have entered into an agreement not to sell furnace coke at less than $1.75 for spot shipment and on contract at $1.90@2. This is a concession from the quotations made in December and indicates that many blast furnaces are still on the idle list. Conditions in foundry coke are better than in furnace, the lowest spot price named so far being $2.15 and on contract $2.25@2.40. The *Courier* gives the production in both regions at 262,440 tons. The shipments amounted to 9118 cars as follows: To the Pittsburg district, 3306; to points west of Pittsburg, 5155; to points east of Connellsville, 657 cars.

Foreign Coal Trade

British Coal Exports—Fuel exports from Great Britain, with coal sent abroad for use of steamships in foreign trade, year ended Dec. 31, long tons:

	1907.	1908.	Changes.
Coal	63,600,947	62,547,175	D. 1,053,772
Coke	981,418	1,193,036	I. 211,618
Briquets	1,480,893	1,440,438	D. 40,455
Total exports	66,063,258	65,180,649	D. 882,609
Steamer coal	18,618,828	19,474,174	I. 855,346
Total	84,682,086	84,654,823	D. 27,263

The larger exports in 1908 were 10,415,430 tons to France, 9,646,868 to Germany, 8,742,634 to Italy and 4,370,468 tons to Sweden.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Jan. 15: Best Welsh steam, $3.48; second, $3.36; thirds, $3.24; dry coals, $3.60; best Monmouthshire, $3.18; seconds, $3.06; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Jan. 27—The iron and steel trades remain quiet and generally in a waiting position. While the tariff discussion may have some effect, this condition of affairs seems to be due rather to uncertainty as to what extent consumers of finished material may be ready to absorb it for final use.

In pig iron the bulk of the business at consuming and distributing centers is still in small quantities. Foundry pig is moving to some extent, but apparently only as melters need it to fill orders already obtained. The busiest consumers of foundry iron seem to be the cast-iron pipe makers who are contracting more freely than any one else.

In finished material the outlook is about the same, except in plates and structural material. The New York Central has ordered 2000 steel cars and the Pennsylvania railroad is understood to be figuring on 3000. These orders will require a good deal of material. Quite a number of building contracts are being taken by the fabricating companies in the East and in Chicago. They are chiefly for buildings of moderate size but make up a considerable total. It is to be noted that nearly all of the material will be furnished by the independent companies which are cutting prices considerably. It is stated that the Steel Corporation is adhering strictly to its schedule rates, but the actual business placed is going at lower prices.

Rail orders are still light from the railroads. There is a considerable business doing in light rails which are, however, generally ordered in small quantities.

A condensed summary of the Steel Corporation report for the December quarter is given elsewhere.

Virginia Pig Iron Association—This association has been formed by owners of Virginia blast furnaces to confer with regard to sale and production of iron. The officers are: President, E. C. Means, Low Moor Iron Company, Low Moor, Va.; secretary, H. L. Haldeman, Pulaski Iron Company.

Baltimore

Jan. 25—Exports for the week included 475,054 lb. tin scrap to Rotterdam; 87,835 lb. spelter and 2,455,800 lb. steel billets to Liverpool.

Birmingham

Jan. 25—Quiet but firm is the way the Southern pig-iron manufacturers put it when asked as to the condition of the market. The sales are about equal to the make and the furnaces in blast are holding up the pace that was set some time back. There appears to be no apprehension in this section, and conditions are being accepted. There is complaint at the agitation on a change in the tariff on iron and steel, the manufacturers in this section being of the opinion that any reduction would play havoc with this district more than elsewhere.

The quotations for Southern pig iron continue on a $13 per ton, No. 2 foundry basis. The make in this territory can be increased just when needed. All demands for iron can be met right along. The sale of the 20,000 tons of iron, delivery during the first half of the year, by the Sloss-Sheffield Steel and Iron Company to one of the leading cast-iron pipe concerns is confirmed. The reported sale of the Dimmick cast-iron pipe plant in this district to the Alabama Consolidated Coal and Iron Company has not yet been consummated. The negotiations have been on for some time. The steel plant at Ensley is in full operation in every department and there is a steady production.

Chicago

Jan. 25—The iron market continues quiet, although inquiries for pig iron are increasing. Present requirements of melters continue small and there is no disposition to venture much into the future. Purchases run from a carload to 500 tons, with an occasional lot up to 1000 tons. For future delivery inquiries range small, few exceeding 1000 tons. Sales now are confined to the needs of the next three months almost entirely.

Prices hold firm on such business as is being done, at $13 Birmingham ($17.35 Chicago) for Southern No. 2 and $17.50 for Northern No. 2. Any considerable transaction would doubtless obtain lower prices. Production of Northern iron is held down closely to prospective requirements, and this seems likely to assure stability of Northern prices locally.

Sales of iron and steel products are not

large, but the market seems firm. In railroad supplies there is a little life, but signs do not point to any heavy business. Coke is selling well, but Connellsville is a trifle lower in price, owing to large shipments, being now $4.75@4.90 Chicago.

Philadelphia

Jan. 27—Consumers of pig iron are exhibiting more indifference to iron than for months. Certain rumors have reached this market concerning possible reductions which may make it worth while for buyers to hold off. One or two well known brands are selling—or rather are offered—at 50c. less than heretofore, but other makers have not followed suit. That crude iron will yet find a lower level is an opinion which prevails among large buyers. There is no buying movement in sight, notwithstanding large consumers are close to the end of their stock. Material for pipe iron was again shaded by two or three Virginia furnaces. Local sales are devoid of significance. Second quarter necessities will be covered very cautiously. Four or five middle and eastern Pennsylvania furnaces are to be put in blast before spring, and canvassing for business is now in progress.

Steel Billets—An average consumption of steel billets is kept up in this territory, and there has been no known departure from December quotations.

Structural Material—The local mills are not increasing output. The Steelton mills are turning out a little more material than in December. Local requirements are unimportant.

Scrap—Scrap dealers are quietly preparing for a large spring demand for heavy steel, railroad and one or two other kinds. They are now buying stock on most advantageous terms.

Pittsburg

Jan. 26—Conditions in the iron and steel trade are more discouraging than at any time since the close of last year. A decided falling off in orders is noted by the large interests with a few exceptions. The large interests refuse to make any concessions in prices and are waiting for a good spring demand. The railroads are not coming into the market for their rail requirements as early as anticipated but the Carnegie Steel Company continues to take on small tonnages for both standard sections and for light rails. The New York Central lines will take 80,000 tons of rails and the Carnegie company will roll a large proportion of this order. It also will be given the order for the Pittsburg & Lake Erie road which will amount to about 10,000 tons. It is understood these contracts will be definitely placed this week. The Baltimore & Ohio Railroad likely will come into the market in a few days for about 100,000 tons, most of which will go to the Carnegie company. The wire trade is dull at present. The American Steel and Wire Company is operating all of its plants in the Pittsburg district at almost 80 per cent. capacity, except the Donora works which are on half time.

Pig Iron—The pig-iron market is in worse shape than it has been for probably a year. What little business is being offerred is at extremely low prices. These sales cannot, however, be regarded as the market as some of them were under special conditions and others were of resale iron. Comment was made on the fact that a large casting company bought 100 tons of standard bessemer for prompt delivery at $16, Valley furnace, and this price was duplicated by another concern yesterday for a 75-ton lot. A large engineering concern last week bought 300 tons of No. 2 foundry at $15, at furnace. Both of these prices are 50c. a ton under what has been considered the minimum market price. Furnaces in the Valleys continue to store iron and one furnace is said to have a stock of fully 80,000 tons. The Jones & Laughlin Steel Company is operating all of its blast furnaces, although its steel plants are running at less than 50 per cent. of capacity. This company is said to have over 200,000 tons of pig iron on its yards Pig-iron quotations for prompt and first-quarter delivery are as follows: Standard bessemer, $16.50; malleable bessemer, $15.75; basic, $15.50; No. 2 foundry, $15.50; gray forge, $14.50, all f.o.b. Valley furnaces. These prices, however, may be shaded.

Steel—There is no new business of any consequence in crude steel and stocks are accumulating. The price remains at $25, Pittsburg, for both open-hearth and bessemer billets with freight divided. Plates are being shaded by about $2 a ton but the regular price remains at 1.60c. Merchant-steel bars are still quoted at 1.40 cents.

Sheets—The sheet market is fairly good as to tonnage, but much of the new business taken is at from $1@2 per ton under the regular quotations which are 2.50c. for black sheets and 3.55c. for galvanized No. 28 gage.

Ferro-Manganese—No new business; prices continue at $46@46.50, Pittsburg.

Foreign Iron Trade

Belgian Iron Production—Pig iron made in Belgium in the 10 months ended Oct. 31 was 1,185,270 metric tons in 1907, and 985,570 in 1908; a decrease of 199,700 tons, or 16.9 per cent.

Iron and Steel in Italy—Official returns give the production of iron ore in Italy, chiefly from Elba, at 518,000 tons in 1907. In that year there were eight blast furnaces in operation, which made 112,000 tons of pig iron. A large quantity of pig is imported for conversion into steel. The wrought iron made was 248,000 tons, and the steel ingots 347,000 tons. The steel was made in two converters and 42 open-hearth furnaces.

British Iron Trade—Values of exports and imports in Great Britain, 12 months ended Dec. 31, as given by Board of Trade returns:

	Exports.	Imports.	Excess.
Iron and steel	£37,328,413	£ 7,679,655	Ex. £29,648,758
Machinery...	31,018,912	4,556,762	Ex. 26,462,150
New ships....	10,566,990	.....	Ex. 10,566,990
Total.....	£78,914,315	£12,236,417	Ex. £66,677,889
Total, 1907..	88,324,752	12 528,858	Ex. 75,795,894

Decrease in exports in 1908 was £9,410,437, or 10.6 per cent.; decrease in imports, £292,441, or 2.3 per cent. The quantities of iron and steel were, in long tons:

	1907.	1908.	Changes.
Exports.....	5,152,227	4,100,976	D.1,051,251
Imports.....	935,472	1,119,024	I. 183,552

The imports in 1908 were largely of blooms, billets and other half-finished material.

Metal Market

New York, Jan. 27—The metal markets have continued quiet during the week, with few changes but some important developments in copper and spelter.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1908..	$ 7,358,707	$ 5,122,538	Exp. $2,235,169
" 1907..	1,004,441	44,448,515	Imp. 43,444,074
Year 1908..	71,215,456	50,246,099	Exp. 30,969,357
" 1907..	55,215,681	143,398,072	Imp. 88,182,391
Silver:			
Dec. 1908..	4,726,289	4,382,290	Exp. 343,999
" 1907..	4,413,698	4,222,036	" 191,662
Year 1908..	51,837,671	42,196,966	" 9,640,705
" 1907..	61,625,866	45,912,360	" 15,713,506

Exports from the port of New York, week ended Jan. 23: Gold, $763,125, principally to Buenos Aires; silver, $974,780, chiefly to London. Imports: $120,689, from the West Indies, South America and Australia; silver, $68,104, from Mexico and Central America.

Gold and silver movement in France, 11 months ended Nov. 30:

	Imports.	Exports.	Excess.
Gold....	Fr.885,968,000	F.22,464,000	Imp.Fr.863,504,000
1907...	416,334,000	142,458,000	Imp. 273,876,000
Silver..	156,509,000	160,465,000	Exp. 3,956,000
1907...	161,723,000	191,436,000	Exp. 29,713,000

Imports of copper and nickel coins, 95,000 fr. in 1907, and 68,000 fr. in 1908; exports, 681,000 fr. and 731,000 fr., respectively.

Coinage of the Royal Mint of Great Britain for the full year:

	Imperial.	Colonial.	Total.
Gold.....	15,725,998	.....	15,725,998
Silver.....	23,804,187	9,510,829	33,315,016
Bronze.....	52,391,808	99,000	52,490,808
Nickel.....	.....	12,817,152	12,817,152
Aluminum	.....	12,134,068	12,134,068
Total....	91,921,993	34,561,049	126,483,042
Total, 1907.....	128,606,058	31,872,134	160,478,192

The total value of gold coined in 1908 was £14,600,000; light and defective coins

withdrawn, £3,300,000; leaving £11,300,000 net increase of coinage.

Gold and silver movement in Great Britain, year ended Dec. 31:

	Imports.	Exports.	Excess.
Gold	£46,145,314	£49,969,099	Exp. £3,823,785
Gold, 1907	57,088,547	50,866,009	Imp. 6,222,538
Silver	16,326,889	13,263,888	Exp. 2,956,999
Silver, 1907	16,983,892	16,920,849	Exp. 936,957

Of the silver imported in 1908 a total value of £8,305,976 is credited to the United States. In 1908 the gold exports exceeded the imports, a very unusual condition.

Gold—The price of gold in the open market in London is lower this week, bars being quoted at 77s. 9¼d. and American eagles at 76s. 4¼d. per ounce. The Bank of France has stopped taking gold for the present, and nearly all the gold arriving from South Africa and Australia this week was taken by the Bank of England. There have been no further exports from New York to Argentina on London account.

Platinum—The market continues quiet, dealers reporting prices unchanged at $23.50@24.50 per ounce for refined platinum; $26.50 for hard and $19@21 for scrap. The market is rather easy.

Our St. Petersburg correspondent writes under date of Jan. 14, that a little depression is to be noted in the market at Ekaterinburg; the small miners and brokers there are offering crude platinum—83 per cent. pure metal—at 5 rubles per zolotnik, equal to about $18.80 per ounce. In St. Petersburg the market was dull on account of the holidays, but some small sales of crude metal were made at 20,500 rubles per pood, equal to about $20.50 per ounce.

Silver—The silver market has fluctuated this week between 23 11/16 and 24⅛d., being influenced by speculative operations in India and China. The market closed steady at 51¾c. in New York.

SILVER AND STERLING EXCHANGE

Jan.	21	22	23	25	26	27
New York	51¾	51½	51⅛	52	52⅜	51¾
London	23 11/16	23¾	23¾	23 15/16	24⅛	23 15/16
Sterling Ex.	4.8730	4.8740	4.8730	4.8730	4.8740	4.8740

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Jan. 14, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India	£ 265,000	£ 100,710	D. £ 164,290
China	91,000	.....	D. 91,000
Straits	.....	.....	.....
Total	£ 356,000	£ 100,710	D. £ 255,290

Receipts for the week: £3500 from Mexico, £7000 from the West Indies and £100,500 from New York; total, £171,000. Exports, £40,000 to India.

Copper, Tin, Lead and Zinc

Jan.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
21	14 @14¼	13½ @13¾	59⅛	27¾	4.15 @4.20	5.10 @5.15	4.95 @5.00
22	14 @14¼	13½ @13¾	59⅞	27⅞	4.15 @4.20	5.10 @5.15	4.95 @5.00
23	14 @14¼	13½ @13¾	....	27⅞	4.15 @4.20	5.10 @5.15	4.95 @5.00
25	14 @14¼	13½ @13¾	59⅝	27⅞	4.15 @4.17½	5.10 @5.15	4.95 @5.00
26	14 @14¼	13½ @13⅝	59⅝	27¾	4.15 @4.17½	5.07½ @5.12½	4.92½ @4.97½
27	14 @14¼	13½ @13⅝	59⅛	27¾	4.15 @4.17½	5.07½ @5.12½	4.92½ @4.97½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The London market, which, in a measure, has been the key to the situation, has again declined, inducing sellers to make further concessions, which early in the week resulted in a fairly active business, at least insofar as electrolytic is concerned. The supply of Lake that is offered being so much less than electrolytic, buyers of it have had to meet the demands of the sellers. This accounts for the increased disparity between the prices for the two grades. Both in Lake and electrolytic the business has been done chiefly for domestic account, European buyers having been conspicuous by their absence. This is, of course, to be explained by the continuance of the price for Standard in London below the New York parity. European manufacturers have, therefore, been able to supply their requirements by buying copper out of warehouse in London, which they can do at a lower price than for shipment from this side. As we have previously pointed out, it would be possible here to re-import American cathodes, but that has not been done and probably will not be attempted. However, the sale from warehouse abroad comes practically to the same thing, inasmuch as depletion of stock there is offset by a corresponding increase here. Since Jan. 25 the activity in this market, above noted, has subsided, due to rumors, which have found wide publication, of the contemplation of a sweeping cut in the price of electrolytic copper. The market closes weak at 14@14¼c. for Lake copper; 13½@13¾c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 13¼@13½ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb., base. Copper wire, 15¾c. base, carload lots at mill.

The Standard market has declined about £1 during the week. Though the close is at the lowest, a little more steadiness is shown, the quotations being cabled at £59 5s. for spot, £60 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@76.

Exports from New York and Philadelphia for the week are reported at 4787 long tons copper. Our special correspondent gives the exports from Baltimore at £1468 long tons.

Tin—There was no special feature to the London market, which ruled fairly steady throughout the week, the transactions in both spot and futures being of small proportions. The close is cabled at £125 15s. for spot, £127 10s. for three months.

The domestic market still suffers from an entire lack of interest on the part of both consumers and dealers. The latter anticipate a lower market on account of the unfavorable statistical position of the metal, and are willing to wait for a decline before again taking an active interest in the metal. Tin can be purchased at the close at about 27⅝ cents.

The Goldschmidt Detinning Company has been organized in New York with $3,000,000 capital, to recover tin from scrap by the chlorine process devised by Dr. Karl Goldschmidt. This process is in successful use at Essen-Ruhr, Germany, and Lyons, France. The president of the new company is William T. Graham, who is also president of the American Can Company. It is understood that the Goldschmidt company has contracted to take all the American Can scrap.

Lead—Business is of small volume and the quantities put on the market by Western sellers can only be disposed of with difficulty. The market closes weak at 4.15@4.17½c., New York.

The London market is unchanged at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—Consumers appear to be well supplied for the time being, and though the quantities offered are not large, there is no ready market, and sales can only be effected by offering concessions. The market closes lower at 4.92½@4.97½c., St. Louis, 5.07½@5.12½c., New York.

The London market is firmer and quotations close higher at £21 12s. 6d. for good ordinaries, £21 17s. 6d. for specials.

It was reported on Jan. 25 that the American Zinc, Lead and Smelting Company has decided to close down 50 per cent. of its smelting capacity, both at Caney and at Deering. This will make a curtailment of 20,000 tons of spelter per annum and will reduce this company's shipment of ore from the Joplin district by about 850 tons per week. This action is inspired by the high price for zinc ore and the relatively low price for spelter.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent

Other Metals

Antimony—The market has been dull during the week, with few sales. Quotations are unchanged, 8⅛@8¼c. being asked for Cookson's, 8@8⅛c. for Hallett's, and 7½@7⅝c. for ordinary brands.

Aluminum—There has been no change during the week. The Aluminum Company of America still quotes 24c. per lb. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is offered at 21½@22c. for ingots.

Quicksilver—New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco prices are $45@46 for domestic orders, and $43@44 for export. The London quotation is £8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers. Business is quiet.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 23—The highest price paid for zinc ore this week was $43.50; the base price was $42 to $43 per ton of 60 per cent. zinc. For 80 per cent. lead ore $50 per ton was paid.

SHIPMENTS, WEEK ENDED JAN. 23

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Highland	241,800	.....	.....
Cuba City	232,050	.....	.....
Strawbridge	204,160	.....	.....
Platteville	203,080	.....	219,500
Days Siding	172,000	.....	.....
Hazel Green	108,400	.....	.....
Galena	80,000	.....	.....
Livingston	80,000	.....	.....
Rewey	56,650	.....	.....
Total	1,437,140	.....	219,500
Year to Jan. 23	8,315,616	60,000	772,400

Highland, Linden and Mineral Point are not reported. Hazel Green shipped last week, not then reported, 405,480 lb zinc ore.

In addition to the above there was shipped this week to the American Zinc Ore Separating Company, formerly known as the Platteville Separating Company, 258,360 lb., and to the Joplin Separator Works 149,000 lb. zinc ore

The district will suffer a loss in tonnage shipment by the indefinite closing of a number of producers at Highland and Benton, including properties which kept producing all through the panic; such losses, however, will be partially overcome by increased shipments from Platteville, Rewey, Harker and Cuba City.

Joplin, Mo. Jan. 23—The highest price reported paid was $44, the base price ranging from $40 to $43 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $20@22.50, the highest being $36.50 per ton. The average price, all grades, was $38.68. The highest price reported paid for lead was $54, medium grades bringing $52 to $53, and all grades averaging $53 per ton.

The market opened early in the week with a few bins selling on $43 and $42.50 base, lowering as the week progressed to a $42 base, and at the week-end $40 base was the best offering. It seems to indicate that the market weakened more than will be sustained at the opening prices next week, yet the output was exceptionally heavy and this may reflect a greater weakness. The weather, following the heavy snow and blizzard of the previous week, was ideal for mining operations.

SHIPMENTS, WEEK ENDED JAN. 23

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,889,560	884,810	$81,238
Joplin	1,962,730	269,240	48,531
Oronogo	1,092,520	27,620	23,641
Galena	910,030	58,670	19,756
Prosperity	338,550	266,950	13,845
Spurgeon	591,620	105,070	12,196
Miami	512,060	133,740	11,735
Alba-Neck	573,320	.....	11,466
Duenweg	575,760	28,200	11,035
Granby	438,200	9,500	6,276
Carthage	215,850	.....	4,317
Badger	202,870	4,200	4,166
Sarcoxie	208,680	.....	2,965
Aurora	144,870	9,870	2,648
Zincite	89,100	1,000	1,808
Cave Springs	61,530	.....	1,230
Quapaw-Baxter	30,960	14,450	932
Totals	10,838,220	1,813,320	$257,785
Four weeks	39,958,060	5,064,840	$905,890
Zinc value, the week, $209,687; 4 weeks,			$775,305
Lead value, the week, 48,098; 4 weeks,			130,585

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1907.	Zinc Ore. Base Price. 1908.	Zinc Ore. All Ores. 1907.	Zinc Ore. All Ores. 1908.	Lead Ore. All Ores. 1907.	Lead Ore. All Ores. 1908.
January	$45.90	$37.60	$45.84	$35.56	$83.58	$46.88
February	48.30	36.63	47.11	34.92	84.68	49.72
March	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	58.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60.34
September	41.00	37.63	40.11	34.44	53.52	54.59
October	41.75	35.95	39.83	33.28	51.40	52.63
November	38.60	39.13	35.19	35.02	43.40	54.53
December	31.50	42.75	30.87	39.63	37.71	49.68
Year	$44.36	$36.63	$43.68	$34.31	$68.90	$53.93

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Jan. 27—The market as a whole has shown no unusual signs of activity. Many dealers view the situation as tame and uninteresting, and buyers do not seem ready yet to do business beyond their immediate needs

Copper Sulphate—Demand is fair and no shading is reported, there being little outside stuff on the market. Quotations are steady at $4.75 per 100 lb. for carload lots and up to $5 per 100 lb. for smaller parcels.

Arsenic—The market is dull, only a few small sales of Canadian product being reported. Quotations are 3@3⅛c. per lb for white arsenic.

Nitrate of Soda—Comparatively little is doing in this article. Current quotations are 2.17½c. for spot and 2.15c. for futures, which are a shade higher.

Mining Stocks

New York, Jan. 27—At the beginning of the week the general markets were inclined to be weak, and there was some drop in quotations; Amalgamated Copper, for instance, falling off several points. The dividend of $3 on Boston & Montana, declared last week, was an indication that there would be no change in the profit division of the Amalgamated, and that company declared the quarterly dividend of 50c. per share, which has been the rule for some time. During the last three days of the week the market was rather dull, but developed considerable firmness, and there was very little change in prices.

On the Curb the coppers followed very much the course of Amalgamated. Cumberland-Ely and Ohio were the leaders in a slight drop on Thursday and Friday, but after that most of the shares remained steady on moderate trading. Fluctuations were small. The Nevada gold stocks received considerable attention during the week, and generally held up well. Cobalt stocks were rather quiet and closed with a softer tendency.

Boston, Jan. 26—There is no rush to trade, and the market for mining shares continues uninteresting. Prices show slight losses for the week in the main, but the changes are unimportant. Outside of a few stocks the market has been extremely narrow. There has been little selling pressure. The declaration of the usual 50c. dividend by the Amalgamated company is what was expected. The stock has varied from $77.87½ to $79.50, closing fractionally below a week ago at $78.50. North Butte has been weak and records a decline of over $2. The regular $1 quarterly dividend is expected to be declared.

Conferences have been held between the Calumet & Hecla and Osceola officials but nothing has come in the matter of a compromise. The closing down of the Arizona mines on account of labor troubles caused weakness in these stocks.

Keweenaw Copper has been taken from the Curb and put on the unlisted department of the Stock Exchange. It did not improve the price of the stock, which is off to $4.50.

First National Copper performed stunts on the Curb, advancing to $0.75, with reaction to $7.62½ today. Ahmeek made a new high record at $160, but there are only 50,000 shares. Raven Mining stockholders are given the privilege of subscribing for new shares at $1 in the proportion of one new for 10 owned. The stock was under 90c. today.

San Francisco, Jan. 22—In the mining-share market in this city, for the first time in years, stocks of the newer Nevada mining districts have been neglected in favor of the old Comstocks. Not only is Eastern capital behind the Comstocks but the local support is better than it has been for years. The control of the Crown Point, Yellow Jacket, Belcher and other mines has changed hands and people have more confidence in the new men than in the old. Expenses have been materially reduced and the work accomplished in the past two years is being recognized.

The active listed oil companies of the California Oil and Stock Exchange paid in December, $615,109 in dividends, which is supposed to be about half what the oil companies of the entire State paid. The total dividends paid by these oil companies to date has been $18,008,882 which is a record to be proud of. Thirty-five of them paid dividends in December last. The petroleum interests of the State are gradually enlarging in importance and have already overshadowed those of the gold miners.

STOCK QUOTATIONS

NEW YORK Jan. 26	
Name of Comp.	Clg.
Alaska Mine	⅜
Amalgamated	78⅞
Anaconda	47
Balaklala	12 1/16
British Col. Cop.	8
Buffalo Mines	3½
Butte Coalition	23⅞
Colonial Silver	⅛
Cum. Ely Mining	8¾
Davis Daly	21 1/16
Dominion Cop.	⅝
Douglas Copper	2⅛
El Rayo	3½
Florence	4 1/16
Foster Cobalt	.56
Furnace Creek	.11
Giroux	8⅝
Gold Hill	⅞
Goldfield Con	7 1/16
Granby	103½
Greene Gold	¼
Greene G. & S.	7
Greenw'r & D. Val.	‡.75
Guanajuato	2
Gugger. Exp.	180
Hanapah	.16
McKinley Dar.	.98
Miami Copper	13½
Micmac	1⅞
Mines Co. of Am.	⅞
Mitchell Mining	1⅛
Mont. Sho. C.	‡1
Nev. Utah M. & S.	3⅞
Newhouse M. & S.	6¼
Nipissing Mines	10¼
Old Hundred	1 1/16
Silver Queen	.97
Stewart	⅞
Tennessee Cop'r.	46
Tri-Bullion	1/16
Union Copper	⅛
Utah Apex	6 1/16
Utah Copper	44
Yukon Gold	4 1/16

BOSTON Jan. 26	
Name of Comp.	Clg.
Adventure	8¼
Allouez	35¼
Amalg. Zinc	24⅝
Arcadian	13
Arizona Com	36
Atlantic	15½
Boston Con	14⅞
Calumet & Ariz.	110
Calumet & Hecla	645
Centennial	30
Con. Mercur	.31
Copper Range	76¾
Daly-West	10⅝
East Butte	7⅞
Franklin	16
Greene-Can	11⅛
Isle Royal	24¼
La Salle	14⅛
Msus	15½
Michigan	12
Mohawk	64
Nevada	18½
North Butte	78
Old Colony	‡.60
Old Dominion	62
Osceola	130
Parrot	28½
Quincy	91
Rhode Island	5
Santa Fe	2¼
Shannon	16
Superior	36½
Superior & Pitts.	15⅞
Tamarack	78
Trinity	15½
United Cop., com.	‡14
U. S. Oil	29¼
U. S. Smg. & Ref.	43
U.S. Smg. & Ref., pd.	45
Utah Con	43¾
Victoria	4⅝
Winona	5⅞
Wolverine	150
Wyandotte	3

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL		
Am. Agri. Chem.	39⅝	
Am. Smelt. & Ref.	86	
Am. Sm. & Ref. pf.	102½	
Colo. Fuel & Iron	41½	
Federal M. & S., pf.	‡84	
National Lead	80½	
National Lead, pf.	107½	
Pittsburg Coal	11⅞	
Republic I. & S.	25⅞	
Republic I. & S., pf.	386¼	
Sloss-Sheffield	78½	
Standard Oil	650	
U. S. Steel	54	
U. S. Steel, pf.	114⅛	
Va. Car. Chem.	47¾	

BOSTON CURB	
Ahmeek	160
Black Mt.	2⅞
Chemung	19
Globe Con	5
Hancock	11¼
Helvetia	4
Keweenaw	14¾
North Lake	17⅞
Ojibway	13¾
Superior & Bost.	13½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Jan. 23		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	2.00	1.50
Cent. C. & C.	68.00	67.00
C.C. & C. pd.	82.00	81.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	21.00	19.00
Doe Run	120.00	110.00
Gra. Bimet.	.25	.20
St. Joe	14.00	12.00

LONDON Jan. 27			
Name of Com.	Clg.		
Dolores	£1	10a	0d
Stratton'sInd.	0	3	3
Camp Bird	0	16	0
Esperanza	3	3	0
Tomboy	0	18	9
El Oro	1	2	6
Oroville	0	11	0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Jan. 27.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.	.10
Belcher	.48	St. Ives	.18
Best & Belcher	.65	Triangle	.03
Caledonia	.33	BULLFROG STOCKS	
Challar	.23	Gibraltar	.03
Comstock	.30	Homestake King.	.08
Con. Cal. & Va.	.86	Mont. Shoshone C	1.08
Crown Point	.62	Tramp Cons	.09
Exchequer	.48	MISCELLANEOUS	
Gould & Curry	.18	Bonnie Clare	.06
Hale & Norcross	.37	Lee Gold Grotto	...
Mexican	.94	Nevada Hills	1.50
Ophir	1.75	Nevada Smelting.	1.25
Overman	.38	Nevada Wonder	.35
Potosi	.33	Nevada-Utah	2.87½
Savage	.49	Penn-Wyoming	.08
Sierra Nevada	.35	Pittsburgh S. Pk.	.80
Union	.47	Rawhide Coal	.50
Utah	.09	Round Mt. Sphinx	.15
Yellow Jacket	.87		
TONOPAH STOCKS			
Belmont	.80		
Extension	.50		
Golden Anchor	.01		
Jim Butler	.16		
MacNamara	.32		
Midway	.24		
Montana	.70		
North Star	.03		
Tono'h Mine of N.	6.25		
West End Con	.92		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.15½		
Booth	.26		
Columbia Mt.	.17		
Comb. Frac	1.21		
Con. Red Top	.12½		
Cracker Jack	.04		
Dia'dfield B. B. C.	.09		
Goldfield Belmont	.06		
Goldfield Daisy	.68		
Great Bend	.19		
Jumbo Extension	.18		
Kendall	.08		
Lone Star	.06		
May Queen	.04		
N. Y. C. O. D.	.07		
Oro	.11		
Red Hill	.15		
Roanoke	...		
Sandstorm	.18		

COLO. SPRINGS Jan. 22	
Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con	13½
Dante	6¼
Doctor Jack Pot	18½
Elkton	72
El Paso	45¼
Findlay	15¾
Gold Dollar	9½
Gold Sovereign	3
Isabella	26½
Index	. .
Jennie Sample	5
Jerry Johnson	4¾
Mary McKinney	35½
Pharmacist	13¼
Portland	1.00
Un. Gold Mines	14⅛
Vindicator	80
Work	6½

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev.	Feb. 2	Feb. 23	$0.05
Andes, Nev.	Jan. 8	Feb. 2	0.10
Bullion, Nev.	Feb. 24	Mar. 18	0.05
Caledonia, Nev.	Jan. 8	Jan. 29	0.05
Challar, Nev.	Jan. 11	Feb. 3	0.10
Con. Imperial, Nev.	Jan. 11	Feb. 3	0.01
Federal-Ely, Utah	Jan. 9	Feb. 1	0.01
Gould & Curry, Nev.	Feb. 15	Mar. 9	0.10
Iowa, Utah	Jan. 5	Feb. 2	0.02
Lady Washington, Nev.	Feb. 19	Mar. 12	0.05
Overman, Nev.	Feb. 18	Mar. 11	0.10
Savage, Nev.	Jan. 6	Jan. 28	0.10
Sierra Nevada, Nev.	Feb. 12	Mar. 6	0.10
Wabash, Utah	Jan. 7	Jan. 30	0.10
Yellow Jacket, Nev.	Dec. 28	Feb. 3	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	69.419	56.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	62.795	30.471	24.877
June	67.090	53.663	30.893	24.760
July	68.144	53.116	31.366	24.514
August	68.745	51.683	31.637	23.858
September	67.792	51.720	31.313	23.877
October	62.435	51.431	28.863	23.725
November	68.677	49.647	27.154	22.933
December	54.565	48.769	25.362	22.493
Year	65.327	52.864	30.188	24.402

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.325	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	26.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58 331
May	24.048	12.598	25.072	12.788	102.376	57 387
June	21.665	12.675	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	58.509
September	15.665	13.388	16.047	13.600	68.376	60.338
October	13.169	13.354	13.551	13.646	60.717	60.139
November	13.391	14.130	13.870	14.386	61.226	63.417
December	13.163	14.111	13.393	14.411	59.113	62.943
Year	20.004	13.208	20.661	13.424	87.007	59.902

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.925	29.144
			Av. year	38.160	29.465

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.726	19.531	14.250
March	6.000	3.838	19.708	13.875
April	6.000	3.993	19.976	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.375
September	4.813	4.516	19.776	13.125
October	4.750	4.351	18.531	13.375
November	4.376	4.330	17.281	13.538
December	3.658	4.213	14.600	13.156
Year	6.325	4.200	19.034	13.439

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26 094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.643	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20.875
December	4.254	5.137	4.104	4.987	20.075	20.625
Year	5.962	4.726	6.812	4.578	23.771	20.163

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.	Authorized Capital	Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 5	$2,112,381	Jan. 1909	$ .40
Alaska Treadwell, g.	Al'ka	5,000,000	200,000	25	10,385,000	Jan. 1909	.75
Alaska United, g.	Al'ka	1,000,000	180,000	5	408,470	Jan. 1909	.25
Amalgamated, c,	Mont	166,000,000	1,538,879	100	69,249,554	Feb. 1909	.50
Am.Sm.&Ref.,com.	U. S.	50,000,000	500,000	100	15,500,000	Jan. 1909	1.00
Am. Sm. & Ref. pf.	U. S.	50,000,000	500,000	100	29,750,000	Jan. 1909	1.76
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	3,465,000	Dec. 1908	1.50
Am. Smelters, pf. B	U. S.	30,000,000	300,000	100	5,250,000	Dec. 1908	1.25
Am.Zinc,Lead&Sm.	Kan.	3,750,000	150,000	25	250,000	Nov. 1907	.50
Anaconda,c.	Mont	30,000,000	1,200,000	25	43,650,000	Jan. 1909	.50
Arizona, c.	Ariz	3,775,000	3,682,620	.....	6,182,361	Apr. 1906	.05
Atlantic, c	Mich	2,500,000	100,000	25	990,000	Feb. 1905	.02
Bald Butte, g. s.	Mont	250,000	250,000	1	1,354,648	Oct. 1907	.04
Beck Tunnel, g.e.l.	Utah	100,000	1,000,000	0.10	675,000	Oct. 1907	.02
Beut'M.&D.,pf.,l.z.	Wis.	600,000	136,607	1	10,949	Nov. 1908	.01½
Boston & Montana.	Mont	3,750,000	160,000	25	52,950,000	Jan. 1909	3.00
Bull.Beck.&Cham.g	Utah	1,000,000	100,000	10	2,728,400	July 1908	.10
Bunker Hill & Sull.	Ida	3,000,000	300,000	10	10,746,000	Jan. 1909	.25
Butte Coalition,c.a.	Mont	15,000,000	1,000,000	15	2,450,000	Dec. 1907	.15
Calumet & Arizona	Ariz	2,600,000	200,000	10	10,300,000	Dec. 1908	1.00
Calumet & Hecla,c.	Mich	2,500,000	100,000	25	107,850,000	Dec. 1908	5.00
Camp Bird, g., s.	Colo	5,500,000	220,000	5	6,313,600	Nov. 1908	.24
Cariss, c.g.	Utah	600,000	500,000	1	55,000	Nov. 1906	.01
Colorado, l. g. a.	Utah	200,000	1,000,000	0.20	1,100,000	Jan. 1909	.08
Columbus Con. c.	Utah	1,600,000	283,540	6	226,832	Oct. 1907	.20
Combi'tion Co.G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.15
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	3,385,313	Dec. 1908	.02½
Continental, z. l.	Mo.	650,000	22,000	25	231,000	Oct. 1908	.25
Copper Range Con.	Mich	40,000,000	384,105	100	7,683,700	Mar. 1909	1.00
Creede United, g.	Colo	2,000,000	1,620,000	1	214,053	July 1906	.00½
Daly Judge, g. a. l.	Utah	300,000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. a. l.	Utah	3,600,000	180,000	20	5,877,000	Dec. 1907	.30
De Lamar, g. s	Ida	500,000	80,000	5	835,200	Sept. 1908	.24
Doctor Jack Pot	Colo	3,000,000	3,000,000	1	277,000	June 1906	.00½
Doe Run, l.	Mo.	10,000,000	69,062	100	1,765,005	Dec. 1908	1.50
Elkton Con., g.	Colo	3,000,000	2,500,000	1	2,191,961	Nov. 1908	.01½
El Paso, g.	Colo	2,600,000	2,460,000	1	315,645	Sept. 1908	.01
Fed. Sm., com.	Idaho	10,000,000	60,000	100	2,708,750	Jan. 1909	1.50
Federal Sm., pf.	Idaho	20,000,000	120,000	100	4,121,250	Dec. 1908	1.75
Findley, g.	Colo	1,250,000	1,250,000	1	337,500	Sept. 1906	.01
Florence, g.	Nevada	1,250,000	1,050,000	1	420,000	Nov. 1908	.10
Frances-Mohawk,g	Nevada	1,000,000	910,000	1	546,000	Jan. 1906	.06
Gemini-Keystone	Utah	600,000	6,000	100	2,000,000	Aug. 1907	10.00
Gold King Con	Colo	6,750,370	5,750,370	1	1,407,504	May 1905	.01
Goldfield Con., g.	Nevada	50,000,000	3,532,471	10	706,494	Nov. 1907	.10
Grand Central, g.	Utah	250,000	250,000	1	1,321,250	Dec. 1907	.04
Gwin Mine, Dev., g	Cal	1,000,000	100,000	10	496,000	Apr. 1906	.05
Hecla, a. l.	Idaho	250,000	1,000,000	0.25	1,660,000	Oct. 1908	.02
Homestake, g.	S. D.	22,000,000	218,400	100	23,827,440	Jan. 1909	.50
HornSilver,g.a.c.z.l	Utah	10,000,000	400,000	25	6,642,000	Sept. 1907	.05
Imperial, c.	Ariz	5,000,000	500,000	10	300,000	June 1907	.20
Inter'l Nickel, pf.	N. Y.	12,000,000	89,126	100	1,737,957	Feb. 1909	1.50
Iron Silver	Colo	10,000,000	500,000	20	4,100,000	Oct. 1907	.10
Jamison, g.	Cal	3,900,000	390,000	10	339,300	Jan. 1909	.02
Jerry Johnson	Cal	2,600,000	2,500,000	1	86,700	Jan. 1908	.03
Kendall, g.	Mont	2,500,000	500,000	5	1,275,000	Oct. 1906	.02
Liberty Bell,g.a.	Colo	700,000	130,651	5	130,440	Jan. 1907	.15
Lightner, g.	Cal	125,000	102,265	1	253,081	Oct. 1906	.05
Lower Mammoth, g	Utah	190,000	190,000	1	57,000	Sept. 1907	.07½
Mammoth, g. s. l.	Utah	10,000,000	400,000	2.50	2,220,000	Mar. 1908	.05
Mary McKinney, g.	Colo	2,500,000	1,309,252	1	841,093	Dec. 1908	.07
May Day, g. a. l.	Utah	800,000	800,000	1	108,000	Sept. 1908	.01½
Mohawk, c.	Mich	2,500,000	100,000	25	1,850,000	Feb. 1909	2.00
Mont. Ore Purch.	Mont	2,500,000	50,833	25	9,437,274	Jan. 1907	15.00
Nevada Hills, a.g.	Nevada	5,000,000	746,000	1	373,000	Dec. 1907	.10
New Century, z., l.	Mo.	300,000	300,000	1	213,000	Dec. 1906	.01
Newhouse M. & S.c.	Utah	6,000,000	600,000	10	300,000	Sept. 1907	.50
New Idria, q	Cal	600,000	100,000	6	1,080,000	Jan. 1909	.30
New Jersey Zinc	U S.	10,000,000	100,000	100	12,000,000	May 1908	4.00
North Butte	Mont	5,000,000	1,000,000	15	6,400,000	Dec. 1908	1.00
North Star, g.	Cal	2,500,000	250,000	10	1,911,988	Dec. 1908	.75
Old Dominion, c.	Ariz	8,750,000	293,245	25	720,710	Dec. 1908	.50
OldDominion,M&Sc	Ariz	6,000,000	162,000	25	364,500	Dec. 1908	1.00
Ophir, g. s	Nevada	604,800	201,600	3	1,816,360	May 1908	.10
Osceola, c	Mich	2,600,000	98,150	25	7,227,950	July 1908	2.00
Parrot, c.a.	Mont	2,300,000	229,850	10	6,807,649	Sept. 1907	.25
Pennsylvania, g.	Cal	5,150,000	1,000,000	5	284,928	July 1905	.10
Pitts. L. & Z., l.z.	Mo	1,000,000	1,000,000	1	20,000	July 1907	.02
Portland, g.	Colo	3,000,000	3,000,000	1	8,227,080	Jan. 1909	.04
Quartette, g. a.	Nevada	1,000,000	100,000	10	375,000	July 1907	.20
Quincy, c	Mich	3,750,000	110,000	26	18,450,000	Dec. 1908	1.00
Rocco Homest'k,Le.	Nevada	300,000	300,000	1	112,000	Dec. 1906	.02
Sacramento, g. q.	Utah	1,000,000	1,000,000	1	265,000	Nov. 1906	.004
St. Joseph, l.	Mo	20,000,000	1,000,000	10	6,158,357	Dec. 1908	.15
Silver Hill, g. s	Nevada	108,000	108,000	1	81,000	June 1907	.05
Silver King, g. a. l	Utah	3,000,000	150,000	20	11,187,500	July 1907	.33½
Silver King Co't'n.	Utah	6,250,000	1,224,425	5	918,402	Jan. 1909	.30
Shannch, c	Ariz	3,000,000	300,000	10	450,000	July 1907	.50
Snowstorm, a. l.	Ida	1,500,000	1,600,000	1	645,000	Jan. 1909	.40
Standard Con., g. s	Cal	2,000,000	178,394	10	5,134,130	Dec. 1908	.10
Stratton'sIndependence	Colo	5,600,000	1,001,007	5	4,895,865	Apr. 1906	.12½
Swansea, g. a. l.	Utah	500,000	100,000	5	329,600	Mar. 1907	.05
Tamarack, c	Mich	1,600,000	60,000	25	9,420,000	July 1907	4.00
Tennessee, c.	Tenn	5,000,000	200,000	25	2,058,250	Sept. 1908	1.25
Tomboy, g. s	Colo	1,750,000	300,000	5	2,016,000	Dec. 1908	.48
Tonopah of Nev.	Nevada	1,000,000	1,000,000	1	4,250,000	Jan. 1909	.25
Tonopah Belmont	Nevada	2,000,000	1,500,000	1	600,000	Apr. 1907	.10
Tonopah Ext'nsion	Nevada	1,000,000	928,433	1	283,030	Apr. 1905	.16
Tonopah Midway	Nevada	1,000,000	1,000,000	1	250,000	Jan. 1907	.06
Uncle Sam, g.e.l.	Utah	500,000	600,000	1	295,000	Dec. 1908	.02
United States, com.	Utah	37,500,000	350,933	50	1,798,099	Jan. 1909	.50
United States, pfd.*	Utah	37,500,000	485,845	50	4,881,377	Jan. 1909	.87½
United Cop. com	Mont	75,000,000	450,000	100	6,962,500	Aug. 1907	1.76
United, c. pf	Mont	6,000,000	60,000	100	1,500,000	May 1907	8.00
United, z. l., pf	Mo.-Kan.	600,000	19,566	25	312,782	Jan. 1908	.50
United Verde, c	Ariz	3,000,000	300,000	10	20,810,322	Aug. 1908	.75
U.S. Red. & Ref. Pf.	Colo	4,000,000	39,458	100	1,005,504	Oct. 1907	1.60
Utah, g.(Fish Sp'ge)	Utah	1,000,000	100,000	10	323,000	Feb. 1909	.02
Utah Con., c	Utah	1,600,000	300,000	5	7,350,000	Dec. 1908	.50
Utah Copper	Utah	7,500,000	725,950	10	725,950	Dec. 1908	.50
Victoria, c.	Utah	250,000	250,000	1	177,600	Mar. 1907	.04
Vindicator Con., g.	Colo	1,500,000	1,500,000	1	1,980,000	Jan. 1909	.03
Wolverine, c.	Mich	1,500,000	60,000	25	6,100,000	Oct. 1908	6.00
Work, g.	Colo	1,500,000	1,500,000	1	172,500	July 1908	.01
YankeeCon	Utah	1,000,000	1,000,000	1	182,500	Jan. 1907	.03
Yellow Aster, g.	Cal	1,000,000	100,000	10	968,789	Aug. 1907	.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States

Name of Company and Location.	Author. Capital.	Shares. Issued	Shares. Par Val. $	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Allis-Chalmers, pf.	U. S.	$25,000,000	161,600	100	$3,108,875	Feb. 1904	$1.75
Amer. Ag. Chem., pf.	U. S.	20,000,000	181,630	100	9,547,342	Oct. 1908	3.00
American Cement	Pa.	2,000,000	200,000	10	1,288,000	Jan. 1909	.30
American Coal	Md.	1,600,000	60,000	25	2,492,500	Sept. 1908	1.25
Bethlehem Steel, pf.	Pa.	15,000,000	150,000	100	900,000	Nov. 1908	.75
Cambria Steel	Pa.	50,000,000	900,000	50	9,450,000	Feb. 1909	.75
Central C. & C., pf.	Mo.	6,125,000	61,250	100	2,536,875	Jan. 1909	1.50
Central C. & C., pf.	Mo.	1,875,000	18,750	100	1,453,125	Jan. 1909	1.25
Col. & Hock. C.&I,pf.	Ohio	7,000,000	69,244	100	383,818	Apr. 1908	1.50
Consolidated Coal	Ill.	6,000,000	60,000	100	360,000	July 1904	1.00
Consolidation Coal	Md.	10,250,000	102,600	100	10,441,650	Jan. 1909	3.50
Crucible Steel, pf	Pa.	25,000,000	244,365	100	8,186,228	June 1907	1.50
Empire S. & I., pf.	N. J.	2,500,000	25,000	100	933,033	Jan. 1909	1.50
Fairmont Coal	W. Va.	12,000,000	120,000	100	1,980,000	Jan. 1909	2.00
General Chem. Com.	U. S.	12,600,000	74,108	100	2,148,987	Dec. 1908	1.00
General Chem., pf.	U. S.	12,500,000	100,000	100	6,255,000	Jan. 1909	1.50
International Salt	Penn.	30,000,000	182,260	100	911,400	Dec. 1906	1.00
Jeff. & Cl'f C. & I., cm	Pa.	1,500,000	15,000	100	330,000	Aug. 1906	5.00
Jeff. & Cl'f. C. & I.,pf.	Pa.	1,500,000	15,000	100	862,500	Aug. 1908	2.50
Kern River Oil	Cal.	2,000,000	20,000	100	84,000	July 1908	.10
Lehigh Coal & Nav.	Pa.	19,113,000	382,260	50	*15,014,890	Nov. 1908	2.00
Maryland Coal,pf.	Md.	2,000,000	18,850	100	‡2,013,997	Dec. 1908	2.50
Monon B. Coal, pf.	Pa.	10,000,000	100,000	100	2,324,000	July 1908	3.50
NationalCarbon,com.	U. S.	6,500,000	65,000	100	715,000	Apr. 1908	1.00
National Carbon, pf.	U. S.	4,500,000	45,000	100	3,071,250	Nov. 1908	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	3,092,872	Jan. 1909	1.25
National Lead, pf.	N. Y.	16,000,000	149,040	100	17,894,248	Dec. 1908	1.75
Nat'l Steel & Wire,pf.	N. Y.	6,000,000	25,778	50	631,661	May 1908	1.75
New Central Coal	Md.	1,000,000	60,000	20	390,000	Nov. 1908	.40
New River Coal, pfd.	W. Va.	4,000,000	37,817	100	451,405	Nov. 1908	1.50
Pacific Coast Borax	Cal.	2,000,000	19,000	100	2,086,500	Aug. 1908	1.00
Peerless Oil	Cal.	1,000,000	92,000	10	711,000	June 1908	.10
Penna. Salt	Pa.	3,000,000	60,000	50	16,098,000	Oct. 1908	3.00
Penna. Steel, pfd.	Pa.	25,000,000	165,000	100	8,662,500	Nov. 1908	3.50
Phila. Gas, com	Pa.	36,000,000	664,800	50	*24,264,600	Feb. 1909	.75
Phila. Gas, pf.	Pa.	6,000,000	120,000	50	2,850,000	Sept. 1908	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas C. C., pf.†	W. Va.	2,800,000	28,000	100	168,000	July 1908	3.00
Pocahontas C. C.,cm†	W. Va.	5,000,000	45,200	100	6,045,338	Apr. 1907	3.00
Republic I. & S., pfd.	Ill.	25,000,000	204,169	100	1,883,000	Dec. 1908	1.00
U. S. Steelfield, com.	Ala.	10,000,000	100,000	100	4,221,000	Jan. 1909	1.75
Sloss-Sheffield, pf.	Ala.	10,000,000	67,000	100	629,522,905	Dec. 1908	10.00
Standard Oil	U. S.	100,000,000	970,000	100	3,683,060	Nov. 1907	1.00
Tenn. C. & I., com	Tenn.	22,553,500	225,636	100	390,040	Nov. 1907	2.00
Tenn. C. & I., pf.	Tenn.	248,000	2,480	100	1,711,710	June 1908	1.00
Texas & Pacific Coal	Texas	2,500,000	23,940	100	5,875,000	Jan. 1909	6.00
United Metals Selling	U. S.	5,000,000	50,000	100	81,306,544	Mar. 1909	.60
U. S. Steel, com.	U. S.	550,000,000	6,083,025	100	225,280,192	Mar. 1909	1.75
U. S. Steel Corp., pf.	U. S.	360,281,100	3,802,811	100	14,340,869	Jan. 1909	2.00
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	517,739	Nov. 1908	.30
Warwick I. & S.	U. S.	1,500,000	148,671	10	8,880,000	Oct. 1908	2.50
Westmoreland Coal	Pa.	3,000,000	60,000	50			

*Since 1894. †Since 1907. ‡Since 1890.

Canada, Mexico, Central and South America.

Name of Company and Location.	Author-ized Capital.	Shares. Issued.	Shares. Par Val. $	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Amistad y Conc'rdia. Mex.	$480,000	9,600	50	$417,070	Apr. 1908	$1.86
Batopilas Mex.	9,000,000	446,268	20	† 56,784	Dec. 1907	.12½
British Columbia, c. B. C.	3,000,000	503,000	6	201,200	Sept. 1907	.40
Buffelo, e. Ont.	1,000,000	900,000	1	307,000	Feb. 1909	.01
Butters' Salvador, g. Salv.	760,000	160,000	5	600,000	Apr. 1905	.25
Cobalt Central, s. Ont.	5,000,000	4,761,500	1	96,230	Feb. 1909	.02
Coniagas (Cobalt) Ont.	4,000,000	800,000	5	720,000	July 1908	.15
Consolidated M & S. B. C.	6,500,000	53,552	100	781,885	Nov. 1907	1.26
Crow's Nest Pass B. C.	4,000,000	180,000	25	2,018,648	July 1907	.62½
Crown Reserve, s. Ont.	1,750,000	1,750,000	1	350,000	Jan. 1909	.18
Dolores, g. a. Mex.	2,000,000	400,000	6	540,000	Feb. 1909	.15
Dominion Coal, com. N. S.	16,000,000	160,000	100	3,150,000	Jan. 1909	1.00
Dominion Coal, pf. N. S.	3,000,000	30,000	100	‡630,000	Feb. 1908	3.50
Dos Estrellas, g. s. Mex	160,000	300,000	0.50	3,780,000	Jan. 1909	1.00
El Oro, g. s. Mex	6,750,000	1,080,000	5	4,989,600	July 1908	.36
Esperanza, e. g. Mex	2,275,000	456,000	5	9,222,400	Oct. 1908	.87½
Foster Cobalt, s. Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.05
Granby Con. B. C.	16,000,000	135,000	100	3,368,630	Dec. 1908	2.00
Greene Con. Copper Mex.	8,500,000	864,000	10	6,137,800	Mar. 1907	.40
GreenGold-Silv'r,pfd. Mex.	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato Mex.	3,000,000	640,000	6	74,250	Oct. 1905	.07
Guanajuato D., pfd. a Mex.	1,000,000	10,000	100	30,000	July 1908	3.00
Guggenheim Expl. Mex.	17,000,000	105,000	100	5,010,000	Jan. 1909	2.60
Hinds Con., g.s.c.l. Mex.	5,000,000	5,000,000	1	100,000	Feb. 1908	.02
Kerr Lake, s. Ont.	3,000,000	600,000	5	970,000	Mar. 1909	.20
La Rose Con., s Ont.	7,500,000	1,143,368	5	400,179	Jan. 1909	.20
LeRoi, Ltd., g. B. C.	6,000,000	200,000	25	425,000	Dec. 1906	.48
LeRoi No. 2, g. B. C.	3,000,000	120,000	25	831,600	July 1908	.48
McKinley-Darragh, s. Ont.	2,500,000	2,000,000	1	480,000	Jan. 1909	.05
Mex. Con. M. & S. Co. Mex.	2,500,000	240,000	10	860,000	Mar. 1908	.25
Mex.Mill.&Trans.pfd Mex.	2,000,000	12,000	100	35,450	Jan. 1908	3.00
Minee Co. of Am. Mex.	2,000,000	2,000,000	1	3,425,000	Jan. 1909	.02
N. Y. & Hond. Ros. C. A.	1,500,000	150,000	10	2,467,000	Jan. 1909	.10
Nipissing, s Ont.	8,000,000	1,200,000	5	2,340,000	Jan. 1909	.25
N. S. St. & Coal, com. N. S.	6,000,000	49,876	100	1,067,856	Apr. 1908	1.50
N. S. St. & Coal, pf. N. S.	1,030,000	10,300	100	458,350	Oct. 1908	2.00
Penoles* Mex	250,000	2,500	100	8,630,000	Dec. 1907	20.00
Peregrina, pfd. s Mex.	1,000,000	10,000	100	188,656	Sept. 1908	3.50
Pinguico, pfd. s Mex.	2,000,000	20,000	100	240,000	Oct. 1908	3.00
Platanillo Mex.	500,000	206,989	1	6,680	Sept. 1906	.00
Rece, g. s.l. B. C.	1,000,000	968,000	1	327,062	Apr. 1906	.02
Securities Corp., pfd. Mex.	200,000	2,000	100	42,699	July 1908	3.50
Silver Queen, s Ont.	1,500,000	1,500,000	1	345,000	Nov. 1907	.05
Temiskaming, s Ont.	2,500,000	2,500,000	1	375,000	Jan. 1909	.06
Tezuitlan Copper Mex.	1,000,000	10,000	100		July 1908	1.50
Tilt Cove, c. N. F.	1,000,000	89,000	2	495,630	May 1908	.55
Trethewey, s Ont.	1,000,000	946,450	1	217,463	Dec. 1908	.10
Tyee, c B. C.	940,000	180,000	5	201,600	Aug. 1907	.36

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The southern branch of the American Steam Gauge and Valve Manufacturing Company, for several years located in the Equitable building, Atlanta, Georgia, has removed its office to 524-525 Candler building, of that city.

A. Wilson & Co., Chesterfield House, 98 Great Tower street, London, E. C., advises us that its agent in Ranjoon, Burma, asks for estimates of petroleum machinery, including piping, viz., a complete plant for boring for crude oil to the depth of 1500 ft. with power.

Chalmers & Williams, Inc., Chicago, Ill., advises that the latest additions to the already large list of purchasers of the Burt rapid cyanide filter are the Amparo Mining Company, Etzatlan, Jalisco, Mex., and the Cherokee Goldfields Ltd., Parral, Chihuahua, Mexico.

Fred M. Prescott Steam Pump Company advises that in order to facilitate the handling of its growing business in Mexico and southwestern portion of the United States, it has opened a district office at El Paso, Texas. City National Bank building, which is in charge of W. R. Thurston.

G. M. Davis & Son, Palatka, Florida, manufacturers of cypress tanks, have issued a souvenir card entitled, "Florida Favorites," instead of the usual calendar. The orange blossoms and fruit portrayed are both tasty in design and typical of the State in which the factory is located.

Arthur Koppel Company has turned over the agency for the sale of its portable track, industrial railways, cars of all kinds, including mine cars, rails, switches, turntables, etc., in the State of Colorado to the Jeffrey Manufacturing Company, 1711 Tremont Place, Denver, Colo.

The Wagner Electric Manufacturing Company has opened a sales office in the Trust building, Charlotte, N. C., to assist in the care of its rapidly growing Southern business. The company's other office in the South is in Atlanta, Georgia, and the factory and main office, as is well known, is in St. Louis, Mo.

The Wood Drill Works announces that it has appointed Harold L. Bond Company, of 140 Pearl street, Boston, Mass., as its exclusive agents for the sale of Wood rock drills in the New England States to take effect January 1, 1909. Harold L. Bond Company has offices at 42 Broadway, New York City, in charge of Joseph C. Sealy.

The Stephens-Adamson Manufacturing Company, of Aurora, Ill., manufacturer of conveying and transmission machinery has removed its New York offices to 50 Church street. F. McWethy, who has conducted the local branch during the last two years, will return to the home office to take up the duties of assistant sales manager. William Reinecke has been appointed as manager of the Eastern office.

Edward C. Brown, manager of the Hawaiian office of the Dearborn Drug and Chemical works at 42 Queen street, Honolulu, is making an extensive oriental trip of three or four months, during which he will visit Japan, the important seacoast cities of China, Australia, the Philippines, Java and other important islands in the Pacific ocean. Mr. Brown has most successfully handled the Dearborn Company's business in the Hawaiian Islands since that department was opened, some ten years ago.

The Wood Drill Works, of Paterson, N. J., has issued a 12 page booklet entitled, "Wood Rock Drills," giving some valuable information and description of the machines showing their adaptability to tunnel driving, drilling in concrete, and open cut work; with detailed costs in driving the Tieton tunnel at North Yakima, Wash., United States Reclamation Service, also on other engineering works with a number of fine testimonials. The booklet is printed in three colors and can be obtained at any of the company's offices in the United States, Mexico and Canada.

The Buffalo Steam Pump Company advises that it has contracted with the city of Grand Rapids to furnish ten immense sewage pumps, having a total capacity under maximum conditions of over 250,000 gal. per min. The pumps are to be placed in three stations, one station to contain two 18-in. pumps, second to contain two 24-in. pumps, third to contain two 24-in. pumps, and the fourth station four 40-in. pumps. The Westinghouse Company furnishes electrical equipment on a separate contract. The ten pumps together, without motors will weigh approximately 200,000 pounds.

The Youngstown Car Manufacturing Company, Youngstown, Ohio, builders of cars for freight and industrial service has issued an illustrated catalog with 200 cuts showing different styles of dump cars, flat cars, special cars, etc. The range and variety of the product is well shown by the catalog which includes everything from the smallest dump car and factory truck to the largest ingot car for iron and steel mills. Standard freight cars, sugar cane cars and logging cars are not omitted. The cover design indicates suitably that both industrial cars and freight cars are built. Size, 8x10 inches; pages, 64.

The Leschen Company's system of aerial wire rope tramways is especially adapted for the transportation of all classes of material, and is recommended for heavy capacities, long distances, long spans, and localities where very steep gradients occur. These advantages have been demonstrated in the Leschen Company's patent automatic tramway constructed for the Penn-Wyoming Copper Company, of Encampment, Wyoming, connecting its mines with the smelter, a distance of over sixteen miles and through the most rugged contour of country. This tramway has a carrying capacity of 400 tons of copper per day.

Mining engineers will be very much interested in the products of the International Acheson Graphite Company, of Niagara Falls, N. Y. One of these products is a thoroughly amorphous, very fine, soft, unctuous graphite known as grade "1340." It is an electric furnace product and is guaranteed at least 99 per cent. pure. Because of its great unctuousness and high purity, it is a true lubricant in itself, but it can be mixed with grease or oil. It is claimed to be wholly without the friction-creating impurities of natural graphites. The company also makes a very superior line of graphited greases in which the world's best graphite and a high grade grease and blended so that the product will do from three to four times more work than any other grease now on the market.

Announcement was made January 18 of the consolidation of the Sirocco Engineering Company, New York, with the American Blower Company, of Detroit, Michigan. Owing to the position of the American Blower Company in this line of manufacture in the United States, the announcement is of exceptional importance to engineering and commercial interests. The Sirocco fan is of English invention. In the United States the fan met competition, but has steadily advanced until it is now used in some of the most important installations in the country, for mine and general ventilation. A distinguished feature of the Sirocco fan is the drum form of the runner, which consists of a large inlet chamber inclosed by 64 long, narrow blades curved forwardly.

We are in receipt of the new catalog of engineering instruments issued by the Bausch & Lomb Optical Company, Rochester, N. Y. Aside from its copious illustrations, this publication is of interest because of the complete specifications given for the optical and mechanical construction of the various transits, levels and theodolites. The several unique features of the Bausch & Lomb instruments are explained in a brief manner, while an entirely original mining transit is cataloged for the first time. The distinguishing features of this new instrument include a prismatic side telescope, which is novel in construction and which will be described more fully at a later date. Also with this instrument the U standard construction together with a compass circle of the usual form is introduced. The catalog is sent gratis upon request.

The Traylor Engineering Company has opened offices in the Farmers' Bank building, Pittsburg, Penn., and George T. Ladd, who has been associated with some of the largest manufacturing industries in this country for the last twelve or fifteen years, is to have charge of same. The offices have already been established, and it is understood that Mr. Ladd will be elected one of the vice-presidents of the Traylor Engineering Company early in January at the annual meeting of the stockholders. On account of the very satisfactory business that the company has done in Pittsburg and that vicinity, it believes that an office at this point will be suitable for covering all of the middle western territory. It is also understood that the company will establish, under Mr. Ladd's management, an office in Chicago. The company has one of the most complete sheet-metal working departments to be found anywhere in the country, and a foundry with 100 tons capacity, and on account of the very great demand for both sheet-steel work and large castings, it will doubtless be able to supply a very large portion of this class of business all through the middle West. The Traylor Engineering Company manufactures all kinds of mining and metallurgical machinery. It has also recently arranged with L. C. Trent, one of the best known mechanical and metallurgical engineers in the machinery trade to represent it. Mr. Trent has probably more experience in the manufacture and sale of mining and metallurgical plants than any one man in this country. He is to open an office for the Traylor Engineering Company as manager of the Pacific western territory, having an office in Salt Lake City, beginning the first of January, 1909; also an office in Reno, Nevada, and one in San Francisco, California.

Trade Catalogs

Tate, Jones & Co., Inc., Pittsburg, Pa. Booklet. Oil vs. Coal. Illustrated, 16 pages, 6x9 inches.

Thos. H. Dallett & Co., Philadelphia, Penn. Catalog No. 100. Air compressors. Illustrated, 24 pages, 6x9 inches, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Catalog 67D. Rubber belt conveyors. Illustrated, 48 pages, 6x9 inches, paper.

Eck Dynamo and Motor Company, Belleville, N. J. Binder containing bulletins of dynamos and motors. Illustrated, 5x8½ inches.

Western Electric Company, 463 West street, New York. Bulletin No. 5910-9. Electrical equipment for central stations. Illustrated, 20 pages, 8x10½ inches.

MacGovern, Archer & Co., 114 Liberty street, New York. List of electrical and steam apparatus, power house equipment, cars, etc. Illustrated, 34 pages, 3½x6 inches.

Lallie Surveying Instrument and Supply Company, 1622 Arapahoe street, Denver, Colo. Thirteenth edition, 1909. Solar Ephemeris. Illustrated, 52 pages, 3x6 inches, paper.

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Ore Formation in the Wonder District, Nevada

The Silver Minerals Are Found in Lines Following the Direction of the Veins Which Vary from a Fractured Zone to a Solid Quartz Lode

BY ETIENNE A. RITTER*

The Wonder mining district is situated a little south of the center of Churchill county, Nevada. It is reached by stage from Fallon, on a branch of the Southern Pacific railroad, the distance from Fallon being 55 miles. Wonder is 12 miles from the mining camp of Fairview. It is situated on rolling hills on the western slope of the Augusta mountains, which belong to the Basin ranges. These mountains form a long and narrow ridge, bearing almost directly north and south, with a gentle slope to the east and a steep slope to the west. They were formed by the tilting of a block of strata along a line of deep faulting. Along this line of great faulting enormous masses of eruptive rocks have been poured out, and among them the trachytes and the rhyolites which form the hills of the Wonder district. During a later geological period the large, sandy valley into which the Wonder hills descend, was an arm of an immense inland sea. Today its dry bottom is a desert expanse.

*Mining engineer, Colorado Springs, Colo.

Rocks and Minerals

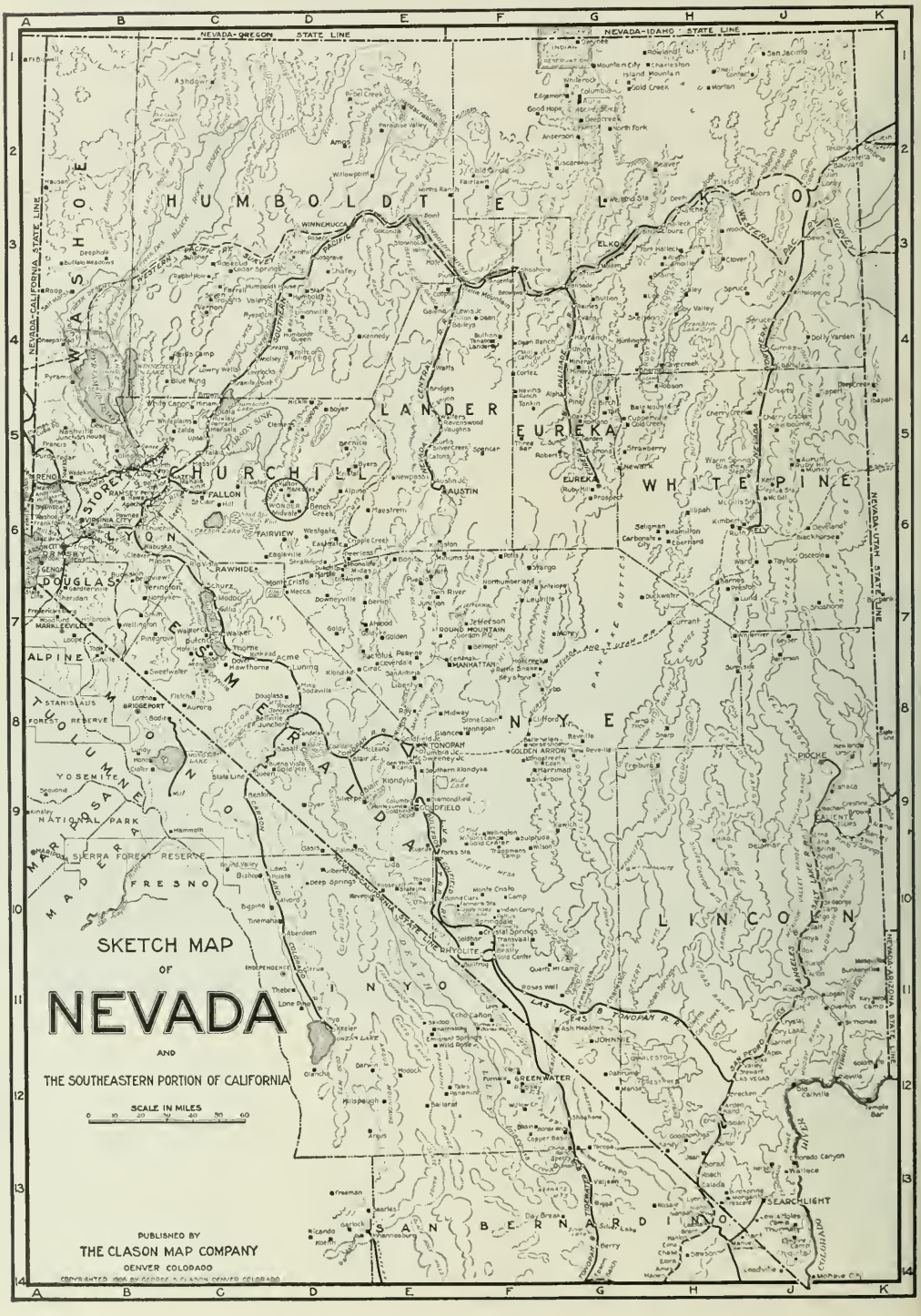
The mineralized territory of the Wonder district has an area of about six miles square. It is in the heart of a vent of very acidic eruptive rocks, with small areas of andesites, and larger areas of trachytes, cut by large dikes and masses of rhyolites. It seems that here, as in the Cripple Creek volcano, it is possible to find all the types of rocks passing by the most complete series of gradations into one another from the andesites to the rhyolites.

The andesites are rare and thoroughly altered. The trachytes are much more abundant and in a better state of conservation. The phenocrysts of orthoclase and of oligoclase are fairly fresh; the biotite has been altered into chlorite and epidote to a great extent. The groundmass has been so charged with decomposition products and so colored by limonite, that it is difficult to recognize its constituent minerals. The rhyolites show phenocrysts of quartz and of orthoclase well formed. They show only occasionally carlsbad twinning. The ground-mass is made up of microscopic crystals of quartz displaying several types of the felsitic structure. They are either in small groups of crystals with the same optical orientation and extinguished together, or they form long needles radiating from a central point and having characteristics of some varieties of quartz porphyries.

The veins run in a general northeast-southwest direction. They are similar to those of the Tonopah mining district, both in the physical characteristics of the fractures and in the way the mineralizing waters have ascended through them.

In the Wonder district, the rocks were complexly fractured and many of the veins split up in two or more branches, as is the case, for example, in the Wasp and Stray Horse veins. The circulation channels were not made by open fissures; they were only fractured zones, through which the circulating waters ascended. As a result, the veins show all the stages in the change, from a fractured zone in trachyte or rhyolite, to a solid quartz vein. This main

WONDER, NEV., FAIRVIEW MOUNTAIN ABOVE FAIRVIEW CAMP IN THE DISTANCE


SKETCH MAP
OF
NEVADA
AND
THE SOUTHEASTERN PORTION OF CALIFORNIA
SCALE IN MILES
0 10 20 30 40 50 60
PUBLISHED BY
THE CLASON MAP COMPANY
DENVER COLORADO
NEVADA-OREGON STATE LINE
NEVADA-IDAHO STATE LINE
NEVADA-CALIFORNIA STATE LINE
NEVADA-UTAH STATE LINE
HUMBOLDT
ELKO
WASHOE
LANDER
EUREKA
WHITE PINE
CHURCHILL
STOREY
LYON
DOUGLAS
ALPINE
MINERAL
NYE
LINCOLN
INYO
SAN BERNARDINO
MONO
TUOLUMNE
MARIPOSA
MADERA
FRESNO
YOSEMITE NATIONAL PARK
SIERRA FOREST RESERVE
TAHOE NATIONAL FOREST RESERVE
WINNEMUCCA
FALLON
AUSTIN
EUREKA
TONOPAH
GOLDFIELD
BULLFROG
RHYOLITE
BEATTY
GREENWATER
SEARCHLIGHT
PIOCHE
CALIENTE
BRIDGEPORT
MARKLEEVILLE
VIRGINIA CITY
RENO
CARSON
BODIE
LONE PINE
INDEPENDENCE
BISHOP
MAMMOTH
JOHNNIE
LAS VEGAS
PACIFIC
CENTRAL
SOUTHERN
TONOPAH R.R.
SANTA FE
UNION PACIFIC
SALT LAKE
MOJAVE
COLORADO
DEATH VALLEY
MONO LAKE
OWENS LAKE
SEARLES LAKE
SALTON SEA
MOJAVE RIVER
COLORADO RIVER
DEVIL'S HOLE
CALIFORNIA STATE LINE
ARIZONA STATE LINE

feature of the ore deposits of the Wonder district is shown in the accompanying illustrations of rock sections.

Vein Structure

In the extreme case, the vein consists simply of a zone of more or less altered trachyte or rhyolite, only a little richer in quartz than the same country rock, which forms the walls. The silver and gold minerals are closely associated, not only with the quartz, but also with the micas and the feldspars. In Fig. 1, ore from the Big Vulture vein, the stephanite is segregated in the ground mass in the same way as the micas and the feldspars. No orientation of any of the minerals, along the direction of the vein, can be seen.

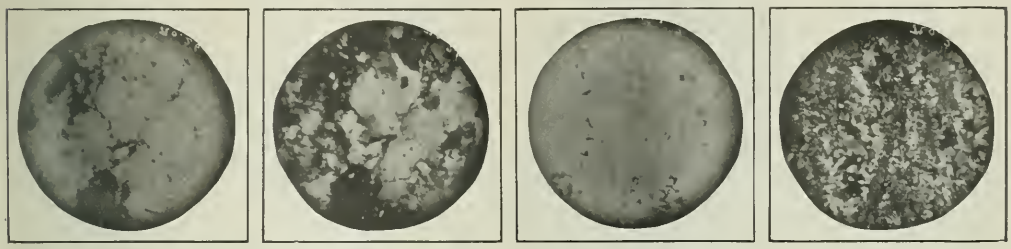
The mineralized zone, which forms the vein, is cut by fractures usually parallel, having the same dip and strike as the walls; the walls are stronger breaks only, of the same kind, which limit the zone of fracturing. In Fig. 2 ore from the Little Vulture and Queen No. 11 vein, the quartz begins to predominate over all the other minerals put together. But no lining of the silver minerals in a special direction can yet be recognized as is the case in Fig. 3, which shows a section of the Jack Pot vein. In this case, the micas have disappeared from the vein rock; the feldspars occur only sporadically, and the silver minerals have a more or less marked lining along the general trend of the vein. A very interesting feature of this microscopic section is that crystals of calcite are closely associated with the silver minerals; no other crystals of calcite have been found in any of 20 or more sections of rock examined. It shows conclusively that the mineralizing waters, which have deposited the Wonder ores were rich in carbonate of lime.

In the next step the metasomatic action of the mineralizing waters is plainly shown. The feldspars and the micas have disappeared, or they have been completely transformed into new products, like sericite, and others not well enough crystallized to be identified under the microscope. Nevertheless the banded structure, so characteristic of the open fissures filled by crustification cannot yet be found. Often the main wall fractures, being the larger ones, have been the main channels of circulation for the mineralizing waters, and the vein shows a zone of little altered trachyte between a hanging wall and a footwall streaks of quartz. Fig. 4 shows ore from the Queen vein on the footwall-quartz streak. In this case the silver minerals have crystallized last into the spaces left by the large crystals of quartz. Fig. 5 is from the Bald Eagle vein, showing large crystals of quartz, which have been fractured and filled by submicroscopic silver minerals. The interesting feature is that the quartz crystals have been broken after solidification, and that the ore lining shows the fractures passing without break from one quartz crystal into another.

With the last step, usually favored by a greater fracturing of the whole rock mass between the two walls, veinlets of quartz cross from one wall to the other, until they form a complete, and finally so close, a network, that the whole mass has been transformed into a solid quartz vein. In this last case the silver minerals instead of being scattered in a haphazard way, in the rock, partake of the general orientation of the quartz. They are found lined up along some main channel of deposition, as can be observed in the accompanying microphotographs, showing ore from the Wasp and from the Wonder veins.

The first shows ore from the Wasp vein, without analyzer; it shows in black the silver sulphides lined up in a well marked direction. That shown in the second is the same section with the analyzer on, showing the lining of large quartz crystals parallel to the silver sulphides. Nothing is seen except the silver sulphides and the quartz in large and small crystals; the micas and the feldspars have disappeared. The third microphotograph, from the Wonder vein, shows without the analyzer, the silver minerals well lined up. In the fourth the analyzer was employed. It shows the quartz in small crystals so well lined that they form a veinlet showing crustification, in the heart of which the sulphides are lined up.

The various conditions I have just described of a vein, simply formed by a set of parallel fissures across the country rock, are found in every one of the well



MICROPHOTOGRAPHS OF ORE FROM THE WASP AND WONDER VEINS

NEVADA WONDER SHAFT

JACK POT MINE

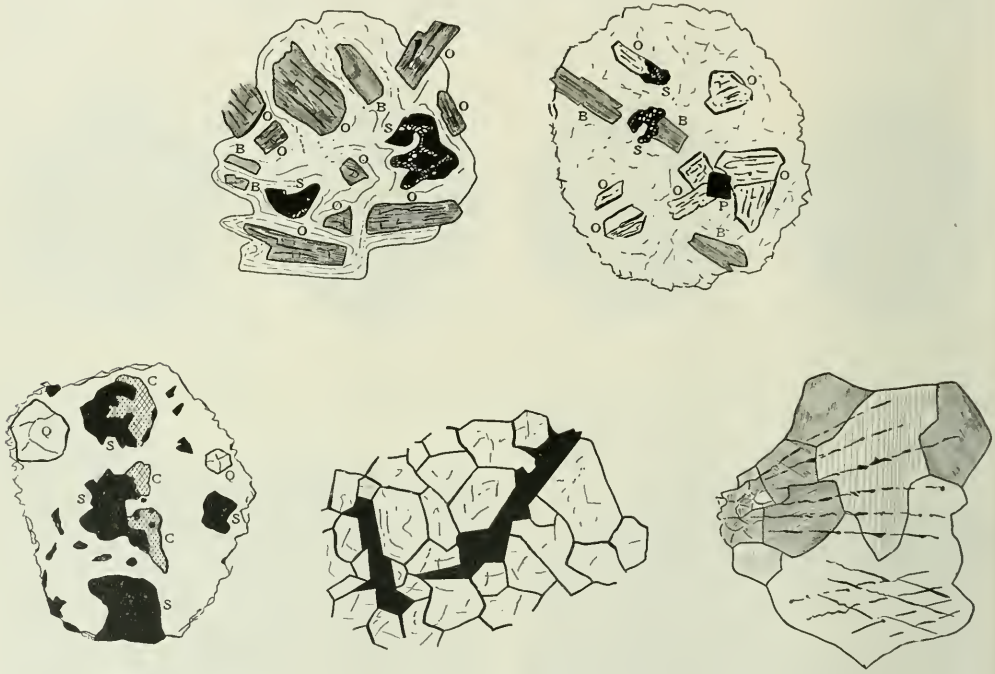
known veins of the Wonder district. In each of these veins, there are places more or less barren, which are characterized by the lowest stage of metasomatism and accompanying ore deposition. The transformation of the rock between the parallel sets of fissures increases more and more as an oreshoot is approached. In the oreshoot itself, the transformation has become complete.

The Camp

The district was discovered on March 15, 1906, by Thomas J. Stroud. He located the Lost claim, and during a second trip the Jack Pot group. On a third trip, he was followed by several parties of prospectors, who located the Nevada Wonder and the Queen groups. It was a month later that some exceedingly rich ore in shipping quantities was found. Then the rush began and the town of Wonder sprang up in a few weeks, with two banks, two newspapers, two hotels, an artificial ice plant, and, of course, many stores and a greater number of saloons.

The camp suffered from the business depression of last year, like all the other camps of Nevada; but is doing much better now and has perhaps 200 men at work on seven or eight properties, the Nevada Wonder, the Queen, the Jack Pot, and some others. The wages are those of the Tonopah scale, $4 and $4.50 per day.

Two railroad lines have been surveyed into the district; a branch line from Fallon, by way of Fairview, and one south from Winnemucca. A pipe line from Bench creek brings 150,000 gal. of water in 24 hours.



FIGS. 1, 2, 3, 4 AND 5. SKETCHES OF VARIOUS ORES FROM THE WONDER DISTRICT

In order from left to right, beginning at the top, the sketches represent: Ore from the Big Vulture vein, showing trachyte; the surface of the Little Vulture vein, showing the first stage of the mineralization; ore from the Jack Pot vein, showing calcite in groundmass of small quartz crystals; the Queen vein, showing ore filling interstices between large crystals of quartz; Bald Eagle, showing large quartz crystals broken and filled with microscopic lines of ore.

Coking of Coal with Fine Ore at Cerro De Pasco

A novel method of treating fine ore by smelting is in use at Cerro de Pasco, Peru. It consists in mixing the ore with coal and coking the coal. The coke being used in the smelting furnaces, the ore that it carries goes into the process in that way. The mixture consists of 25 per cent. by weight of fine ore and 75 per cent. of raw coal. The raw ore assays 22.36 per cent. silica, 20.90 iron, 9.75 copper, 5.08 alumina, 4.1 lead, 3.2 zinc and 24.58 sulphur. The raw coal analyzes 25.4 per cent. ash, 39.85 volatile matter and 34.75 fixed carbon. The coked product, after being coked in ordinary bee-hive ovens for 48 hours gave the following analysis: 8.2 per cent. iron, 3.11 copper, 4.41 sulphur, 33.9 ash, 2.01 volatile matter and 54.09 fixed carbon.

Magnesite in California

Special Correspondence

The new magnesite mines of the Tulare Mining Company at South Tule, in Tulare county, Cal., are showing up good quantities of ore, and if present indications are borne out, other calcining furnaces will be put in and preparations made to market the ore on a larger scale. The old mines at Porterville have some 1100 ft. of tunnels but the deposit is in such a condition that the cost of mining has been increased. Both mines really belong to the Willamette Paper and Pulp Company and it is probable that the supply for the paper mills will shortly be drawn entirely from the new deposits at South Tule. It is thought by the owners of these and other magnesite mines that if Congress imposes the duty asked for, they can ship to eastern points at a profit. The Fresno Magnesite Company has recently opened a mine in that county and has installed furnaces for furnishing calcined material to be made into articles for building purposes. The company is not selling to the paper mills, as the owners of these mills on this coast now own their own mines.

The Progress of Gold Mining in North Carolina

The Mines Which Were Large Producers Prior to the Civil War Are Again Attracting Attention; Many of Them Have Been Re-opened

BY EDWARD WEST LYON*

Gold was produced in the Southern Appalachian States before the Revolutionary War by the Cherokee Indians and others; the first gold minted by the United States Government in 1793 was mined in North Carolina. Estimates compiled from reports of the United States mints including the three mints established in the Southern States prior to 1848, at New Orleans, La., at Dahlonega, Ga., and at Charlotte, N. C., in 1837, and from State reports, show that the gold and silver production of the Southern States from 1799 to 1908 amounted to $49,900,000. Of this, 80 to 90 per cent. was gold, having a fineness varying from 750 to 980. North Carolina is credited with $23,000,000; Georgia with $18,000,000; the rest came from South Carolina, Virginia, Alabama, Tennessee and Maryland.

Gold was extensively coined between 1831 and 1857 by the Betchler family at Rutherfordton, N. C., until stopped by the Government. Their $1, $2.50 and $5 coins are now rare, as most of them were remelted with profit. During this time much gold was sold to country storekeepers; some of this was sent to the mint, but probably a considerable amount does not appear in the mint reports as coming from the Southern States.

*Mining engineer, Greensboro, N. C.

History

Gold nuggets were of frequent occurrence in early as well as later operations; the largest of these nuggets on record weighed 28 lb., and was found at the Reed mine, North Carolina, in 1803. Up to the middle of the last century most of the gold was produced from irregularly worked placers and similar detrital deposits, such as gravels in beds of streams, or on hillsides, surface gravel, and the gossan outcrops of the veins. To work these deposits required little skill and only a few cheap appliances, such as pans, sluice boxes, log rockers, arrastras and Chilean mills with "dolly tubs," these being usually run by horse whim or water power. Over limited areas some of these placer deposits yielded from $100 to $200 per rocker per day. Usually the gravel carried from 50c. to $2 per cubic yard.

Prospecting led to the discovery of the veins and the wide, lower-grade belts of silicious schists and slates that were the sources of the placer gold. The quartz veins, according to the report for 1856 of the State geologist of North Carolina, Mr. Emmons, were in places from 2 to 8 ft. wide, and contained or yielded at that time from $10 to $100 per ton; the schistose deposits were from 20 to 60 ft. wide, and yielded then from $2 to $6 per ton with open-cut mining and Chilean mills. At a few of the mines the quartz veins were worked to a depth varying from 100 to 500 feet.

The greatest mining activity occurred between the years 1829 and 1849; after that date, owing to the discovery of gold in California, there was a considerable exodus of Southern miners to the newer fields. Wooden stamp mills, as well as iron stamps with a few Cornish buddles for concentrating the auriferous and copper minerals in the sulphide ores, were in use when, in 1861, the Civil War stopped all mining operations. Before that time several North Carolina mines had been worked to a depth varying from 250 to 700 ft., and had produced from $200,000 to $2,500,000. Among these were the McCulloch (or Lindsay), the North State, the Phœnix, the Howie, the Hanover Hill, the Russell, the Jones, the Loftin (or Herring), the Rudisil, and the Gold Hill mines. Among the placer mines, the Portis had a recorded production of more than $1,000,000.

Mining was resumed by a new, inexperienced generation between the years 1870 and 1880. Since then there have been several spasmodic revivals, with intervening periods of depressions and irregular

CATAWBA MINE; A SCHISTOSE ORE DEPOSIT

SAWYER MINE, GRIZZLY AND WATER FEED

work. Nevertheless, the production has been considerable for the amount of development at the few locations worked.

In many cases where hydraulic mining, or where the modern stamp mill was used, the fineness of the gold and the slimes in the ore prevented a recovery of more than 40 to 60 per cent. But now an extraction of from 80 to 95 per cent. is possible from the soft ores by new pulverizing and washing methods, and from the hard ores by either the barrel chlorination, pyritic smelting, or the more recently perfected cyanide process. The cyanide process has recently been used successfully at the Iola mine, North Carolina, on free ores containing $15 to $20 gold per ton. The Modern pulverizer and concentrator washing process is used at the Catawba mines, North Carolina, on a schistose ore carrying 60c. per ton, and the barrel chlorination method at the Haile mine in South Carolina on pyrite ore carrying $2 to $4 per ton. Some of the ores can also be successfully smelted.

Principal Causes of Decreased Production

While the changing of the surface ore to refractory sulphide ore at greater depth, or the impoverishment of the orebodies at depth have caused some failures, many of these have been caused by poor management; by the adoption of experimental processes that in the end proved commercially unsuccessful; by the erection of mills before the orebody had been sufficiently developed; or by starting with a capital too small to provide for correcting initial mistakes.

These failures have given the Southern field a bad reputation among mining operators and investors, and many mining engineers, not having personally examined its history and record, its geological formations and ore deposits, hesitate on account of the before-mentioned reasons, and because of its being such an old and accessible field, to advise investment in, or even investigation of, mines in the South.

Consequently, the recent discoveries and the possibility of other discoveries, the new development proving the persistency of orebodies in these fissure and contact veins, and the increased profits obtainable from the application of new extraction methods to these ores, are being neglected.

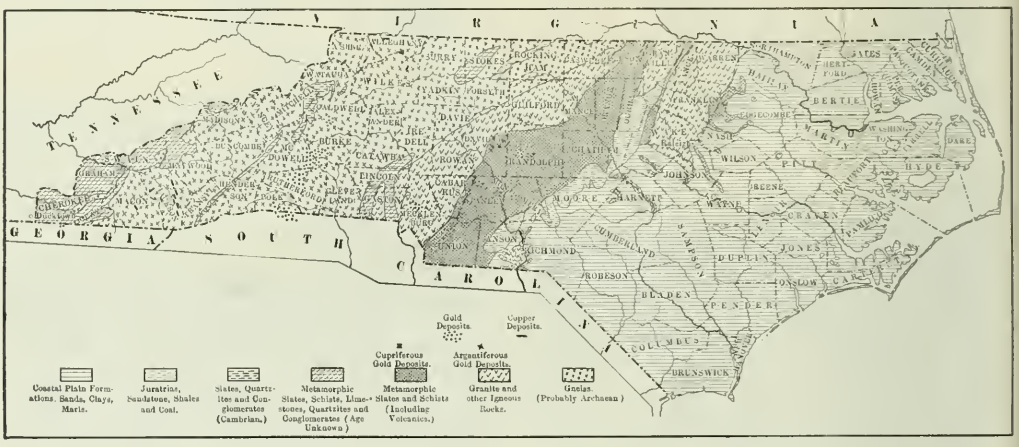
Geological Occurrence and Mineralogical Character of North Carolina Orebodies

The auriferous deposits of North Carolina are contained in the crystalline rocks, that, according to the geologists, cover one-half the State. The rocks include gneisses, metamorphic argillaceous, sericitic and chloritic schists, slates, silicious limestones, igneous plutonic rocks, such as granites, diorites, diabases, as well as ancient volcanics, such as rhyolite, quartz-porphyry and pyroclastic breccias. The limestones and some slates show sedimentary origin, but all are so metamorphosed that they may be included under the general term of crystalline rocks. They appear to be Archean, Algonkian and, in part, Paleozic in age; in geological literature the slates characteristic of southeastern Montgomery and Union counties have been called the "Monroe slates."

Structurally the ore deposits are of two principal types: the quartz-filled veins and the impregnated belts of schist and slate. The gold in the quartz veins occurs both free and in the iron, copper, and other sulphides. The veins differ greatly in mode of occurrence. Some are clean-cut fissures in the massive and the schistose rocks, intersecting the latter, both in dip and strike, at a well defined angle; others occur along contacts between the granites or diorites, and the schists or slates, while still other veins are composed of a system of larger and smaller lenticular bodies, generally conformable to the schistosity of the rocks, but sometimes intersecting the schists, usually at small angles. These veins vary in width from 1 to 8 feet.

The impregnation of free gold and fine-grained auriferous sulphides in the country schists and slates are sometimes accompanied by small intercalated quartz lenses. These schists are sometimes hundreds of feet in width, but usually only a portion of their width carries sufficient mineral to pay for mining. It is these large schistose orebodies that form the low-grade deposits of North Carolina and the other Southern States; from them considerable gold has been produced.

In both the veins and the schists, the ore generally occurs in chimneys and shoots. The general strike of the schistosity is north 20 to 55 deg. east, and the dip varies from 55 to 85 deg. toward the northwest. Most of the veins have a northeast-southwest strike and dip to the northwest. The rocks of the gold belt are much decomposed. The veins are often oxidized to a depth of 100 ft. and in some instances, as at the Iola and Cagle mines in North Carolina, the ore in the vein is oxidized or carries free gold to a depth of several hundred feet, while the inclosing wall rocks carry sulphides.



GEOLOGICAL MAP OF NORTH CAROLINA, BASED ON MAP MADE BY NORTH CAROLINA GEOLOGICAL SURVEY

Gold Belts of North Carolina

The North Carolina field may be divided geologically and geographically into three main belts: the Eastern Carolina belt, the Carolina belt and the South Mountain belt. The Eastern Carolina belt forms a small area in Halifax, Warren, Nash and Franklin counties; it is bounded by the coastal plain and the Louisburg granite. The country rock is diorite, in places changed by shearing into a chloritic schist; other intrusions, some of diabase, occur. The quartz veins vary in width

from a few inches to several feet. They occur in the schists and also along the contact of slates and granite. In places, the surface soil near the veins carries sufficient fragmentary quartz to make it minable. In this area there are some rich placers.

The Carolina belt is subdivided into the Carolina Slate belt and the Carolina Igneous belt. The Carolina Slate belt, which is composed of argillaceous and sericitic slates, crystalline schists, rhyolites, quartz-porphyries, andesite and pyroclastic breccias, is from 8 to 50 miles wide and extends in a southwesterly direction across the Central Piedmont section of the State. It is called by Emmons, one of the former State geologists, "the Taconic," and by Kerr, a successor of Emmons, "the Huronian" belt. In this belt occur fissure and contact veins containing auriferous quartz. Such veins have been worked at Gold Hill, Hoover Hill and other mines. There are also in this belt wide low-grade impregnations of the schists and slate, in which the gold occurs both free and in pyrite as at the old Russell, Jones, Lafflin, Empire, Pine Hill and Haile mines. At the Parrish mine the gold ore is an impregnation of actinolite and tremolite.

The Carolina Igneous belt is west of the Carolina Slate belt. It is from 15 to 30 miles wide, and extends southwesterly across the State through Guilford, Rowan, Mecklenburg and other counties. The rocks in it are granites, diorities, gabbros and diabases cut by later, granitic and diabasic dikes. Schistose or gneissic structure is developed at places. In this belt the gold-bearing quartz occurs in fissure veins, several feet wide; the gold occurs free and in the sulphides. Often, these gold ores are cupriferous, sometimes carrying from 3 to 20 per cent. copper. The old Fentress and Gardner Hill mines, the McCulloch, North State, Lindsay, Fisher Hill, Phœnix, Reed and Rudisil mines are in this belt.

The South Mountain Belt

The South Mountain belt is subdivided into the King's Mountain belt, East Blue Ridge belt and the West Blue Ridge belt. The King's Mountain belt adjoins the Igneous belt on the west and passes through Gaston, Lincoln, Catawba, Yadkin and other counties. The country rocks are crystalline schists and gneisses in which lenticular bodies of silicious magnesian limestone and beds of quartzite occur occasionally. Pegmatite dikes are found in the King's Mountain district in Gaston and Cleveland counties; some of these dikes are tin-bearing. In this belt the ore occurs not only in fissure veins, but also as impregnations of the silicious, magnesian-limestone intercalations in the mica schist. The old King's Mountain mine (Old Catawba), which produced several hundred thousand dollars, is an example of the latter form of deposit. The schists or gneisses at the Catawba (Old Shuford) mine in Catawba county are profitably worked to a width of more than 100 ft. and to a depth of 90 feet.

The East Blue Ridge belt has an area of 250 to 300 square miles, and is principally on the eastern side of the Blue Ridge mountains in Burke, McDowell, Rutherford and Caldwell counties. The crystalline rocks are for the most part micaceous and hornblendic gneisses and schists that often contain garnet and sometimes zircon and monazite. Pegmatite and also granite and diabase dikes occur. This complex is cut by a system of parallel quartz fissures, containing free gold and auriferous sulphides. These fissures vary in width from 1 in. to 4 ft., and many fissures are only 1 to 3 in. wide. These veins strike north 60 to 70 deg. east. Some of them have produced high-grade gold ore. Near the veins some of the saprolites are auriferous. The principal mining ground is composed of the placers, the gravel deposits in the stream beds, gravel in hillsides and gulches, and the saprolites.

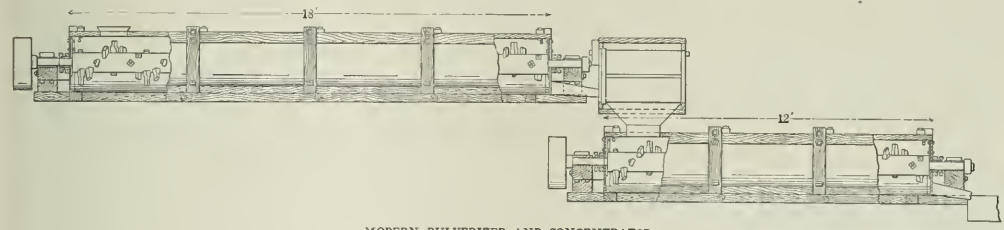
A large amount of gold has been produced by sluicing and hydraulicking in the Brindletown district in Burke and Rutherford counties. Where washing or sluicing is now being done, the gravel carries from 20c. to several dollars per cubic yard.

In the West Blue Ridge belt the ore deposits are scattered. The country rocks are mica and hornblende schists; these are cut by granitic dikes. At Boylestown, Henderson county, limestone underlies the schists. The principal mines of this belt are in Swain, Jackson, Macon, Clay and Cherokee counties, where placer-mining operations are carried on. The country rock is supposed to be mainly Ocoee in age.

The Iola Mining District

The Iola mining district is a comparatively new district near Candor, Montgomery county, N. C. The Iola, the principal mine in the district, has produced over $300,000 in gold since its discovery in 1901. This mine was first worked with Chilean mills, then a 10-stamp, and later a 20-stamp mill and a 40-ton cyanide plant were erected to treat the ore. The Iola Mining Company owns about 65 acres covering approximately 2000 ft. along this vein. Recently a 40-stamp mill equipped with concentrating tables has been completed; the cyanide plant is now being moved and re-erected with additional tank capacity below the new mill. The production for April, when the mill was operating at only about three-fourths its capacity, is stated to be $9000. The country rock is a greenstone of slaty character, probably a sheared andesite. A dike, resembling basalt, and running at right angles to the country, occurs not far from the adjoining Golconda mine.

The surface soil near the veins is sandy and shallow. Although the ore outcrops in one place only, the vein can be traced by iron-stained quartz float along its strike, which is approximately north 40 deg. east. The vein varies from 2 to 6 ft., and averages 2½ to 3 ft. in width; it dips 45 to 50 deg. toward the northwest. The only outcrop of the vein occurs at the discovery shaft. At the surface the ore is a hard, milky quartz, showing visible gold, but a few feet deeper the vein matter became soft and changed to a slaty quartzite ore carrying some lime spar between distinctively slaty walls. Quartz did not appear in the vein again above a depth of 130 ft. In other shafts pay-ore was not encountered until a depth of 30 to 50 ft. was reached. A few faults of small displacement have been encountered underground, but as yet no cross-vein or dikes. Down to 327 ft., the present depth of mining, the gold is fairly evenly distributed in the vein; nearly all the gold is in a free state, the vein carrying only a small amount of sulphides. A good deal of sulphide impregnates the wall rocks; this is unusual at Southern ore deposits. The gold, although fine, is usually granular. Pay-ore has been developed along the vein for 650 ft. by four shafts but drill



MODERN PULVERIZER AND CONCENTRATOR

holes have extended the length of the known pay-ore 150 ft. farther southwest.

Persistency of the Ore

The persistence of the ore is shown at the main or No. 1 vertical shaft, which cuts the vein at a depth of 265 ft. and follows it 72 ft. deeper. Crosscuts have been run from this shaft at the 150- and 200-ft. levels; drifts have been driven on the vein and some stoping has been done. On the 255- and 327-ft. levels north and south from this shaft, the highest grade of ore in the mine, much of it showing visible gold, has been developed. Samples from these levels assay $35 to $45 per ton. Recently, some of this ore has been mined and milled, but on this level a considerable reserve of ore remains. No. 2, a vertical shaft, 333 ft. southwest of No. 1, cuts the vein at 115 ft. and follows it 50 ft. deeper; drifts have been driven from it in both directions on the 116-ft. level. The No. 3 shaft, 150 ft. deep and 214 ft. east of No. 1 shaft, was sunk to work a body of high-grade ore developed in the discovery incline that has since caved; most of this ore has already been mined. No. 4, a new incline shaft sunk on the vein to the southwest of No. 2, is 180 ft. deep; it is in a pinch of the vein, which for the last 20 ft. has been only 15 in. wide. This shaft, which is located near the new mill and is to be the main working shaft, was started to be sunk to a depth of 600 ft.; work on it has been suspended.

These developments have proved a considerable reserve of ore. While the driving of drifts to the southwest may add to this reserve more rapidly than it is required to supply the mill, still, either the new No. 4 combination shaft or the No. 1 shaft should be sunk several hundred feet so as to develop the vein at greater depth, for the Iola vein warrants such development.

Sullivan and Rand drills are used in mining the harder ore. The Mecklenburg Iron Works 8-in. Cornish pump at No. 1 shaft does all the pumping. A 3-in. pipe line, 1½ miles long, supplies water for milling. At surface, and also underground, electricity generated at the mine is used for lighting. The different engines at surface are run by steam.

The ore is delivered to mill from No. 1 and No. 3 shafts in cars by cable and from other opening by barrows. It is fed by hand to the 40 stamps, that weigh 700 lb. and crush through 50-mesh screens. After passing over amalgamating plates, 16 ft. long, and shaking tables, the pulp which carries $4 to $6 gold per ton goes in flumes to the cyanide plant. The stamp duty is a little over one ton per stamp in 24 hours.

At the new 60-ton cyanide plant the usual method of agitation and decantation will be used in treating the slime and the sand will be leached in small tanks. Compressed air will be used in the agitators to loosen the slime before throwing into gear the agitation clutches. The sand from the separators will be partially dried on a dump before loaded into the leaching tanks, lime being added to the sand as the tank fills.

Such were the plans a few weeks ago, but since then a receiver has been appointed to take charge of the Iola Mining Company, mainly on account of mismanagement previous to April, 1907.

Montgomery and Golconda Mines

The Montgomery mine adjoins the Iola on the northeast and contains the extension of the Iola vein in that direction. The main shaft at the property is 235 ft. deep; on that level considerable work has been done on two veins, one having the general character and grade of ore as the Iola vein. The property is equipped with a 10-stamp mill and cyanide plant. This mine is not being worked at present, but the water is being kept down. A new shaft, several hundred feet from the present openings, was recently started.

The Golconda mine adjoins the Montgomery; its workings are on a vein, 2 to 6 ft. wide, east of and parallel to the vein in the Iola and Montgomery properties. It is opened by an incline shaft 150 ft. deep from which levels have been driven at depths of 50, 100 and 150 ft. Some of the ore exposed assays $15 to $20 per ton, but, as the mine was full of water, examination of the deeper workings was impossible. The ore differs from the Iola ore in its brownish color and quartzy character; it also contains considerable sulphide. The dike, outcropping in its vicinity, possibly has played a part in the genesis of this vein. The mine and its 10-stamp mill are idle.

Neither the northeasterly or southwesterly extension of the Iola district has been prospected much, but identical iron-stained float and gold-bearing gossan or gravel is known to exist at several locations. Recently a new development company has been buying property on the northeastern extension of the vein.

By drill holes, new coal measures have been found in brown sandstone and shales within 15 to 20 miles of the Iola district. This find may develop into a source of cheaper fuel for that part of the State.

Catawba Mine

One of the low-grade schistose mines is the Catawba, situated four miles from Catawba, N. C. This mine produced considerable gold by crude washing and milling methods, but when hydraulic mining was tried, the undertaking proved a failure. Its massive decomposed schistose and gneissic formation, intersected at places by small quartz seams, is opened and the entire width mined by an open cut several hundred feet long, 100 to 150 ft. wide, and 50 to 90 ft. deep. The ore is free milling, and its average gold content is 60c. per ton.

At present the ore from this mine is profitably treated with a stated extraction of 80 to 90 per cent. by the new Modern pulverizer and concentrator. This machine was adapted to treat this class of ore, and was installed at the mine by the mine superintendent, A. J. Overton, about three years ago. The cost of mining and treatment is said to be from 15 to 25c. per ton. One set of pulverizers and washers, shown in an accompanying cut, was installed at first, but additions have been made until four sets, with sluice boxes, are now in operation. From 160 to 200 tons are washed in 10 hours; it is claimed that 300 tons per 10-hour day have been mined and washed. The property is not operated at night.

The Modern pulverizer and concentrator is an improvement on the old Snodgrass washer, which in the newer machine has been adapted to the treatment of schistose and placer formations. This device is a combined disintegrator, pulverizer, concentrator, scourer and washer; it saves a high percentage of the coarse and finer as well as the flour gold. The machine consists of two iron concaves, the first 18 ft. and the second 12 ft. long, with revolving shafts, extending through each washer. The shafts make from 150 to 250 r.p.m., and to them are bolted a series of spirally arranged iron or steel blades. The machines discharge, near the bottom of the lower ends, through 1-in. and ¼-in. revolving screens, respectively. Any lumps or uncrushed rocks go to a belt conveyer; the pulp that passes through the disintegrator goes to sluice boxes.

The feed ends of the machines are set 8 in. and 4 in. higher, respectively, than the discharge end; the sand and fine gravel accumulates, and the free gold is recovered where it settles near the upper end of the disintegrators. Most of the gold is caught in the 4-in. space below the concaves, and from 60 to 70 per cent. of gold is caught in the first machine. In the weekly cleaning-up, the concentrators are discharged through an opening in the bottom. Quicksilver is used only in the riffles and in the crude clean-up boxes.

Method of Mining

The ore is delivered from the open cut by cable in one-ton wooden ore cars and in large scoops to the grizzly on the side hill above the mill. One man sledges the oversize from this grizzly. At present the ore from the grizzly is flumed with 3-in. and 5-in. water lines under a head of 35 ft., to the washers about 200 ft. distant, but the company will soon move the washing plant several hundred feet below the present site so that the ore can be delivered by gravity from the mine to the washers, thus avoiding maintenance and cost of their present hoisting plant and delivery method.

The mill and hoist are operated by a 200-h.p. boiler and a 70-h.p. engine. A

pipe-line ¾ mile long supplies water from a dam, which also catches the water draining from the tailings. From the dam the water is pumped to the grizzley. The necessary equipment for the four-washer plant, including buildings, power, pumping outfit and mining equipment, probably cost, erected, between $20,000 and $25,000.

The capacity of one pair of washers is rated at from 40 to 100 tons in 10 hours. One pair requires 75 gal. of water per minute, and from 15 to 25 h.p. to operate it. The price per set of two machines, including shafting, is $1750 f.o.b. Chattanooga, Tenn. The erection and equipment of an ordinary one-set plant, including power, buildings, water, etc., costs approximately $5000. By using crushers to break the ore before it goes to the washers, the harder types of schistose ores may be cheaply and efficiently treated with this washer.

Working tests with one set of machines at both the Sawyer and the Parker mines showed a good recovery in the machines, but large losses occurred through careless or crude clean-ups of the gold-bearing sands and concentrates.

The use of Pierce separators and amalgamators below the washers, when maximum tonnage is desired, and the use of a modern clean-up pan are recommended. The clean-up pan will prevent the loss in the clean-ups of the gold saved in the machines.

The Catawba Mining Company owns and controls several hundred acres along the northeastern extension of their ore deposit, so that the company is considering an addition to their plant.

Silver, Copper and Tellurium Ores

Silver ore is found at few places in North Carolina. At Silver valley the lead carbonate and the galena associated with zinc blende are argentiferous. The old Silver Hill mine, at that place, was worked to a depth of 735 ft. by the Confederate Government, in order to obtain lead for bullets. Native silver has been found in this mine.

Tellurium has been found in the ores of the Belle mine, Montgomery county, and also at a new location in Halifax county in the Eastern Carolina belt.

The 1906 State report shows that the gold production of North Carolina comes from 34 counties; in the State there were, not including minor operations, nine placer mines and 15 deep or vein mines operating; the yield per ton of ore milled was $7.70. The number of mines under development or operation is, therefore, less than during the last few years.

The copper produced from North Carolina ores comes mainly from gray copper and bornite ores in Person county and from chalcopyrite ores in Rowan county. From 1900 to 1907, there was produced 3,763,916 lb. of copper, valued at $658,519. The production for 1906 was 582,200 lb., valued at $135,829. This is an increase in value of 81 per cent. over the 1905 production, due partly to the higher prices of copper prevailing during that year. Incomplete figures tabulated by United States Geological Survey from reports of the production and value of gold, silver and copper from 18 counties in North Carolina gotten directly from the principal mines, shows a total production for 1907 of $212,909 against $288,781 for the year 1906.

	1907.	1906.	Decrease.
3,976.08 oz. gold.....	$ 82,193	$122,008	$ 39,815
21,666 oz. silver.....	14,300	30,944	16,644
582,082 lb. copper.....	116,416	135,829	19,413[1]
	$212,909	$288,781	$ 75,872

[1] Decrease in pounds copper produced was 127 lb.

In spite of this decreased production, at several new properties prospecting and developing have been started during the present year. Among these are the Morehead property, containing a silver-lead-zinc ore, in Davidson county, the Gray gold property in Guilford, the Portis gold mine and other properties in Catawba and Rutherford counties.

American Crude Oils

The accompanying table, taken from the *Petroleum Review*, Aug. 15, 1908, which states that the table is only an approximation, gives a good idea of the composition of the crude oil from the different oilfields in the United States.

APPROXIMATE COMPOSITION OF THE CRUDE OILS OF THE UNITED STATES

Products.	Appalachian. %	Lima-Indiana. %	Mid-Cont. %	Gulf. %	California. %	Corsicana. %	Colorado. %
Naphthas—gasolene, benzine, etc.	12	11½	11	3	6	7	3½
Illuminating oil	67	43	41	15	18	50	35
Lubricating oils (including grease)	12½	15	—	6	1½	—	3
Gas oil			25	45	72	—	—
Fuel oil (including acid oil, asphaltum oil and asphalt)	4	25	20	28		40	55
Paraffin wax	2	2	—	—	—	—	—
Total	97½	96½	97	97	97½	97	96½

Trial of the Karns Tunneling Machine

(Special Correspondence)

Recently I made a trip to Magnolia, nine miles from Boulder and 39 miles from Denver, to witness a trial of a newly installed rock borer, known as the Karns rotary tunneling machine. The trial was made at a mine owned by one of the gentlemen who financed the drill company.

The cutting head of the drill is 6 ft. in diameter; the power is furnished by a Rand Imperial compressor, giving about 1500 cu.ft. of air per minute. The entire machine weighs about 10 tons; the head and shaft, or in other words, the reciprocating parts, weighing 5½ tons, and the carriage the rest.

The water, which was thrown against the breast, and which carried the "muck" back of the machine, was furnished from a reservoir by a No. 9 Cameron pump, through a 4-in. pipe, reduced to 2 in. at the discharge.

We arrived at the mine at 1 p.m., and the machine was at once started up, with the result that in 90 min. of actual drilling time it bored a hole 6 ft. in diameter 64¼ in. into solid granite; the measurements were carefully made by disinterested engineers in the party. The entire time occupied in drilling the hole was 110 min., but the screw was moved up twice, taking 10 min. each time. The machine can cut from 4 to 5 ft. without being advanced, but in this trial, it was put forward twice in the 5 ft. 4¼ in.

There were, as far as I could see, no parts of the machine that were weak or liable to breakage; the moils or cutting points, of course, became dull, as any drill would, but these can be easily replaced with sharpened ones. The water and a sort of endless-chain rake in connection with the device brings the "muck" back of the machine, but the conveying for long distances to the mouth of the tunnel of the two tons of chippings per foot of advance has yet to be reckoned with. Automatic conveyers are being perfected, and doubtless this want will soon be filled.

At any rate, the cutting power of the machine was amply demonstrated — further I cannot say, for its durability under a long period of work has yet to be proved.

Gold and Silver in New Zealand

The Mines Department reports the exports of gold from New Zealand for the full year at 508,210 oz. bullion in 1907, and 506,447 oz. in 1908; a decrease of 1763 oz. The bullion reported in 1908 was equal to $9,758,197, or 472,095 oz. fine gold.

Silver exports for the year were 1,562,603 oz. in 1907, and 1,731,366 oz. in 1908; an increase of 168,763 oz. This silver is chiefly from the gold mines of the Ohinemuri district.

Rusty gold concentrates from blanket tables are amalgamated (*Journ.*, Met., Chem. and Min. Soc. of South Africa, Nov., 1908) by treating them for four hours with nitric acid in a revolving amalgamation barrel. After that treatment, upon adding mercury, the gold amalgamates readily.

Prevention of Accidents in Metal Mines

Accidents Due to Carelessness Are Preventable. It Should Be the Duty of the Superintendent to See That the Miners Are Not Careless

BY CLAUDE T. RICE

Falls of ground, reckless handling of explosives, and carelessness at and in the shaft are the three principal causes of accidents in metal mines. Carelessness in the shaft causes many accidents; explosives cause more; and falling slabs of rock the most. Many of these accidents can be prevented by study and foresight; yet the discussion of this subject of mine accidents is shunned by mining engineers—possibly because they hate to acknowledge how many accidents are due to poor management.

The one book treating of mine accidents and the articles which occasionally have appeared deal mainly with accidents at coal mines, while the little that has been written on accidents at metal mines consists mainly of statistics regarding the frequency of different classes of accidents, and rarely contains any comments that would aid in preventing their recurrence. A few years ago one of the Western mining periodicals, the *Mining Reporter*, published each week a list of the mine accidents that had occurred during the preceding week together with the causes as far as ascertained; but that section of the paper seems to have reached too tender a spot in the anatomy of mining men for it finally was discontinued. The motive of that column was good, for it brought home each week to the men in charge of mines this question of mine accidents; yet it did not arouse any discussion.

Mine accidents do not decrease in number by being ignored, so it seems to me to be high time that some of the time and the space devoted to wild hypotheses in regard to ore formation were given to the humanitarian side of mining and that the study of the causes of mine accidents and of ways of preventing recurrence of similar accidents were undertaken.

During the first two and a half years after I left college, I worked as a miner at many of the important mines in the Western States. While mucking, running machines, single-jacking and timbering, I had a chance to observe mine workings in their every-day condition, as well as in the holiday attire that a stope dons when the superintendent or manager obligingly tells the foreman that he will probably go underground at a certain time. In this article I shall state some observations that I have made upon the causes of different mine accidents, and in some instances I shall try to point out ways of avoiding the recurrence of such accidents. While discussing accidents in mines I shall also discuss mine fires.

Accidents from Overwinding

Few accidents, at least in the United States, result from breaking of the hoisting rope or from overwinding; still I once had the experience of being hoisted within 10 ft. of the sheaves by a drunken engineer. As a rule the hoisting engineers are the most reliable men in a mining camp, and no one should infer from this that drunkenness is common among hoisting engineers. Still it emphasizes the fact that all classes of men must be watched. To guard against this class of accidents it is well to have some device for preventing overwinding, such as those that shut off the power at a certain point.

While speaking of drunkenness it might be well to say that drunkenness is a contributory cause in many accidents, for many times miners go to work in a partially intoxicated condition. By hiding among his fellows, often the miner conceals this condition, but as soon as he goes underground the hot, vitiated air soon increases the stupor. An intoxicated or partly intoxicated miner does not work, and he is a danger to himself and others. In order to guard against a drunken miner's getting underground, all miners, before going on shift, should have to report to the timekeeper in a well-lighted room where for some distance the miners must file past him. Any miner coming to work drunk or even partially intoxicated should be fired. The miners should be double-checked, i.e., they should be checked both when they go on and come off shift. This double checking insures that all the men are out of the mine at the end of the shift. Besides, it shows that all the miners stay underground the full time. At some mines where on night shift the shift boss makes only one round after dinner the miners have been known to sneak home before the end of the shift.

Accidents in Shafts

The few accidents that happen in the shaft during hoisting are mainly due to the following three causes: Riding on the same deck with timbers; riding on the cage with tools, such as picks, drills, etc., in the hand; and riding in empty, or on top of loaded cars.

Timbers should be securely lashed when lowered in the shaft, and no one should be allowed to ride on the deck with them, even when there is plenty of room, for the timbers often slip in a very mysterious manner on the wet iron of the cage floor. No one should be allowed to carry tools on the cage, for if the hoisting engineer stops the engine suddenly the men will probably drop the tools with the possibility of their catching between the cage and the timbers. Loose drills should never be lashed on the cage, but a special box, mounted on a low truck with a broad axle base, should be provided in which to lower the steel. If the steel or tools, such as picks, are placed in a box of that kind, the truck is locked on the cage, the tops of the drills are securely lashed, and the tool "nipper" is made to ride on the other deck, no accident will happen when lowering the steel or tools.

Gates on the Cages

Riding on the cage in a car, whether loaded or empty, is extremely dangerous, and many are the deaths that have been caused by it. Fortunately most companies in the United States strictly forbid riding on cars in the shaft, yet at some otherwise well managed mines this is allowed. The danger arises from the fact that the miners are apt to forget to latch the catch that holds the car. The jar of the cage throws the car off, and the men are caught between the cage, the car and the timbers.

Hoisting of the shifts without gates on the cage is another source of accident in shafts. At mines where more than 30 men work on a shift it should be made a criminal offense to hoist or lower the shifts without gates on the cage, for generally the cages at which times are so crowded that if gates are not used men are apt to be pushed off, while being hoisted. The gates do not cost much, and when they are used the men can be hoisted and lowered in less time. The gates should be of the swinging type and not of the folding latticework or pantograph type, for the latter are apt to belly out under pressure and so cause an accident. Overhead bars low enough so that the men can hold onto them easily should be provided on all cages used for hoisting men. These can be arranged so as to swing out of the way when the handling of the men is finished.

At large mines the men often crowd badly at the stations when they are being loaded onto the cages at the end of the shift. This is dangerous; the foreman or the superintendent should see to it that it does not occur. The station tenders, unless backed up by a special order from the foreman, are generally unable to cope with the difficulty. Still, if the station tenders skip the levels where the crowd-

ing occurs, and hoist first from the other levels, the crowding generally ceases.

In hoisting with buckets many accidents result. These happen more frequently from the non-use than from the use of crossheads. The accidents with crossheads are due to their "hanging up" in the shaft and then falling upon the men in the bucket. If the hight of the crosshead is two-thirds of its width there will be little danger of its catching between the guides; if one of the several recently designed crossheads is used, such accidents cannot happen, for the bucket is fastened to the crossheads is used, such accidents cannot is not used for sinking, the crosshead should be securely fastened to the hoisting rope as near as possible to the bucket, and if the bucket is designed to dump by rotating in its bale, the bale should be fastened securely to the crosshead. When sinking with a bucket not provided with an improved locking crosshead, a clip should be securely fastened to the hoisting rope far enough above the bucket so that the crosshead could not strike even a 7-ft. man on the rim of the bucket. A little platform on the top of the crosshead, providing room for four men, will do away with the need of riding in the bucket except when shifts are being changed. If at that time the bucket is lashed to the crosshead, such accidents will be prevented. Many deep shafts have been sunk by means of a bucket without using crosshead and guides, but I think that the use of a crosshead and guides should be made compulsory unless the hoisting is done with a windlass. In case the ground stands so well that timbering is not required, rope guides can be used.

Accidents with Explosives

In considering accidents due to explosives I will not consider those that result from carelessness in thawing dynamite, for generally the person who blows himself up in that way is one of those who knows it all, and no advice would have aided him. Fortunately, as knowledge regarding dynamite becomes more common, accidents due to carelessness in thawing dynamite are rapidly decreasing in number.

At several mines in the West there have been serious accidents arising from the storage of dynamite in large quantities underground. The correct place for the storage of dynamite is in a short drift driven at some distance from the mine entrance and closed by a thick door covered with a piece of turn-sheet. Several accidents have resulted at mines where the dynamite was stored in a wooden house. In some instances no one had been near the building for some time, and the only explanation suggested was that a stray bullet from some hunter's rifle had exploded the dynamite. In case that owing to flat topography, a drift cannot be driven conveniently, the powder-house should be made of brick or stone and should have iron-protected doors.

In no case should more than two days' supply of dynamite be taken into the mine, and only one day's supply should be kept on each level. The dynamite on the different levels should be stored in a dry part of the mine (some unused drift is often convenient), and if possible this place should be electric-lighted. No miner should be allowed to carry a lighted candle into the powder room, if it is lighted by electricity, and in no case should anyone be allowed to take a pipe (in fact all smoking should be forbidden in a mine) or capped fuse into the powder room. The caps and fuse should be kept at least 100 ft. away, and the place for the fuse should not be too warm, since some fuse deteriorates rapidly in a warm temperature and, owing to swelling, becomes difficult to cap. The place where the detonators are kept should be tightly floored so that if any are spilled they can be picked up easily; and none will then be lost under foot, possibly later to be exploded, disabling someone.

The carelessness of miners in handling explosives is notorious, but an occasional watching of the men at powder time together with an occasional firing of a man caught handling dynamite carelessly will soon result in a greater respect for dynamite.

At many large mines several powder-monkeys are employed. In the morning they keep busy capping fuse, thawing dynamite, and packing it into sacks for the different levels. In the afternoon the powder-monkeys go through the stopes distributing the dynamite and fuse to the men, keeping record of the amount of dynamite and the number of fuse given to each miner. In several mines this has resulted in a large decrease in the bill for explosives. Anyway the method is safer than letting the miners get their own dynamite for explosives are handled mainly by experienced men in whom the company has confidence.

Accidents Caused by Missed Holes

Missed holes are the cause of most of the accidents with explosives. Misfires may occur from many causes, chief among them being improper loading and improper placing of the holes. When holes are drilled too closely together cut-off holes result; if the cap and fuse are torn out of the charge, a missed hole results. More frequently, the misfire is caused by improper loading. One would naturally think that miners must know how to load a hole properly, but many do not. In cold stopes a frequent cause of misfire is the placing of the primer in the hole with the fuse end ahead. This necessitates so sharp a bend in the fuse, that frequently the powder train in the fuse is broken; and a misfire results. Among other mistakes in loading is the improper use of tamping. For these reasons the foreman and superintendent should investigate the manner of loading used by a miner guilty of frequent missed holes.

All miners should count their holes as they explode, and should report any misfires to the shift-boss. The shift-boss should immediately record these on a blank slip that is left for the boss on the other shift. Before he goes home, the shift-boss should post a copy of this on a bulletin board so placed that the miners when they go on shift cannot help but see it.

When "short a hole" frequently the miners assumed that an unusually loud report was a "double," and do not report a missed hole. Any miner can count, and after spitting the holes he can go to some safe place where he can hear his holes go off; consequently any remissness in reporting holes is carelessness pure and simple. To insure that, in cases of doubt, the miners will report a missed hole, any miner who fails to report a misfire should himself be fired.

Most missed holes occur in development work, and it is just in those places that it is sometimes difficult for a miner to find the missed hole. Consequently all miners working in drifts, crosscuts, raises, winzes and shafts should be made to show by means of arrows on a diagram the position, direction and relative length of all holes blasted. This enables the other shift to find quickly a missed hole. Besides, in case of failure to report the misfire, the miners on the next shift, after looking at the diagram of the holes blasted, would probably recognize the presence of a missed hole. In stopes a miner can generally tell from the shape of the breast whether or not there has been a missed hole; indeed a good miner before he begins work generally tries to figure out how much and where the other shift drilled.

Government Inspection of Explosives Needed

While discussing explosives and their use, it is well to draw attention to the fact that, while in other countries explosives, detonators and fuse are carefully tested, in the United States any old thing can be used. For instance there is no regularity in the rate of the burning of fuse. In one mine one kind of fuse with a certain rate of burning is used; in another a different kind with a different rate. Miners change frequently from mine to mine; at each change they are apt to use a new kind of fuse. They ask other miners about the speed of the fuse, and cut the fuse accordingly. They may cut it too short, and then they must scamper to get to safety. In Western Australia fuse must burn not faster than 80 sec. per yd. nor slower than 100 sec. per yd. At first this limitation seemed impracticable to some, but according to the Report for 1907 of the Department of Mines, Western Australia, page 221, out of 311 samples of fuse tested in 1907 only 28 did not comply

with the requirements of the State law; 17 samples went over and 11 under the prescribed limits. In regard to detonators, E. A. Mann, chief inspector of explosives, Western Australia, in the July, 1908, issue of the *Monthly Journal* of the Chamber of Mines of Western Australia states that frequently in his tests he has found that the nominal strength of detonators is not rigidly adhered to by manufacturers. He recommends, therefore, the use of only such detonators as experience has shown to be reliable. His statements should be borne in mind for possibly some misfires may be due to poor grade of detonator. It seems to be high time that some action were taken by the United States Government in regard to explosives, detonators and fuse. Anyway the superintendent should have each purchase of fuse tested for speed and regularity of burning before the shipment is accepted. At present too little attention is given to explosives in the United States, especially by mining men.

Accidents in Stopes

Men frequently fall down chutes and manways, or are injured by rocks or tools falling down manways. Such accidents in stopes and drifts are needless as they can easily be prevented. In the first place all chutes and manways should start from an offset on the level below, and should "hole" into an offset on the level above. Then timbers can be hoisted or lowered to the stope without blocking the drift, drills slipping out of the chain while being hoisted will land in the offset without tearing up the rails, and rocks falling down the manway will not strike some passing carman on the head or dirty up the track later possibly causing an upset. When the raise and chute "hole" by the side of the track, they should be railed in so that no one can walk into them. A raise should never be driven so as to "hole" into the level under a track, for if it is, sooner or later someone will fall down the raise and be killed.

The tops of all chutes and manways, as well as the bottom of all manways, should be covered with trap doors so that, when the stope is not being worked, the doors can be closed and the air caused to go up through those stopes that are being worked. Moreover, such trap doors are better than the railings for preventing persons or objects from falling down raises or chutes, and as has been shown, greatly aid in properly ventilating the stopes. The timbers in all manways that are in use should be cleaned from time to time in order to guard against accidents from falling rocks when several men are using the manway at the same time.

In the stopes, accidents from falling down chutes or manways can be prevented by means of grizzlies and railings in the case of square-set, and by means of grizzlies and trap doors in the case of stull chutes. The grizzlies also prevent large "round heads" from being thrown into the chute.

Poisonous Gases at Metal Mines

While poisonous gases are more frequently in coal mines, still at a few metal mines there has been trouble with flows of gas from solid rock. This is unusual, but one or two cases have been reported from Colorado and, as I remember, but I may be mistaken, one man was killed by the gas. This gas contained principally carbon dioxide. The death of this man indicates the chances that men will sometimes take in bad air. No man should be allowed to stay long in a place where a candle will not burn. In fact he should not stay at all in such a place; not because it is very dangerous to health if the oxygen is just insufficient to nourish a candle flame, but because after that point is reached the person has no way of telling how much farther the oxygen has been depleted. Still I know of mines in the West where many Italians are working in electric-lighted drifts and stopes, electric-lighted because the air is too poor to support combustion. Such practice is criminal, unless it is absolutely necessary.

Such workings are generally in caved sulphide orebodies, and the depletion of the oxygen is due mainly to the rapid oxidation of the sulphur in the heated particles of finely pulverized sulphide minerals. The heat in these places is due partly to the oxidation and partly to the grinding and crushing of the caved ore. The necessary oxygen can be supplied by opening wide the valve on the air pipe or by using a blower. Generally the compressor is already too small for its work, or what is almost the same thing the shift boss thinks so; consequently the poor miner works in bad air.

Whenever any such places are being worked in the mine, special care should be taken in hoisting from those levels, for these men are very apt to faint when they suddenly encounter the cool, fresh air in the upper part of the shaft. Men who have been working long in a stuffy raise or in a stope in which the powder smoke hangs badly, are also apt to faint while being hoisted. It is especially because of these facts that the gates ought to be used on the cages. Yet I know of one case in which, even when gates were used, a miner upon reaching the cold air fainted, his head protruded beyond the cage, and he was crushed to death. Therefore, owing to that possibility, whenever a miner has a bad powder headache or has been working in bad air, he should be ordered to report the fact to the station tender, who should load him as near the center of the deck as possible so that if he faints his companions can hold him.

In tapping old shaft workings the workmen should be prepared to meet with quantities of carbon dioxide, and, in case the workings contain much timber and have been under water for some time, the superintendent should not be surprised if, on connecting with those workings, he finds inflammable gases.

Mine Fires

The subject of gas leads us to that of fire, for most of the carbon dioxide giving trouble at metal mines is due to the burning of timbers. Fires are apt to occur at any time at mines where much timber is used, and even where little timber is used the shaft timbers are liable to catch fire if the shaft is dry. Although fires at metal mines have caused the death of many miners, still, comparatively speaking, few metal miners die in mine fires. Nevertheless, owing to the fact that at most mines little provision is made for fighting or preventing fires I will treat of the subject.

In dry shafts in order to prevent fire a little trickle of water should be allowed to fall on the top sets and flow slowly down the other timbers. Since it is only necessary to keep the timbers moist, the flow of water should not be enough to make the shaft wet. This moisture also prolongs the life of the timbers, for it diminishes the growth of bacteria; especially is this the case in warm, upcast shafts where the bacteria and fungi increase rapidly.

Many lives have been lost at metal mines in trying to rescue men from burning workings. This rescue work can be carried on with little danger if one or two helmets for fighting fires are kept at the mine. Some of the later invented helmets, in which the wearer carries the supply of oxygen along with him, are to be preferred as they are less cumbersome than the older type supplied with air from a hose, yet the homemade Anaconda helmet recently described in the Journal by Robert N. Bell is sufficiently good at mines where compressed air is handy. At least two helmets should be kept at mines where much timber is used underground. At a number of mines thousands of dollars, to say nothing of lives, might have been saved if fire-fighting helmets had been at hand in the early stages of the fire.

The compressed-air pipes at all shaft mines should be connected to the surface water-supply so that by opening a valve the air-line can be converted into a water-line. If then several nozzles, so constructed that they will screw into the couplings on the air-drill hose, are kept in the storehouse, the mine is equipped with a good fire-fighting system.

Fireproof Door near Portal of All Adits

Fires are especially dangerous at mines worked through adits, for generally at such mines there is a strong ventilating current sucking up through the stopes. At mines, where the blacksmith shop and

other buildings are connected with the adit by snow sheds, in case the surface buildings catch fire the smoke is apt to be sucked through the adit up into the stopes. Frequently this smoke suffocates some of the miners before they can escape through the upper workings.

Such accidents happen almost every summer, and yet they are easily prevented by a few precautions. In the first stretch of untimbered ground in the adit an air-tight, self-closing door should be hung, which is arranged so that it can be closed from a distance. The door should be held open by a wire or rope running on pulleys to the entrance of the mine. Outside of the mine, in case that a wire is used, a rope must be attached to the wire. The end of the rope should be fastened in the blacksmith shop or at some other place where men are constantly present. Then in case of fire someone can unfasten the rope and let the mine door close. This rope should be carried along near the top of the snow shed so that, in case the shed catches fire and no one unfastens the rope, it will burn, releasing the door. The door being air tight and in an untimbered portion of the mine prevents the sucking of the smoke into the mine workings, no matter how violent the fire may be outside. This door should be frequently tested so as to see that it works easily, and in winter special care should be taken that ice does not form so as to prevent the door from closing air-tight.

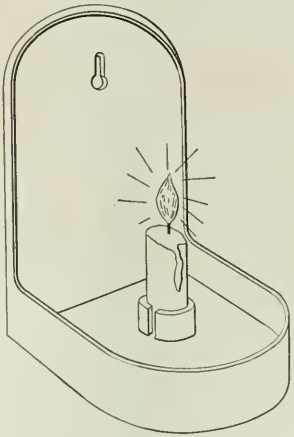
On each level of all mines in the drifts leading to the shaft stations similar air-tight doors should be placed. In case the drifts are timbered, a concrete bulkhead with an iron door should be built. By closing these doors the stopes of each level can be shut off from the shaft in case of fire.

Mine fires may start from the caving of timbered stopes in orebodies rich in sulphur, but most start from the carelessness of the miners. The fire at the Homestake mine, Lead, S. D., started, it is said, from a blast that set fire to some old timbers in a portion of the mine that was being reopened. When such work is being done, not only should the miner be required to go back to the face after blasting, but also the shift-boss or, if there is a "fire bug,"[1] the "fire bug" should be specially ordered to visit all such workings. Moreover, when reopening old stopes or drifts in which many old timbers are found, a water pipe should always be carried along as the drift advances.

In square-set mines most fires start in stopes from candle snuffs left on the timbers. The explosion of the holes generally extinguishes these lights, but in some cases it does not. Leaving a lighted candle in a mine is good cause for discharging a miner. If much timber is used, a "fire bug" should go through all the workings, unless sconces are used. Sconces are far better than any "fire bug."

The Sconce

The sconce is an old Cornish device which is used in the square-set stopes of the Copper Queen Consolidated Mining Company's mines at Bisbee, Ariz., to hold the candles placed at the chutes and at other places in the stopes. It is shown in an accompanying illustration. The sconce is made of cast iron, and in order to resist the rough usage that it undergoes it should be made especially strong. The sconce used at Bisbee is a one-piece casting consisting of a back and a bottom portion meeting at right angles. The back, which keeps the flame from blowing against the timbers, has a hole in it for hanging the sconce from a nail. The lower round part of this hole is large



SCONCE USED AT COPPER QUEEN MINES, BISBEE, ARIZONA

enough to go over the head of even a 60-penny nail, while the slotted upper portion is wide enough to slip along the body of a nail of this size, but not wide enough for the head of a 40-penny nail to slip through it; this prevents the sconce from being knocked off the nail on which it is hung. The hole should be placed at least an inch from the rim for this part of the sconce is the weakest. The bottom piece has a rim ½ in. high extending all around it so as to catch the melting grease or paraffin from the burning candle. In the center of the bottom and about 2 in. in front of the back is the candle holder. This is a ring 1 in. high having the diameter of the candle used at the mine; it is slotted so that the miner can easily gouge out, with his candlestick, any butt of a candle remaining in the holding ring.

If this ring holder is kept cleaned out so that the candle is securely held, and the grease is not allowed to accumulate on the bottom, there is no possibility of the burning candle setting fire to the timbers, for it cannot fall out of the sconce. As soon as the miners have been trained so that they will not burn candles in, or on, anything other than their candlesticks, or these sconces, no "fire bug" is required to go through the stopes to guard against fire. Sconces have been used in the Copper Queen mines at Bisbee for years without, I think, a single fire. This speaks well of the sconce, and other mining companies using the square-set method should adopt it. A few fire extinguishers are also very useful about the surface plants at mines.

Accidents Caused by Falling Rocks

Finally we come to the main cause of accidents at metal mines, and for that matter at coal mines; that is, falling ground. Accidents from falling ground are of two classes—those due to carelessness, and those that are due to unforeseeable circumstances. In the latter class belong those accidents in which stopes suddenly cave, or large blocks of ground—so large that on testing they sound as if they are solid—fall. These accidents are due to unsuspected slips that cut across the vein. Geological maps, on which the principal movement planes are indicated, aid in preventing such accidents.

The other, the careless class of accidents—those accidents that the mine inspector and the coroner's jury generally report as unavoidable and due to no contributory negligence on the part of the company—claims the most victims. All accidents due to the falling of slabs of rock weighing less than a ton are due to carelessness; most people say due to the carelessness of the miner; certainly, but also due in most cases, I claim, to the contributory negligence of the company. In Mexico the men in charge of the mines realize that they must watch the miners so as to safeguard them (besides the Mexican government investigates the methods used at mines where accidents are too frequent); but in the United States, mining men assume that the miners know enough to safeguard themselves. Such an assumption, I assert, is the cause of half the accidents at metal mines.

Men accustomed to danger become careless. It is not because the miner in the United States has insufficient brains that he requires watching, but it is because in time almost every miner develops a contempt for small dangers such as the falling of a small rock from the roof. He becomes lazy, and rather than take a little time to make the place safer he begins work after picking down the worst of the roof.

You can depend upon the machinemen's picking down the back immediately surrounding the place where they are going to set up the drill, but, since picking down the back takes time and is hard work, they generally skim over the rest of the roof near the face. In case the mucker is a

[1]In Western mining camps the name "fire bug" is applied to the man who goes through the stopes after the shift leaves the mine to see that no fire, such as a burning candle snuff, etc., is left in the mine.

fellow countryman the machinemen will be more careful, but if he is of some other nationality the miners will soon call out that the back is all right. During the last few years most of the mucking in the West has been and for that matter is still done by those nationalities that the Western miners call "dagoes"—not necessarily Italians, but also Hungarians, Poles, Finns, Austrians, Montenegrins, Servians, etc. These fellows are generally stronger in the muscles than in the head, so they begin to muck whenever they are told by the miners (in the main, Irishmen, Cornishmen or their American-born descendants) that it is safe to do so.

When the shift-boss comes along he first looks at the muck pile that the other shift has left for him, then he notices what kind of a set-up his miners are going to have, and finally he looks to see if any timbers are needed. Then he hurries along probably with some admonition to the muckers to "sail in" and get him out some "muck." The foreman comes along soon after, and his trip is even faster than that of the shift-boss, for he must cover the whole mine and must spend time keeping up his reports and letting miners "rustle" him for a job. Neither the shift-boss nor the foreman pays especial attention to the condition of the roof.

The mucker mucks on, finally a slab, jarred loose by the blows of the machine drill, falls and hits him. He is hurt, possibly killed. Whose fault? The coroner's jury will say that it was due to his own carelessness, but I say that it was due to his own ignorance, the laziness of the miner, and the want of care on the part of the company's agents, the shift-boss and the foreman.

The majority of the readers of this will probably say that I exaggerate, but I can judge only from my own observations for I know of no others who have contributed theirs. During the two and a half years that I worked as a miner, and it was mostly at the better mines of the West, I can remember (and of this I am almost positive) only two occasions when I saw or heard of any miner's being "called down" for not picking down the back. Both those times it was myself who was "called down." Once when I was mucking in the Camp Bird mine, Colorado, the shift-boss "jacked me up" because I, greenhorn that I was, was shoveling under some slabby ground. He ordered me to take the ground down, but to the miner whose duty it was to keep the stope safe he said not a word. Another time in another mine I was deservedly "called down" for beginning to drill before I had picked the face of the drift clean of loose rock.

Events Leading up to an Accident

I have timbered in several places where my partner and I would not stand a stick of timber before we had picked down the back; but the muckers had been working under the ground for some time. They did not know better; we did, or at least my partner did. I well remember picking down over a ton of rock from a roof under which muckers had been working for two shifts, and even then my partner and I would not stand the timbers while the air drill was running. These occurrences were in well-known mines of the West that were in other respects very well managed; such occurrences were not unusual.

The cycle of events leading up to accidents from falling ground is a long one, but almost universally it is somewhat as I will describe it. The manager asks the superintendent for tonnage; the superintendent demands ore from the foreman; the foreman tells the shift-boss to get out the rock; and the poor shift-boss goes through the stopes yelling to the machinemen and the muckers, "Rock! Rock! Rock!" Consequently the shift-boss looks upon the timbermen as a nuisance who block the tracks and the stations with their timbers, thus decreasing the tonnage; and the stope—well, as long as it does not cave, the shift-boss inwardly says: "The stope be dammed." His first anxiety is to see the pile of rock that the other shift has left for him; his main activity is watching the chutes from the different stopes and the tally-boards at the different stations.

The machinemen notice this, and they see that neither the shift-boss nor the foreman watches the roof. Consequently the time that they spend in thoroughly picking down the back is not considered, and, as they probably have a family depending upon them and therefore desire to hold their jobs, they have to work harder the remainder of the shift in order to get in their round of holes and make a "showing." The miners begin to slight the back of the stope; nothing is said. They get bolder, they skim over the back and only pick down where they are going to set up the machine, and still nothing is said by the bosses. An occasional small rock falls on a shoveler's back. The poor foreigner frightened runs back, then swears in broken English at the miners. Unfortunately that is all that he does; if he only hammered the miners over the head with a shovel, he might save his own head later. As it is, a few punches at the roof with the pinch bar suffices to reassure the shoveler; then the miners begin drilling again. Everything goes lovely in this manner for days until finally a rock falls from the roof and someone is hurt or killed. Then for a few weeks the miners are more careful, but soon they, the shift-boss, and the foreman are back again in the old lazy, careless ways.

Conclusion

Consequently I say that, unless the superintendent sees that the foreman sees that the shift-bosses see that the miners pick down the back, the miners will only skim over the roof and will not pick it down properly. Until the miners are made to pick down the roof properly, falling ground will continue to be the cause of most mining accidents.

I hope that possibly these notes may induce some companies to begin the study of this problem of preventing mine accidents, and that they may serve to make life less hazardous for the miner—especially for those partners who patiently endured me while I was trying to learn to mine. In conclusion I ask those readers who are in charge of mines to take a trip through the stopes so as to observe in their own mines the condition of the roof at the different faces, the position of the raises, the amount of rock on the timbers in raises, winzes and shafts; then I hope that they also will discuss this question of accidents. The number of accidents at mines can only be diminished by studying their causes and by improvizing some system to prevent their recurrence. This can best be accomplished by each telling the other what he has learned about mine accidents, and by suggesting to one another ways of preventing similar occurrences. Finally—let me whisper it for no one will pay attention to the suggestion if it is shouted—possibly, if the miners learn that the men in charge of mines are taking a vital interest in their (the miners') safety underground, labor troubles may be less frequent than in the past.

Drawback on Zinc Shavings

Special Correspondence

In accord with a decision rendered by the division of customs in the Treasury Department, a drawback of the amount of duties levied, less 1 per cent., will be allowed in future upon the exportation of zinc shavings manufactured from imported zinc in sheets. The drawback entry is required to show the total quantity of zinc shavings exported, the quantity of imported sheet zinc used in the manufacture, the quantities of the different kinds of waste and the market value thereof, together with the value of the imported zinc at the factory. It must also show that the shavings were manufactured of the material and in the manner set forth in the sworn statement of the exporter. In liquidation the quantity of the imported material which may be taken as the basis for the allowance of the drawback may equal that claimed in the entry, after official verification of exported quantities, provided it shall not exceed the net weight of the exported shavings with the proper quantity added there to compensate for worthless waste. In estimating this waste the value of the scrap is to be duly considered.

All drifts where much tramming is done should be well lighted.

Mining Methods for Maximum Recovery of Coal

Early Systems of Mining the George's Creek Coal Secured About 50 Per Cent. of the Seam, Present Methods Insure Recovery of 95 Per Cent.

BY H. V. HESSE*

There is no phase of human endeavor in which man's extravagance has been so forcibly exemplified as in the mining industry of the United States.

The conservation of our natural resources is a subject which is focusing the attention of the American people. Much has been written and many addresses have been delivered on this subject of grave import. It has been discussed by men of all degrees from the chief ruler of the land to the humblest citizen, and the scientific world is busy devising ways and means to prevent the extravagant methods which have held forth for many years in unrestrained recklessness. The "get-rich-quick" spirit has resulted in the devastation of our forests, the depletion of a large percentage of our fabulous deposits of minerals and left us face to face with the greatest problems that have been encountered.

The tremendous development in the United States during the past generation fairly staggers the mind. In the mad chase of the "almighty dollar," the great absorbing idea has been the desire for quick results. No sooner had the investment been made than immediate results and big returns were expected. The investor became impatient and chafed at the least delay, thus causing methods to be employed in extracting our minerals, which were not economic, but, on the contrary, extravagant, and created conditions which have proved dangerous to life and property.

Four Important Factors

There are four factors, any one of which is sufficient to cause a serious loss in the percentage of coal recovered and an increase in cost of production, reducing the ultimate earnings of the property:

1. Insufficient or incompetent engineering. Until very recently the engineer was regarded by many coal operators as a luxury and an unnecessary refinement. This unreasonable conservatism or prejudice still exists to some extent; however, the rapid depletion of properties which have been regarded for many years as practically inexhaustable, is quickly bringing the operator to a full realization of the necessity for the careful planning and scientific projection of the mine by a competent and sufficient engineering force.

2. Incompetent management: There are some mine managers or superintendents who produce better results from a poorly designed mine than others can obtain from a first-class plant. Many managers have been entirely satisfied with a low cost sheet, neglecting the conditions both inside and outside the mine, which ultimately resulted in an abnormal increase in cost of production or the abandonment of valuable acreages of coal, in order to maintain lower costs. This method was often repeated until finally after millions of tons of coal had been buried, which could have been recovered by a prudent and careful manager without materially affecting his cost of production, those in charge have been brought to a sudden realization of an unnecessarily high cost and a diminished tonnage, resulting in loss of prestige and position for the manager, and thousands of dollars to the owners. Such an official is surely a shining example of the ancient aphorism, "as thou sowest, so shalt thou reap."

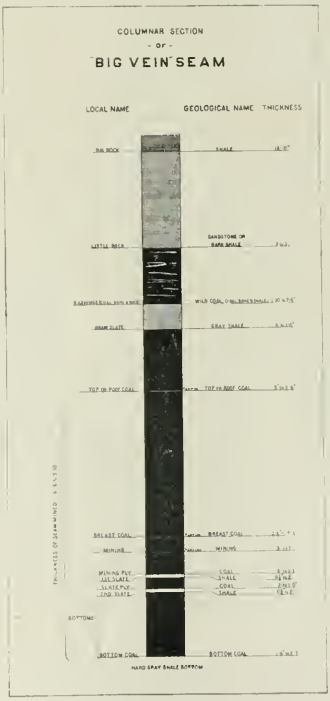


FIG. 1. A SECTION OF SEAM FROM FLOOR TO MASSIVE ROCK ABOVE

The necessity for a mine manager to be familiar with not only the outside, but also the inside condition of his property, either personally or through tried and competent assistants, cannot be underestimated. Unless he is thoroughly familiar with these facts, how can he know if the individual mine superintendent or mine foreman is giving him the desired results of low cost with maximum recovery and the best conditions for a continuation of that low cost?

3. Unfavorable labor conditions: The employment of unskilled miners renders it impossible to obtain a good recovery. Strikes and shutdowns have often interfered with the application of economic methods of extracting coal. Labor unions sometimes insist on conditions which, while operating for the convenience of the miner, increase the expense or induce an unnecessary loss of coal to the operator. For instance, in some districts of the country, the track must be laid in the center of the room with the "gob" on either side. Few or none of the pillars are recovered and many acres have been lost through "squeezes" and "creeps" because of wide rooms and small pillars. Nor is interference with the methods of mining the only manner in which the unions sometimes operate against the maximum recovery of coal. There have been men discharged for incompetency, who were reinstated by the management on demand of the union. And it is thus, that discipline, which is such an important factor in the economic administration of a mine with a view to the best ultimate results, is defeated.

4. The impatience of owners for quick returns on their investments: The deleterious effect on the economic development of a property by the demand of the investor for an immediate profit, can hardly be overestimated. Many a rich and valuable property has been irreparably damaged by the insistence of owners for immediate and large profits before its proposed economic development has been fairly launched. This impatience and greed has oftentimes resulted in the changing of slow, but good plans of development for bad ones, and the poor results thus obtained were further accentuated in later years by the demand for big tonnage, thereby causing the loss of millions of tons of coal and thousands of dollars to the investors. Indeed, this demand for large tonnage from

*Mining engineer, Frostburg, Md.

a poorly developed mine has been the greatest factor in encouraging careless methods of recovering coal both from rooms and pillars, and it is no exaggeration to state that the abandoning of many acres of good coal, which could have been recovered by more thorough and known methods, can be traced directly to this cause.

The Property Should First Be Carefully Explored

In the development of a coal property after a reconnaissance has been made, a reasonably thorough knowledge of the seams to be exploited should be attained before the installation of a permanent plant. This can be done by diamond drilling, numerous crop openings, or a pair of headings driven through the property at some favorable location. The coal from such headings could be disposed of locally, shipped from a temporary dump, or, in the absence of railroad facilities, stocked until disposition could be arranged later.

While this is going on, a competent surveying party should be engaged in accurately locating the boundaries, principal streams, etc. If the property is large and the topography favorable, a triangulation survey can be made and all boundary lines carefully tied in. The mining rights in the original grants should be thoroughly studied in this connection and complete records made. Too much stress cannot be laid on the necessity for an accurate survey. Much money has been wasted in unnecessary litigation due to encroachments and violation of mining rights. The main haulways of more than one mine have been driven far into another man's property, because of inaccurate maps and surveys. Accurate surveys of the surface features of a property have a direct and important bearing on the inside workings in other ways, such as showing the relative position of two or more mines in the same property, the proper location of bore holes or shafts for drainage and ventilation purposes and the determination of thickness and nature of strata overlying the seams under development. Armed thus with a general knowledge of mining rights, thickness, continuity and quality of coal, dip of the measures, probable roof and floor conditions and the thickness and nature of overlying strata, the struggle for maximum recovery is well begun.

FIG. 2. METHOD OF WORKING GEORGE'S CREEK "BIG VEIN" SEAM IN 1850

Selection of Permanent Sites

After this preliminary reconnaissance has been completed and some idea of the boundaries of the property has been obtained, the selection of the sites for permanent plants is in order. The spot offering the most favorable outside features for cheap instalment of a plant is often the one accepted, whereas by selecting one with less favorable surface conditions, which, by the reasonable additional expenditure of money, could be molded satisfactorily, the best conditions favorable to haulage, drainage and ventilation in the mine could be obtained.

After the location of the new plant has been selected and the drift, slope or shaft opening completed, it must then be determined what general method of mining will be adopted; that is, whether the seam is to be worked longwall, or by pillar-and-chamber. The former is especially adapted to deep mines where the great weight of the superincumbent strata makes the pillar method impracticable, or to thin, flat seams with a brittle top under shallow cover as is found in the central Western States. The general conditions encountered thus far in the Appalachian field are probably more favorable to the pillar-and-chamber or one of its many modifications than to the longwall method of mining.

After the general method has been selected, the main headings should be commenced and driven in a direction favorable to haulage and drainage. Much money has been spent in operating properties where these two factors did not receive careful attention in the beginning. Where the seam is of uniform thickness and the dip of the measures regular, economic haulage and drainage is a comparatively simple problem, but where the measures are of a rolling nature, it may become a standing menace to cheap production. Furthermore, the employment of improper drainage methods has resulted in the abandoning of large areas and the loss of much coal in pillars. Since

main haulways and airways should be free from all interference, a traveling-way for men and animals should also be provided and therefore not less than three parallel headings should be driven for the main entries.

at the lowest cost of production, and with the greatest degree of safety to the men. Whatever method is selected, be it pillar-and-chamber with its wide rooms, pillar-and-stall with its narrow rooms, or the panel system, the great and important

termined by what judgment and experience dictate, after a careful study of the nature of the superincumbent strata. It is not intended to ignore empirical rules based on actual observation of the effect on certain stratification by the removal

FIG. 3. METHOD OF WORKING GEORGE'S CREEK "BIG VEIN" SEAM IN 1870

FIG. 4. METHOD OF WORKING GEORGE'S CREEK "BIG VEIN" SEAM IN 1890

SELECTING THE METHOD OF OPERATION

In determining the method of extraction to be adopted, the engineer, after a careful analysis of the data obtainable, should be careful to select that system which will effect a maximum recovery of coal in the best condition for the market,

factor to be considered is the size of the pillars to be left in first working.

Although the limit of subsidence varies with the hight of the excavation, there has never been established a uniform ratio between the two, and as a consequence, the size of pillars must be principally de-

of pillars under known conditions, but great care should be exercised in applying such rules to conditions, which, though appearing similar, may vary considerably. Only a careful study of the measures above and floor beneath the seam to be developed can give the necessary data

for intelligently determining the size of the pillars to support haulways and working places.

The Size of Pillars

The size of pillars to be left in a mine forms a question about which there are widely divergent opinions among mining men, and too much thought cannot be given to this important subject. Many thousand tons of coal lie buried and abandoned as lost beneath "creeps" and "squeezes" resulting from a lack of knowledge or foresight in this respect. There are cases on record where not only the pillars supporting the working places were too small, but those supporting main haulways, shafts and slopes as well, and a "squeeze" starting over the working places in one section of the mine has extended over the main entries, closed the shaft or slope and the whole mine has consequently been abandoned. It is better, therefore, to lay out the pillars too large rather than too small.

The principal points affecting size of pillars are depth, thickness and structure of the seam and the inclination and nature of the overlying and underlying strata. Other factors which have a bearing on this subject, because they modify the detail method of working to be adopted, are the ventilation required and the tonnage desired from each district.

Pillars should not be left standing, but taken out as soon as possible after rooms have been driven. The percentage of coal won in the first working should not be too great, because it increases the cost of re-

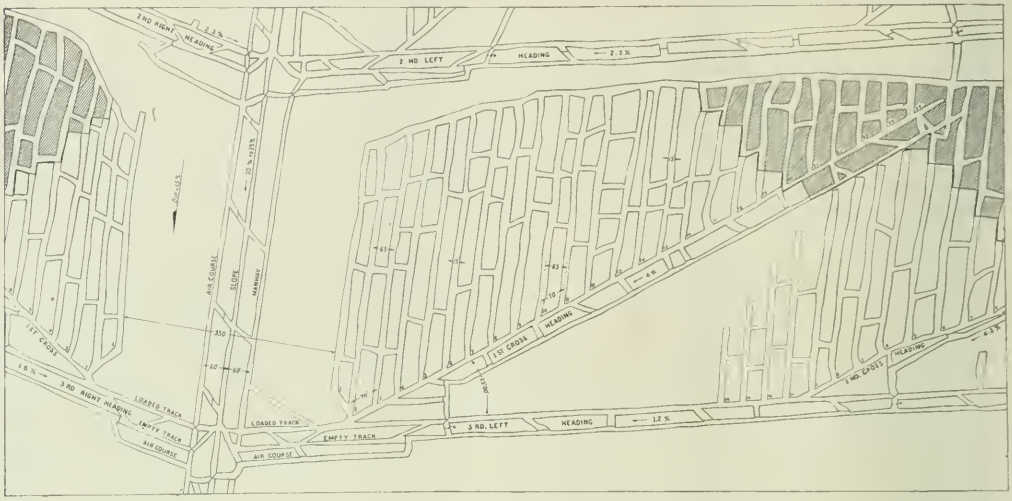


FIG. 5. METHOD OF WORKING GEORGE'S CREEK "BIG VEIN" SEAM IN 1900

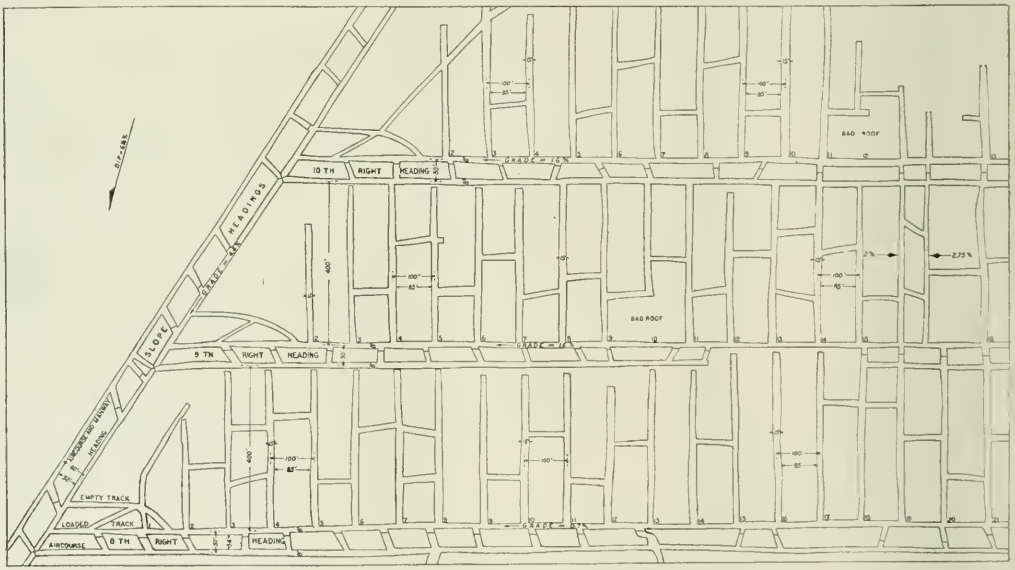


FIG. 6. METHOD OF WORKING GEORGE'S CREEK "BIG VEIN" SEAM IN 1904

covering the pillars and induces "squeezes." It is not within the scope of this paper to discuss in detail the different methods of extracting coal. There are many varying conditions existing even in the same region which sometimes render it impracticable to use a given method throughout the development of a single property without modifications.

The George's Creek Field

A region of uniform and unusually severe conditions in the bituminous fields has been selected to illustrate the results obtained over a long period. The George's creek region of Maryland with its remarkable deposit of semi-bituminous "big vein" coal has shipped its product to the market for nearly 100 years. Like all old mining regions, it has its traditions. More than one miner still lives who "dug coal" before the war with the South, and, when in reminiscent mood, he tells of the detail method of extracting the coal, on account of which thousands of tons lie buried today, much beyond recovery. One of the largest coal companies, at a considerable cost, has made a thorough and accurate resurvey of its holdings in this region, during the past six years; much abandoned territory has been mapped and the quantity of coal remaining carefully calculated.

The "big vein" seam occupies the geologic horizon of the Pittsburg bed, but differs considerably in structure and quality from the coal produced at Pittsburg, Connellsville and Fairmont. A section of the entire seam from floor to the massive rock above is shown in Fig. 1. The top coal, averaging 2 ft. thick, is left up for a roof. Where this comes down, the strata immediately above promptly follows. Very little of this top coal is, therefore, recovered. Both roof and breast of the seam contain slips known among the miners as "horsebacks," which frequently fall out without any warning. The coal is soft, and "butts" and "faces" are entirely absent.

Various Methods of Working the George's Creek Coal

The methods of extraction in vogue at different periods in the history of this field have established the fact that it is impossible to maintain wide working places for any length of time. Headings are driven 8 ft. wide, and rooms from 12 to 15 ft. In the earlier days there was practically no definite system of extraction, headings and rooms being driven at random and no pillars recovered. Fig. 2 shows such a method in use about 1850. This is reproduced from an actual survey made under the most trying circumstances. The operating company is at the present time engaged in cleaning up the heavy falls scattered throughout these workings with a view of reclaiming the pillars, which were abandoned long ago. It is estimated that fully 55 per cent. of the original coal, not counting the top coal, remains, and it is expected to recover at least one-half of this tonnage, or 27 per cent. of the original, by careful operations and the use of about double the amount of timber necessary under a good system of mining. The maximum cover over this district is 300 ft., and the few comparatively large pillars, which were inadvertently left standing at irregular intervals, saved the balance from being crushed.

In other sections of the same mine where a similar method was followed, but these large pillars not left in, the workings are entirely closed and the remaining pillars, containing over 50 per cent. of the original coal, have probably been lost forever. Fortunately, mining operations during this period were not conducted on a large scale, and, consequently, the territory thus affected is limited to a very small portion of the company's holdings.

Fig. 3 illustrates two methods followed during the years between 1870 and 1880. These workings are inaccessible to surveys at the present time owing to the "creeps" and "squeezes" induced by the irregular method of robbing the small pillars. The sketch was constructed from some old projection drawings and from information obtained from a number of men actually engaged in the work. The main headings consisting of haulage-road and airway were driven on the strike of the coal.

In the first method, the room headings were driven in pairs from the main entry at intervals of 600 ft. and on the rise of the coal on about a 10-per cent. grade. From these headings, approximately 25 rooms were driven to the right and left at 40-ft. centers on a grade of 4 per cent., giving an average length of about 350 ft. The rooms were 14 ft. wide and pillars 26 ft. These pillars were found to be totally inadequate and extracting them was impossible. Cross-cutting the pillars at frequent intervals was then attempted after completion of the rooms, but this was generally accompanied by "creeps" closing a whole district at a time. The maximum hight of the superincumbent strata in this territory is 200 feet.

The second method shown on Fig. 3 was adopted later. The maximum thickness of the overlying strata is 150 ft. By this method headings were driven from the main entry on the rise of the seam at intervals of 1000 ft. to the level above and two pairs of cross-headings were turned to the right. The rooms were driven from these cross-headings at 50-ft. intervals and 14 ft. wide, leaving a 36-ft. pillar. The length of rooms varied from 300 to 550 feet.

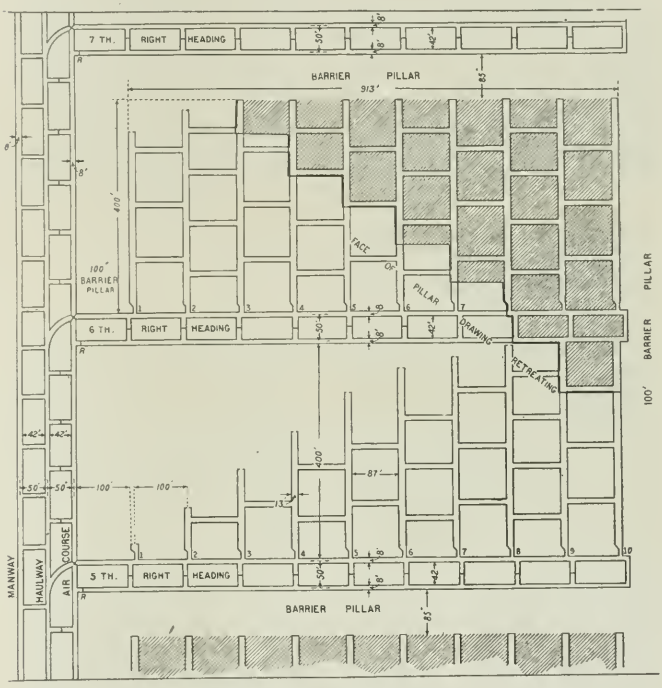


FIG. 7. SUGGESTED PANEL METHOD OF WORKING SOFT THICK SEAMS WITH BRITTLE ROOF

These pillars were also of insufficient size, robbing was conducted spasmodically and although more coal was recovered than in the adjoining districts, a large quantity was lost. In addition to the small pillars, the method of robbing them was calculated to promote "squeezes." It appears to have been the method to hold the strata with props until sufficient coal had been removed to enable the weight to break the props. As a general rule, however, before this was attained, the weight had induced a "creep" which is well known to have no limits within a territory of small pillars.

Method Used in 1890

Fig. 4 represents a method in use in 1890. The main entries were driven from the slope on the strike of the seam, sufficient grade being allowed for drainage. Cross-headings were driven on an angle of about 35 deg. to the main entry and headings were turned off these parallel to the main entry. Rooms were turned, as shown, from all headings on 100-ft. centers, and pillars were split by half-rooms to 2¼ per cent. in favor of the loads. From these haulways crossheadings are deflected at intervals of 240 ft. at an angle of about 25 deg., and driven on a grade of 4 to 7 per cent. Rooms varying in length from 100 to 800 ft. are turned on the rise of the coal from these cross-headings. The rooms are driven 15 ft. wide on 65-ft. centers, leaving pillars 50 ft. wide. Twenty-five rooms are driven in each of these diagonal panels. Unusually large protecting pillars are left along the main haulage-roads. This system has been found to be especially adapted to rapid gathering of cars, thus insuring a large tonnage.

It has been found, however, that a very large recovery from the pillars is impossible, owing to the many sharp angles, which, in a thick seam of soft coal, are always difficult and ofttimes impossible to extract. This sharp-angle method was even resorted to formerly in cross-cutting the pillars preparatory to drawing them, but this has been changed to a rectangular method, thereby increasing the actual percentage of pillar coal recovered, from 80 to 83 per cent. The distance of rooms apart has also been increased in the last few years to 100-ft. centers giving pillars 85 ft. thick. It is expected that the extraction of these latter will show a further increase in the percentage of yield from pillars. The present yield from headings, rooms and pillars under this system is about 90 per cent., considering the recovery from headings and rooms as 100 per cent.

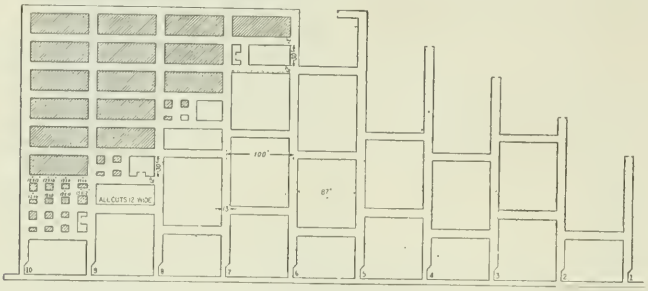


FIG. 8. SUGGESTED METHOD OF EXTRACTING COAL FROM SOFT, THICK SEAMS, WITH BRITTLE ROOF

The length of rooms varied from 300 to 600 ft., and they were 14 ft. wide, leaving pillars 36 ft. wide. These pillars were not strong enough to support the overlying strata 500 ft. high, and the usual "creep" resulted when pillar drawing commenced.

This half-room method has the advantage of facilitating gathering of coal and doubling the support of the haulway. The "squeeze" in this district could have been prevented by turning the rooms from the haulway on 200-ft. centers, and, after driving the half-rooms, the resultant pillars would be 85 ft. wide. While this would have avoided a "squeeze," the great weight to be supported by this pillar of soft coal would not have permitted a very high percentage of recovery.

Fig. 5 shows a method adopted in 1900. The maximum dip is 15 per cent., and the greatest thickness of superincumbent strata 425 ft. The slope, together with a parallel air course and manway, is sunk on the heaviest dip of the coal, and double entries are turned off to right and left at intervals of 1000 ft. on a grade of 1¼

New Method Adopted in 1904

Fig. No. 6 illustrates a method instituted in the latter part of 1904. The main haulway is an extension of the slope from the opposite side of the basin. Double entries are turned off from this entry on a 1½ per cent. grade 400 ft. apart, from which rooms are driven directly on the rise of the coal. Rooms are from 13 to 15 ft. wide and practically no barrier pillar is left between the room face and the air course of the panel above. They are driven at 100-ft. intervals, leaving a pillar 85 ft. wide. The length of a panel is about 2500 ft., and contains 22 rooms.

There are five such panels in this district, and when completed, it is proposed to draw the pillars in a retreating fashion with the line of pillar work on an angle of 45 deg. across the whole district. A similar method in another district, but with rooms on a deflection of 35 deg. from a right angle, is yielding 88½ per cent. from the pillars with a total recovery of 94 per cent. from headings, rooms and pillars, and it is believed that this can at least be duplicated if not exceeded in the case of Fig. 6. The maximum dip in this district is 6½ per cent. and the greatest hight of the overlying strata 250 feet.

A Suggested Panel Method

With this resumé of systems used at different periods under conditions now known, a suggested method of extracting the coal from thick soft seams with a brittle top and a hight of superincumbent strata of 400 ft. or less is presented in Fig. 7. The general designs of the mine for haulage, drainage and ventilation are not given, because they are variable quantities, depending on conditions which change with the locality, and the method suggested is, therefore, limited to the ultimate recovery of the coal.

By this method a territory under development is divided up into rectangular panels of ten rooms each. The room headings are driven on easy grades favorable to drainage and haulage and the panels are worked in pairs. When the upper heading has been driven to its end, the rooms are turned at intervals of 100 ft. with the drawing of pillars following by the retreating method. The rooms are 400 ft. long and 13 ft. wide, leaving pillars 87 ft. in width. The rooms in the upper panel are limited by a barrier pillar separating them from the heading above and those on the lower panel are driven through to the "gob" of the upper panel. The line of pillar work extending over the two panels should have an angle of about 45 deg. The length of rooms can be varied to suit the conditions, and when the hight of the overlying measures exceeds 400 ft., the thickness of pillars should be increased accordingly.

Fig. No. 8 shows the method of drawing the pillars in detail. The rectangular method should be carefully adhered to and all sharp angles avoided.

When the work commences, a cut is made separating a block of coal 30 ft. wide and 87 ft. long. This piece is further subdivided into blocks varying from 6x12 ft. to 15x12 ft. in size, which are cut off and extracted successively, as shown. In no case should the small blocks cut off exceed in size the distance a man can shovel under average conditions, which is about 15 ft. The largest of the small blocks should be removed last because it is there that the greatest

pressure manifests itself in the removal of the original block cut from the pillar. When this block has been removed, another cut is made and the process repeated.

The line of "gob" should be approximately on an angle of 45 deg. If it is found impossible to take out the small blocks clean, on account of the "gob" from the preceding work running in on the new cut, a row of props can be set on the upper side of the large block to hold the "gob" when the small blocks below are removed. This method of working should result in a total average recovery of fully 95 per cent. of the seam from headings, rooms and pillars and insure the workings against "creeps and squeezes."

The Tennessee Copper Company in 1908

By B. Britton Gottsberger*

The year 1908 was for the Ducktown copper district a busy one, in marked contrast with that of most of the copper-mining centers of the country. The Tennessee Copper Company mined during the year 501,000 tons, and smelted 476,000 tons of ore. The copper production will amount to approximately 14,500,000 pounds.

The labor situation which has, on account of the isolated location of the mines, always been a serious one, was much relieved by the general business depression, and while the actual number of men employed did not much exceed that of 1907, a great increase in efficiency was obtained, resulting in increased output and a material reduction in working costs.

The decrease in the price of copper prevented making any but the most necessary additions to the plant, but the development of the mines was actively pushed. The shaft at the Burra Burra mine was sunk to the seventh level and the drifts on the third level, which had been in progress for some time, were completed; so that the orebody is now opened up on that level for its entire length, a distance of more than 2000 ft. Diamond drilling in the new ground developed a large orebody in the north end of the mine.

At the Polk county mine an additional level was opened and a considerable body of ore of good grade was exposed and will soon be ready for stoping.

Steam Shovel Underground

An item of interest, as regards the mine work was the trial of the method of loading ore in the stopes by means of a special shovel furnished by the Bucyrus company. The shovel operated by compressed air worked smoothly, no difficulty being experienced in handling ore which had been broken to a reasonable size. Its use was, however, not found to be an advantage, since it was difficult to obtain a sufficient tonnage in one stope to meet the capacity of the shovel.

In attempting to do this large blasts were necessary, and great difficulty was experienced in breaking large pieces of ore, after the blast, to a proper size for handling by the shovel and later by the crusher. The shovel itself would easily handle any pieces small enough to pass through the dipper, which was of 1¼ cu.yd. capacity; but after hoisting to the surface many of the lumps proved too large for the 18x36-in. Blake crusher, and hoisting was often interrupted on this account. These difficulties were mainly due to the small space available for working the shovel, the face of the stope being about 80 ft. wide. The shovel has been transferred to the company's quartz quarry where flux for the smelter is obtained, and at this point it is doing excellent work.

Smelting

At the smelter no special change in methods of operation occurred, the most important fact developed during the year being that while the production in one operation of a matte of converter grade (30 per cent. or more) is quite feasible and in fact was made for one month on practically all the furnaces, the copper losses by this method were larger than the loss by smelting in two operations. It is hardly likely that any further attempts along this line will be made.

The adoption on the blast furnaces of a slotted tuyere 12 in. long by 4 in. wide, in place of two tuyeres 3¼ in. in diameter each, proved a decided success, remedying the defect of too small tuyere area in the original design. The furnace equipped with these new jackets handled a much larger tonnage than the others, and the new tuyere will be adopted on all the furnaces.

When the smelter was built the method of conveying air to the blast furnaces was by independent blast pipes from each engine to the various furnaces. On account of changes to the furnaces this system was abandoned; all engines now deliver air to one large air main from which connections are made to the different furnaces. No change in the operation of the furnaces was noted with the new arrangement, and its flexibility will be a decided advantage in operating the furnaces for the production of gas for the acid plant, removing all danger of the blast's being cut on the furnace from failure of the engine.

Sulphuric-acid Plant

The development of greatest interest was that of the sulphuric-acid plant. The year was largely spent in gaining experience as to the proper method of correlating the work of the smelter and the acid plant and solving the many problems which naturally arise in so novel an undertaking. It was found that a radical change in the construction of the furnace tops was necessary, and that special care must be taken at all points to prevent the dilution of the gases by means of false air. After some preliminary attempts a comprehensive plan was devised, and is now being executed, which will completely solve the question of converting the sulphur fumes into commercial sulphuric acid on a profitable basis, rendering available the sulphur hitherto wasted, but now considered a constituent of the ore no less valuable than the copper. The development of the plant will undoubtedly control the fumes to such an extent that the troublesome question of damage to vegetation, which has so long been a matter of dispute, will be eliminated.

*General manager, Tennessee Copper Company, Copperhill, Tenn.

The Question of Expert Evidence

The New York State Bar Association has been considering reform in legal procedure, especially with respect to expert evidence. While its deliberations have pertained particularly to medical testimony, practically the same things may be said as to engineering evidence and consequently we deem the matter to be of interest to our readers.

Protesting against "the commercializing of scientific knowledge," which "lessens its accuracy and value," the report of the committee of the Bar Association makes a plea for the insuring of such conditions that expert witnesses, without regard to anything but justice and truth, may give their testimony without bias and without being subjected to improper and contemptuous cross-examinations, misrepresentations and other things tending to create an atmosphere in which the scientific mind cannot be expected to reason calmly and logically.

The committee's report, which was adopted, included a proposed statute as a beginning of the desired reform. It provides briefly that justices of the appellate division shall designate at least 10 and not more than 60 physicians in each judicial district, who may be called as medical expert witnesses by the trial court or by any party to a civil or criminal action; when so called they shall testify and be subject, like other witnesses, to examination and cross-examination. They shall be paid out of the county funds on the order of the trial judge, who shall also decide the amount of the fee. The report in part follows:

"It is apparent to all that theoretically an expert is the scientist interested solely in facts who should retain freedom of judgment and liberty of speech and should be free from the embarrassment of any personal relations to or with the parties to an action; that he should have no client to serve and no partisan interest nor opinions to vindicate; that he should give his opinion as the advocate neither of another nor himself; that when he speaks he should do so judicially as the representative of the special branch of science which he invokes, governed by the opinion of the great body of scientists in this relation and in accordance with their most recent investigations.

"That no one should be permitted to distort, pervert or misrepresent his testimony; that when this is done and not until it is done shall we have expert testimony rescued from the disrepute into which it has fallen and thus elevated to its true position as the expression of the particular science for which it speaks; that by the adoption of some such system the mature judgment of the best minds could be obtained and the superficial opinions of quacks and mountebanks would not be thrust upon the jury to their confusion and the hindrance of justice; that such scientific openmindedness is almost impossible where the expert entirely depends for his emolument upon the good graces of contending parties and largely is without the recognition and protection of the court.

"That the commercializing of scientific knowledge under the existing conditions lessens its accuracy and value. That the enormous modern development of special knowledge makes doubt and controversy among experts hired to create it inevitable and aggravates the evils of private expert hire, unscrupulous so-called experts finding it easy to lease themselves and their opinions to aggrieved and aggressive parties who may profit either fairly or unfairly by the technicalities and doubts which they are able to inject into the case in full consciousness that no rebuke will be administered by the tribunal before which their testimony is given; that, therefore, the gravest abuses, not to say scandals, in the introduction of expert testimony have arisen until it has come commonly to be believed that such witnesses are so biased if not corrupt that hardly any weight should be given to their opinions.

During the last 20 years, since the introduction of deep wells in Burma, the petroleum output has grown to about 138,000,000 gal. per year ("Sketch of the Mineral Resources of India"). This has reduced the import in 10 years from 87,000,000 to 62,000,000 gal. even with the constantly increasing consumption. The export of paraffin wax has meanwhile steadily grown.

Refusal to Adjust Prices, a Menace to Prosperity

Elliott C. McDougal, president of the Bank of Buffalo and the newly elected president of the Buffalo Chamber of Commerce, made the following remarks at the annual banquet of the latter organization:

"Never after any previous panic within the recollection of living men have the underlying conditions necessary for the resumption of prosperity been so universally encouraging. After no previous panic have railroads been in so strong a position. After no previous panic have farmers been so prosperous. After no previous panic have we had what we have today—a business public with its material resources, its confidence and its mental vigor unimpaired, ready boldly to take advantage of business opportunities.

"With the exception of the tariff agitation, there is only one small cloud in the sky, and as yet it is only of the size of a man's hand. I refer to the present tendency to maintain, and in many cases to increase, prices. A dealer in leather belting told me the other day that prices had recently risen 15 per cent. I have read that the printers expect to raise prices in the near future. Lumbermen say that they expect that prices of lumber will rise. Many other industries take the same position. The largest industrial corporation in this country—the United States Steel Corporation—is officered by men of ability; men whom an ordinary man hesitates to criticize, but there can be no reasonable doubt that the present policy of the United States Steel Corporation and its attitude with regard to the maintenance of prices is in danger of administering a very severe check to business. I am not competent to argue with a lumber dealer concerning a business about which I know nothing, and about which he knows everything. I am not competent to argue technically with a printer or with a leather dealer, or with the officers of the United States Steel Corporation, but I know that the average scale of prices must come down; that we will have no lasting return toward prosperity until it does come down. If we do not make prices to encourage business we may have no business. We are facing a period of forced economies and of smaller profits. Out of this period will come increased efficiency and new prosperity. The sooner these facts are recognized and acted upon by business men, the sooner will we get started on the road to permanent recovery."

On the same line the Pittsburg correspondent of *The Evening Post* writes under date of Jan. 29, especially with respect to the Steel Corporation:

"Why should the progressive improvement of the last months of 1904 not have been repeated in 1908? One answer is very frequently heard nowadays in Pittsburg. Between the beginning of trade reaction in July, 1903, and the middle of 1904, steel prices had been severely readjusted; there was, therefore, even ignoring the question whether or not the consuming community was less hard hit than it is today, a strong incentive for buyers to come at once into the market. The Steel Corporation offers no such incentive today. Both labor and materials had been reduced in the reaction of 1903, whereas, with minor exceptions, wages have this past year remained at the high level of the boom period, for skilled labor at any rate, and there has been organized effort to sustain an artificial price level for finished and semi-finished products. It is true that a number of reductions were officially made last June, but they were very slight, and it is the practically unanimous opinion among representative trade authorities that recuperation has been retarded by seeking to maintain a selling level far above the ideas of the general consumer

"As matters stand today, price cutting has been freely admitted for some time; it is now openly stated here that the Bethlehem, Lackawanna, and Inland Steel companies have taken a hand in it, that even the Jones & Laughlin Steel Company has been making concessions recently. In other words, producers are taking the business offering below established prices. This is believed to apply chiefly to plates, shapes, tubing, and sheets. It has, however, been stated that the Steel Corporation will not meet the cuts, but it is not stated that official reductions are not likely.

"There are steel manufacturers who defend the attempt to keep prices at a reasonable level because of the high prices prevailing in other industries. The quotations on wheat, corn, and oats, on live stock, lumber, leather, brick, plate glass, textiles, etc., are all referred to in justification. But this does not help the matter with consumers. If the tariff is reduced as it now appears it will be, a wage reduction is predicted.

"Meanwhile Pittsburg expects an indifferent market for iron and steel and is still looking for the reduction in prices which it is contended is necessary to revive business. At the same time, it is admitted that never before have farmers been so prosperous, the railroads in so high a state of efficiency, and the signs of real prosperity so abundant in the first year after a serious panic."

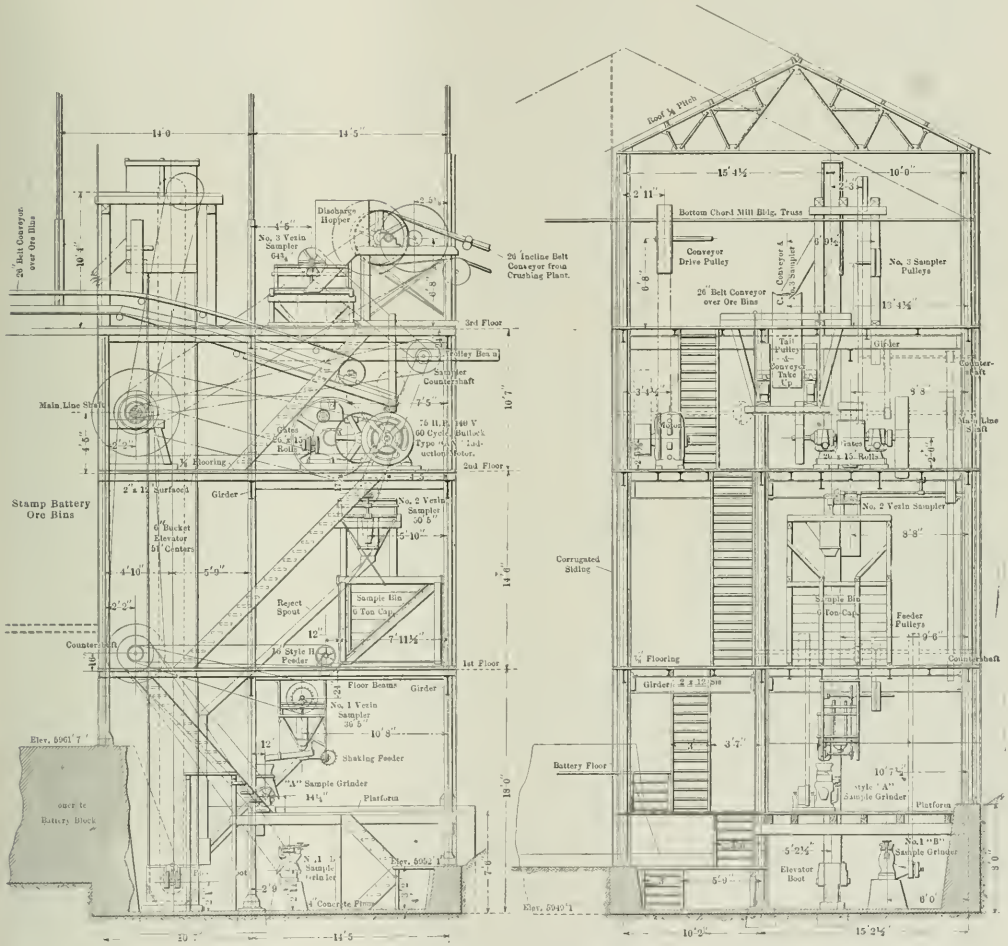
Blanketing having a special texture similar to that of the ordinary military rug is used (*Journ.*, Chem., Met. and Min. Soc. of South Africa, Nov., 1908) on the blanket tables at the Giant mine, Rhodesia. The slime from the blanket tables is then treated on canvas tables covered with best fine white duck canvas.

The Goldfield Consolidated Sampling Mill

By John A. Church*

All of the sampling mills that have been illustrated in the Journal, work on a quantity of ore that is only a part of the mine's daily output, or of a purchased lot, and the first cut, which may be either 5 or 10 per cent., corresponds to the whole quantity received by mills of the other sort. No handwork and no operation of human agency affects the result which is produced entirely by automatic machines, down to the usual coning floor. Many details of this mill were given in the Journal of Sept. 5, 1908. The construction is shown in the accompanying illustrations. will be 175 to 200 ft. per minute. The cut will be 5 per cent. with one scoop, or 10 per cent. with two. The reject falls to a belt conveyer which moves directly under the sampler and runs to the stamp mill bins.

The first cut falls four or five feet to Gates 26x15-in. rolls running at 97 r.p.m. and is reduced to ⅜ in. The rolls are directly over and about 3 ft. above a No.



SAMPLING MILL, GOLDFIELD CONSOLIDATED MINES COMPANY, GOLDFIELD, NEVADA

a fifth or a tenth, and this portion has been obtained usually by taking every fifth or tenth car or bucket of ore. The Goldfield Consolidated mill operates on a different system and one that is interesting and important from the fact that it is likely to be the system of the future. All the ore goes through the sampling mill,

The ore is crushed outside the mill and screened in a revolving trommel with 1½-in. perforations which gives a ring size of 1¼ in. All oversize is returned to the crusher and the screened product goes to the mill *via* a 26-in. belt conveyer. It falls into a small hopper which feeds a No. 3 Vezin sampler of 48 in. diameter in the sampling circle, taken at the center of the stream. The velocity in this circle

2 Vezin, which has a sampling diameter of 38 in. and will have the same speed per minute. Here again the cut is either 5 or 10 per cent.

Novel Features

The second cut falls into a small bin holding 6 tons or 1 per cent. of the day's supply. It is fed by a shaking spout to a No. 1 Vezin with sampling diameter of 27

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in. and the same speed as the others. It will cut out 5 per cent., and the cut falls upon a shaking feeder which delivers to a sample grinder where it is ground and halved. It is further ground and halved in two other sample grinders so the final sample amounts to 75 lb. or ⅛ lb. per ton of supply.

This mill is noticeable for the fact that there is only one recrushing and two samplings before the sample grinders are reached, for the first cut takes the place of work that usually is done outside the mill. This can be done at Goldfield because of the fineness to which the ore is crushed for the stamps.

The ore supply will be 600 tons in 8 hours or 75 tons per hour. The first sampler receives 42 lb. per sec. or nearly 156 lb. per revolution. The second sampler (if the first cut is 10 per cent.) will receive 4.2 lb. per second and (at 20 r.p.m.) 12.6 lb. per revolution. The third sampler will run on a solid stream, being fed from a bin.

It will be noticed that the feed spout to the first sampler is placed so that the scoop cuts from front to back of the ore stream instead of from side to side as is usual. The stream is probably less thick than wide and the edge of the scoop will pass across the thickness in shorter time than when it has to pass across a spout 12 in. wide. This will shorten the time of imperfect, or selective, sampling and lengthen the time of perfect work.

In examining the designs of various mills I have noticed that some scoops cut the ore stream from side to side, others from front to back and others from back to front. In no case was this variation due to intention. Always it was merely an accident of construction, some beam preventing the convenient placing of the spout so as to obtain the usual side to side cut and causing an installation that gave one of the others and which one seems to depend entirely upon which way the motor happens to turn round. I think there is a choice between these ways of cutting and that the cut from back to front of the stream has advantages over the others.

A bucket elevator with 51-ft. centers lifts all rejects, after the first cut, to the mill bin conveyer.

Courtland, Arizona, a New Copper Camp

By H. W. Chittenden*

The new copper camp of Courtland, which is now attracting much attention in the southwest, is situated in the central part of Cochise county, 35 miles north of Bisbee, and nine miles south of Pearce, a silver camp on a branch of the Southern Pacific railroad. For several years a little prospecting work was done near the surface, and a little ore was shipped by wagons to Pearce from this district, formerly called the Turquoise district. But only with the recent advent of the Calumet & Arizona and Copper Queen companies into the camp, and the development of large orebodies on the property of the Great Western Copper Company, has the district assumed any considerable importance.

The rock series at Courtland consist of quartzite, probably Cambrian in age, overlaid by limestone that probably includes ages from the Cambrian to the Upper Carboniferous. The total thickness of the limestone does not appear to be more than 2000 ft. The whole series has been tilted to a fairly uniform, steep northeast dip, and many large faults have broken the formation into rather small fault-blocks, duplicating the sedimentary series and greatly increasing its apparent thickness.

Into these sedimentary rocks, have been intruded two igneous rocks, a rather coarse-grained diorite porphyry, and a quartz porphyry that varies in texture from very fine to fairly coarse grain. The diorite porphyry varies greatly, in places being almost entirely free from quartz, and in others containing many large quartz crystals. There have probably been several distinct intrusions of diorite porphyry. The age relation between the two igneous rocks has not yet been definitely determined, since the two come in contact in very few places, and the contacts are for the most part covered with talus.

The Orebodies

The ore in the district occurs along zones of fracture in the limestone and quartzite, replacing the rock between the fractures. In all places so far discovered the ore has been closely associated with one or both porphyries, and probably both have been instrumental in the formation of the ore.

The primary ore, as shown in the deeper workings in the western part of the camp, is a mixture of iron and copper sulphides in a silicious gangue usually resulting from the alteration of limestone. Except for small rich streaks, the primary ore has been of very low grade. Secondary alteration, however, has resulted in great enrichment and in the eastern part of the camp the bottom of the enriched ore has not yet been reached. The secondary ore consists of malachite, azurite, cuprite, and other oxidized copper minerals, in a gangue of iron, manganese, and aluminum oxides, often very siliceous. The oxidized ore is often of very high grade. Beautiful specimens of crystallized malachite, azurite and cuprite are fairly abundant. Surrounding the ore are large masses of nearly barren siliceous iron and aluminum oxides, passing into the unaltered country rocks.

The orebodies are usually marked on the surface by large outcrops of gossan, often copper stained.

The Copper Queen, Calumet & Arizona, and Great Western companies are each operating two shafts, and a few smaller prospecting shafts are also in operation. The Copper Queen has considerable ore developed about the Casey shaft, and is sinking the Silverton shaft to open up the eastern part of the camp. The Calumet & Arizona has large orebodies blocked out at the Germania shaft, and is sinking the April Fool shaft to develop the northern part of the camp. This company is also exploring its territory with a diamond drill. The Great Western company has fine orebodies well opened up at the Mary shaft, and also has much ore near the surface at the Humboldt shaft. At the Leadville shaft, belonging to an independent operator, some sulphide ore of good grade has been encountered.

A company has been incorporated under the laws of Arizona to build a railway connecting Courtland with Douglas, where the Copper Queen and Calumet & Arizona smelters are situated. This road, which is to be called the Colorado & Mexico railroad, will be controlled by the Phelps-Dodge interests, and operated in connection with the El Paso & Southwestern. The length of the line with its spurs will be about 45 miles. Surveys for this road are already well under way, and construction will probably be started very soon. Ore can be shipped from several of the shafts as soon as the railroad is finished.

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Transvaal Gold Mines

In the cabled reports from South Africa there has been some confusion, owing to the fact that some of the reports sent were from the Witwatersrand only. The statement of the Chamber of Mines gives the values of gold for the full year from all Transvaal mines at $133,364,858 in 1907, and $145,793,702 in 1908; an increase of $12,428,844, or 9.3 per cent. last year.

The labor statement gives the following comparison for three years past, showing the total number employed at mines and mills—not including Europeans—on Jan. 1 of each year:

	1907.	1908.	1909.
Kafirs..	83,567	118,204	148,722
Chinese	53,828	31,840	12,283
Total.	137,395	150,044	161,005

This shows the changes made since the passage of the law against Chinese labor. Most of the natives now coming to the mines are from north of the Zambesi, and require some time to become accustomed to the work, and to the climate of the Transvaal. The Chinese will probably disappear in the course of the present year.

American Institute of Mining Engineers

A provisional program has been arranged for the 96th meeting, to be held at New Haven, Conn., beginning Feb. 23. This program is subject to such changes as may be made advisable by circumstances not now foreseen. The sessions will be held in North Sheffield hall of Yale University. The leading topics of discussion to be presented at the first three sessions are stated below. It is understood that if the special topic assigned to any one of the first three sessions should require either more or less than the time provided, the pending discussion may be adjourned, or papers on other subjects may be introduced.

Tuesday evening, Feb. 23. Opening session. Leading topic: The Conservation of Natural Resources. Papers by Dr. James Douglas and others.

Wednesday, Feb. 24. Morning session. Leading topic: A Sea-level Canal at Panama. Afternoon session. Leading topic: The Technical Education of Mining Engineers. After the latter session a visit will be made to the Hammond laboratory and other buildings of Yale University. Evening session. Papers on general subjects.

Thursday, Feb. 25. Morning and final session at New Haven for the reading and discussion of papers. It is, however, probable that a supplementary session of this meeting will be held at New York City in March, 1909, as a joint session of the Institute with other national engineering societies, for the further discussion of the Conservation of Natural Resources.

On Thursday afternoon, visit to the works of the National Pipe-Bending Company (exhibiting the electric, oxy-acetylene, and thermit processes of welding); the plant of the New Haven Gas Company, and the Bigelow boiler works. On Thursday evening a reception will be given to members and guests of the Institute by the governing board of the Sheffield Scientific School, at Byers Memorial hall.

Friday, Feb. 26. Excursion, embracing visits to the Farrel Foundry and Machine Works and the brass and copper rolling mills of the Coe Brass Company, at Ansonia; reception and luncheon at Bridgeport, tendered by the Bridgeport Board of Trade; and visits to the Locomobile works, the American Tube and Stamp works, and the works of Crane & Co., at Bridgeport.

On Friday evening, Dr. R. W. Raymond will deliver at North Sheffield hall, in the Sheffield scientific course, a lecture on the Influence of Geology upon the History of Jamaica, to which members and guests are invited.

Saturday morning, Feb. 27. Visit to the Cos Cob power plant of the New York, New Haven and Hartford railroad. Arrangements will permit members returning to New York on Saturday to join.

Papers Announced

The majority of the papers in the following list will be, as usual, read by title, or presented in brief oral abstract only. Printed copies of many of them will be on hand at the sessions:

1. Conservation of Natural Resources. By James Douglas, New York.
2. The Work of the National Conservation Commission in Relation to Mineral Resources. By Joseph A. Holmes, Washington.
3. Conservation of Natural Mineral Resources of the United States. By John Birkinbine, Philadelphia.
4. The Mineral Wealth of America. By R. W. Raymond and W. R. Ingalls, New York.
5. The Future Supply of Iron Ore. By Henry M. Howe, New York.
6. A Sea-Level Canal at Panama—A Study of Its Desirability and Feasibility. By Henry G. Granger, Cartagena, Colombia.
7. Technical Education of Mining Engineers. By Cortlandt E. Palmer, New York.
8. The Mining Course at the Sheffield Scientific School, Yale University. By John D. Irving, New Haven, Conn.
9. The Hammond Mining Laboratory at Sheffield Scientific School, Yale University. By Louis D. Huntoon, New Haven, Conn.
10. Biographical Notice of James D. Hague. By R. W. Raymond, New York.
11. A Proposed Hydraulic Gold Dredge. By Henry G. Granger, Cartagena, Colombia.
12. The Residual Brown Iron Ores of Cuba. By C. M. Weld, New York.
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14. Blast Pressure at Tuyeres and Inside the Furnace. By R. H. Sweetser, Columbus, Ohio.
15. The Limit of Fuel Economy in the Blast Furnace. By N. M. Langdon, Mancelona, Mich.
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17. The Concentration of Silver-Lead Ores. By V. T. Stanley Low, Broken Hill, Australia.
18. Slime Treatment on Vanners. By Rudolf Gahl, Morenci, Arizona.
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21. Metal Losses in Copper Slags, and a Means of Reducing Them. By Lewis T. Wright, San Francisco.
22. The Laws of Fissures. By Blamey Stevens, Seattle, Washington.
23. The Geology of the Mount Morgan Deposit. By J. Bowie Wilson, Sydney, Australia.
24. Kentucky Fluorspar, and Its Value to the Iron and Steel Industry. By F. Julius Fohs, Lexington, Ky.
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26. Discussion of the paper of John Hays Hammond, "Professional Ethics." By Henry Louis, Newcastle, England.
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28. Discussion of the paper of Carl Scholz, Effect of Humidity in Mine Explosions. By Howard N. Eavenson, Gary, W. Va.
29. Discussion of the paper of Albert Bordeaux, The Silver Mines of Mexico. By Alfred H. Bromly, Mexico.

The Annual Election

The following list comprises all the nominations so far received for officers and members of the council, to be voted for—in person or by proxy—at the annual meeting, which will be held at the office of the Institute in New York, Feb. 16: President, D. W. Brunton, Denver, Colo.; vice-presidents, H. V. Winchell, St. Paul, Minn.; W. L. Saunders, New York; W. C. Ralston, San Francisco; councillors, A. C. Humhreys, New York; W. G. Miller, Toronto, Ont.; Karl Eilers, New York; secretary, Dr. R. W. Raymond, New York.

A Novel Belt Conveyer

A novel arrangement of belt conveyers is a combination of two belts at right angles to each other recently installed by the Robins New Conveyor Company, New York, for the power house of the Buck Eye Pipe Line Company, Green Springs, Ohio. The problem to be solved was the storing of coal in an overhead bin. While this could be accomplished by two lines of belt conveyers, yet with a combination of a main belt and a cross belt in the same plane but perpendicular to it, one of the long belts is done away with, thereby saving 100 ft. or more of conveyer, besides having a simpler and less expensive outfit. The main belt is of the usual Robins' type with a tripper to which one end of the cross-belt is attached and the other supported by a rail fastened to and extending along the side of the building. The tripper and cross-belt thus move as one.

Colliery Notes

A nitroglycerin explosive is less sensitive with a small diameter cartridge, but an ammonium nitrate explosive is more sensitive with a small diameter cartridge.

Telephonic or telegraphic communication between various parts of the workings of all coal mines and the manager's office, or other suitable place at the shaft head, should be compulsory in all dangerous mines; similar lines of communication should be maintained from the offices to the fan and engine houses and rescue stations.

In many European mines where shots have been fired by electricity, the custom has been to use primary batteries. The latter are less costly to start with, but soon get out of order, and as a consequence, many superintendents now advocate the use of a good magneto machine, which is more reliable, and although it costs considerably more, it is easily kept in good order.

A recently published record of underground costs for working a 2-ft. seam of coal as compared with similar expenses incurred in working an 8-ft. bed showed a difference in cost of 17c. per ton in favor of the thicker seam. The cost sheet from which the figures were taken is complete in every detail and gives a fair idea of the extra expense that will result when we attempt to work our very thin seams.

As a general rule, a coal seam with heavy top and highly pitched, is best worked with a stepped face, which permits a better control of the weight. In a flat seam or one that is only slightly inclined, where mining machines are employed, if the roof will permit, it is best to work such a seam with a straight face so as to eliminate the necessity of moving the cutting machine from place to place.

The two principal dangers which arise through want of sanitation in mines are (1) spread of ankylostomiasis, and (2) spread of typhoid fever. Concerning the first disease, it is a matter of record in German mines that ankylostomiasis was not a serious matter until they commenced to water the mines. The Germans, however, were compelled to choose between two evils, and they preferred to be free from the danger of dust explosions, at the same time adopting other methods of dealing with ankylostomiasis, with the result that they have practically stamped out the disease; this successful outcome, however, cost them a lot of money, and for a time disorganized trade in some districts.

It is a matter of considerable importance to properly decide the direction of working when a coal seam has cleavage planes running through it. Such planes are commonly known as "face" and "butt." The question of safety is the first and most important consideration in determining the direction of working. If the bed contains many "slips" running parallel to the strike of the seam and on into the roof, it would be advisable to drive the face in an oblique direction, generally known as driving "half-on." This same direction of working is also most desirable in a soft seam with heavy top, for it gives the greatest percentage of round coal. In a hard seam, it is best to work the coal on the face so that the weight of the roof will assist in breaking down the cut and thus doing away with much shooting.

As the roof at the coal face of a longwall working is partly supported by the timber, and partly by the coal itself, it is most important to arrange the props in such a manner that the coal has just sufficient weight thrown upon it to cause it to work easily. One authority states that at such a face, the packs should be built entirely of hard lumps, as large as can be obtained. It is also suggested that in such a case, the goaf be completely stowed; this enables the roof in the roadways and at the face to settle down gradually, and also prevents any large accumulation of gas, at the same time permitting the air current to be more easily conducted along the face.

At an English colliery, where considerable attention has been directed to the proper sanitation of the underground workings, the manager has erected closets near the pit bottom and near one of the principal roadways of the mine; it is purposed extending the accommodation which has already been provided, to other parts of the mine. Each closet is situated in a brick structure, provided with a wooden door, and consists of a galvanized iron pan containing coal dust placed underneath a wooden seat. Each closet is satisfactorily ventilated with an iron pipe placed over the pan and communicating with the return airway. The total cost of such a closet, including brickwork is less than $25. One of the stable men empty the pans about twice a week, by taking the contents to the surface. It is stated at this mine that such sanitary arrangements are not necessary at the working face.

The increase in accidents due to hangfires only emphasizes the fact that at all mines, there should be a rule forbidding miners to return to the place before a certain prescribed time, say, one-half hour, has elapsed after the shots have been exploded. Many of these hang-fires are due to the flash of hot gases of one shot igniting the fuse of another which has been prepared at the same time, and which is intended to be fired immediately after. Others again, are due to the hemp of the fuse being left smoldering by an ineffectual attempt to ignite the core; the man already having lighted another shot is forced to leave the place, and in his absence the smoldering hemp fires the core. When the first shot has exploded, the man returns with the object of completing the task he thinks he has left undone, and is caught by the delayed explosion. Electric shot-firing largely eliminates hang-fires.

Few mine managers fully realize that "friction" is the important item to look after in the operation of a mine. In ordinary underground haulage, 50 per cent. of the energy developed is often expended in overcoming friction. It is in colliery ventilation, however, that frictional resistance becomes the all-important consideration, for in this work practically all of the energy applied is expended in overcoming friction. A full realization of this fact can best be obtained by remembering that, in mine ventilation, if friction were entirely absent, a difference of pressure equal to a water column one-quarter inch high (1.3 lb. per sq.ft.) would be sufficient to produce a movement in the air current equal to more than 2000 ft. per minute. To attain this velocity at a colliery with large well-kept airways, however, it would be necessary to have a pressure equal to a 7- or 8-in. water gage; this shows the necessity of devoting much attention to the elimination of avoidable friction.

Two of the most delicate tests for gas in a mine are known as the Pieler and the Clowes methods. The Pieler lamp burns alcohol and is similar to the Davy in construction. Air is admitted to this lamp through a tube which is protected by a wire gauze disk placed in the alcohol vessel in a vertical position. The Pieler lamp is a good gas tester, as it will plainly give a cap when less than ¼ per cent. of gas is present. The great difficulty with this lamp is that even a mild amount of heat causes the alcohol to take the form of a vapor, which latter is highly explosive when mixed with air. This lamp is also easily extinguished. The Clowes lamp burns hydrogen gas and shows the percentage of firedamp present by means of a scale on which the hight of "cap" is recorded. In the Clowes method of testing gas, an ordinary safety lamp may be used, providing it has a hole through the oil vessel. Through this hole a steel tube is inserted, and is connected to a steel cylinder on the outside of the lamp, the steel tube coming on a level with the oil flame. Inside the steel cylinder, compressed hydrogen is stored and is regulated by a screw valve. When about to test for gas, the hydrogen is turned on and becomes ignited by the oil flame; the latter is then turned out, and the hight of the hydrogen flame is regulated by adjusting the flow of hydrogen from the cylinder.

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The Question of Prices

It is admitted that the commercial depression of 1907-09, as acute in Great Britain, Germany and elsewhere as in America, resulted from the world's living beyond its means, one of the concomitants of over-expansion and extravagance being the boosting of commodity prices. To regain the full measure of prosperity it is nesessary to practice economy, to accumulate savings. As *The Evening Post* remarked the other day, it may seem ridiculous to preach economy "to a country which is talking of an issue of $500,000,000 in bonds for the Panama canal, and habitually thinks in hundred millions, but it is the tiny savings that make the big loans possible."

But if the cost of labor and material continue so high as to check work that ought to be done; if men continue, therefore, to be out of employment; and if the cost of living is unameliorated—How are people going to save? Are they not rather bound further to diminish their accumulations?

The answer is in the negative if the theory of the trusts—both of capital and of labor—be correct. The trust magnates have reasoned that if the world will not now pay for their goods the price demanded, sooner or later it will have to do so. Diminished competition and command of vast credit have fortified them in this defiance of the law of supply and demand. Labor unionism, true to its fallacy that work is a boon to be distributed rather than a factor in the creation of wealth, has preferred to waste time rather than consent to a reduction of wages.

Since the nadir of 1908 there has been a betterment of conditions, to which many things bear testimony. The index numbers have been a little more favorable to revival of consumption, but after all they did not decline far below the zenith of 1907; nor did wages. Has it not been this very resistance to economic laws that has protracted the commercial depression? It is undeniable that now, close upon two years since the reverse began and 12 months since business was at lowest ebb, hopes have been disappointed.

In this country the Steel Corporation has been the leading exponent of the theory that reductions of prices were unwise and unnecessary. We have repeatedly argued against that fallacy, as have other journals. We understand that the directors of the Steel Corporation at last recognize among themselves that they were mistaken.

A Building for the Geological Survey

The Secretary of the Treasury has transmitted to Congress a communication from the Secretary of the Interior, urging the erection of a fireproof building for the Geological Survey and other bureaus of the Department of the Interior, and submitting an estimate of $2,500,000 as the probable cost of such a building as is required. We have previously pointed out the reason why the Geological Survey should have such a building. We hope that Congress will promptly grant the necessary appropriation.

It is perhaps modesty that inspires the Secretary of the Interior to ask for a building to be used by the Geological Survey, the General Land Office and the Office of Indian Affairs in combination. We think that the Geological Survey ought to have a building of its own. This should be a monumental building like the home of the geological survey of Mexico, which adorns the capital of our sister republic. The possession of such a building would be a fitting recognition of the high esteem with which the U. S. Geological Survey is held by the scientists of the world, and everyone concerned in the mining industry of the United States would be pleased.

The Yukon Gold Company

S. R. Guggenheim, president of this company, has issued to the stockholders a letter concerning the object of the enterprise, what has been accomplished and what is still to be done, estimated earnings, etc. His statement is frank and to the point, except that no data as to the operating costs are given. However, if he accepts the facts as stated, together with the estimate of the profits, the stockholder is able to form a fair idea as to the value of his property.

At the time of the Lawson flotation, the net profit of the developed ground was estimated at $36,000,000. It is now stated that $40,000,000 net is to be expected. The earnings in 1908 were about $550,000. In 1909 they are expected to be $1,100,000

to $1,500,000. In 1910 the net profit "should be from $2,000,000 to $2,500,000 and in 1911 and thereafter $2,500,000 net per annum should be the minimum."

This gives, for the first time, notice of the time that the management contemplates for the working out of the property, which apparently will be 16 to 20 years. This is in line with the analysis in the JOURNAL of April 18, 1908. Unfortunately, Mr. Guggenheim does not give any indication of what part of the estimated net profit will be applicable to the payment of dividends, and what part must go back into the property for maintenance. Perhaps he means that it will all be available for dividends. There is always a vagueness about the term "net profits." In the case of the Yukon Gold Company it might have been dissipated if Mr. Guggenheim had gone into the matter of gross yield and operating expense.

The discredit arising from the Lawson connection has deprived this company of the recognition to which it is entitled. Mr. Guggenheim's letter appears to be inspired in part by the desire to correct the false impression. The company is, indeed, engaged in a great industrial undertaking. Some extraordinary engineering feats have been accomplished and the introduction of new methods marks an era in Alaska placer mining. To O. B. Perry, the managing engineer of the company, is chiefly due the credit for this.

The Steel Corporation in 1908

The United States Steel Corporation in 1908 passed through the worst period of depression it has encountered since its first organization. This period followed the best year in its history, and the contrast was much greater than that between 1903 and 1904. It is true that through its influence and diplomacy it was successful in some degree in preventing the fall of prices which has marked previous years of depression; but it is a question whether the business which might have been secured by concessions would not have put the company into better condition than it occupies at present.

Speaking briefly of the results of the year, the net earnings over operating expenses were $69,138,154 less than in 1907, and were smaller than those of any year since 1904. They were sufficient, however, to meet all the fixed charges and the dividends on the preferred stock, and also to continue the 2 per cent. which the company has for several years paid on the common stock. This was done by cutting down the depreciation and renewal charges to the lowest possible point, and by omitting all appropriations for new work and construction. These had been on a liberal scale for three years, and in 1906 and 1907 had amounted to the great sum of $57,500,000 in each year. That the maintenance of dividends was possible in a year when the net earnings fell off 43 per cent., is an evidence of the large profits earned in the boom years.

The monthly earnings in the latter part of 1907 showed the sharpest fall on record, decreasing from a maximum of $17,052,211 in October to $5,014,728, or less than one-third of the former amount in December. This fall was not without warning, however, for the tonnage of unfilled orders, as reported at the end of each quarter, began to fall off early in the year, and continued to decline steadily. In 1908 the monthly earnings began to improve from January on, but the advance was very slow, though in December the net earnings were $3,000,000 above those of January.

What the effect on the revival of business might have been had the Steel Corporation encouraged construction and investment by a general reduction in prices, has been heretofore discussed. There can be no doubt that such a course would have hastened the recovery of trade. It appears now the managers have at last seen their mistake, and are prepared to try the opposite course, so that price reductions may be expected.

The Cost of Labor

The Ways and Means Committee of the House of Representatives, which is engaged in drafting a new tariff bill, appears to be profoundly concerned as to the lower rates of wages in foreign countries. This is to a large extent a waste of thought. Modern economists seem to be fairly well agreed that differences in the wage rate cut comparatively little figure. It may be stated as a general rule, to which, of course, there are some exceptions, qualifications and limitations, that the laborer is worthy of his hire. Where labor is low the performance per man is generally correspondingly low.

Legislative Inquiry Concerning Cave-ins over Anthracite Mines

The question of responsibility for cave-ins of the surface over anthracite mines, where damage to property has resulted, has been a constant litigation in the mining districts of eastern Pennsylvania. The towns in the anthracite region are almost without exception underlaid by seams of workable anthracite coal. The increasing value of this product, combined with the depletion of the easily accessible beds, has caused the larger anthracite companies to mine as much coal from beneath the towns as can be obtained without injuring the surface. In many instances, however, the limit of safety has been exceeded, with the result that buildings on the surface have been wrecked.

In answer to a petition submitted by the mayors of five cities and the burgesses of 13 towns, Governor Stuart has just sent a special message to the General Assembly recommending the creation of a commission with authority to inquire into the subject and make a report to the next legislature.

The work of the commission will be important; however, it will face a problem that has already been solved in European countries. Some anthracite operators have indeed anticipated such action, and have introduced flushing systems, whereby the worked-out portions of their mines are filled with culm and waste material, thus permitting the extraction of all pillars, without injury to the surface. This system adds somewhat to the cost of the coal produced, but insures a greater recovery.

There is no reason why many square miles of surface in the anthracite region should be made insecure, if not worthless, by the refusal of a few mine operators to adopt methods that have already been tried and proved successful.

WHILE THE FEDERAL GOVERNMENT is concerning itself so much as to conservation of resources and the reduction of waste, why does it not begin with itself and eliminate some of the scandalous wastes that go on in the administration of its own affairs?

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Electric Shocks and Fires in Mines

The article on "The Use of Electricity in Australian Collieries" in the JOURNAL of Nov. 14, 1908, is exceedingly interesting. The troubles Selwyn Brown points out as having been experienced in Australian mines, are exactly those that have been experienced in English mines. There has been the same trouble with the exposure of live metal, and from the deterioration of the insulation of cables, and from cables being stripped.

I venture to think, however, that the workmen of New South Wales, and the New South Wales government, are wrong in endeavoring to keep the pressure employed at a very low figure. If the pressure is kept at a figure which is safe under all circumstances, it will render the use of electricity in mines absolutely prohibitive, on account of the enormous cost of the cables. In one case which passed through my hands, the difference between employing 2000 volts, and 500 volts, for cables alone, I estimated at $30,000.

On the other hand, once the limit of safe voltage is passed, there is no reason why as high voltages as the management chooses, within very wide limits, should not be employed. About 140 volts in alternating current kills, and about 400 volts in continuous currents. Once those pressures are exceeded, the danger is practically the same for all pressures, so far as the men about the mine are concerned, until rather high voltages are reached, and then the paradox arises, that, owing to the burning effect of the arc which is almost invariably produced when a man touches a very high pressure conductor, greater safety is enjoyed than with pressures just above the limit.

SOURCES OF DANGER

The great danger from shock in mines arises from conductors' being stripped of their insulation, and making connection with some other innocent-looking metals. A stripped conductor may transmit the ability to give shock, to some metal at a considerable distance from it, that is not actually in contact with it, but which is in contact with a second piece of metal, or even a third, the second or the third being in contact with the live conductor. A girder has accidentally stripped the covering of an insulator, and has killed a man handling it. The insulating envelop of the flexible cable carrying current to a coal cutter has been punctured, and the man moving the haulage rope has been killed. Naked galvanized-iron wires employed for signaling, have been rendered "live" by one or two connections, and have killed men touching them. The remedy for all is the provision of very good insulation, and as much of it as funds will allow, in the first instance, and its careful maintenance after.

Fires have unfortunately been caused in not a few cases, in mines, by the arc that has been formed between a pair of broken conductors, or between one of them and the rails, when coal dust has been present in a position to be ignited. The continuous current arc is far more liable to cause fires than an alternating current, and the danger of the arc's causing fire increases with the pressure.

SYDNEY F. WALKER.

Bath, England, Dec. 4, 1908.

Adair-Usher Process in Pachuca

In the JOURNAL of Sept. 5 and 19, 1908, there is a reference to the so-called failure of the Adair-Usher process at Pachuca, Mexico, where it had been installed by the Blaisdell company for trial under working conditions.

It was never contemplated by us that this process would be applied to anything but slimes, and we should certainly have endeavored to stop its use under the conditions prevailing at Pachuca, had we known that mining as practiced in Mexico had not reached the stage of complete separation of sand and slimes as performed here on the Rand.

The presence of large quantities of silver or any other metal in the ore, provided it is amenable to cyanide or any other lixiviating treatment is no detriment at all to the process, as we presume that cyanide managers in America endeavor by some means, such as circulation or agitation to get the gold and silver completely dissolved, or as nearly so as possible, before washing is commenced.

We inclose a list of the mines on which our process has been successfully worked on the Rand, and we are convinced that under similar conditions in other countries the process can be worked with equally good results.

BALL & STUART, Secretaries,
Adair-Usher Process, Ltd.

Johannesburg, Transvaal, Dec. 14, 1908.

[From the statements received with this letter it appears that the Adair-Usher process has at six different mines effected reductions in the losses in the tailings varying from 5d. to 8s. At the Crown Reef, where 8000 tons per month were subjected to the process, the time of treatment was reduced from 5 days 8 hours to 3 days and 14 hours. At the New West Bonanza the gold in the tailings was reduced from 2.50 to 0.75 dwt. per ton.

The process is either in successful use, or in course of installation at plants of the following mines and companies: Crown Reef, Geldenhuis Estate, Treasury, Geldenhuis Deep, Worcester Exploration, Geldenhuis Main Reef Tributors, West Rand Mines Slimes Tributors, New Heriot, Cinderella Deep, Robinson Randfontein, Champ d'Or, Durban Roodepoort, Ferreira, Transvaal, Jumpers, New West Bonanza, Durban Roodepoort Tributors, Burnham Slimes Tributors, Nigel, West Rand Mines, Langlaagte Estate, Tributors Molyneux Gold Mines, Ginsberg, Blaisdell & Co., Consolidated Main Reef and Estate, Glynn's Lydenburg, Jubilee, Paarl Central Slimes Tributors, Nourse Mines, Salisbury.—EDITOR.]

Withdrawal of Western Phosphate Lands

The remarks in the JOURNAL of Dec. 19 on this subject coincide fully with my own views. The stand taken is good, sound Americanism, however little it may agree with the views of certain exploiters of American resources for foreign profit.

In the light of the present withdrawal of phosphate lands I believe the letters which I inclose may be of interest as being the first suggestion along that line. President Roosevelt by this far-reaching decision has done an incalculable service to the American nation, and if it were feasible to follow this up and render the exportation of phosphate prohibitive, notwithstanding present curses from certain quarters, future generations would arise and call him blessed.

The JOURNAL did me the honor in May, 1907, to publish the first article that appeared concerning the Western phosphates. About the same time the subject was treated by the U. S. Geological Survey in "Contributions to Economic Geology for 1906, Part 1," in which almost

the opening sentence it spoke of the business to be built up possibly in supplying Australia and Japan. Fortunately recent discoveries in the Pacific islands do not now make that feature of the business so attractive, and I thoroughly agree with the JOURNAL that American phosphate deposits should be conserved for the American people.

If now, while the western business is in its infancy, a fair plan can be evolved whereby the United States can recover title to the deposits already located and patented it would seem the logical sequence to the present withdrawal of phosphate lands.

It might be accomplished by 50-year leases with the fixed royalties to be an offset against the present actual cost of the properties to the different companies and individuals until these costs had been extinguished and they had been reimbursed through that source, after which the royalties to become payable to the Government. Some such plan could be made equitable to all parties and finally place in the hands of the Government this veritable backbone of the nation.

CHARLES COLCOCK JONES.

Los Angeles, Cal., Dec. 24, 1908.

[The correspondence referred to in Mr. Jones' letter is too voluminous for publication in these columns. A letter dated Oct. 16, 1906, and addressed to President Roosevelt, urges the withdrawal of the phosphate lands from mineral entry, and one from H. C. Rizer, acting director of the U. S. Geological Survey, dated Nov. 1, 1906, recognizes the force of Mr. Jones' suggestion and requests further information on the subject.—EDITOR.]

The Milan Mine, New Hampshire

George A. Packard is in error in stating in his article in the JOURNAL of Jan. 9, 1909, that the Milan mine in 1908 shipped several carloads of ore said to run 5 per cent. copper and as high as 50 per cent. silica. The fact is that we shipped to the American Smelting and Refining Company two trial carloads of ore which showed the following analysis: Copper, 8 per cent.; silica, 7.8; sulphur, 38.18; iron, 31.83; gold, 0.08 oz. and silver, 4 oz. per ton. Subsequent to this, we shipped in 1908 nine schooner-loads of ore which averaged from $8 to $10 per ton in metallic contents at the smelter. We expect in a short time to have our new milling and ore-dressing plant in operation.

J. B. CARPER, President and Manager,
Milan Mining and Milling Company.

Jan. 15, 1909.

An average of 2338 machine drills were in operation during the first six months of 1908 at the mines on the Rand, South Africa.

The Conservation Commission

SPECIAL CORRESPONDENCE

The next forward step in the conservation movement has been taken by Chairman Pinchot in transmitting to President Roosevelt the report of the National Conference on Conservation, accompanied by the complete text of the proceedings of the conference. President Roosevelt has sent the report to Congress (Jan. 22) with a message urging certain important legislative acts. Simultaneously with this step, Mr. Pinchot has announced the personnel of the joint committee which is to represent the States and the Federal Government in making plans for the development of a conservation policy. Six of its members are chairmen of State conservation commissions, and three are members of the national conservation commission, besides the chairman and secretary of the national body. The membership of the committee is as follows: Representing the State conservation commissions: J. N. Teal, Portland, Ore.; Paris Gibson, Great Falls, Mont.; W. K. Kavanaugh, St. Louis, Mo.; W. H. Milton, Marianna, Fla.; Prof. Frank W. Rane, Boston, Mass.; O. J. Salisbury, Salt Lake City, Utah. Representing the national conservation commission, Knute Nelson, Alexandria, Minn.; Newton C. Blanchard, Shreveport, La.; George C. Pardee, Oakland, Cal. Gifford Pinchot is chairman, and Thomas R. Shipp, secretary. These men were selected with a view to having all sections of the country represented on the "Joint Committee on Coöperation," as it will in future be known. All have taken an active part in the conservation movement, and are said to be thoroughly familiar with the situation in their own districts.

President Roosevelt in his message speaks of the report of the commission as "one of the most fundamentally important documents ever laid before the American people." He says that "the facts set forth in this report constitute an imperative call to action and adds "with the statements and conclusions of this report I heartily concur." The President recommends the organization of efficient fire patrols and the enactment of good fire laws by the States, while he indicates the necessity of such a reformation of State taxation as will permit the perpetuation of existing forests. As to lands he thinks that the remaining public lands should be classified, the arable lands disposed of to home-makers, the timber and stone act and the commutation clause of the homestead act be repealed and the desert-land law be modified in accordance with the recommendations of the public-lands commission. He further suggests that the use of the public grazing lands be regulated, while "rights to the surface of the public land should be separated from rights to forests upon it and to minerals beneath it, and these should be subject to separate disposal." Also "the coal, oil, gas, and phosphate rights still remaining with the Government should be withdrawn from entry and leased under conditions favorable for economic development." In dealing with the subject of minerals, Mr. Roosevelt, accepting the estimates of the conservation commission, reckons the present mineral waste at about one-sixth of the product. The President further points out that mineral resources are limited in quantity and that the supply will shortly be exhausted unless better methods are devised or substitutes are found. Further investigation, he thinks, is urgently needed in order to improve methods and to develop and apply substitutes. He then adds: "It is of the utmost importance that the bureau of mines be established in accordance with the pending bill to reduce the loss of life in mines and the waste of mineral resources and to investigate the methods and substitutes for prolonging the duration of our mineral supplies. Both the need and the public demand for such a bureau are rapidly becoming more urgent. It should coöperate with the States in supplying data to serve as a basis for State mine regulations."

The report of the conservation commission as transmitted by the President covers ground already dealt with in this correspondence. A few important changes have, however, been introduced into the inventory of natural resources, some figures being modified and certain additions made. The report in dealing with minerals takes the view that while waste is still very great, there has been progress in ascertaining methods of economy. This is particularly true in the case of coal, the present mine waste averaging little more than half the amount saved, and the chief waste occurring in connection with imperfect combustion. It is pointed out that the uses of all the mineral resources are interdependent and that this is particularly true of coal and iron. Special stress is laid on the necessity of protecting phosphate rocks used for fertilizers, inasmuch as the original supply cannot long withstand the increasing demand. A plea is also made for the saving of fire losses which are said to have approximated $450,000,000, or one-half the cost of construction in 1907. Of lands it is generally claimed that the present public land laws do not serve the interests of the nation, and that they should be reclassified and mineral rights disposed of separately from the lands themselves under a lease system. The usual recommendations with reference to forestry and water power are made, and in conclusion it is argued that the conservation of resources is an immediate and vital concern. "The pressing need is for a general plan under which citizens, States, and nation may unite in an effort to achieve this great end."

Operations of the Yukon Gold Company

The following letter to the stockholders of the Yukon Gold Company was issued by President S. R. Guggenheim on Jan. 30, 1909:

In submitting for your consideration a résumé of the company's mining operations, construction work, and plans for further equipment, I desire to call your attention to the magnitude of the undertaking in the Klondike district, Yukon Territory; what has been accomplished thus far, and what we expect to accomplish within the next two years.

At the time our engineers made their first examination in 1905, the famous placer fields of the Yukon were fast becoming depleted of their rich ground; the volume of gravel workable at a profit by hand method was rapidly being reduced, and the cost of working, under the most approved methods then in vogue, precluded the extension of the operations to take in the large bodies of lower-grade material.

The principal factors making toward the high cost were:

(1) The disconnected nature of the holdings (the claims being not over 500 ft. in length and owned largely by individuals), which reduced the workings to a number of small-scale operations, and prevented systematic mining upon any larger scale.

(2) The scarcity of water. The miners, both those working upon the creek levels and those upon the bench and hill deposits, were entirely dependent upon the rain-fall for their supply of water. As the snow and rain-fall is very irregular in the Klondike district, a corresponding irregularity entered into the mining operations, with a consequent increase in cost. No large scale hydraulic operations were possible with such limited and intermittent water supply.

(3) The high cost of fuel, labor and supplies. Wood fuel is available in the Klondike for mining purposes, but its cost is high and constantly increasing. Coal is to be had, but it is as expensive as wood. Labor is high, due to the short season for outside work, and supplies expensive because of high transportation charges, and the small and irregular character of the purchases.

Basis of the Enterprise

Our investment in the Yukon was based upon three fundamental hypotheses:

(1) That we would be able to acquire large and connected blocks of ground for systematic working.

(2) That we would be able to secure and make available at sufficient elevation a continuous water supply.

(3) That we would proceed to equip the properties with the most modern mechanical appliances, such as dredges and elevators, for handling the gravels upon a large scale and at a low cost, depending for power not upon local fuel, but upon electrical energy generated in our own hydro-electric plant.

All of these things have been accomplished. At the present time our holdings amount to about 90 per cent. of the claims located on the hills and creek bottoms of Bonanza, Bear, Hunker, and El Dorado valleys, which were wanted for the enterprise. These properties have been acquired mainly by outright purchase, although in some cases, where unacquired claims adjoin the properties of this company, advantageous working agreements have been made with the owners.

Early in 1906 construction was begun upon a water system which will insure to the Klondike a continuous water supply for all time. This was in itself a tremendous undertaking, involving the diversion of Tombstone river (the main right fork of the Twelvemile), carrying it a distance of about 62 miles by flume, ditch and pipe lines, through a country which was an absolute wilderness when our engineers first went upon the ground. In its course the main ditch follows the contour of the country, which, due to its rugged and partly frozen character, required miles of continuous flume construction. The line crosses five depressions, making an aggregate of nearly 12 miles of pipe line. The ditched sections, aggregating 37 miles, required the use of seven steam shovels in excavation, and the employment of more than 1000 men throughout three summers. The water is carried across the wide Klondike valley in an inverted siphon, which for length, size and pressure involved, is not, so far as we know, equalled in the world.

Construction

The construction of this water system was carried on in the face of great difficulties. It involved the distribution of thousands of tons of supplies and construction material; the manufacture, distribution and use of more than 8,000,000 ft. of lumber, produced by our own logging and sawmill operations; the hauling over winter roads; and distribution of several thousand tons of steel and wood-pipe line; and its installation at an average distance of 35 miles from the base of supplies.

In the construction of the flume, ditch and pipe line, innumerable engineering difficulties were encountered and overcome, which would not be met anywhere, except in the far northern country. The complete work today is evidence of persistent and untiring effort upon the part of the men in charge. Many of the engineering feats accomplished have prompted praise from the technical press. They mark an era in Alaska mining history.

Simultaneously with the construction of the water system, a hydroelectric power plant was installed on the Little Twelvemile river, capable of delivering 2000 h.p., which is transmitted to the placer fields by a high-tension line, 36 miles straight across country, with three substations and 18 miles of secondary line.

A huge dam has been built at the head of Bonanza creek to conserve the water of the Upper Bonanza watershed for use upon the company's Bonanza and El Dorado Creek properties.

Equipment plans have been caried forward in a manner to evoke enthusiasm, and inspire confidence in a speedy consummation of the enterprise as a whole. Seven dredges have been erected, the last of which was completed and put in operation late in the season of 1908. These dredges are of large capacity and great strength, able to withstand the most severe service. Their operation in the latter part of 1908 demonstrated the entire success of this method of mining, as applied to the gravels of the Yukon. The difficulties due to frozen ground have been overcome within the limit of a reasonable working cost, and this cost will, without doubt, be greatly reduced when the main water supply is available for stripping the gravels in advance of the dredges.

Three mechanical elevators were installed, two of which were put into operation during the season of 1908. It is a great pleasure to say that the mechanical elevators, electrically driven, which were designed by our own engineers and used here for the first time in any country, were entirely successful. They will be presently operating upon the ground from which the gold could not be thoroughly extracted by any other method of mining known to us. The successful operation of the elevators solves one of the most difficult problems in connection with our Yukon business—that of handling flat, shallow gravels, largely frozen, where the bedrock is rough and irregular and the gold extends to some depth into the crevices.

Since acquiring the properties in the Yukon, we have carried on hydraulicking to a limited extent, and dependent upon the local intermittent water supply. The operations have shown a profit, and have proved not only the value of the gravel, but also that a very low working cost can be reached.

In the season of 1909 we expect to have the equipment working up to at least one-half of its ultimate capacity. In the season of 1910 we fully expect to show a production which will make the Yukon Gold Company take rank as one of the largest gold mines in the world.

Holdings and Proved Ground

We have only proved our holdings in part, first, because of the advisability of concentrating our engineering staff upon the installation of the present equipment, and second, because of the expense attendant upon the thorough prospecting of

ground in the north. Our engineers having reported that we now have nearly $40,000,000 net in proved ground, which is approximately 100 per cent. profit on the shares at par, and provides for many years' dividends, we concluded to postpone further prospecting of our holdings, until our present plant and equipment are running to full capacity. There is good reason to believe that additional workable ground will be developed and economies introduced which will greatly increase the ultimate net profit.

The shareholders will be interested to know that a large majority of the outstanding capital stock of the Yukon Gold Company is owned by the Guggenheim Exploration Company, whose engineers have under their direction the equipment and operation of the properties. The Guggenheim Exploration Company has financed the scheme from its inception, justifying its investment by the conclusions of its engineers after rigid examination and exhaustive reports. That the members of the company are satisfied with their investment is evidenced by the fact that they have not disposed of a share of their holdings. The fact is that the directors of the Guggenheim Exploration Company feel that they, as pioneers in the industrial development of the North, have taken the first steps toward the establishment of a permanent and substantial mining industry in the Yukon Territory and Alaska. The day of the small operator had come and gone, and in his place entered the corporation, to do the things which few individuals, having the means, would care to undertake; that is, to supply sufficient capital for the development of the resources of the country and make its mining future definitely assured. It required courage to make such an investment, running well up into millions of dollars, but the directors feel that the money and time they have expended in developing the resources of the North, will ultimately result in a large profit to the stockholders of the first company to go into placer mining in this region upon so gigantic a scale. That others will follow in our footsteps we hope and have no doubt, now that we have demonstrated that the frozen gravels can be worked within reasonable operating cost, and in fact that all of the handicaps under which the individual operator labored can be overcome. We feel safe in predicting, therefore, for the future, an immense increase in the gold output of Alaska and the Yukon Territory which naturally will be attended by improvement in local conditions and increasing prosperity.

Past Results

For the last season final results have not as yet been actually determined, but incomplete figures show that the net earnings to Dec. 31, 1908, will be about $550,000. Without doubt, we should have reached our estimated net of $800,000, had it not been for delay in delivery at Dawson of machinery, which was held up at Whitehorse by unusually low water in the Yukon river immediately after the opening of navigation. This delay cut the length of our season materially, but possibility of repetition may be omitted from future calculations, now that our equipment has been delivered and installed.

Our engineers have estimated the probable earnings for 1909 at from $1,100,000 to $1,500,000. The wide difference in these figures is due to the unknown factors entering into the water supply, and the uncertainties attendant upon the first operation of a new ditch line of such length, and constructed under such difficulties. If we have comparatively few washouts or accidents on the main ditch system or the equipment, our earnings will probably reach the higher figure.

In 1910 the net profits of the company should be from $2,000,000 to $2,500,000, and in 1911 and thereafter, $2,500,000 net per annum should be the minimum.

I have no doubt that the directors will authorize the commencement of dividends during this year, probably in the second quarter; but before deciding definitely as to the date and rate, they deem it prudent to wait until the coming season's operations have sufficiently advanced to enable them to estimate more accurately the probable earnings for 1909.

Chronology of Mining, January, 1909

Jan. 2—General strike of miners in New Zealand on account of Workers' Compensation Act, effective Jan. 1, requiring medical examination for certain diseases.

Jan. 4—Strike of miners at Broken Hill, N. S. W.

Jan. 5—Outside steel makers reduced prices.

Jan. 6—J. W. Gates in letter to Ways and Means Committee advocated duty-free iron ore, coal and lumber and reduction in duty on iron and steel. Tennessee Steel Company incorporated in Maine with $20,000,000 capital stock. Pueblo Indians attacked miners of the American Turquoise Company, New Mexico.

Jan. 7—U. S. Steel Corporation offers common stock to employees at 50, besides the usual offer of preferred at 110, this being held to imply increased confidence in the common stock. Senator Culberson accuses President Roosevelt of violating law in Tennessee-Steel Trust deal.

Jan. 8—Concentrator of Arizona Copper Company, Clifton, destroyed by fire. Manufacturers of lead products petitioned Ways and Means Committee for duty-free pig lead and for duty on manufactures.

Jan. 9—Statistical number of the Journal gave world's mineral production for 1908.

Jan 10—Explosion in Leiter mine, Zeigler, Ill., killed 27 men.

Jan. 12—Organization of Copper Producers' Association to report monthly production and stock of refined copper. Announcement that Cole and Ryan had secured control of Giroux Consolidated Mines Company. Explosion at Lick Branch colliery at Switchback, W. Va., killed more than 105 men. Earthquake on Pacific coast. Goldfield Consolidated mill began dropping 100 stamps.

Jan. 13—Explosion of gas at Almassy mine, Resicza, Hungary, killed 12 men.

Jan. 14—Explosion of gas, followed by a dust explosion, at Aika colliery, Veszprem, Hungary, killed 56 men.

Jan. 19—U. S. Circuit Court of Appeals affirms decisions of Circuit Court and Board of General Appraisers that zinc ore is not dutiable under the Dingley Act.

Jan. 22—The President, in a message to Congress on the conservation of resources, recommended that the coal, oil, gas and phosphate rights still remaining with the Government be withdrawn from entry and leased under conditions favorable for economic development. Flood on the Rand, Transvaal, broke dam and flooded a mine, drowning 160 miners. Kelvin-Calumet copper properties acquired by Ray Consolidated Company, a $5,000,000 corporation.

Jan. 24—Judge Hunt, in the Federal Court, Helena, Mont., gave a decision against the farmers in the Washoe smelter fume case, refusing the injunction asked for. Shutdowns of all the mines at Globe, Ariz., because of labor agitation.

Jan. 26—U. S. Steel Corporation quarterly report showed gain in unfilled orders.

Jan. 27—Reports multiply of price cutting by independent steel manufacturers. Explosion in Merchants coal mine of the United Coal Company, Boswell, Penn., killed five men.

Jan. 28—Copper River Railroad, Alaska, completed from Condova to Abercrombie rapids. Fire in Sutro tunnel, Comstock lode, caused minor damages.

Jan. 29—Senate begins taking testimony respecting Tennessee-Steel Trust deal. Resumption of work at Globe, Ariz.

Correction

In the article "Examining and Fitting up a Hydraulic Mine" by H. A. Brigham in the Journal of Jan. 2, 1909, the last sentence of the fourth paragraph from the bottom of page 27 was transposed. It should be the last sentence in the next paragraph which should read: "A giant under heavy pressure, placed at the lower end of the sluice, may be used to great advantage in stacking or elevating the tailings whenever the dump room is ample in area but deficient in grade. Any boulders, stumps, etc., that will run through the sluice, can be elevated by this process equally as well as the fine gravel."

Pig Iron and Steel in 1908

The completed figures for the production of pig iron and bessemer steel, as collected by the American Iron and Steel Association, are now available for 1908, and show the sharpest decrease in that year which has ever been reported. The pig iron make fell back almost to that of 1907 and was only about two-thirds of that reported in the previous year.

Pig Iron

The American Iron and Steel Association has received from the manufacturers complete statistics of the production of all kinds of pig iron in the United States in 1908. The figures, as given in the *Bulletin* of the association show the total production for two years as below, in long tons:

	1907.	1908.	Changes.
First-half	13,478,044	6,918,004	D. 6,560,040
Second-half	12,303,317	9,018,014	D. 3,285,303
Total	25,781,361	15,936,018	D. 9,845,343

The second half of 1908 showed an increase of 2,100,010 tons over the first half; the total decrease for the year being 38.1 per cent. The division of the make according to the fuel used was as follows:

	1907		1908	
	Tons.	PerCt.	Tons.	PerCt.
Coke	23,972,410	93.0	15,331,863	96.2
Anthracite	1,371,554	5.3	355,009	2.3
Charcoal	437,397	1.7	249,146	1.5
Total	25,781,361	100.0	15,936,018	100.0

Very little iron is made with raw bituminous coal, and that is included with the coke iron. Nearly all the anthracite furnaces use some coke also, the quantity made with anthracite alone having been only 36,268 tons in 1907, and 1694 in 1908. A small quantity of iron was made experimentally in Michigan with producer gas as fuel; and a small quantity was made, also experimentally, in the electric furnace.

Division of Product

The more important division according to the purposes for which the iron was intended is as follows:

	1907		1908	
	Tons.	PerCt.	Tons.	PerCt.
Foundry & forge	6,397,777	24.8	4,307,734	27.0
Bessemer pig	13,231,620	51.3	7,216,976	45.3
Basic pig	5,375,219	20.9	4,010,144	25.2
Charcoal iron	437,397	1.7	249,146	1.5
Spiegel and ferro	339,348	1.3	152,018	1.0
Total	25,781,361	100.0	15,936,018	100.0

The bessemer pig in 1908 included 130,616 tons of special low phosphorus iron. The spiegel and ferro included 152,018 tons spiegeleisen and 40,642 tons ferromanganese; besides a few hundred tons of ferrophosphorus.

Active Furnaces

The whole number of furnaces in blast on Dec. 31, 1908, was 236, against 168 on June 30, 1908, and 167 on Dec. 31, 1907. The number of furnaces in blast at the end of 1907 was smaller than at the close of any year since 1896, when but 169 furnaces were active. At the close of 1908 there were 223 idle furnaces, as compared with 276 idle furnaces at the opening of the year.

Production by States

The production by States for two years past was as follows:

States.	1907.	1908.
Mass. and Connecticut	19,119	13,794
New York	1,659,752	1,019,495
New Jersey	373,189	225,372
Pennsylvania	11,348,549	6,987,191
Maryland	411,833	183,502
Virginia	478,771	320,458
Georgia and Texas	55,825	24,345
Alabama	1,686,674	1,397,014
West Virginia	291,066	65,551
Kentucky	127,946	45,096
Tennessee	393,106	290,826
Ohio	5,250,687	2,861,325
Illinois	2,457,768	1,691,944
Indiana and Michigan	436,507	348,096
Wisconsin and Minnesota	322,083	148,938
Missouri, Colorado, Washington and California	468,486	313,071
Total	25,781,361	15,936,018

The smallest proportional losses shown in 1908 were in Tennessee and Alabama.

Bessemer Steel Production

The decline in bessemer steel was even greater proportionally than that in pig iron, being 47.5 per cent. In part this was due to the increased use of open-hearth steel, which has been so much in evidence for several years past. The production by States was as follows, in long tons:

	1907.	1908.	Changes.
Pennsylvania	4,351,841	2,106,382	D. 2,245,459
Ohio	3,636,679	1,955,446	D. 1,681,233
Illinois	1,723,073	1,237,747	D. 485,326
Other states	1,955,956	817,180	D. 1,138,776
Total	11,667,549	6,116,755	D. 5,550,794

The totals include castings made direct from the converter, which were 33,273 tons in 1907, and 20,559 in 1908. The total production of bessemer steel was the smallest reported since 1897, when 5,475,315 tons were made. The maximum output was in 1906, when the total reached 12,275,830 tons, or a little more than double the make of last year. The largest proportional decrease was in Pennsylvania. This was probably due to the substitution of open-hearth furnaces for bessemer converters by the Carnegie works.

The figures for open-hearth steel are not yet available; but the indications are that the open-hearth was greater than the converter make last year.

Rail Production

The production of all kinds of rails for two years past was, in long tons:

	1907.	1908.	Changes.
Bessemer steel	3,380,925	1,354,236	D. 2,025,789
Open-hearth steel	252,704	567,304	I. 314,600
Iron	925	71	D. 854
Total	3,633,654	1,921,611	D. 1,712,043

This includes all classes of rails, rerolled, as well as those made from new steel. The rerolled rails were about 71,000 tons. The production of bessemer-steel rails was the smallest reported since 1896. The output of open-hearth steel rails was more than doubled, which is one result of the sharp controversy over bessemer-steel rails, which has been going on for the past two years. The open-hearth rails were made chiefly by the Bethlehem Steel Company and the Tennessee Coal, Iron and Railroad Company.

The following table gives the production of all kinds of rails, according to the weight of the rails per yard. Street and trolley rails are included:

Section:	1907.	1908.	Changes.
Under 45 lb	295,838	183,869	D. 111,969
45 to 85 lb	1,569,985	688,198	D. 881,787
Over 85 lb	1,767,831	1,049,544	D. 718,287
Total	3,633,654	1,921,611	D. 1,712,043

The total decrease in 1908 was 47.1 per cent. The greatest proportional decrease was in rails between 45-lb. and 85-lb. section; the smallest was in light rails, under 45-lb. section.

Exports of rails decreased from 338,996 tons in 1907 to 196,510 in 1908; a reduction of 142,396 tons, or 42 per cent. This was slightly less than the decrease in production, but does not indicate that export trade made up in any appreciable degree for the decline in home demand.

Balata Belts

Special Correspondence

Balata belts have been manufactured in Scotland for the last 20 years, and while they have been extensively used in South Africa, Australia and Europe, their use in the United States is of a comparatively recent date. The Robins New Conveyer Company is now introducing them in this country. The basis of the belt is a closely woven cotton duck, and balata which is a gum, is applied in a hot liquid form, thereby saturating the plies of duck. The gum is used in an unadulterated form, without mineral or other ingredients. Balata belts are recommended for conveying and transmission purposes in damp and exposed places. In South Africa they have been widely used for carrying ore to the stamp mills.

By-product Plant for the Frick Coke Company

Reports from Pittsburg state that the Frick Coke Company has abandoned work which was to cost $3,700,000 on 1700 additional coke ovens at Uniontown, Penn., and will substitute for the proposed bee-hive ovens an enormous by-product coke plant at Gary, Ind. The abandonment of the projected 7000 bee-hive ovens at Filbert, 5000 at Ralph and 500 at Sarah, means that the Frick plants in those localities will hereafter be merely coal-loading plants.

The United States Steel Corporation

The publication of the earnings of the December quarter of 1908 makes it possible to give a summary of the operations of the United States Steel Corporation for the full year 1908; subject only to some slight corrections which the complete report may make. As compared with 1907 the net earnings show a decrease of $69,138,154, or 42.9 per cent. The corporation was able to pay its usual dividends, notwithstanding this heavy decrease, by cutting off the appropriations for new work and improvements which had been made on a liberal scale in the two or three preceding years.

The income accounts for two years past can be compared as follows:

	1907.	1908.
Net earnings	$160,964,674	$91,826,520
Sinking funds	$7,115,258	$6,361,668
Depreciation and reserve	22,241,983	15,396,121
Interest	22,860,355	23,862,649
Adjustments	681,515	.....
Total charges	$52,899,121	$45,620,438
Balance	$108,065,563	$46,206,082
Add adjustments	.....	289,183
Total net	$108,065,563	$46,495,265
Special improvements	3,500,000	.....
New construction	54,000,000	.....
Dividends	35,385,726	$35,385,726
Total appropriations	$92,885,726	$35,385,726
Undivided surplus	$15,179,837	$11,109,539

The dividends declared were the same in both years; 7 per cent., or $25,219,676 on preferred, and 2 per cent., or $10,166,050, or common stock.

The gross receipts, which were $757,014,768 in 1907, have not yet been stated for 1908. The net earnings, as published, "were arrived at after deducting each month the cost of ordinary repairs and maintenance of plants, employees' bonus funds and interest on bonds and fixed charges of subsidiary companies." These net earnings, by months, were as follows in 1908:

Jan.	$5,052,743	July	$8,599,630
Feb.	5,709,428	Aug	9,152,311
March	7,466,834	Sept	9,334,333
April	6,761,680	Oct	9,415,668
May	6,021,279	Nov	8,756,729
June	7,482,797	Dec.	8,053,088

The monthly earnings showed a fair recovery from January to March, but from that month a considerable decrease for two months. From June on there was a steady advance until October, but then they fell off again, losing $1,361,580 from October to December. The earnings of the latter month were, however, $3,000,345 above those for January, a gain of 60 per cent. In 1907 the monthly net earnings reached a maximum of $17,052,211 in October, the largest ever earned by the company. From that point there was a sharp fall, November recording only $10,467,253—a loss of 38.6 per cent. from October; and December $5,014,728, a loss of 70.6 per cent.

The report includes a statement of the total tonnage of unfilled orders at the close of each quarter for a series of years. These orders reached their highest point at 8,489,718 tons on Dec. 31, 1906. There was a decrease in 1907 to 8,043,858 tons on March 31; 7,603,878 on June 30; 6,425,008 on Sept. 30; and 4,624,553 on Dec. 31. In 1908 the figures were 3,765,343 tons on March 31; 3,313,876 on June 30, this being the lowest point reached since Sept. 30, 1904; 3,421,877 tons on Sept. 30; and 3,603,527 tons on June 30, a slight recovery from the low point of the June quarter.

Mineral Concessions in India

In practically all of the native states of India mineral rights belong to the respective rulers, and concessions for mining and prospecting are granted under rules involving some supervision by the government ("Sketch of Mineral Resources of India," by T. H. Holland). In some parts of the country surface rights, by the terms of settlement, carry mineral rights as well; however, in the remainder of the country the government retains rights over the minerals and grants concessions for exploration in accordance with the terms set down in a set of rules.

Two sorts of concessions are granted, prospecting licenses and mining leases. The former are granted only to persons holding certificates of approval from the local governments. The application for such a license must contain certain specified particulars and the holding of it entails upon the holder the following out of a number of conditions. These are clearly set forth in the license and are in no way onerous.

The mining leases too may be granted by the local governments for periods of 30 years, but only under the condition that no one lessee, or those joint in interest with him, shall hold more than 10 square miles, the block not to exceed, without previous approval of the government of India, four times its breadth. To insert a renewal clause in a lease also requires the same approval.

As with prospecting licenses the conditions to be contained in the lease are specified besides which the local governments are allowed to add such stipulations and conditions as seems fit.

In buying an air compressor, S. K. Patteson (*Min. Sci.*, Jan. 7, 1909) recommends the purchase, other things being equal, of the compressor that gives the desired capacity at the slowest speed. This should be done even at a somewhat greater first cost so that the air capacity can be increased considerably whenever desired by simply increasing the speed at which the compressor is run. This is an extension of a principle used in Cornish pump design.

January Dividends

The accompanying table shows the dividends paid in January, 1909, by mining and industrial companies in the United States and by some foreign mining companies:

U. S. Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Alaska Mexican	Alaska	$0.40	$72,000
Alaska Treadwell	Alaska	0.75	150,000
Alaska United	Alaska	0.25	45,000
Am. Smg. & Ref., com.	U. S.	1.00	500,000
Am. Smg. & Ref., pfd.	U. S.	1.75	875,000
Anaconda	Mont.	0.50	600,000
Boston & Mont.	Mont.	3.00	450,000
Bunker Hill & Sullivan	Idaho	0.25	75,000
Colorado	Colo.	0.08	80,000
Copper Range	Mich.	1 00	384,185
Federal, M. & S., com.	Idaho	1.50	90,000
Homestake	S. Dak.	0 50	109,200
Jamison Min. Co.	Cal.	0.02	7,800
New Idria	Cal.	0 30	30,000
Portland	Colo.	0.04	120,000
Silver King Coalition	Utah	0.30	367,328
Snowstorm	Idaho	0.03	45,000
Tonopah of Nev.	Nev.	0.25	250,000
Utah Cons.	Utah	0.50	150,000
United States, com.	Utah	0.50	175,467
United States, pfd.	Utah	0.87½	425,114
Vindicator, Cons.	Colo.	0.03	45,000
Total			$5,046,094

Foreign Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Buffalo Mines	Ont.	$0 06	$54,000
Crown Reserve	Ont.	0.16	280,000
Dominion Coal	N. S.	1.00	150,000
Dos Estrellas	Mex.	1.00	300,000
Guggenheim Expl.	Mex.	2.50	262,500
La Rose	Ont.	0.20	228,674
Mines Co. of Am.	Mex.	0 02	40,000
McKinley-Donagh	Ont.	0.05	100,000
Nipissing	Ont.	0.25	300,000
N. Y. Hond. Rosario	C. A.	0 10	150,000
Temiskaming	Ont.	0.06	150,000
Tezuitlan	Mex.	1.50	15,000
Total			$2,030,174

U. S. Industrials.	Location.	Amt. per Share.	Amt. Paid.
American Cement	Pa.	$0.30	$60,000
Central C. & C., com.	Mo.	1 50	76,875
Central C. & C., pfd.	Mo.	1 25	23,438
Consolidation Coal	Md.	3 50	358,750
Empire Steel & Iron, pfd.	N. J.	1 50	37,500
Fairmount Coal Co.	W. Va.	2 00	240,000
General Chemical, pfd.	U. S.	1 50	150,000
National Lead, com.	U. S.	1 25	186,318
Sloss-Sheffield, pfd.	Ala.	1 75	117,250
United Metals Selling	U. S.	5.00	250,000
Va.-Car. Chem., pfd.	U. S.	2 00	360,000
Total			$1,860,131

At Broken Hill Proprietary mine, Australia, 10x10-in. sills are used for the drift sets in soft ground and 4x10-in. sills in hard ground.

Australasian Gold Production

Advance statements cabled from Australia give the gold production of the several States for the year; the figures varying but slightly from the estimates made by our correspondent, and published in the JOURNAL of Jan. 9. Any further changes made by the final returns will be slight. In the following table the figures are given in fine ounces, the comparison being with the corrected returns for the previous year:

	1907.	1908.	Changes.
W. Australia...	1,697,554	1,648,505	D. 49,049
Victoria..	695,576	676,001	D. 19,575
Queensland...	465,882	461,359	D. 4,523
New S. Wales..	247,363	224,792	D. 22,571
Tasmania.	65,355	60,453	D. 4,902
S. Australia...	10,651	14,500	I. 3,489
Commonwealth..	3,182,381	3,085,610	D. 96,771
N. Zealand...	477,312	472,095	D. 5,217
Total...	3,659,693	3,557,705	D 101,988
Value..	$75,645,854	$73,537,762	D $2,108,092

The returns for South Australia include the gold from the Northern Territory, which is attached to that State for administration purposes.

The total gold production of Australasia was, therefore, less in 1908 than in 1907 by $2,108,092, or 2.8 per cent. The causes for the changes have been recently explained. The figures show that gold mining in Australia last year very nearly held its own, and is apparently recovering from the depression of the previous year.

Saddle Reefs of Bendigo, Australia

The ore at Bendigo, Victoria, Australia, occurs in saddle reefs which are simply bedded veins that occur along anticlinal folds and which "peter out" on the legs of the anticlines. These saddle reefs extend longitudinally for a great distance, being traced by the headframes along them for miles. There are three main lines of saddle reefs, according to Donald Clark (*Aust. Min. Stand.*, Nov. 18, 1908). The New Chum line is five miles long. Sometimes several reefs occur one above the other separated by varying distances of barren rock. The centers of each of these saddles is farther east than that of the one above. The deepest one of these reefs that contains pay ore is the one found at a depth of 4124 ft. in the Victoria Quartz mine. Vein material containing gold, but not in paying quantity, has been struck in this mine at a depth of 4525 ft. in a crosscut from the bottom of a winze from the 4254-ft. level. This is the deepest known occurrence of gold in the world.

New Stack of the Boston & Montana Company

The program of the 22d annual meeting of the Montana Society of Engineers, held at Great Falls, Mont., contains a new photograph of the great Custodis stack of the Boston & Montana company, recently described in the JOURNAL. The accompanying reproduction shows a comparison in size with the old chimney even more striking than that which appeared in earlier photographs.

NEW AND OLD STACKS, GREAT FALLS SMELTER, MONTANA

The amount of ore mixture that can be run over a water-jacketed steel connection-spout on a copper blast furnace is approximately 25,000 tons.

Rhodesian Mines

The gold production of Rhodesia in December is reported at 51,637 oz., making the total for the year 607,015 oz. Comparisons by quantities cannot be made with the previous year, since the reports in 1908 were made chiefly in fine gold, while in 1907 they were in bullion. By values the total for the year was $10,603,907 in 1907, and $12,293,234 in 1908; an increase of $1,689,327 last year.

Other metal production reported in the month of December included 22,349 oz. silver, 69 tons lead and 10 tons copper. Ores reported were 4081 tons chrome ore, 6 tons wolframite and 3 tons scheelite. The asbestos mined was 18 tons. The coal production from the Wankie mines was 18,094 tons.

Personals

Herbert C. Hoover will be in New York about the middle of February.

G. W. Maynard, of New York, is recovering from a serious illness.

H. B. Pulsifer is at his permanent address, 817 Oak street, Kansas City, Missouri.

Mark R. Lamb is now with the Allis-Chalmers Company at Milwaukee, Wisconsin.

Carl F. Dietz, having finished his work at Parral, Mexico, has gone to Magdalena, New Mexico.

E. McCormick, of Calumet, Mich., is examining copper properties in the Northwest for local clients.

J. W. Mercer has returned from Ecuador, where he has been since last October. He will in a few days start on a trip to the West.

R. V. Norris, of Wilkes-Barre, Penn., has been delivering a course of lectures on coal-mining to the students of Harvard University.

Alfred R. Glancy, general superintendent of the Juragua Iron Company, Cuba, sailed from New York Jan. 29, for Santiago de Cuba.

Willard S. Morse has not resigned from the American Smelting and Refining Company, the previous report to that effect being incorrect.

E. G. Smith has been appointed superintendent of the Westmoreland Coal Company in Pennsylvania, succeeding B. F. Jones, deceased.

T. Lane Carter, of Johannesburg, Transvaal, is examining mines in Nicaragua. His address is care American Consul, Bluefields, Nicaragua.

J. H. Susmann has resigned his position as treasurer of the Tennessee Copper Company, and Walter Lewisohn has been elected in his place.

J. B. Tyrrell, Toronto, Ont., has been chosen a corresponding member of the council of the Institution of Mining and Metallurgy, London.

Thomas L. Lewis has been reëlected president of the United Mine Workers of America by a decided majority over his opponent, John H. Walker, of Illinois.

Henry M. Adkinson, manager for the Gold Pioneer Company at Telluride, Colo., has returned to Denver from a business trip to the East of six weeks' duration.

Herbert Haas has resigned his position as manager of the mining department of the Union Iron Works Company, San Francisco, and will resume practice as a consulting engineer.

Frank Dunbar, recently superintendent of the Gallatin mine of the Monongahela River Consolidated Company, has been appointed general manager of the Sesser Coal Company's mines at Sesser, Illinois.

Frank A. Keith has resigned his position as general manager of the Tonopah Mining Company, of Nevada, and has opened an office as mining engineer in the First National Bank building, San Francisco.

Percy E. Barbour is at Minas Nuevas, Sonora, Mexico, where he is engaged with A. J. Yeager, the general manager, and W. M. Clark, the consulting engineer, upon the design of a 200-mill and cyanide plant for the Zambona Development Company.

H. F. de Bardeleben, Jr., has resigned his position as superintendent of the Woodstock Iron Company, at Anniston, Ala., to enter business with his father, H. F. de Bardeleben, Sr., of Birmingham, Ala., who has large holdings of mineral lands and is one of the pioneers of the district.

R. Y. Williams, who has been a member of the staff of engineers conducting the work at the United States Geological Survey station at Pittsburg, has been transferred to Urbana, Ill., where he will have charge of the Survey's substation, established to disseminate knowledge of mine-rescue work.

H. Hunter, of London, who have been engaged in examining mines in Japan for seven months past, sailed from Kobe Dec. 31. He will spend some time examining tin mines in the Straits Settlements, and also the new tinfields in Siamese Malay and Burma, and expects to reach London about the end of May.

Ladd & Baker, Incorporated, is the name of a corporation formed to conduct a practice as consulting, metallurgical and contracting engineers, with offices in the Real Estate Trust building, Philadelphia. The officers are James B. Ladd, president; David Baker, vice-president; Francis H. Easby, treasurer.

F. R. Wadleigh, for 12 years chief inspector and fuel engineer for Castner, Curran & Bullitt, has been appointed assistant general manager of the Chesapeake & Ohio Coal and Coke Company, with headquarters in New York. Mr. Wadleigh will act as chief inspector and fuel engineer for the company, and will have charge of the inspection, preparation and use of its coal.

Obituary

John Cadegan died in Bridgeport, N. S., Jan. 20, aged 51 years. He was born in Nova Scotia and worked for a number of years as a coal miner and foreman. For eight years past he had been mine inspector for the Cape Breton district.

Edward L. Fuller, known as a large operator of salt mines and works, and also through his successful formation of the International Salt Company, died of apoplexy Jan. 29, at Augusta, Ga., where he went for his health. He was 57 years old. He was president of the Retsof Mining Company, Empire Limestone Company, and a director of the Western Railroad Mining Company. He was a member of several New York Clubs.

Thomas Jones died of apoplexy at his home in Neodesha, Kan., Jan. 11, aged 68 years. Mr. Jones worked in the zinc smelters at Swansea, Wales, from his boyhood until 1867, when he engaged with Mr. Siemens in the steel business and in 1869 was employed by the German government to operate Siemens furnaces in connection with some steel works in Germany. In 1872 he came to the United States and superintended the construction of steel works near Providence, R. I. Following this he engaged in the manufacture of spelter near Providence, from dross and other waste from works in Massachusetts and the Connecticut valley. About 1879 he bought, through a broker, some ore from Virginia and, recognizing its excellent quality, located the mine in Wythe county, Va. In 1880 he, with others whom he had interested in the project, went to Virginia, bought the mine and built a smelting plant at Martin's Station (now Pulaski City, Va.) organizing the Bertha Zinc Company. This plant is still running, and is known as the Bertha Mineral Company. Mr. Jones operated these works until 1893, when he built another zinc-smelting plant at Pulaski, Va. This venture was short-lived. In 1896 he went to Sandoval, Ill., and built a small zinc plant which is still running as the Sandoval Zinc Company. In 1902 he went to Canada and succeeded in interesting the miners of that country in saving their zinc products, and in 1904 was engaged as works manager to build a zinc plant at Frank, Alberta. This plant was never completed. He was also connected with mine development work in Arkansas and Colorado at various times. Mr. Jones leaves a wife and six children. Three of his four sons are engaged in metallurgical work: T. J. Jones, superintendent of the Mountain Copper Company at Keswick and Iron Mountain, in Shasta county, Cal.; D. A. Jones, accountant for the Granby Mining and Smelting Company at Neodesha, Kan. and Archibald Jones, superintendent of the Prime Western Spelter Company's plants at Iola and Gas, Kansas.

Societies and Technical Schools

Rocky Mountain Club—At the annual meeting, Jan 12, John Hays Hammond was elected president. The club is now planning to build a house of its own. Editors of all Western papers are invited to become guests of the club at any time while visiting New York.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 27—Weather conditions have not improved; the heavy rains continue and all the streams are overflowing their banks, causing floods in the valley sections and doing more or less damage in the mountain and foothill regions. A number of mines have had to cease all work except pumping. In all the mining sections of the State more or less damage is being done by the high waters and many power plants have been put out of business. Reservoirs have been carried away and ditches broken in all directions.

The legislative bill which appropriates $400,000 for the improvement of the Sacramento, San Joaquin and Feather rivers to be spent in conjunction with a similar amount from the U. S. Government will probably pass without opposition. Considerable dredging will have to be done to improve those streams.

Joseph Weissbein and associates of San Francisco have obtained control of the Pittsburg, Gold Flat and Potosi Consolidated mines at Gold Flat, Nevada City district, and these mines will now be worked under consolidation through one large central shaft. A large plant will be installed.

Six miners were killed and several others injured in an explosion at the Stone Cañon Coal mines in Monterey county last week. This explosion comes just in time to aid the passage of the Rutherford bill pending in the legislature which provides for a State Inspector of Mines. When an affidavit is made by any three persons making complaint of the condition or management of any mine, then this inspector is to visit the property and make an examination and advocate such changes as he considers necessary and bring them to the attention of the management. Assemblyman Rutherford has also introduced a bill providing for the regulation of hours of labor for men who work underground and establishing an eight-hour day for miners. Senator Riley has also a measure, which is classed among the employers' liability measures.

The Forest Service will not include certain lands in the Tahoe and Plumas national forests until after further examination. This land embraces a strip from 10 to 30 miles wide from Forbestown, Butte county, to Placerville, El Dorado county, and is foothill land fit for agriculture and for mining purposes.

The California Liquid Asphalt Company is moving its plant from Summerland to Edna, San Luis Obispo county. The new refinery will have a capacity of 2500 tons per month. There is an abundance of heavy oil available at the new place. It is cheaper now to produce asphalt from the base of the heavy California oils than to mine the clear asphalt itself. As a result, most of the asphalt miners of the State have quit working. California asphaltum has to be shipped East on sailing vessels, as it will hardly bear railroad or steamship rates. There are very few vessels, however, sailing to New York from the California ports. The first one in a year was lately loaded at San Francisco. Large quantities of asphalt are being made into coke at the greater refineries at Point Richmond, on San Francisco bay.

A new corporation of local men has arranged to deliver water at any one of the four sidings of the Midway oilfield in Kern county at the rate of 5c. per barrel. The fact of the shipments being regular will be of great benefit to the oilmen of the district. Two 13-in. wells 680 ft. from the starting point of the Sunset line are the source of supply. The plant is equipped with both electric and steam power. The Midway oilfield has been held back by lack of water heretofore, and this new steady supply is of great benefit.

Salt Lake City

Jan. 29—The Yampa smelter is treating more than 800 tons of Yampa ore per day; everything is working smoothly. The plant comprises nine McDougal furnaces, three reverberatories, three blast furnaces and a converter.

The Phœnix mill is treating 50 tons of Utah-Apex ore per day, and the Wall mill 50 tons per day. The Utah-Apex company is shipping from 50 to 60 tons of smelting ore per day. Connections with the Boston Consolidated railroad have been made, and ore can now be loaded directly into railroad cars.

Before Feb. 15 the United States company will add 1280 sacks to its bag house, making a total of 3380. The company's concentrating plant at Bingham Junction will probably be enlarged in the near future.

D. C. Jackling returned on Jan. 28 from a meeting of the Ray Consolidated Copper Company at Colorado Springs. At this meeting he was made general manager of the company; he will design a large concentrating plant and smelter to be erected at Kelvin, Ariz. Mr. Jackling states that the new position will not interfere in any way with his management of the Utah Copper Company's properties.

On Jan. 27 the case of the Mammoth Mining Company *vs.* The Grand Central Mining Company came before the Supreme Court at Washington on a writ of error from the Supreme Court of Utah. The Grand Central brought action to recover $300,000, the value of ore alleged to have been taken by the Mammoth company. The Grand Central won in the Utah court. The question involved is the right of the Mammoth company to follow a vein, the apex of which it is claimed was in Mammoth ground, to a point where it underlies the Silveropolis claim, the surface of which is owned by the Grand Central.

At Park City last week was the liveliest one in many months. At the Daly-West all energies are directed toward completing the drain tunnel, and making connections with the upper workings. The mine will soon be drained to a depth exceeding 2000 ft. At the Daly-Judge considerable work is being done, and connection between the McSorley and Daly drifts will shortly be effected. This will give the Bonanza Flat region a shorter outlet.

A drift on the 300-ft. level of the Little Bell at Park City has cut a body of rich carbonate and chloride ore. The orebodies of the Little Bell have been developed from the 400-ft. to the 700-ft. level.

The Uintah Treasure Hill Company has levied an assessment of 1c. per share. This will put $10,000 in the treasury.

In reply to the opposition of the present management of the Daly-West Company, J. E. Bamberger, president of the company, states that no consolidation of the Daly-West with the Ontario company has been or is under consideration. The reason for suspension of dividends last year was on account of labor difficulties and low metal prices, but during the year extensive development was done in opening the mine at greater depth. This development is expected to show up large quantities of milling ore, and extensive additions to the mill are planned. He announced that the Daly-West company is now in first-class physical condition, well equipped, has no debt, has about $300,000 in the treasury, and can resume dividends at an early date.

Grading work has commenced on the Tooele Valley railroad, which will connect the International Smelting and Refining Company's projected smelter with the Salt Lake route at Garfield and Tooele

city. Upon the completion of the line from Tooele, which will require about two months to build, building material will be shipped to the smelter site. Preliminary smelter plans are expected some time during February. The plant will have a capacity of 2000 tons a day and will cost from two to three million dollars.

The Conkling Mining Company has filed in the Federal court a suit of ejection against the Silver King Coalition Company; the plaintiff seeks an accounting for 20,000 to 25,000 tons of ore, valued at between $800,000 and $1,000,000 which the King company is alleged to have extracted from Conkling ground. The Silver King Coalition Company is again loading ore, and shipments will be resumed at once. The Miners Smelting Company, a Heinze concern, had a contract with the Silver King company which went into effect Jan. 1. Under this the King ore was to be treated at the Milford plant of Heinze's company, but it is said that an agreement has been reached under which the ore will be shipped to the Murray smelter.

For the week ending Jan. 14, the mines of Tintic shipped 76 thirty-ton cars of ore and 89 twenty-ton cars. The Tintic Smelting Company shipped 5600 bars of bullion.

The Colorado mine shipped 51 twenty-ton cars; Black Jack, 5; Brooklyn, 5; Beck Tunnel, 8; Dragon Iron, 22; Mammoth, 1 car. The Bullion Beck mine shipped 2 thirty-ton cars; Centennial Eureka, 42; Eureka Hill, 1; Iron Blossom, 2; May Day, 4; Ridge & Valley, 2; Sioux Consolidated, 14; Uncle Sam Consolidated, 4; Yankee Consolidated, 2 cars.

Butte

Jan. 28—The recent visit of H. G. Elliott, expert for the Pittsburg Coal Company, to the coalfields near Great Falls, Cascade county, is thought to be the forerunner of active participation by the company in operations in that part of the State.

In the contest of the Government against the British-Butte company, preventing the issuance of the patent to the company for its placer claims at Rocker, five miles west of Butte, the acting receiver and register have rendered their opinion in favor of the company, and recommend that the patents be issued. The contention of the Government was that the company had fraudulently applied for patent of the ground as placer when in fact the land was valuable only for its lode deposits, and also that the company failed to do the required $500 worth of work on its claims.

Denver

Jan. 30—The great activity in the Boulder oilfield, which has been caused by the opening of the 300-bbl. well of the Inland company, continues, and numbers of new wells for oil and gas will be put down at once.

Mining operations in the Silverton, Telluride, Ouray and other districts of the San Juan region have been greatly hampered by snow slides during the recent storms. Railways are blocked in places, and may remain so for weeks, as the avalanches have packed the snow so tightly that the rotary plows are powerless to cut through it. Telegraph, telephone and power lines are down, the coal supply is cut off from many towns, and general discomfort prevails. At Telluride the Liberty Bell mine is said to be producing 10,000 tons per month of $8 and $10 ore, with reserves sufficient to keep the mill running for 15 years.

In the Cripple Creek district, the Vindicator Consolidated Gold Mining Company has issued its report for 1908, showing proceeds, after deducting freight and treatment, of about $712,000, of which lessees received $161,567; total cash balance after paying $225,000 dividends in 1908, $78,814. This company has paid dividends of nearly $2,000,000.

Indianapolis

Feb. 1—The irregular condition of the Indiana coalfield was suddenly interrupted by an increased number of orders for coal due to a spell of genuine zero weather which broke over the central States the latter part of the week. The local dealers had permitted stock to run low.

The action brought by the Vandalia Coal Company against 18 coal miners who received injuries by an explosion in the Rosebud mine in Vigo county, to prevent them from maintaining separate suits at law to recover damages and to compel all of them to prosecute their claims in one proceeding in equity, has been decided adversely to the company by the Appellate Court, which held that a bill of peace cannot be maintained to prevent a multiplicity of suits in such a case.

A bill has been introduced in the Indiana legislature to prohibit employers of miners and other labor from taking out indemnity insurance against judgments in case of injury or death of an employee. It is claimed that such security makes employers careless regarding the safety and welfare of employees.

London

Jan. 20—The gold output of the mines of the Witwatersrand district, Transvaal, during the month of December was announced as 637,853 fine oz. of gold. These figures, however, include about 36,000 oz. of reserve gold accumulated from previous months. The custom of holding gold reserves, still maintained by several companies detracts from the value of the monthly statistics. The professed aim of the directors of the companies in keeping a gold reserve is to equalize the monthly outputs and to prevent the shareholders from being unduly elated or depressed with the fluctuating returns that might otherwise take place. The absurdity of the system is revealed at the end of the year when the average yield has been incorrectly estimated and a large balance of undeclared reserve gold remains. In the December return several of the mines have declared a surplus of from 2000 to 3000 oz. equivalent to 2 to 7 per cent. increase in the profits for the year. The profits earned during the 11 months January to November have been to this extent inaccurately reported. An extreme case is that of the Ferreira gold mine, which at the close of the year let loose as much as 12,330 oz. from the accumulated gold reserves, equal to £51,786. The average monthly profit reported for 11 months was £33,333, whereas in reality it was about £4310 more per month. Consequently the published monthly returns were about 8 per cent. below their actual value, and the shareholders, whose nerves the Rand directors take so much trouble to protect by their gold-reserve system, have to suffer a severe, though not unpleasant, shock in December.

It is well known that the profits shown on working account differ considerably from the profits distributed in dividends and the nearer such profits can be brought to the dividend the better pleased will the stockholder be. As an example of the discrepancy between the published profits and dividends the case of the Ferreira may again be noticed. This mine published profits for the year 1908 amounting to, in round figures, £400,000. A further profit, as mentioned above, in the shape of gold reserve, amounting to £51,786, was declared in December, making altogether a working profit of £451,786. The dividend declared was, however, only £285,000, namely, 300 per cent., on a capital of £95,000. Shareholders may well ask why so large a margin is being accumulated.

While on the subject of returns, it may be questioned whether the elaborate statistics, some of which as explained above, are inaccurate, are necessary. Every month each mine cables home the number of stamps, tube mills, tons, ounces won from the different processes; indeed, so many figures that it takes some time for a shareholder, interested in any mine, to pick out the figures he really wants, namely, the tons treated and the profit earned. The expense of all this cabling must be heavy as well as the preparation of the statistics. It is doubtful whether all this technical data is wanted monthly. At all events this much is certain: that if monthly reports were dropped and quarterly reports substituted, a considerable saving for the shareholders could be made.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

For a number of years the Tennessee Coal, Iron and Railroad Company and the Sloss-Sheffield Steel and Iron Company have been working convicts in some of their coal mines. This year three other companies have begun to operate with convict labor. The Red Feather Coal Company contracts with the State of Alabama for the hire of a number of convicts, who will be employed in getting out coal at the company's mine at Lucile, in Bibb county. The Bessemer Coal, Iron and Land Company has contracted for State convicts, who will be employed at one of the mines at Belle Ellen, in Bibb county. The Pratt Consolidated Coal Company has agreed to hire the county convicts from Jefferson, Tuscaloosa, Walker, Blount and Morgan counties. These men will be used at the company's coal mine at Banner, in Jefferson county.

A syndicate represented by Dr. G. B. Crowe has purchased a large tract of land at Bessemer from the Bessemer Coal, Iron and Land Company. It is announced that the improvements to be made will include 250 coke ovens, the coal for which will come from the Yolande and other mines now operated by Doctor Crowe; also two blast furnaces with a capacity of 250 tons each daily. An electric plant will be operated by the waste gases from the coke ovens. A brick plant will also be erected.

Jefferson County

Johns Coal Mine—At this mine, owned by the Tennessee Coal, Iron and Railroad Company, a coal washer of the bumping-table type is being put in by Heyl & Patterson, of Pittsburg, Penn. A thorough test of the washing system will be made.

Birmingham Coal and Iron Company—An explosion on Feb. 2 in slope No. 2 of the company's coal mine at Short Creek killed 17 men.

Arizona

Gila County

Arizona Commercial — Development work continues to open good orebodies. A 350-ton smelter will be erected next summer.

Superior & Globe—It is reported that this company plans to develop vigorously during the next few months.

Pinal County

Roy Consolidated—This company is to build a mill and smeltery at Kelvin. The first unit of the mill will be of 3000 tons daily capacity. Upward of 7,000,000 tons of 2 to 2½-per cent. ore is now said to be developed, which has been done chiefly by churn drilling.

California

Amador County

South Eureka—The North drift 500 ft. long on the 2700-ft. level has struck the same footwall and payshoot found on the 2500-ft. level. It forms a 20-ft. vein of milling ore.

Butte County

Big Blue Lead—Power lines have been installed and the arastre will be operated by electric power.

Mesilla Valley—This company, E. C. Wilson, superintendent, has acquired the old Flea Valley ditch so as to have its own water power. A bedrock tunnel is being run to intersect the old channel.

Cape Horn—This company is shipping gold bars.

Calaveras County

Angels—At this camp a shortage of water closed down most of the mines for some weeks. Now the rainfall has been so heavy that the mines are having more water than they want.

El Dorado County

Gravel—Under management of T. G. Patton men are at work opening a large gravel property near Pacific, about three miles from the Prevolcanic property.

Greenwood Creek—At this place the company which is opening several quartz claims has struck good paying lodes on the Lipton No. 1, and also on the Dundee No. 1. The ore carries gold, silver and copper.

Inyo County

Loretta—This mine, formerly the McAffee, at Eureka valley, 30 miles east of Big Pine, is being developed.

Nevada County

Omega Placer—Work is about to be resumed on this mine at Omega.

Murchie—This company has shipped 60 tons of sulphides to the Selby smelter.

Plumas County

Greenville-Pacific—This company, W. S. Haskins, manager, has bonded the New York mine at Greenville from J. D. Whitney. A 400-ft. tunnel is expected to open up valuable oreshoots.

San Luis Obispo County

Hamilton Quicksilver Mine—A large deposit of cinnabar ore has been struck in this mine on San Simeon creek, near Cambria. Work has been prosecuted on the property for two years, hitherto without much success.

Shasta County

Minnie Shasta—This company has made its last payment of the purchase price of $20,000 for the Bracket quartz mine, four miles west of Redding.

Hazel—In the Gladstone mine of this company, at French Gulch the vein found on the 600 level is wide and rich.

Sierra County

Bonanza King—From this mine at Alleghany, E. H. Wilson manager, very rich quartz is now being taken. The vein is about two feet wide. Another tunnel will shortly be run.

Twenty-One—This mine, a continuation of the Rainbow at Alleghany, has been placed under bond to C. C. Crary representing eastern men. Development work has commenced.

Siskiyou County

A new company has taken hold of the Foster & McIntosh quartz mines near Callahan, and men have been set at work.

Sonora County

Culver-Baer Quicksilver Mining Company—This company, of Cloverdale, intends to erect a 40-ton Scott furnace.

Trinity County

Trinity Gold and Milling Company—For loosening up ground at this hydraulic mine at Minersville, 15 tons of powder were exploded simultaneously in four blasts. A 300-ft. tunnel was run into the gravel and from this were run drifts to contain powder.

Tuolumne County

C. W. Wagner and W. C. Bowman are opening a copper mine at Chinese. Some gold is found in the ore.

Imperial—This group near Jacksonville has been bonded to San Luis Obispo county men and the mines are to be worked on a large scale.

Central Mother Lode—At this property, J. P. Mangante, superintendent, a two-

compartment shaft has been started to be sunk 200 ft. before drifting is commenced. An engine and hoist are shortly to be installed and later a ten-stamp mill will be put up.

Nevada Gold Mining Company—This company has secured options on the purchase of the Galena and Buckeye mines near Italian Bar for $30,000. Miss F. M. Colby is president and general manager of the company.

Option—Plemon, Vierira & Lind have taken an option on 400 acres of patented land owned by A. Bonavio on which mining will commence at once; 25 per cent. of the net proceeds of the returns are to be paid to the owner of the ranch.

Colorado

Lake County—Leadville

Dinero Tunnel—Work has been resumed on this property, Sugar Loaf, and the upraise, to connect with the old shaft, is being pushed. When this connection is made attention will be turned to developing the large body of ore at the breast of the tunnel.

Yak Tunnel—Four drill holes have penetrated the water in Resurrection No. 1 shaft, and the water in that property is being lowered at the rate of 5 ft. per day. Four more drill holes will be drilled and it is expected that the bottom of the shaft will be seen within 30 days. In the meantime the water pouring into the tunnel will be piped, and when this is completed the work of driving ahead will be resumed.

Alps Group—This property, head of South Evans gulch, is under lease to James Kavanaugh and associates. A shaft is being sunk.

Cleveland Shaft—The management of this property, South Evans, has decided to sink this shaft 200 ft. instead of 100 ft. as first intended. When the work is completed the shaft will be 825 ft. deep.

Tribune—This property, Breece hill, is worked from the Yak tunnel by a drift following a small streak of ore high in gold; it is expected that in another 30 ft. an ore shoot from the Ibex will be caught.

Belvidere Tunnel—This bore, Horseshoe district, is in 400 ft. and the orebody shows up well. On account of the heavy snows the ore is piled on the dump. With the disappearance of the snow connections will be made with the Chance-Hilltop tramway, which will facilitate the handling of the ore.

Little Bertha—This property, Breece hill, is under lease to J. B. McDonald, who has sunk the shaft to 225 ft. and from this point with drifts north and south opened a body of gold ore. The property adjoins the President.

Chrysolite—In this mine, Fryer hill, a fair body of lead ore has been opened at the lower level and shipments are being sent. The mine is also producing some excellent iron.

Great West—A tunnel has been driven on this mine, Buckskin gulch, for 200 ft. on a fissure vein that averages in width 4 ft., carrying gold, silver, lead and zinc; several shipments have been made from the vein giving returns of $600 per ton. The tunnel will be driven 300 ft. farther into the hill, so as to drain the ground; then stoping will be started. The property is being worked by Leadville men.

Result—This mine, Carbonate hill, is owned by the Small Hopes Company, and recently a promising body of oxidized iron carrying 18 oz. silver to the ton was opened in the lower workings; the body has been developed for 20 ft., and at the breast is 12 ft. long and 6 ft. thick. Shipments have been started.

Shamus O'Brien—This mine, Yankee hill, is being worked at the lower levels by lessees, and recently they opened a 4-ft. body of ore that runs well in silver and lead; in addition to this there is some low-grade ore; shipments are going out weekly.

Vinnie—Some rich gold ore is being taken from this mine, Breece hill, while from the main orebody regular shipments are going to the smelter.

Teller County—Cripple Creek

Drainage Tunnel—At the annual meeting of the stockholders of the tunnel company the following directors were elected: F. G. Peck, Sherwood Aldrich, A. E. Carleton, F. F. Castello, F. J. Campbell, C. C. Hamlin, J. T. Milliken, William Lenox and A. L. Burris. The old board was re-elected with the exception of S. S. Bernard who was succeeded by A. L. Burris. The annual report of the treasurer shows that of the $388,500 subscribed for driving the tunnel $175,000 is still due. Cash on hand $23,820 with all the work paid for up to Jan. 1, 1909. This gives about $200,000 for the work and it is estimated that it will take about $120,000 more to complete the work. At present work is pushed at both the portal entrance and the intermediate shaft. The work is done under contract by A. E. Carleton, of Cripple Creek.

Wish Bone Mill—Additional machinery is being put in place at this mill which is situated on the north side of Mineral hill. Surveys are also being made for a railroad from the main part of the district to this mill. The road will be run from Hoosier Pass and will be of standard gage. The mill was originally built to treat ore on the ground but for some reason no ore was ever put through and the management has decided to handle custom ore, for which purpose the railroad is being constructed.

Cripple Creek & Colorado—The shaft house on the property, usually known as the Rittenhouse property, was burned this week and was almost a total loss. The shaft house was equipped with a fine plant of machinery and, it is understood will be rebuilt at once. The property is worked under lease by W. A. Birdsall, of Cripple Creek.

Gold Coin—This company has declared a dividend of 2c. per share amounting to $20,000.

Idaho

Shoshone County

Alice—About $1,000,000 worth of ore has been blocked out and an official states that work will commence within the next 60 days on a new concentrator.

Success—Work will be resumed on this zinc property about the beginning of April. A force of about 100 men will be employed in both the mine and mill.

Copper Plate—A report issued to the stockholders states that about $7000 worth of work was done last year, bringing the total development to about 2200 feet.

Oreano—A financial statement by the secretary shows that, in 1908, $3000 was spent on the property, mainly from assessments on capital stock. Another assessment has been levied for continuing development work.

Ajax—The force of workmen has been doubled and the long drift tunnel has been driven about 1600 feet.

H. E. M.—A contract for 400 ft. of work has been let.

Tiger—A large area of the upper workings caved in, but no damage was done. The property was recently abandoned by the Federal Mining and Smelting Company and had just been dismantled of machinery. Some ore is still shipped under lease.

Black Horse—The ore recently encountered has widened to about 7 ft., practically all of shipping grade.

Boise County

Columbia Mining Company—A concentrator has been added to the Last Chance mill. Work will be started on material from the new orebodies recently uncovered.

Gold Hill & Iowa Mines Company—The upper levels are worked by lease. Plans are being made to drive all machinery electrically. For this purpose the new power line will be extended from Centerville, where it will tap the main line from the Payette dam.

Indiana

Daviess County

The Indiana-Kelly Coal Company has leased 740 acres of coal land a few miles south of Washington, and will develop the territory. A few Washington capitalists

are interested. The company is also making an investigation of a newly discovered block coalfield in Fountain county.

VERMILION COUNTY

The Clinton Coal Company has purchased for $29,000 a tract of 574 acres of coal land west of Clinton. The company is one of three operating in the Clinton field. It now has the Crown Hill mines 1, 2 and 3, and proposes to open mines on the newly acquired land. The Deering Coal Company, which has eight mines in this field, is preparing to sink additional shafts west of Clinton.

Michigan

COPPER

Calumet & Hecla—In the Federal Court at Cincinnati on Feb. 2 the appeal of Charles Bigelow, president of the Osceola Consolidated Mining Company, from the decision of the Circuit Court of Western Michigan in Bigelow's case against the Calumet & Hecla company was refused. The Calumet & Hecla company is in control of the voting power of the majority of the Osceola company's stock, and at the last annual meeting placed directors in office who were opposed by Bigelow and the stockholders represented by him. In his suit brought in Michigan Bigelow alleged that the control of the Osceola company's votes by the Calumet & Hecla company was a violation of the interstate commerce act. The Court of Appeals holds that there is no violation. Bigelow will carry the case to the Supreme Court.

Obijway—No. 2 shaft has reached the 3d or 650-ft. level, and a crosscut has been started to cut the lode, which in all probability will be reached within a week. The lode when opened in the level above was about 14 ft. wide and well charged with copper, being a decided improvement over the showing on the 1st level. No. 1 shaft is approaching this same depth. The shaft has not cut the footwall below the 500-ft. level, but it will not be necessary to crosscut very far to reach it. The lode opened at the 1st or 500-ft. level of this shaft was in two beds, about 20 ft. and 13 ft. wide, respectively, and separated by about 15 ft. of trap rock.

Atlantic—Section 16 shaft is being sunk below the 2000-ft. mark. The rock passed through is much shattered. The lode, intersected by the crosscut from the 15th level about 400 ft. west of the shaft, is strong and may be the much sought Baltic lode.

Wyandot—Another copper-bearing lode has been found in the crosscut driven from the 700-ft. level of the exploratory shaft. Driving on this find will soon begin. About 100 ft. of drifting has been done on the lode first found; the breasts of both drifts consist primarily of epidote well charged with heavy stamp and barrel copper. This has been the most important development in the history of the company and gives promise of good results.

Adventure—This company has discontinued the two vertical diamond-drill holes and with the aid of this additional data, is now drilling another on the approximate pitch of the formation.

Superior—The second mill gave even better results than did the first. After a few minor alterations have been made, regular shipments will begin.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

Lizzie D—This company will erect a 200-ton mill on the Malang land at Peacock. It has a 15-acre lease with a shaft and three drill holes showing a 15-ft. face of ore at 192 feet.

Microbe—This company, of Joplin, has been incorporated with a capital stock of $50,000 to operate a mine at Spring City. Adam Scott, of Joplin and Kansas City and Abilene, Kan., men, are the stockholders.

Continental Zinc—This company is replacing the balanced skips in the double-compartment shaft at Prosperity, with balanced self-dumping cages. With the old arrangement the water has to be kept about 30 ft. below the drift. Large cars will be used in the mine and mules to haul to the shaft.

Cameron—This company at Sarcoxie will complete its 250-ton mill about Feb. 15.

Katherine D.—This company is preparing to sink a shaft on its 30-acre lease on the Gray land southwest of Joplin. Two drill holes show rich ore. George Pearson, of Joplin, is superintendent.

Montana

BUTTE DISTRICT

British-Butte—The new gold dredge will be put in operation on Jan. 30. Invitations to witness the event have been issued to prominent mining men and State officials.

Butte Hill Copper Company—At the annual meeting of stockholders held Jan. 23, the following were elected directors: Maurice Eisenberg, H. A. Frank, J. W. Murphy, Duncan MacRea, W. P. Cary, W. H. Hall, Thomas Driscoll, James Higgins and John F. Davies.

Columbia-Butte Mining Company—A petition for permission to change the company's name to Columbia-Butte Gold Mining Company has been filed in the local district court. It is stated that the word "Gold" was ommitted by mistake.

BROADWATER COUNTY

Keating Gold Mining Company—Jesse B. Root, president, is now in New York for the purpose of placing the stock on the curb. The management states that shipments are being made at the rate of about 65 tons per day and that the ore is giving a net return of $5.50 per ton after all expenses are paid.

MADISON COUNTY

Fortune Group—Richard T. Cook and Alfred T. Cook are working a force of men on the claims, located about five miles west of Virginia City. At a point about 300 ft. from the mouth of the tunnel on the Fortune claim a crosscut is being driven.

MISSOULA COUNTY

Kennedy Creek Coal and Coke Company—The company was incorporated a short time ago by John A. Scott, T. C. Marshall, W. J. Rhoades and Frank Thomas, of Missoula, and W. C. Edwards, of St. Paul. Its properties are located on Kennedy creek, near Stark, and when the transfers are completed will comprise about 700 acres of coal lands.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Portland Florence Lease—A vein of milling ore was recently opened on the 400-ft. level. Crosscuts are being driven on the 200-ft. and 300-ft. levels to intercept the Combination Fraction vein. This lease was formerly the Nevada Leasing Company's ground and adjoins the old Reilly lease.

Commonwealth Leasing and Mining Company—A shipment of 16 tons was made last week from this property. All this ore came from a shallow shaft. At a depth of 100 ft. several stringers have been found in the shaft, which although narrow, are rich.

Daisy Florence Lease—The four inches of rich ore that was found last week in the stope from the 200-ft. level has now widened to 2 ft. of shipping ore.

Matilda Lease—This company, leasing on the Atlanta property, is re-timbering its shaft between the 200-ft. and 300-ft. levels preparatory to sinking. A large vein was found in the drift on the 250-ft. level, but did not contain pay ore: exploration work will be carried on at greater depth.

February Premier Lease—This company, operating on the February claim of the Goldfield Consolidated, has its shaft down below 400 ft. and will continue sinking until a depth of 500 ft. is reached: then crosscuts will be run east and west to the limits of the ground.

Goldfield Star Mining and Leasing Company—The shaft on the Minnevade Fraction of the Lone Star company is 250 ft. deep. In a crosscut on the 150-ft. level

the footwall of the Lone Star vein has been cut. On the 250-ft. level a crosscut has been started to intercept the vein underneath the underhand stope, from which the Patrick lease was extracting ore at the time of the forfeiture of the lease for underhand stoping.

Goldfield Golden Pick—The shaft at this lease on the Pipe Dream lode has reached a depth of 350 ft., and is the deepest shaft on the Silver Pick property. A crosscut on the 250-ft. level disclosed a vein 4½ ft. wide carrying some gold. Work will be pushed in this crosscut, as well as on a new vein just found in the station cut on the 350-ft. level.

Goldfield Merger Mines Company—A crosscut is being driven on this property from the 600-ft. level to cut the St. Ives vein. Good ore has been found in several places.

Mohawk Ledge—This lease on the Jumbo Extension, which was granted an extension of 221 days on account of the litigation last summer between the Jumbo Extension and Goldfield Consolidated companies, resumed shipments last week. The lease does not expire until the middle of March.

C. O. D. Consolidated—The orebody between the Gold Bar and Victor claims continues to improve. A crosscut is being run from the 300-ft. level to intercept the shoot at that depth. In a drift from the bottom of the winze, 30 ft. below the 200-ft. level, the ore, 4 ft. wide, continues to be of good grade. For the last two years this orebody has been known to exist and shipments amounting to $30,000 were made from it, but work was not resumed until a consolidation securing the Victor claim was effected.

Little Florence—The annual meeting of this company was held in Phœnix, Ariz., Jan. 18. George Vickers, of Goldfield, was elected a director to succeed James E. Keelyn. The larger holders at the meeting assessed themselves so as to continue work in the lease on the Combination Fraction ground. The three-compartment shaft is now 500 ft. deep; the different levels will be prospected.

Esmeralda County—Rawhide

Murray Lease—On the 200-ft. level the rich high-grade ore recently struck is 2 ft. wide; through the high-grade ore small seams of native gold are seen. On this level about 75 ft. of drifting have been done. On the 100-ft. level the vein averages 7 ft. in width, and the ore is of milling grade. On the 80-ft. level the vein is also 7 ft. wide, but the ore is slightly richer.

Kerns No. 1 Lease—At this lease, owned by George F. Von Polenz and associates, on the Rawhide Queen property, some exceedingly rich ore has been developed. Last week two shifts were put on; about 15 men are working at this property.

Holland Rickard Lease—Some rich stringers of gold ore have lately been struck in this lease on the Coalition ground.

Daisy—At this property on the east side of Ballon Hill, a 4-ft. vein of good ore was recently struck.

Gregory Mining District—This is a new district opened up about 14 miles southwest of Fallon. The veins are large; the country rock appears to be an andesite, and from all appearance the district resembles Goldfield both topographically and geologically. Many claims have been located.

Esmeralda County—Bovard

Bovard Strike Mining Company—This property has been developed by a tunnel which is in fine milling ore. The Bovard district lies about 18 miles southeast of Rawhide.

Humboldt County—Seven Troughs

Harris Lease—Ore of exceptionally good grade has been found in the winze from the 200-ft. level. High-grade milling ore has also been opened up in the raise from the same level. A shipment is about to be made to the Kindergarten mill.

Reagen Lease—High-grade ore is being broken at several places in this property; in a drift from the raise on the 200-ft. level 2 ft. of shipping ore was recently opened.

English-George Lease—The ore being extracted from this property and now treated at the company's new mill is said to assay between $50 and $60 per ton.

Cleghorn-Duke Leases—The management of these leases on the property of Seven Troughs Signal Peak Mining Company and of the Seven Troughs Consolidated Mining Company, has recently purchased a 2¼-in. machine drill, air compressor, and two gasolene engines of 25- and 10-h.p. The equipment has been received at Lovelock and will be installed at once. The tunnel which is to be driven to develop these leases is already 400 ft. long, and will be rapidly pushed to a length of 1500 ft. so as to open the vein at considerable depth.

Wihuja Lease—On Jan. 14 the drift on the 340-ft. level broke into the oreshoot; 18 in. of this vein shows some of the richest specimens ever taken out of the property. The shoot is the same as that opened on the 265-ft. level; the ore will be stoped from the 340-ft. level. Preparations are being made for another mill run.

Lincoln County—Pioche

Finsen Ray-Black Wonder—A syndicate composed of Pioche and Salt Lake City mining men recently purchased the Finsen Ray mine the price is said to be $60,000. The Black Wonder, an adjacent property also changed hands. It is reported that a consolidation of these two properties will be effected. The ore carries lead and silver together with a little gold.

Prince Consolidated—A station has been cut on the 550-ft. level, and a crosscut is being driven to the vein. Driving is also in progress on the 300- and 400-ft. levels.

Pioche King Mining Company—This company was recently incorporated at Goldfield, the capitalization being 1,000,000 shares having a par value of $1. The ground that the company holds includes the Bullion-Belcher group of six claims, the Gladstone group of three claims and several other single claims. The ground surrounds the Prince Consolidated on the north, west and east. On completion of patent proceedings, now pending, a complete equipment will be installed and development work started.

Nye County—Helena

Broken Hills—The last carload shipment of ore from this property brought $122 per ton; the ore assayed $77.60 gold and $44.47 silver per ton. The ore was taken from the Ols shaft in which shows a vein carrying 3 ft. of high-grade ore. On account of the heavy expense of hauling, production is being curtailed until the completion of a mill which the company plans to build this spring.

Lease Block No. 16—A vein 3 ft. wide containing ore that equals in richness the Broken Hills ore was discovered last week in this lease.

Nye County—Bullfrog

Pioneer—Smelter returns on the last two carloads of ore shipped amounted to $15,000 for the entire lot; one car of 40 tons, taken out during the earlier period of development, averaged a little more than $100 per ton; the other car, sampling approximately $220 per ton gave $11,000. Another car was shipped Jan. 23 to Salt Lake City. Only the ore already broken is mined from the upper winze; all other work in the winze has stopped. Milling ore is showing in the breast of the drift on the 210-ft. level.

Nye County—Hannapah

Silver Glance—Shipments continue from the Conrad & Lain lease, the output being about one carload a week. The ore is being treated at the Belmont mill at Millers.

Nye County—Tonopah

Belmont—The South vein, which was faulted on the 1000-ft. level was found again last week; the orebody is now 5 ft. wide in the face of the drift. On the 1100-ft. level a crosscut is being run to a point under the old Belmont shaft with which connection will be made for ventilation. The raise from the west drift on 1100-ft. level to the 1000-ft. level is

finished and was in ore the entire distance of 127 ft. on the dip of the vein. Production for the week ending Jan. 23 was 550 tons.

Montana—Drifts are being extended east and west from the crosscut on the 515-ft. level which recently cut the Triangle vein. Both drifts are in ore averaging 5 ft. in width. Stoping is being carried on from the 390-, 465- and 565-ft. levels. A raise has been started on the vein from the 615-ft. level to connect with the 515-ft. level, the ore showing a width of 2 ft. Production for the week was 750 tons.

Tonopah Mining Company—Work was resumed on Jan. 20 in the drill hole being run from the 740-ft. level of the Silver Top claim; the bottom of this hole is 260 ft. below the level. The 200-gal. electric pump, which is to be installed on the 1200-ft. level of the Mizpah shaft has been shipped, and a station is now being cut for it. When in operation, sinking will be continued to a depth of 1500 ft. During the week the mill treated 3000 tons of ore averaging $23.60 per ton, and shipped 105 bars of bullion valued at $87,150 and 22 tons of concentrates valued at $9350.

Mogul Consolidated—This property, 10 miles north of Tonopah, recently made a shipment of 85 tons which returned $31.85 per ton. The ore is a lead carbonate carrying gold and silver in a quartz gangue. The main shaft is 575 ft. deep; 20 men are working at the mine.

South Dakota

Lawrence County

Branch Mint Operating Company—The first clean-up from 1300 tons of dump ore was better than expected and the New York interests have ordered work to proceed. The gold extraction is about 80 per cent. and the mill is treating about 250 tons daily.

Homestake—A new and simpler valve system to regulate the water supply to the mills, has been installed. The company has also purchased the timber, tie and lumber pickling plant at Englewood from the Government and will treat its own timber by the creosote method.

Warren Peak—The Rochford owners have decided to build a mill to treat the ore which averages $7 per ton gold.

Pennington County

Standby—Supt. J. B. Baker, of Rochford, is planning to increase the stamps at the mill from 20 to 100 during the coming summer. Work on the property will resume as soon as the weather permits.

Mystic—A new hydraulic placer mining company has been organized by Thomas Ormsby to operate on Castle creek among the early-day placer diggings.

Tennessee

Polk County

Tennessee Copper Company—Of the $2,500,000 in cash that this company is to get from the Independent Fertilizer Company, $875,000 has so far been received.

Utah

Juab County

Tintic Utah Consolidated—A drift on the 300-ft. level is being run east of the shaft in the expectation of cutting the Humbug vein. The Utah Consolidated claims are situated north of the Sioux Consolidated and the Colorado company's properties.

East Tintic Development Company—On the 200-ft. level a cave 60 ft. long and from 10 to 25 ft. wide has been cut, carrying as much as 10 ft. of lead sulphide and carbonate. The ore does not run high in silver.

Yankee Consolidated—At the recent meeting the following officers were elected: J. E. Dubois, president; J. E. Frick, vice-president; B. M. Lehman, treasurer and general manager; A. E. Canfield, secretary. Last year 4800 ft. of development work was done. There is a surplus in the treasury, and drifting will be pushed on the 300-, 400-, 500-, 600- and 900-ft. levels.

Beck Tunnel—This company is searching for ore on the 1100-ft. level where the showing is promising.

Plutus—The Plutus and Tetro holdings were consolidated a short time ago, and operations at the property will be started early in February. Jesse Knight is president and David Evans general manager. The company owns 14 claims. Development work will proceed in both Tetro and Plutus ground.

Alaska

Copper River District

It is announced that the Copper River railroad has been completed from Cordova to a point above the Abercrombie rapids on the Copper river, a distance of 54 miles. A wharf for handling heavy material has been provided and four steamers are to be built to develop the copper districts of Copper and Chitina rivers. Contracts have been let to extend the railroad up the Copper river toward Fairbanks.

Canada

Ontario-Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ending Jan. 23 were as follows: Chambers-Ferland, 62,000 lb.; Kerr Lake 62,460; King Edward, 53,920; La Rose, 393,650; Nova Scotia, 410,390; Nipissing, 186,033; Peterson Lake, 81,560; Right of Way, 244,715; Temiskaming, 60,000; Temiskaming & Hudson Bay, 184,060. Total 1,369,788 pounds.

Cobalt Central—On the Bailey property operated under lease by this company some good finds have recently been made at 140 ft. from the Big Pete shaft on the first and second levels, and the same vein is showing up well at a depth of 180 feet.

Colonial—Development work has resulted in the discovery of large deposits of low-grade ore, with some of higher quality. Concentration has been decided on, and work is temporarily suspended while a stamp mill and concentrator are being installed.

Ontario—South Lorrain

Harris-Lorrain Syndicate—This property adjoining the Wettlaufer has a force of 18 men at work. Altogether 24 veins have been opened and three shafts have been started. Machinery will be ordered before spring.

Mexico

Chihuahua

Rio Plata—Manager D. W. Shanks' annual report to stockholders for the 11 months ending Nov. 30, 1908, contains the following items: Ore delivered to mill, 14,183 tons, of an average value of 90 oz. silver and total 1,296,470 oz.; shipping ore sorted, 90 tons of an average of 1502 oz. silver, and total 135,180 oz.; total stored in tailings pond on Nov. 30 of last year amounted to 14,616 tons containing 645,098 oz. silver. The total expenses are given as $100,886, or $7.113 per ton, and $0.1382 per oz. silver recovered. The net profits for the period were $248,608. The new cyanide plant will be in operation within three months.

International Gold Mines Company—This company is making ready its cyanide plant at the El Socorro mine in the Ocampo section for an extended experimental run on dump ores that are said to average $20 gold and silver to the ton. It is the plan to start regular milling on mine ores by the first of May. Col. J. W. Pender is the manager in charge of operations for this Kansas City company.

Rio Tinto—This company's lately blown in smeltery at Terrazas is turning out copper matte at the rate of about 12 tons daily. This output will be considerably increased as soon as minor difficulties at the works are overcome.

Laguna—Prospecting of an encouraging sort is carried on in a district west of Laguna, a station on the Mexican Central in the northern part of the state. The ores are mainly gold and silver-bearing copper and lead sulphides.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 3—The coal market in the West is reported as more active. Cold weather and storms throughout nearly all the western territory have stimulated sales and shipments of coal for domestic use. There is a little improvement in steam coal, but not to any marked degree. For the time being, however, dealers have enough to do to take care of domestic sales and are somewhat encouraged.

Coke shipments are showing a considerable increase, which is due to the greater activity at furnaces. There are more furnaces in blast now than for several months, while others are putting in stocks with the expectation of blowing in before long.

The Seaboard bituminous trade is quiet, sales of steam coal showing little improvement in the East. The anthracite trade is also quiet, but shipments continue fairly steady from the mines. It is still reported that much anthracite is going into stock as a provision against any contingencies which may arise next spring.

It was reported that the United States Supreme Court would this week give its decision on the appeal from the Circuit Court on the commodities clause of the Interstate Commerce law, which prohibits railroads from carrying coal which they own or mine. The Court, however, has adjourned for two weeks so that no decision will be handed down for that time. The Circuit Court, it will be remembered, decided that this clause of the law was unconstitutional.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Jan. 25, 1908, and Jan. 23, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	353,966	302,763	D. 51,203
Bituminous	2,237,985	2,175,888	D. 62,087
Coke	457,999	639,545	I. 181,546
Total	3,049,950	3,118,196	I. 68,246

Average daily tonnage, 121,998 in 1908, and 135,574 in 1909: increase, 13,576 tons.

New York

Anthracite

Feb. 3—The cold wave from the West which reached New York this week, sending the thermometer down nearly to zero, gave a temporary lift to the retail trade. It has not yet, however, touched the wholesale business; whether it does or not depends upon how long it continues, which at the present writing seems very uncertain. Otherwise there is no change from the dullness which has prevailed for some time.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.50@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

Business in soft coal is still very quiet, with irregular increases followed by quick decreases. The far East is not taking any more coal, but there is a little business along the Sound. New York harbor is still dull. There is no pressure to sell coal, however. Good grades of steam coal can be bought at $2.40@2.50 and gas coal at $2.25 for run-of-mine. Gas slack is still in some demand.

All-rail trade continues to be better than tidewater, though it is not extremely active. Cars are abundant but the railroads are taking matters quietly and are not pushing transportation.

In the Coastwise trade little is doing and rates are still pegged at about 75c. to around the Cape. The Department of Commerce and Labor has issued an order limiting the size of tows to three barges and the length of towing lines to 75 fathoms. This is the result of many complaints of the danger to navigation resulting from long tows. It may have the result of increasing Coastwise freight rates by barge.

Birmingham

Feb. 1—The Alabama coal trade is not very active just now. A number of mines in this State have been running on short time; in fact a movement was started among the coal operators recently to curtail the production in order that the output might be held down to something near the demand. There has been no change as yet in coal prices. The loss of the Louisiana trade, which had come to the rescue of this district, is being felt.

The coke production is being maintained at the top notch. What coke is not being consumed immediately is being stacked, as the indications point to a need of the product. Coke prices remain firm.

Chicago

Feb. 1—Another cold wave has stirred up the demand for domestic coals, and sales have been brisk. The market is closely responsive at this stage of the winter to weather changes, but dealers and consumers seem to have concluded that the winter will be open but for an occasional cold wave, and cease buying as soon as the mercury ascends. Steam coals are less affected and the consumption of western steam grades is steady and probably is increasing slightly. Screenings, highly important in the steam trade, have become firmer and lump has weakened, in the last week. In the domestic trade the demand is largely for low-priced coals.

Illinois and Indiana lump sells for $1.75@2.55, run-of-mine for $1.60@1.75 and screenings for $1.35@1.60. Eastern coals continue sluggish partly because of the turning of consumers to lower-priced Western coals, and partly because of large shipments that depress the market. Smokeless continues in overabundance with run-of-mine selling for $2.75@2.85 and lump at $3.20@3.65, for Pocahontas and New River. Hocking is cut 25 or 30c. under the circular price of $3.15 and has been in too large supply. Youghiogheny is quiet at $3.15, movement being restricted to contracts, chiefly.

Anthracite is decidedly better as a result of the last cold wave, but was lifeless just before that. Retailers' bins are not holding any considerable supplies in city or country, but the wholesale supply is abundant and leads everybody to delay buying until the moment of need.

Pittsburg

Feb. 2—Coal shipments to southern ports have stopped, as the rivers have fallen to below a barge stage. It is expected that the rivers will be navigable again before the end of the month. On this rise fully 10,000,000 bu. of coal were shipped. All the river mines are in operation, but the railroad mines are being run irregularly. One independent company is running at about 60 per cent. of capacity, but the general average of operations of railroad mines is not at more than 25 per cent. of normal production. Prices remain unchanged on the basis of $1.15 a ton for mine-run coal at mines; slack continues around 75c. Some large transactions in slack are reported this week.

Connellsville Coke—Coke prices for prompt shipment have declined and some low rates have been named. Sales of furnace coke for spot are reported at $1.60 a ton and even less although a number of the large producers are holding

firmly at $1.75 for spot and $1.90@2 on contract. A number of plants have been closed and production is being curtailed by some producers who are running their works but five days a week. Foundry coke for spot shipment has dropped to $2, but in some instances $2.15 has been paid. On contracts for deliveries running through the first-half quotations are still $2.25@2.40 at ovens. The *Courier* gives the production in both regions at 267,709 tons. The shipments amounted to 9825 cars as follows: To the Pittsburg district, 3497; to points west of Pittsburg, 5373; to points east of Connellsville, 955 cars.

Foreign Coal Trade

Nova Scotia Coal—Coal shipments from Nova Scotia mines, year ended Dec. 31, long tons:

Company:	1907.	1908.	Changes.
Dominion	3,193,000	3,199,000	I. 6,000
Nova Scotia Steel	623,162	644,338	I. 21,176
Cumberland	276,549	362,339	I. 85,790
Acadia	321,192	320,122	D. 1,070
Inverness	243,075	256,910	I. 13,835
Intercolonial	274,388	244,897	D. 29,491
Total	4,931,366	5,027,606	I. 96,240

The total coal mined, including that used and sold at mines, in 1908 was, by counties: Cape Breton, 3,930,000; Pictou, 599,000; Cumberland, 467,000; Inverness, 354,000; total, 5,350,000 tons, an increase of 187,000 tons, or 3.6 per cent., over the previous year.

The output of the Crow's Nest Pass Coal Company, British Columbia, for the year ended Dec. 31 was, in long tons:

	1907.	1908.	Changes.
Coal	981,939	986,230	I. 4,291
Coke	231,368	269,944	I. 38,576

The December output is estimated on the actual production for two-thirds of the month.

United States Coal Exports—Exports of fuel from the United States, year ended Dec. 31, long tons:

	1907.	1908.	Changes.
Anthracite	2,698,072	2,752,358	I. 54,286
Bituminous	10,454,677	9,100,819	D. 1,353,858
Total coal	13,152,749	11,853,177	D. 1,299,572
Coke	874,689	622,228	D. 252,461

Coal furnished to steamships in foreign trade not yet ascertained. Canada took in 1908 a total of 9,252,943 tons of coal. The decrease in coal in 1908 was 9.9 per cent.; in coke, 28.9 per cent.

United States Coal Imports—Imports of fuel into the United States, year ended Dec. 31, long tons:

	1907.	1908.	Changes.
Anthracite	9,896	16,483	I. 6,587
Bituminous	2,116,122	1,487,116	D. 629,006
Total coal	2,126,018	1,503,599	D. 622,419
Coke	132,536	129,591	D. 2,945

Canada furnished 1,107,737 tons of coal and nearly all the coke in 1908; Australia, 327,441 tons of coal. Imports are mainly on the Pacific Coast. The decrease in coal in 1908 was 29.3 per cent.; in coke, 2.2 per cent.

Spanish Coal Imports—Imports of coal into Spain 11 months ended Nov. 30 were 1,760,969 metric tons, a decrease of 23,618 tons; imports of coke, 255,023 tons, an increase of 27,371 tons.

German Coal Syndicate—The Rhenish-Westphalian Coal Syndicate, which handles about 55 per cent. of the coal output of Germany, has made public its figures for 1908. The principal results are as follows, in metric tons:

Coal:	1907.	1908.	Changes.
Production	80,156,000	81,921,000	I. 1,765,000
Sales	80,147,000	79,884,000	D. 263,000
Coke sales	15,536,500	12,820,800	D. 2,714,700
Briquet sales	2,860,100	3,129,200	I. 269,100

The efforts made to increase export sales, in order to compensate for reduced house consumption met with little success.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Jan. 22: Best Welsh steam, $3.48; second, $3.36; thirds, $3.24; dry coals, $3.60; best Monmouthshire, $3.18; seconds, $3.06; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 3—The iron and steel markets generally show little or no improvement over the last report. They are still in a waiting condition. This condition is emphasized by a very general impression in the trade that a general reduction in prices may be looked for before long.

In pig iron comparatively little new business has been done. Most of that going is in basic iron, and there is manifest some disposition on the part of furnaces to accept a lower price in order to secure orders. Thus, some considerable sales of basic are reported at $17 for Seaboard delivery or $16 at Pennsylvania furnaces. A considerable order for foundry, the largest of the week, is reported taken at $16.95 for No. 2X, Seaboard delivery.

Finished material is dull, except for structural material, in which small orders have been placed, making up a considerable total tonnage. Most of these have been taken by contracting companies at rates which imply a cut in material prices.

Orders for rails are not coming. The Pennsylvania Railroad Company has placed orders for 2200 steel cars for its lines west of Pittsburg, the order being divided among the following companies: Cambria Steel, 1000; Pressed Steel Car, 500; American Car and Foundry, 600; Standard Steel Car, 100 cars.

Pig Iron and Steel Production—As stated in detail elsewhere, the production of pig iron in the United States in 1908 was 15,936,018 long tons, a decrease of 9,845,343 tons, or 38.1 per cent., from 1907. The production of bessemer steel was 6,116,755 tons, a decrease of 5,550,754 tons, or 47.5 per cent.

Lake Superior Corporation—A reorganization of this company has been effected, which includes the investment of $6,000,000 of British capital in the allied industries of Sault Ste. Marie. The new interests are represented by Robert Fleming, of Edinborough and London, and Dr. F. S. Pearson, of London and New York. It is understood that the general direction of the affairs of the corporation will be intrusted to Dr. Pearson, who is prominent in connection with several Canadian industrial enterprises, being a director of the Dominion Iron and Steel and the Dominion Coal companies. The plans in contemplation include extensive additions to the blast furnaces and mills at the Sault, and the extension of the Algoma Central railway to connect with the Grand Trunk Pacific. Close investigation of the condition and possibilities of the company will be made by Dr. Pearson before the course to be pursued is finally determined. The last installment of the loan of $2,000,000, guaranteed by the Ontario government in 1904, of which $1,000,000 remained due, was repaid on Jan. 13, and the guarantee canceled.

Baltimore

Feb. 2—Exports from this port during the week included 1,575,600 lb. steel billets to Glasgow, Scotland.

Birmingham

Feb. 1—The aggregate business of the past month will equal the production and the greater portion of the trading was done on the basis of $13 per ton, No. 2 foundry. There was some iron sold under $13. Since that time there has been a strengthening in the quotations and the new month is opening up with $13 asked on all sides. The shipments of iron have been steady while the home consumption is beginning to show improvement. The cast-iron pipe makers have purchased recently to tide them over a little period. Their trade is healthy. The machine shops and foundries are doing better. The steel plant at Ensley is working practically in all departments and the output is satisfactory. There is a good demand for all shapes of steel, and so far as can be learned there have been no concessions made in this line in this district.

Chicago

Feb. 1—Dulness continues in the iron market. Pig iron sales are confined to needs of the immediate future—30 to 90 days from the date of the sale. The needs of melters probably are increasing slightly, but they are buying more closely to current requirements than in the closing months of 1908. By some observers of the market this condition is ascribed to the uncertainty of the trade about tariff re-

vision. It seems more generally evident now, however, that the revival of business will be slow and the foundryman has learned caution. The size of lots varies from a carload up to 200 or 300 tons, on the great bulk of the business. Inquiries have fallen off in number and are not for large individual amounts.

To say that prices are holding firm is to say that for much of the business now being done $13 Birmingham ($17.35 Chicago) for Southern and $17.50 Chicago for Northern No. 2 pig iron is doubtless being obtained. There can be no doubt, however, that on some business 25c. less is the price and any prospect of a transaction in which a large amount of tonnage would be concerned would bring 50c. less —perhaps even a lower price. This obtains more closely on Southern than Northern, the production of the latter being well restricted.

Iron and steel products are quiet, though there is considerable structural tonnage in sight and merchant steel is in fair demand. Coke is steady, shipments from the ovens being held down. Connellsville holds up to $4.75 or more.

Philadelphia

Feb. 3—The makers and agents of furnaces report a quiet and unsatisfactory market. The only exception is a little temporary activity in basic and bessemer, the aggregate of which may reach 15,000 tons with inquiries amounting to that much more. All other kinds of crude iron are neglected The consumption of material for cast pipe is heavy and there are inquiries from pipe works but they are not likely to result in business very soon unless makers shade prices. Strong concerns in this territory are not making any effort to get business. Foundrymen are buying very little this month.

Steel Billets—Further business on a small scale is reported this week, including a few lots of forging billets. Prices hold their own.

Structural Material—Large orders for structural material are coming along, and are taken at cut prices. A general improvement is believed to be at hand in this branch.

Rails—Good sized orders for mine rails continue to come.

Scrap—Interest in scrap has again subsided, and dealers are not able to report any business of importance.

Pittsburg

Feb. 2—There has been no improvement in the iron and steel markets and the prospects seem to be getting worse instead of better. The general situation is extremely disappointing and consumers and jobbers are only buying for immediate requirements. Mill operations, however, do not show much falling off, although in some lines the large concerns have been compelled to curtail production. The uncertainty regarding the proposed revision of the tariff, together with persistent rumors of a probable general readjustment in prices are assigned as the reasons for the delay in placing large orders. It is known that the independent interests are cutting prices on sheets, plates and structural shapes, but the Steel Corporation concerns, the Jones & Laughlin Steel Company and the Republic Iron and Steel Company are adhering strictly to the established prices. Representatives of the large interests deny that any price reduction is contemplated, but the rumors are sufficient to cause consumers to hold off. The heavy buying of the jobbers that usually occurs at this season of the year has not materialized and the outlook is not regarded as particularly bright except in wire products and tinplate.

Pig Iron—The market is unusually irregular and former quotations are ignored by furnaces and dealers in efforts to get what little new business is offered. Some of the large producers are trying to maintain prices, but without success. An indication of the condition of the market may be found in a sale of 300 tons of No. 2 foundry made to a Pittsburg interest for delivery in the second quarter. A number of the dealers were after the business, one of them bidding $15, Valley furnace, but did not get the contract, as it went at a lower price. Bessemer iron can be had for first quarter shipment at $16 at furnace, and while basic is quoted at $15.50 and malleable bessemer at $15.75, it is believed that if any business was offered fully 50c. a ton less could be easily done. Gray forge is quoted nominally at $14.50. These prices are all at Valley furnaces.

Steel—A sale of 2000 tons of billets last week is the only new business in crude steel. Prices on bessemer and open-hearth billets remain at $25, Pittsburg, with freight divided. Plates are still quoted at 1.60c., but this price is being shaded. Merchant steel bars at 1.40c. are firm.

Sheets—Some new business is coming out almost every day, but it is being taken by independents at low prices. Regular quotations continue, black sheets, 2.50c. and galvanized 3.55c. for No. 28 gage.

Ferro-Manganese—Prices are weak, quotations for prompt shipment being $45.50@46 a ton.

Foreign Iron Trade

As reported by the American Iron and Steel Association, the total production of all kinds of pig iron in Canada in 1908 amounted to 563,672 tons, against 581,146 tons in 1907, a decrease of 17,474 tons, or about 3 per cent. In the first half of 1908 the pig-iron production of Canada amounted to 307,074 tons and in the second half to 256,598 tons, a decrease of 50,476 tons.

German Iron Production—The German Iron and Steel Union reports pig-iron production of the German furnaces in December at 1,016,526 metric tons, an increase of 85,788 tons over November. For the 12 months ended Dec. 31 the total make was, in metric tons:

	1907.	1908.	Changes.
Foundry iron	2,259,416	2,254,644	D. 4,772
Forge iron	786,113	635,228	D. 150,885
Steel pig	1,034,650	934,940	D. 99,710
Bessemer pig	471,355	361,472	D. 109,883
Thomas (basic) pig	8,494,226	7,627,227	D. 866,999
Total	13,045,760	11,813,511	D. 1,232,249

The total decrease in 1908 was 9.4 per cent. Steel pig includes spiegeleisen, ferro-manganese, ferrosilicon and all similar alloys. The lightest decrease was in foundry iron.

Metal Market

New York, Feb. 3—The metal markets continue in a rather depressed position, the January results having been generally unfavorable. Copper is governed largely by the European markets.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1908	$ 7,358,707	$ 5,122,538	Exp. $2,235,169
" 1907	1,004,441	44,448,515	Imp. 43,444,074
Year 1908	71,215,456	50,246,099	Exp. 30,969,357
" 1907	55,215,681	143,398,072	Imp. 88,182,391
Silver:			
Dec. 1908	4,726,289	4,382,290	Exp. 343,999
" 1907	4,413,698	4,222,036	" 191,662
Year 1908	51,837,671	42,196,966	" 9,640,705
" 1907	61,625,866	45,912,360	" 15,713,506

Exports from the port of New York, week ended Jan. 30: Gold, $1,150,000, chiefly to Panama and Argentina; silver, $1,070,594, chiefly to London. Imports: Gold, $41,163; silver, $18 183, both from the West Indies and South America.

No gold has been taken this week in New York for export to Europe. A total of $1,750,000 has, however, been shipped to Argentina on London account.

Gold—The price of gold in the open market in London has fallen off slightly this week, bar gold being quoted at 77s. 9d. per oz., and American eagles at 76s. 4d. The Bank of France has stopped buying gold for the present, being apparently satisfied with its reserve holdings, now that the Russian loan has been financed. Nearly all the gold bought in London this week was taken by the Bank of England.

Platinum—There is no change in prices, dealers in New York quoting $23.50@24.50 per oz. for refined platinum, $26.50 for hard metal and $19@21 for scrap. The market is very dull, with light sales.

Silver—The market has ruled steady the past week and closes firm at 24d. in London on buying by Chinese banks.

SILVER AND STERLING EXCHANGE

Jan.-Feb.	28	29	30	1	2	3
New York....	51¾	51½	51⅞	52⅛	51⅞	52⅛
London.....	23 13/16	23¾	23⅞	24	23⅞	24
Sterling Ex..	4.8740	4.8765	4.8770	4.8775	4.8770	4.8765

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Jan. 21, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India... ...	£ 298,000	£ 216,110	D. £ 81,890
China.....	91,000	80,000	D. 11,000
Straits.....	.....	61,000	I. 61,000
Total....	£ 389,000	£ 357,110	D. £ 31,890

Imports for the week, £200,000 from New York; exports, £61,000 coin to the Straits, and £110,000 bars to India; £171,000 in all.

Copper, Tin, Lead and Zinc

Jan.-Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Spel'r. New York, Cts. per lb.
28	13¾ @14	13¼ @13½	58⅞	27⅝	4.12½ @4.17½	3.97½ @4 00	5.07½ @5.10
29	13¾ @14	13¼ @13½	58¼	27½	4.12½ @4.17½	3.97½ @4 00	5.07½ @5.10
30	13¾ @14	13⅛ @13½	. . .	27½	4.12½ @4.17½	3.97½ @4.00	5.07½ @5.10
1	13⅝ @13¾	13⅛ @13⅜	57⅛	27¼	4.10 @4.15	3.95 @4.00	5.05 @5.07½
2	13⅝ @13¾	13⅛ @13⅜	58¼	27¼	4.10 @4.15	3.95 @4.00	5.05 @5.07½
3	13⅝ @13¾	13¼ @13⅜	58⅞	27⅞	4.10 @4.15	3.95 @4.00	5.05 @5.07½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium. Spelter prices at St. Louis, Jan. 28-Feb. 3, were 0.15c. below New York.

Copper—The liquidation in the London market to which reference has previously been made continued until Feb. 1. Since then there has been a better tone and reports from abroad are to the effect that the liquidation of speculative accounts appears to be completed for the time being. However, it is well known that speculative copper is still being carried both on this side and the other. Refined copper declined here in sympathy with Standard. Between Jan. 28 and 30 some fair sales, both of Lake and electrolytic, were made to domestic consumers. Since Monday, business has been of less amount, but at the close inquiries from abroad have been in the market. Late on Tuesday, the United Metals Selling Company announced a reduction of its price for electrolytic to 13½c., delivered, 30 days, but so far this has not resulted in bringing about an increase in buying. The close is uncertain at 13⅝@13¾c. for Lake copper; 13¼@13⅜c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 13@13¼ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb., base. Copper wire is ½c. lower, at 15¼c. base, carload lots at mill.

The Standard market turned weak again last Friday, and bordered on demoralization on Monday when £57 7s. 6d. for spot and £58 7s. 6d. for three months was reached. The liquidation having ceased, covering of short sales began on Tuesday, carrying prices up to £59 2s. 6d. for spot and £60 for three months. The close is again easier at £58 17s. 6d. for spot and £59 16s. 3d. for three months.

Refined and manufactured sorts we quote: English tough, £63; best selected, £62@63; strong sheets, £74@75.

January was a gloomy month in the copper market. During the first day or two round quantities were sold, but a quieter tone followed immediately, and then discouraging reports from Europe caused prices to give way, a fair tonnage being sold at the decline. In the latter half of the month the publication of exaggerated estimates of accumulated stock on this side led to liquidation in the London market of some of the large speculative accounts that had been carried for several months. This caused a break in the market for Standard, and thereafter the decline was rapid, both at London and New York. The London parity being below New York throughout the second half of the month, European consumers bought their supplies out of London warehouse and sales in New York for export were practically nil. This is reflected in the decrease in the statistics of visible supply reported from London, and in the falling off in exports from America. The exports reported were, of course, to a large extent copper sold in December and November. One of the large agencies, in particular, was successful in disposing of its January product during the big sales of early November, but the agencies generally were much less fortunate. Demand in January was small, and recognizing this, some of the sellers held aloof, maintaining a nominal asking price of 14½c., delivered, 30 days, but receiving no orders, while others were aggressive sellers at repeated concessions, capturing the business offered, which was chiefly for domestic account. The sellers of Lake being far less eager to realize, an unusually large disparity between the prices for Lake and electrolytic developed.

Exports from New York and Philadelphia for the week are reported at 3483 long tons copper. Our special correspondent gives the exports from Baltimore at 1074 long tons.

Copper exports in January were 18,540 long tons, against 21,590 in December.

Tin—In sympathy with copper, the tin market in London declined, reaching its lowest point on Feb. 1 at £123 15s. for spot and £125 10s. for futures. Some demand which was brought about by the lower values in this market and inquiries which, in consequence, were cabled abroad, tended to stiffen values in London. The advance, however, was not maintained and the market closes flat at £126 2s. 6d. for spot and £128 for three months.

In New York, tin can be bought at the close at about 27⅞ cents.

Visible stocks of tin Feb. 21, reported in long tons:

	In Store.	Afloat.	Total.
London.....	8,994	4,128	13,112
Holland...	1,823	187	2,010
U. S., exc. Pacific ports ...	3,559	3,204	6,763
Total...	14,376	7,519	21,895

The total shows an increase of 1967 tons over the January report.

Exports of tin from the Straits, 11 months ended Nov. 30, long tons: United States, 9432; Great Britain, 38,206; other Europe, 7900; India and China, 2000; total, 57,538 tons, an increase of 2933 tons over the previous year.

Arrivals of tin at Pacific Coast ports, year ended Dec. 31, were 1943 long tons in 1907, and 1756 in 1908; a decrease of 187 tons.

Tin output of the Federated Malay States for the 12 months ended Dec. 31 is reported at 48,431 long tons in 1907, and 50,646 in 1908; an increase of 2215 tons.

Lead—The market is extremely dull and there is more lead pressed for sale than can be placed, so that prices have declined further and the market closes weak at 4.10@4.15c. New York, and 3.95@4c. St. Louis.

The London market is also somewhat lower and quotations are cabled at £13 for Spanish lead, £13 2s. 6d. for English lead.

Spelter—The metal, which has been held back in anticipation of a higher market, in view of the exorbitant prices which have ruled for ore, is now being forced for sale, due to a decline which has taken place in Joplin ore prices. Consumers show little interest, as the galvanizing business is less active. The close is weak at 4.90@4.92½c. St. Louis, 5.05@5.07½c. New York.

The London market is quoted at £21 for good ordinaries and £21 15s. for specials.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market is still quiet, with only moderate current sales. There is no material change in prices, 8⅛@8¼c. being named for Hallett's; 8@8⅛c. for Cookson's; 7½@7¾c. for ordinary brands.

Aluminum—The Aluminum Company of America continues to quote 24c. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is offered at 22c. for ingots, but can probably be had a shade lower for good orders.

Quicksilver—New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco prices are $45@46 for domestic orders, and $43@44 for export. The London quotation is £8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers. Business is quiet.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Imports and Exports of Metals

Exports and imports of metals in the United States for the year ended Dec. 31 are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	301,080	97,636	Exp. 203,444
Copper, 1907....	234,619	113,181	Exp. 121,438
Tin, long tons....	244	36,832	Imp. 35,588
Tin, 1907.....	562	36,852	Imp. 36,290
Lead, short tons.	76,354	112,046	Imp. 35,692
Lead, 1907....	51,502	79,815	Imp. 28,313
Spelter, sh. tons.	2,640	881	Exp. 1,759
Spelter, 1907....	563	1,778	Imp. 1,215
Nickel, lb.....	9,770,248	16,586,423	Imp. 6,816,155
Nickel, 1907....	8,772,578	18,418,305	Imp. 9,645,727
Antimony, lb....	.....	8,114,651	Imp. 8,114,651
Antimony, 1907.	.....	8,662,683	Imp. 8,662,683
Platinum, oz.....	.....	49,868	Imp. 49,868
Platinum, 1907.	.....	74,208	Imp. 74,208
Quicksilver, lb...	224,692	.....	Exp. 224,692
Quicksilver, '07	384,913	.....	Exp. 384,913
Aluminum, value	$330,092	.....	Exp. $330,092
Aluminum, 1907	304,938	.....	Exp. 304,938
Ores, etc.:			
Zinc oxide, lb.	24,016,054	.....	Exp.24,016,054
Zinc oxide, '07.	26,512,920	.....	Exp.26,512,920
Zinc dross, lb....	16,810,259	.....	Exp.16,810,259
Zinc dross, '07.	19,186,737	.....	Exp.19,186,737
Zinc ores, lg. tons	23,311	49,996	Imp. 25,685
Zinc ores, 1907.	18,171	.....	.....
Antim'y ores, lb.	.....	3,280,922	Imp. 3,280,922
Ant. ores, 1907.	.....	2,780,186	Imp. 2,780,186

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reexports of foreign material. Imports of zinc ores in 1908 were 21,012 tons calamine and 26,984 tons other ores; in 1907 only partially reported.

Spanish Metal Exports

Exports of metals and ores from Spain, 11 months ended Nov. 30, metric tons, as reported by *Revista Minera*:

Metals:	1907.	1908.	Changes.
Copper.....	8,258	13,109	I. 4,851
Copper precipitate.	16,845	18,020	I. 2,175
Zinc.....	1,321	1,386	I. 66
Lead.....	164,495	171,846	I. 7,351
Quicksilver.....	1,500	1,504	I. 4
Minerals:			
Iron ore.....	8,108,251	6,780,388	D. 1,327,863
Copper ore.....	1,115,252	1,096,905	D. 18,327
Zinc ore.....	143,834	118,736	D. 25,098
Lead ore.....	5,116	2,926	D. 2,190
Manganese ore.....	62,368	20,957	D. 41,411
Pyrites.....	1,216,929	1,299,312	I. 82,383

Exports of salt, 452,758 tons in 1907, and 518,191 in 1908; increase, 65,433 tons.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 30—The highest price paid for zinc sulphide ore on this week's market was $43 per ton, the base ranging from $37 to $40 per ton of 60-per cent. zinc. Zinc silicate sold on a base of $19 to $21 for 40 per cent. zinc, and as high as $26 per ton. Average, all grades $36.58. Lead was largely sold this week on a base price also, offerings of $54 per ton of 80-per cent. lead being made, running the high price to $56. Average, all grades, $52.92 per ton.

Four days of the week were ideal for outputting, but a severe storm formed Thursday, the temperature changing to below zero. A tornado swept the district for 24 hours, the gale reaching, at times, as high as 50 miles per hour. Many tail elevators and smokestacks were leveled, and in some instances the falling elevators crushed in a portion of the mills. It is estimated the output was decreased this week approximately 8 per cent., and it may decrease next week's output 12 to 15 per cent.

SHIPMENTS, WEEK ENDED JAN. 30

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,343,060	933,000	$88,248
Joplin.....	1,620,710	253,720	39,139
Miami.....	351,150	425,580	16,543
Galena.....	553,280	145,020	14,356
Alba-Neck.....	601,540	.....	11,428
Granby	764,290	1,000	10,101
Spurgeon.....	473,230	86,050	9,504
Duenweg.....	631,200	.....	9,477
Aurora.....	483,240	.....	8,963
Prosperity.....	343,640	.....	6,526
Carthage.....	255,750	.....	5,135
Badger.....	194,710	.....	3,699
Sarcoxie.....	160,750	.....	2,577
Carl Junction.....	86,520	15,050	2,121
Zincite.....	95,020	.....	1,805
Oronogo.....	72,510	.....	1,247
Cave Springs.....	62,740	.....	1,192
Totals	9,994,340	1,859,420	$232,066
Five weeks.....	49,952,400	6,924,260	$1,139,945
Five weeks 1908.....	35,479,300	4,704,070	742,352

Zinc value, the week, $182,832; the month, $958,137
Lead value, the week, 49,223; the month, 179,808

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February.....	36.63	....	34.92	....	49.72	....
March.....	36.19	....	34.19	....	49.90	....
April.....	35.40	....	34.08	....	52.47	....
May.....	34.19	....	33.39	....	56.05	....
June.....	33.06	....	32.07	....	60.48	....
July.....	34.65	....	31.67	....	59.90	....
August.....	36.53	....	33.42	....	60.34	....
September...	37.63	....	34.44	....	54.59	....
October.....	35.95	....	33.28	....	52.63	....
November...	39.13	....	35.02	....	54.63	....
December...	42.75	....	39.63	....	49.68	....
Year.....	$36.63	....	$34.31	....	$53.93	....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Feb. 3—The market as a whole has shown no signs of activity. Dealers are buying only according to their immediate needs.

Copper Sulphate—Demand is fair and trade conditions remain unchanged. Quotations are steady at $4.75 per 100 lb. for carload lots and up to $5@5.50 per 100 lb. for smaller parcels.

Arsenic—The market is dull, only a few small sales being reported. Quotations are 3@3⅛c. per lb. for white arsenic.

Nitrate of Soda—A good normal trade on this article has been done during the past week. Current quotations are 2.17½c. for spot and 2.15c. for futures, which are a shade higher than last week.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States 12 months ended Dec. 31 were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	7,663,882	E.	7,663,882
Bleach, lb.....	74,602,059	121,511	I. 74,480,548
Potash salts, lb..	300,073,012	1,046,689	I. 299,026,323
Soda salts, lb....	11,366,614	838,852	I. 10,527,762
Acetate lime, lb.	.....	56,703,015	E. 56,703,015
Nit. of soda, tons	310,713	9,955	I. 300,758
Phosphates, tons	26,734	1,228,989	E. 1,202,255
Sulphur, tons....	19,118	27,884	E. 8,766
Pyrites, tons.....	668,115	.....	I. 668,115

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 286,364 long tons.

Mining Stocks

New York, Feb. 3—The general stock markets have been somewhat irregular during the week, but on the whole rather dull. The volume of trading was not heavy at any time. A period of weakness was followed by some recovery, so that there was no marked change in quotations. The report that the Supreme Court decision on the commodity clause of the Interstate Commerce law would be given out had some effect on the anthracite coal stocks; but the postponement of the decision affected them but slightly.

On the Curb the copper stocks developed some weakness, but recovered at the close. They were not especially active, the whole market being inclined to quiet. Cobalt stocks were sluggish, with no material change in prices. The Nevada gold stocks were inclined to be dull, and business in them was not heavy.

Boston, Feb. 2—It would seem as if copper mining shares had been sold almost to a standstill. After a sharp break, which extended pretty much through the entire list, prices recovered as sharply, although net declines are to be recorded for the week as a rule. The decision by the Cincinnati Court of Appeals in favor of the Calumet & Hecla proved a fillip and prices responded readily under the leadership of Osceola and Calumet & Hecla. Concentrated buying in Isle Royale caused an advance from $24 to $26.75 even while the balance of the market was weak. Conferences between the Calumet & Hecla and Osceola people were continued and again discontinued without accomplishing anything. Report says that Mr. Bigelow demands $8,000,000 to capitulate.

Allouez had a $6 spurt Monday to $40, and closes the week with a net advance of $6.75. The striking of the Kearsarge lode with rich formation was responsible for this. Calumet & Arizona had a bad break from $110 to $97, but rallied to $103.75 tonight. Amalgamated fell $5.75 to $72.75, rallying to $75.37½, and Copper Range broke $5.75 to $71.25, recovering to $74.25. North Butte broke $7.75 to $70.50, rallying to $75.50. Osceola fell $7 to $123, rallying to $133 on the Cincinnati decision, and Calumet & Hecla, after falling $25, to $625, rose to $640.

Superior Copper rose from $35.75 to $38.50. Utah Consolidated fell $3.75 to $39.75, rallying to $41.

Curb prices have been more regular and closed strong tonight.

STOCK QUOTATIONS

NEW YORK	Feb. 2	BOSTON	Feb. 2
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	¼	Adventure	8
Amalgamated	75½	Allouez	40⅝
Anaconda	40¼	Am. Zinc	†24⅛
Balaklala	†2⅝	Arcadian	22½
British Col. Cop.	7⅞	Arizona Com	34⅞
Buffalo Mines	‡3½	Atlantic	14¾
Butte Coalition	24	Boston Con	14
Colonial Silver	½	Calumet & Ariz.	103¾
Cum. Ely Mining	8¼	Calumet & Hecla	640
Davis Daly	2⅛	Centennial	32
Dominion Cop.	¼	Con. Mercur	‡.30
Douglas Copper	2¼	Copper Range	74½
El Rayo	3½	Daly-West	10½
Florence	3 11/16	East Butte	8¼
Foster Cobalt	.66	Franklin	15
Furnace Creek	.12	Greene—Can	10⅝
Giroux	½	Isle Royal	26½
Gold Hill	¾	La Salle	14
Goldfield Con	7 1/16	Mass	15¼
Granby	100½	Michigan	10½
Greene Gold	¼	Mohawk	61⅝
Greene G. & S.	7	Nevada	18
Greenw'r & D. Val.	‡.75	North Butte	75
Guanajuato	1¾	Old Colony	‡.60
Guggen. Exp.	181	Old Dominion	52
Hanapah	.15	Osceola	130
McKinley Dar.	1	Parrot	27¼
Miami Copper	13⅞	Quincy	89
Micmac	1¾	Rhode Island	5
Mines Co. of Am.	⅞	Santa Fe	22
Mitchell Mining	⅛	Shannon	15⅛
Mont. Sho. C.	1¾	Superior	38½
Nev. Utah M. & S.	3 9/16	Superior & Pitts.	15¾
Newhouse M. & S.	6¼	Tamarack	79
Nipissing Mines	9⅞	Trinity	15½
Old Hundred	1 1/16	United Cop., com.	‡13½
Silver Queen	.87	U. S. Oil	†29¼
Stewart	¾	U. S. Smg. & Ref.	41
Tennessee Cop'r.	40	U.S. Sm. & Re., pd.	45
Tri-Bullion	⅞	Utah Con	41
Union Copper	1⅛	Victoria	4½
Utah Apex	6¼	Winona	15
Utah Copper	41⅝	Wolverine	143
Yukon Gold	4¾	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38⅝
Am. Smelt. & Ref.	84¾
Am. Sm. & Ref. pf.	103
Colo. Fuel & Iron.	40
Federal M. & S., pf.	‡84
National Lead	78
National Lead, pf.	109¼
Pittsburg Coal	11⅞
Republic I. & S.	24¼
Republic I. & S., pf.	85⅛
Sloss-Sheffield	76½
Standard Oil	649½
U. S. Steel	53
U. S. Steel, pf.	114⅞
Va. Car. Chem	46

BOSTON CURB	
Ahmeek	‡145
Black Mt.	2⅞
Chemung	‡18
Globe Con	6¾
Hancock	‡11¼
Helvetia	3¾
Keweenaw	‡4¾
North Lake	17½
Ojibway	12¼
Superior & Bost.	13½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS		Jan. 30
N. of Com.	High.	Low.
Adame	.40	.30
Am. Nettie	.07	.05
Center Cr'k	1.90	1.50
Cent. C. & C.	78.00	76.00
C.C. & C. pd.	81.00	80.00
Cent. Oil	120.00	110.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	120.00	110.00
Gra. Bimet.	.20	.18
St. Joe	14.00	12.00

LONDON	Feb. 3		
Name of Com.	Clg.		
Dolores	£1 10s	0d	
Stratton's Ind.	0 3	3	
Camp Bird	0 16	0	
Esperanza	3 0	9	
Tomboy	0 18	9	
El Oro	1 2	6	
Oroville	0 9	3	

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 3

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.08
Belcher	.32	St. Ives	.17
Best & Belcher	.61	Triangle	.02
Caledonia	.15	BULLFROG STOCKS	
Chollar	.13	Gibraltar	.03
Comstock	.30	Homestake King.	.07
Con. Cal. & Va.	.66	Mont. Shoshone C.	1.87½
Crown Point	.48	Tramp Cons	.09½
Exchequer	.36	MISCELLANEOUS	
Gould & Curry	.13	Bonnie Clare	.04
Hale & Norcross	.22	Lee Gold Grotto	...
Mexican	.82	Nevada Hills	1.37½
Ophir	1.55	Nevada Smelting	1.00
Overman	.14	Nevada Wonder	.36
Potosi	.18	Nevada-Utah	3.25
Savage	.26	Penn-Wyoming	.08
Sierra Nevada	.22	Pittsburgh S. Pk.	.78
Union	.34	Rawhide Coal	.44
Utah	.05	Round Mt. Sphinx	.07
Yellow Jacket	.74		
TONOPAH STOCKS			
Belmont	.80		
Extension	.48		
Golden Anchor	.01		
Jim Butler	.16		
MacNamara	.32		
Midway	.22		
Montana	.70		
North Star	.03		
Tono'h Mine of N.	6.00		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.13		
Booth	.22		
Columbia Mt.	.12		
Comb. Frac	1.14		
Con. Red Top	.12		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.05		
Goldfield Daisy	.74		
Great Bend	.19		
Jumbo Extension	.14		
Kendall	.07		
Lone Star	.05		
May Queen	.04		
N. Y. C. O. D.	.04		
Oro	.10		
Red Hill	.11		
Roanoke	...		
Saudatorm	.15		

COLO. SPRINGS	Jan. 29
Name of Comp.	Clg.
Acacia	6¾
Black Bell	....
C. C. Con	3½
Dante	6¾
Doctor Jack Pot	8
Elkton	71
El Paso	48½
Findlay	16
Gold Dollar	9⅞
Gold Sovereign	3⅛
Isabella	25¾
Index	....
Jennie Sample	5
Jerry Johnson	‡4¾
Mary McKinney	‡35½
Pharmacist	‡3½
Portland	1.00
Un. Gold Mines	4½
Vindicator	‡80
Work	7

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev	Feb. 2	Feb. 23	$0.05
Bullion, Nev	Feb. 24	Mar. 18	0.05
Gould & Curry, Nev	Feb. 15	Mar. 9	0.10
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Overman, Nev	Feb. 18	Mar. 11	0.10
Sierra Nevada, Nev	Feb. 12	Mar. 5	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	.....	25.855	.....
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.803	13.901	14.280	62.386	61.197
February	12.905	.....	13.098	.....	58.786	.....
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.351	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	.....	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	3.691	4.175	14.469	13.113
February	3.725	.....	14.250	.....
March	3.838	.....	13.975	.....
April	3.993	.....	13.469	.....
May	4.253	.....	12.938	.....
June	4.466	.....	12.600	.....
July	4.447	.....	13.000	.....
August	4.580	.....	13.375	.....
September	4.515	.....	13.125	.....
October	4.351	.....	13.375	.....
November	4.330	.....	13.538	.....
December	4.213	.....	13.156	.....
Year	4.240	.....	13.439	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	.....	4.638	.....	20.875	.....
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for $1.00, thirty-three for $5.00 and one hundred for $15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

ALUMINUM

8369—BRITISH WORKS—Three New British Aluminum Works. (Electrochem. and Met. Ind., Jan., 1909; 3¾ pp.) Describes the plants at Doigarrog, Wallsend and Kinlochleven quite fully and gives many details of their operations. Special mention of the aluminum furnaces is made. The first two works belong to the Aluminum Corporation, Ltd., and the latter are being erected by the British Aluminum Co. 40c.

8370—CASTINGS—Production of Aluminum Castings. (Foundry, Dec., 1908; 6 pp.) Describes the manipulation of aluminum in the foundry and the practice of the Allyne Brass Foundry Co., probably the largest consumer of aluminum in the world. 20c.

8371—ELECTROLYTIC REDUCTION of Aluminum as a Laboratory Experiment. M. de Kay Thompson. (Electrochem. and Met. Ind., Jan., 1909; 2 pp.) Contains tabulated results of a series of laboratory experiments, and describes the difficulties encountered in attempting to electrolyze a solution of aluminum oxide in melted cryolite, according to the Hall patent. 40c.

AMMONIUM SULPHATE.

8372—PRODUCTION of Ammonium Sulphate. C. G. Atwater. (Am. Fertilizer, Dec., 1908; 5 pp.) A discussion of the production of ammonium sulphate as a by-product from coke ovens, giving tables of the world's output as well as consumption. 20c.

BARYTES.

8373—TENNESSEE—Barytes in Tennessee. A. H. Fay. (Eng. and Min. Journ., Jan. 9, 1909; ⅔ p.) A short review of the barytes industry in Tennessee during 1908. 20c.

BORAX.

8374—BORAX. (Eng. and Min. Journ., Jan. 9, 1909; ⅔ p.) A short review of the borax industry in California and the operations of the Pacific Coast Borax Company. 20c.

CALCIUM CYANAMIDE

8375—CALCIUM CYANAMIDE—On the Utilization of the Atmospheric Nitrogen in the Production of Calcium Cyanamide, and Its Use in Agriculture and Chemistry. Albert R. Frank. (Trans. Faraday Soc., Oct., 1908; 30 pp.) A historical résumé of the various attempts to produce calcium cyanide, together with tables showing its value as a fertilizer compared with other fertilizers now in use. Illustrated.

CEMENT

8376—CEMENT WORKS at Southam. (Engineer, Jan. 1 and 8, 1909; 4 pp.) A description of the cement works of Kaye & Co., Ltd., with plan and sectional drawings of the entire plant, including the two rotary kilns used. 60c.

8377—PORTLAND CEMENT INDUSTRY—A New Viewpoint of the American Portland Cement Industry. E. C. Eckel. (Eng. Rec., Jan. 9, 1909; 4 pp.) Paper read before the annual meeting of the Assn. of Am. Portland Cement Mfrs., in which the author discusses the future growth of the cement industry; possible price regulation; influence of patents; improvements in marketing conditions and the development of export trade. Illustrated. 20c.

COAL AND COKE

8378—ALBERTA—Coalfields of Alberta. Geo. B. Ellison. (Northwest Min. News, Jan., 1909; 2 pp.) The author gives a short discussion of the developments that are taking place in the Northwest. He considers that the coalfields of Alberta are very extensive. Illustrated. 20c.

8379—ANALYSIS—Some Fundamental Considerations on Coal. W. Jones. (Electrochem. and Met. Ind., Jan., 1909; 1 p.) This paper has special reference to the economic value of coal from the buyer's standpoint based upon the chemical analysis.

8380—AUSTRALIA—Coalfields and Collieries of Australia. F. D. Power. (Aust. Min. Stand., Nov. 4 and 18, 1908; 2 pp.) Continuation of article previously indexed. 60c.

8381—BRIQUETTED COAL—Comparative Tests of Run-of-Mine and Briquetted Coal on Locomotives. W. F. M. Goss. (Bull. No. 363, U. S. Geol. Surv., 1908; 57 pp.) A discussion of the briquet industry in Europe with tabulated results and comparative tests, together with chemical analyses. Also notes on foreign specifications for briquets. A short bibliography is attached. Illustrated.

8382—CANADA—The Mining Operations of the Dominion Coal Company. III and IV. F. W. Gray. (Can. Min. Journ., Dec. 15, 1908, and Jan. 1, 1909; 9 pp.) This article gives a short historical sketch of the early operations and a description of the present plant. Illustrated. 40c.

8383—CHARCOAL KILNS OF VARIOUS CONSTRUCTIONS—Hilding Bergström. (Jernkontorets Annaler, 1908; 42 pp.) Describes the various types of charcoal kilns employed in Sweden and discusses the output of charcoal and by-products and the economic results from their operation.

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8614—DUST-FLUE — Neuere Gesichtspunkte beim Bau der Hüttenrauch-Kondensationsanlagen. (Oest. Zeit. f. B. u. H., Oct. 24, 1908; 2 pp.) Describes a dust-flue of peculiar shape containing a longitudinal scraper-conveyor for extracting the dust. 40c.

8615—ELECTRIC FURNACES—Recent Developments of the Kjellin and Röchling-Rodenhauser Electric Induction Furnaces. J. Härdén. (Trans. Faraday Soc., Oct., 1908; 12 pp.) A discussion of the development of the electric induction furnace during the last two years, together with a description of this new furnace and the results obtained therefrom. Illustrated.

8616 — ELECTRICITY IN MINES. Joseph D. Griffin. (Aust. Min. Stand., Nov. 4, 1908; 1⅔ pp.) A discussion of the advantages of electricity, its simplicity and the saving of labor in the operating department of the North Mount Lyell mine. Illustrated. 40c.

8617—EXCAVATORS AND CONVEYORS—Moderne Verladekrane, Gebaut von Adolf Bleichert and Company in Leipzig-Gohlis Georg von Haffstengel. (Zeit. des Vereines Deutscher Ingenieure, Oct. 31, 1908; 8 pp.) Describes, with numerous shop drawings, several kinds of scoop excavators and the cranes for operating them for handling ore, coal, etc.

8618—FACTORS OF SAFETY. A. S. Ostereicher. (Journ. Transvaal Inst. Mech. Engrs., Dec., 1908; 5 pp.) The object of this paper is to investigate the points upon which the safety of a correctly designed structure or a piece of machinery depends. The author discusses the properties and strengths of materials. Illustrated. 60c.

8619—GAS FURNACE—The Loder Oxy-Hydrogen Gas Furnace. Will C. Higgins. (Salt Lake Min. Rev., Dec. 15, 1908; 2 pp.) A description of a gas furnace in use at Nelson, Eldorado Canyon, Nevada. It is claimed that higher silicious charges can be run than with the other types. Illustrated. 20c.

8620—GAS PRODUCER PRACTICE—Notes on Anthracite Producer Practice. George C. Stone. (Journ. Ind. and Eng. Chemistry, Jan., 1909; 2¾ pp.) Describes a series of experiments made to improve the practice at one of the author's plants. The experiments included change in the size of fuel and reconstructing the producers. 60c.

8621—HYDROELECTRIC PLANT—Dalmatian Carbide Works Using 30,000-Volt Generators. F. Koester. (Elec. Rev., Jan. 9, 1909; 4 pp.) A description of the Manojlovac plant in Dalmatia, its generating room switchboard and transmission system. Illustrated. 20c.

8630—PRODUCER GAS — Gas-Firing and the Advantages of Gas-Firing Over the Direct Use of Coal. Ernest Schmatolla. (London, 1908; Published by the author, 16 pp.) Compares direct and gas firing, boiler firing, lime kilm firing, reverberatory furnaces, etc. Illustrated.

8631—PRODUCER GAS—Moisture in Producer Gas. J. MacFarlane. (Irbn and Coal Tr. Rev., Nov. 27, 1908; ½ p.) Abstract of paper before the West of Scotland Iron and Steel Institute. Gives calculations made by the author to illustrate the effect of moisture on the thermal efficiency of producer gas. 40c.

8632—PUMPS—Experiments with Two Electrically-Driven Pumps. Thomas Lindsay Galloway. (Trans. Min. Inst. Scot., Aug. 8, 1908; 11 pp.) These experiments were made with a view to testing a high lift turbine pump and was subsequently extended for the purpose of ascertaining the relative merits of this type of pump and a reciprocating pump of the triple-ram pattern, each working under varying condition of load.

8633—SWITCHBOARDS for Mine Power Plants. W. B. Clarke. (Mines and Minerals, Nov., 1908; 2½ pp.) Describes the equipment desirable and the reasons for certain arrangements. Illustrated. 20c.

8634—TUBE MILL LININGS—Honeycomb Tube Linings. H. P. Barry. (Aust. Min. Stand., Dec. 2, 1908; 1 p.) The author describes a patent method of securing any hard rock in tube mills or other grinding machines without costly and sometimes impossible preliminary work of dressing the material. Illustrated. 40c.

8635 — WATER POWER — Pressure Fluctuations in Turbine Pipe Lines. A. Budan. (Journ. Assn. Eng. Soc., Oct., 1908; 30 pp.) Discusses the problem of utilizing water power and devices used therewith together with some theoretical investigations by the author. Illustrated. 40c.

ANALYTICAL CHEMISTRY

8636—BARIUM—A Volumetric Method for the Determination of Barium. A. E. Hill and W. A. H. Zink. (Journ. Am. Chem. Soc., Jan., 1909; 6½ pp.) The method here proposed depends upon the precipitation of barium as iodate and upon the oxidal action of this compound upon an iodide solution, with subsequent titration of the free iodine with sodium thiosulphate. 80c.

8637—SILICA—The Determination of True Silica in Zinc Residues. R. S. Beall. (West. Chem. and Met., Dec., 1908; 2 pp.) Simply a statement of the method used in the author's determinations. 80c.

INDUSTRIAL CHEMISTRY

8638 — SULPHURIC ACID — W. W. Wilke. (Drugs, Oils and Paints, Dec., 1908; 1½ pp.) A discussion of the development and application of the contact process for manufacturing sulphuric acid as patented by the Verein Chemischer Fabriken in Mannheim, Germany. 20c.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—
Bort, good drill quality, carat. $85.00
Carborundum, f.o.b. Niagara Falls, powd. lb. .08
Grains " .10@.17
Corundum " .07@.10
Crushed Steel, f.o.b. Pittsburg " .05¾@.06
Emery, in kegs: Turkish flour " .01¾@.02½
Grains " .03¼@.04½
Naxos flour " .01¾@.02½
Grains " .03¼@.04½
Chester flour " .01½
Grains " .03½@.04½
Peekskill, f.o.b. Easton, Pa., flour " .01¼@.01½
Grains, in kegs " .02½@.03
Garnet, per quality...sh. ton 25.00@35.00
Pumice Stone, Am. Powd., 100 lb. 1.60@2.00
Italian, powdered " .01½@.02
Lump, per quality " .03@.20
Rottenstone, ground " .01¾@.04
Lump, per quality " .05½@.20
Rouge, per quality " .05@.30
Steel Emery, f.o.b. Pittsburg " .07½@.07¾

ACIDS—
Acetic 28% lb. .021 up
Boric " .07
Hydrofluoric, 30% " .02¾@.03
" 48% " .05
" 60% " .10
Hydrochloric acid, 20°, per lb. 1.25@1.50
Nitric acid, 36° per lb. .03¾@.04½
Sulphuric acid, 50°, bulk per ton. $12 up
60°, 100 lb. in carboys. .85@1.12½
60°, bulk, ton 16.00@18.00
66°, 100 lb. in carboys. 1.00@1.25
66°, bulk, ton 18.00
Oxalic " .06¼@.06½

ALCOHOL—Grain 95% gal. 2.63
Denatured " .45@.47
Refined wood, 95@97% " .50@.55

ALUM—Lump 100 lb. $1.75
Ground " 1.85
Chrome Alum " .03¾@.04

ALUMINUM—Sulphate, com'l. lb. 1.10@1.75

AMMONIA—24 deg. lb 04½@.05½
" 26 deg. lb .04¾@.05¾

AMMONIUM—
Bromide lb. .28
Carbonate " .07¾@.09½
Muriate grain " .05¾@.06½
Lump " .09½@.09¾
Sulphate, 100 lb. 3.05@3.10
Sulphocyanide com " .30
" chem. pure " .40

ANTIMONY—needle, lump. " .04@.05½

ARSENIC—White " .03½@.03¾
Red " .07½@.07¾

ASPHALTUM—
Barbadoes per ton. 40.00@80.00
West Indies 20.00@60.00
Egyptian lb. .11@.14
Gilsonite, Utah ordinary per ton. 32.00
Trinidad " 22.50@30.00
California " 21.00@27.00

BARIUM—
Carb. Lump, 80@90% lg. ton. 30.00@35.00
Precipitated 96@98% 36.00@40.00
Powdered, 80@90% lb. .02@.02½
Chloride com'l ton. 37.00@39.00
Nitrate powdered, in casks lb. .05½@.06½
Blanc Fixe per lb. .02½

BARYTES—
Am. Ground, prime sh. ton. 16.00@17.00
Floated " 17.00@18.00
Foreign floated " 20.00@22.00

BISMUTH—Sub-nitrate lb. 1.45

BLEACHING POWDER—35%, 100 lb. 1.25@1.40

BLUE VITRIOL—(copper sulphate), carload, per 100 lb. 4.75

BONE ASH lb. .02¾@.04

BORAX, sacks " .04½@.05

CALCIUM—Acetate, gray, 100 lb 1.50@1.55
Acetate, brown lb. 1.00@1.05
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J. sh. ton. 65.00
Chloride, f.o.b. N. Y. " 11.00@14.00

CEMENT—
Portland, Am. 500 lb bbl. 1.55@1.60
Foreign " 2.25@2.90
"Rosendale," 300 lb " .85
(in sacks) " .65
Slag cement " .75@1.25

CHROME ORE—
New Caledonia 50% ex. ship N. Y. per lg. ton. 17.50@20.00
Bricks, f.o.b. Pittsburg, M ton. 175.00

CLAY, CHINA—Am. common ex-dock, N. Y. ton. 8.00@9.00
Foreign " 11.50@18.00

COBALT—Oxide lb. 1.45@2.60

COPPERAS—Bulk 100 lb. $0.55
In bbls. " .65@.75
In bags " .60@.70

CRYOLITE lb. .06½@.06¾

FELDSPAR—Ground best sh. ton. 10.50@15.00

FIRE BRICK—
American per M. 30.00@40.00
Imported " 30.00@45.00
St. Louis No. 1 " 18.00
" No. 2 " 15.00
Extra " 20.00@23.00

FIRE CLAY—F.o.b. St. Louis.
St. Louis, extra quality per ton. 5.00
" ordinary " 2.50
Dowestic f.o.b. shipping port:

FLUORSPAR—
Domestic f.o.b. shipping port:
Lump lg. ton. 8.00@10.00
Ground " 11.50@13.50
Foreign crude ex. dock 8.00@10.00

FULLER'S EARTH—Lump, 100 lb. .80@.85
Powdered " .80@.85

GRAPHITE—Ceylon.
Flying dust, finest to best lb. .02½@.04
Dust " .02¾@.05
Chip " .04@.08
Lump " .05¾@12
Large lump " .08¾@.10½

GYPSUM—
Feritlizer sh. ton. 5.00
Ground " 4.00@7.00

INFUSORIAL EARTH—
Ground Am. Best lb. .01¾
German " .02¼@.02¾

LEAD—Acetate (sugar of) brown, lb. .07¾
Nitrate, com'l " .08¼@.08¾

MAGNESITE—Greece.
Crude (95%) lg. ton. 8.00@10.00
Calcined, powdered sh. ton. 26.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg M. 160@200

MAGNESIUM—
Chloride, com'l 100 lb. .90@1.25
Sulphate (Epsom salt) 100 lb. .85@1.00

MANGANESE—
Foreign, crude, powdered:
70@75% binoxide lb. .01@.01½
75@85% binoxide " .01½@.01½
85@90% binoxide " .01½@.05
90@95% binoxide " .06½
Ore, 80%-85% sh. ton. 16.00@32.50

MARBLE—Flour sh. ton. 8.50@10.00

MINERAL WOOL—
Slag, ordinary sh. ton. 19.00
Selected " 25.00
Rock, ordinary " 32.00
Selected " 40.00

MONAZITE SAND—
Guar. 97%, with 5% Thorium oxide, nominal lb. .08 and up

NICKEL—
Oxide, crude, lb. (77%) for fine metal contained .47
Sulphate, single lb. .09@.11
Sulphate, double " .06½@.08

NITRATE OF SODA—100 lb. 95% for '08 2.17½
95% for 1909 2.17½
95% for 1910 2.17½
96% is 2½@7½c. higher per 100 lb.

OZOKERITE—best lb. .14@.17

PAINTS AND COLORS—
Litharge, Am. powdered lb. .06¾@.07
English glassmakers' " .08½@.08½
Lithopone " .03¾@.07
Metallic, brown sh. ton. 16.50@22.00
Red " 14.00@18.00
Ocher, Am. common " 8.50@9.00
Best " 16.00
Dutch, washed lb. .02½@.03
French, washed " .01½@.02½
Paris green, pure, bulk " .21½
Red lead, American " .06¾@.07
Foreign " .08½@.08½
Turpentine, spirits bbl., per gal. .45½
White lead, Am., dry lb. .05¾@.05½
American, in oil " .06½@.06¾
Foreign, in oil " .10½@.10¾
Zinc white, Am. extra dry " .05½@.05¾
French, red seal, dry " .08¾@.08¾
French, Green seal, dry " .10¾@.10¾

PHOSPHATES—Acid 57@60c. per unit
*Fla., hard rock 77% 8.50@9.00
land pebble 68% 4.00@4.25
†Tenn., 78@80% 5.00@5.50
75% 4.75@5.00
68@72% 4.25@4.50
‡So. Car. rock, dried 7.00@7.25
" " rock, undried 5.50@5.75

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—
Bicarbonate crystal lb. $.08½@.09
Powdered or granulated " .09@.09½
Bichromate, Am. " .08½@.08¾
Scotch " .10¾
Bromide " .20
Carbonate (80@85%) " .03¾@.04
Caustic, ordinary " .04½@.05¾
Elect. (90%) " .05½@.06
Chloride (muriate), 100 lb 1.90
Chlorate, powdered " .09½@.09¾
Crystals " 09@09½
Cyanide (98@99%)
Carloads (30,000 lb.) " 18c.
5-ton lots " 18½c.
Less than 5 tons " 20c.
Kainite, long ton, bulk, 8.25; bags, 9.50.
Permanganate lb. .10@.11
Prussiate, yellow " .13@.13¾
Red " .30@.33
Sulphate 100 lb. 2.18½@2.21½

PYRITE—
Domestic, non-arsenical, furnace size, f.o.b. mines per unit. 11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines 10@10½c
Imported non-arsenical, furnace size, per unit .12½
Imported, arsenical, furnace size, per unit .12
Imported fines, arsenical, per unit. .08½@.09
Imported fines, non-arsenical, per unit 10½@11c.
Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl. .72@1.13
N. Y. agricultural sh. ton. 3.80@4.50

SALTPETER—Crude 100 lb. 4.00@4.50
Refined, crystals " 5.50@6.00

SILICA—
Ground quartz, ord'ry. lg. ton. 10.00@15.00
Silex, ground " 13.00@15.00
Silex, floated " 35.00@40.00
Lump quartz " 5.00@6.00
Glass sand " 2.75

SILVER—Nitrate, crystals oz. .33¾@.36¾

SODIUM—
Acetate lb. 04@.04½
"Alkali," per 100 lb., 58/48 " 80@.87½
Bicarb. soda, per 100 lb. 1.00@1.30c.
Soda, caustic, per 100 lb., 76/60 1.75@1.85
Soda, caustic, powdered " .02¾@.03¼
Salt cake, per 100 lb., bulk " .40
Salt cake, bbl " .65@.85
Soda, monobydrate, per lb. 1.4@1.75c.
Bichromate lb. .06½@.07
Bromide " .13@.14
Chlorate, com'l " .09@.09½
Cyanide ("100% KCN")
Carloads (30,000 lb.) " 18c.
5-ton lots " 18½c.
Less than 5 tons " 19c.
Hyposulphite, Am. " 1.35 up
German " 1.60@1.70
Phosphate 100 lb. 2.25@2.50
Prussiate " .08@.08½
Sal soda, f.o.b. N. Y. " .60@.70
Foreign, f.o.b. N. Y. " .80@1.00
Silicate, com'l, liquid " .75@.90
Sulphate, com'l (Glauber's salt) 100 lb. .60@.75
Sulphate, com'l, calcined " .65@.85

STRONTIUM—Nitrate lb. .07½@.08

SULPHUR—
Louisiana (prime) to New York, Boston or Portland lg. ton. 22.00
To Philadelphia or Baltimore " 22.00
Roll 100 lb. 1.85@2.15
Flour " 2.00@2.40
Flowers, sublimed " 2.20@2.60

TERRA ALBA—French & Eng. 100 lb. .80@1.00

TALC—Domestic sh. ton. 15.00@25.00
French " 18.00@25.00
Italian, best " 25.00@40.00

TIN—Bi-chloride, 50% lb. .09½ up
Crystals " .21 up
Oxide, lb " .33@.35

URANIUM—Oxide " 3.50

ZINC—
Chloride solution, com'l 20° " .02¼
Chloride, granular " .04½@.04¾
Dust " .05@.05½
Sulphate " .02@.02½

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites, and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.	Authorized Capital	Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 6	$2,112,381	Jan. 1909	$ .40
Alaska Treadwell, g.	Al'ka	5,000,000	200,000	25	10,385,000	Jan. 1909	.75
Alaska United, g.	Al'ka	1,000,000	180,200	5	468,470	Jan. 1909	.25
Amalgamated, c.	Mont	165,000,000	1,538,879	100	69,249,554	Feb. 1909	.50
Am. Sm. & Ref., com.	U. S.	50,000,000	600,000	100	15,500,000	Jan. 1909	1.00
Am. Sm. & Ref. pf.	U. S.	50,000,000	500,000	100	29,750,000	Jan. 1909	1.75
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	3,455,000	Dec. 1908	1.50
Am. Smelters, pf. B	U. S.	30,000,000	300,000	100	6,250,000	Dec. 1908	1.25
Am. Zinc, Lead & Sm.	Kan.	3,750,000	80,000	25	280,000	Nov. 1907	.50
Anaconda, c.	Mont	30,000,000	1,200,000	25	43,650,000	Jan. 1909	.50
Arizona, c.	Ariz	3,775,000	3,682,620	.....	6,182,361	Apr. 1906	.05
Atlantic, c.	Mich	2,500,000	100,000	26	990,000	Feb. 1905	.02
Bald Butte, g. s.	Mont	250,000	250,000	1	1,364,648	Oct. 1907	.04
Beck Tunnel, g. a. l.	Utah	100,000	1,000,000	0.10	675,000	Oct. 1907	.02
Bent'n M. & D., pf., l. z.	Wis.	600,000	196,607	1	10,949	Nov. 1908	.01½
Boston & Montana.	Mont	3,750,000	150,000	25	52,950,000	Jan. 1909	3.00
Bull, Hock. & Chem. g	Utah	1,000,000	100,000	10	3,728,400	July 1908	.10
Bunker Hill & Sull.	Ida.	3,000,000	300,000	10	10,746,000	Jan. 1909	.25
Butte Coalition, c. a.	Mont	16,000,000	1,000,000	15	2,450,000	Dec. 1907	.15
Calumet & Arizona c	Ariz	2,600,000	200,000	10	10,300,000	Dec. 1908	1.00
Calumet & Hecla, c.	Mich	2,500,000	100,000	26	107,850,000	Dec. 1908	6.00
Camp Bird, g., e.	Colo	6,500,000	820,000	6	5,510,400	Feb. 1909	.24
Carisa, c. g.	Utah	500,000	500,000	1	56,000	Nov. 1906	.01
Colorado, l. g. s.	Utah	200,000	1,000,000	0.20	1,100,000	Jan. 1909	.08
Columbus Con. c.	Utah	1,500,000	283,540	5	226,832	Oct. 1907	.20
Combi'tion Co. G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.16
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	8,385,313	Dec. 1906	.02½
Continental, z. l.	Mo.	560,000	22,000	26	231,000	Oct. 1908	.25
Copper Range Con.	Mich	40,000,000	384,185	100	7,683,700	Jan. 1909	1.00
Creede United, g.	Colo.	2,000,000	1,625,000	1	214,063	Nov. 1906	.01
Daly Judge, g. & l.	Utah	300,000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. s. l.	Utah	3,600,000	180,000	20	5,877,000	Dec. 1907	.30
De Lamar, g. s	Ida	500,000	80,000	5	835,200	Sept. 1908	.24
Doctor Jack Pot	Colo	3,000,000	3,000,000	1	277,000	June 1906	.00½
Doe Run, l.	Mo.	10,000,000	59,062	100	1,765,005	Dec. 1908	1.50
Elkton Con., g.	Colo	3,000,000	2,600,000	1	2,191,961	Nov. 1908	.01½
El Paso, g.	Colo	2,000,000	2,480,000	1	1,315,545	Dec. 1908	.01
Fed. Sm., com.	Idaho	10,000,000	300,000	100	2,708,750	Jan. 1909	1.50
Federal Sm., pf.	Idaho	20,000,000	120,000	100	4,121,250	Dec. 1908	1.75
Findley, g.	Colo	1,250,000	1,250,000	1	337,500	Sept. 1906	.01
Florence, g.	Nevada	1,250,000	1,050,000	1	420,000	Nov. 1908	.10
Frances-Mohawk, g	Nevada	1,000,000	910,000	1	546,000	Jan. 1908	.05
Gemini-Keystone	Utah	500,000	5,000	100	2,000,000	Aug. 1907	10.00
Gold King Con.	Colo	5,750,000	5,750,000	1	1,407,504	May 1906	.01
Goldfield Con., g.	Nevada	60,000,000	3,832,471	10	706,494	Nov. 1907	.10
Grand Central, g.	Utah	250,000	250,000	1	1,321,250	Dec. 1907	.04
Gwin Mine, Dev., g.	Cal	1,000,000	100,000	10	496,000	Apr. 1906	.06
Hecla, s. l.	Idaho	250,000	1,000,000	0.25	1,690,000	Dec. 1908	.01½
Homestake, g.	S. D.	22,000,000	218,400	100	23,827,440	Jan. 1909	.50
Horn Silver, g. s. c. z. l	Utah	10,000,000	400,000	25	6,642,000	Sept. 1907	.05
Imperial, c.	Ariz	5,000,000	500,000	10	300,000	June 1907	.01
Inter'l Nickel, pf.	N. Y.	12,000,000	80,000	100	1,737,957	Feb. 1909	1.50
Iron Silver	Colo	10,000,000	600,000	20	4,100,000	Oct. 1907	.10
Jamison, g.	Cal	3,900,000	390,000	10	339,300	Jan. 1909	.02
Jerry Johnson.	Cal	2,600,000	2,600,000	1	86,700	Jan. 1908	.01
Kendall, g.	Mont	2,500,000	500,000	5	1,275,000	Oct. 1908	.02
Liberty Bell, g. s.	Colo	700,000	130,551	5	130,440	Jan. 1907	.15
Lightner, g.	Cal	125,000	102,255	1	253,081	Oct. 1906	.06
Lower Mammoth, g	Utah	190,000	190,000	1	57,000	Sept. 1907	.07½
Mammoth, g. s. l.	Utah	10,000,000	400,000	2.50	2,220,000	Mar. 1908	.05
Mary McKinney, g.	Colo	2,600,000	1,309,252	1	841,093	Dec. 1908	.02
May Day, g. s. l.	Utah	800,000	800,000	1	108,000	Sept. 1908	.01½
Mohawk, c.	Mich	2,600,000	100,000	26	1,850,000	Feb. 1909	2.00
Mont. Ore Purch.	Mont	2,600,000	80,833	26	9,437,274	Jan. 1907	15.00
Nevada Hills, s. g.	Nevada	5,000,000	746,000	5	373,000	Dec. 1907	.10
New Century, z., l.	Mo.	300,000	300,000	1	213,000	Dec. 1906	.01
Newhouse M. & S. c.	Utah	6,000,000	600,000	10	300,000	Sept. 1907	.50
New Idria, q.	Cal	500,000	100,000	5	1,080,000	Jan. 1909	.30
New Jersey Zinc	U. S.	10,000,000	100,000	100	12,000,000	May 1908	4.00
North Butte	Mont	6,000,000	400,000	15	6,400,000	Dec. 1908	1.00
North Star, g.	Cal	2,500,000	250,000	10	1,911,988	Dec. 1908	.75
Old Dominion, c.	Ariz	8,750,000	293,245	25	720,710	July 1908	.50
Old Dominion, M. & S.	Ariz	1,000,000	40,000	25	364,500	Dec. 1908	1.00
Ophir, g. a	Nevada	604,800	201,600	3	1,816,360	May 1908	.10
Osceola, c	Mich	2,600,000	96,150	25	7,420,250	Jan. 1909	2.00
Parrot, c, e.	Mont	2,800,000	229,850	10	6,807,649	Sept. 1907	.25
Pennsylvania, g.	Cal	5,150,000	51,500	100	284,925	July 1905	.10
Pitts. L. & Z., l. z.	Mo	1,000,000	1,000,000	1	20,000	July 1907	.02
Portland, g.	Colo	3,000,000	3,000,000	1	8,227,080	July 1908	.04
Quartette, g. s.	Nevada	1,000,000	100,000	10	375,000	July 1907	.20
Quincy, c	Mich	3,750,000	110,000	25	18,450,000	Dec. 1908	1.00
Rocco Homest'k, l. e.	Nevada	300,000	300,000	1	112,000	Dec. 1906	.02
Sacramento, g. q.	Utah	1,000,000	1,000,000	1	255,000	Nov. 1906	.00½
St. Joseph, l.	Mo.	20,000,000	1,000,000	10	6,158,357	Dec. 1908	.15
Silver Hill, g.	Nevada	108,000	108,000	1	81,000	June 1907	.05
Silver King, g. s. l. †	Utah	3,000,000	150,000	20	11,187,600	July 1908	.33⅓
Silver King Co't'n. †	Utah	6,250,000	1,224,425	5	918,402	Jan. 1909	.30
Shannon, c.	Ariz	3,000,000	300,000	10	450,000	July 1907	.50
Snowstorm, s. l.	Ida	1,500,000	1,500,000	1	645,000	Jan. 1909	.03
Standard Con., g. s.	Cal	2,000,000	178,394	10	6,194,130	Dec. 1908	.10
Stratton's Independ	Colo	6,500,000	1,000,077	6	4,896,865	Apr. 1908	.12½
Swansea, g. s. l.	Utah	600,000	100,000	6	329,500	Mar. 1907	.05
Tamarack, c.	Mich	1,600,000	60,000	25	9,420,000	July 1907	4.00
Tennessee, c.	Tenn	1,000,000	200,000	25	2,056,250	Sept. 1908	1.25
Tomboy, g. s	Colo	1,750,000	300,000	5	2,016,000	Dec. 1908	.48
Tonopah of Nev.	Nevada	1,000,000	1,000,000	1	4,250,000	Jan. 1909	.25
Tonopah Belmont	Nevada	2,000,000	1,500,000	1	600,000	Apr. 1907	.10
Tonopah Ext'nsion	Nevada	1,000,000	928,433	1	283,030	Apr. 1906	.16
Tonopah Midway	Nevada	1,000,000	1,000,000	1	250,000	Jan. 1907	.05
Uncle Sam, g. s. l.	Utah	500,000	500,000	1	295,000	Dec. 1908	.02
United States, com.	Utah	37,500,000	350,935	50	1,798,099	Jan. 1909	.50
United States, pfd. *	Utah	37,500,000	486,845	50	4,881,377	Jan. 1909	.87½
United Cop. com.	Mont	76,000,000	460,000	100	5,962,500	Aug. 1907	1.75
United, c. pf.	Mont	6,000,000	60,000	100	1,500,000	May 1907	3.00
United, z. l., pf.	Mo.-Kan.	600,000	19,556	26	312,782	Jan. 1908	.50
United Verde, c.	Ariz	3,000,000	300,000	10	20,835,322	Jan. 1909	.75
U.S. Red. & Ref. Pf.	Colo	4,000,000	39,458	100	1,005,504	Dec. 1907	1.60
Utah, g. (Fish Sp'ga)	Utah	1,000,000	100,000	10	323,000	Feb. 1909	.02
Utah Con., c.	Utah	1,500,000	300,000	5	7,350,000	Jan. 1909	.50
Utah Copper	Utah	7,500,000	725,950	10	725,950	Dec. 1908	.50
Victoria, Utah	Utah	250,000	250,000	1	177,500	Mar. 1907	.04
Vindicator Con., g.	Colo	1,500,000	1,500,000	1	1,980,000	Jan. 1909	.03
Wolverine, c.	Mich	1,500,000	60,000	25	5,100,000	Oct. 1908	6.00
Work, g	Colo	1,500,000	1,500,000	1	172,500	July 1908	.01
Yankee Con	Utah	1,000,000	1,000,000	10	182,500	Jan. 1907	.03
Yellow Aster, g.	Cal	1,000,000	100,000	10	958,789	Aug. 1907	.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States

Name of Company and Location.	Author. Capital.	Shares. Issued.	Shares. Par Val. $	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Allis-Chalmers, pf.	U. S.	$25,000,000	161,600	100	$3,108,875	Feb. 1904	$1.75
Amer. Ag. Chem., pf.	U. S.	7,000,000	181,630	100	9,647,342	Oct. 1908	3.00
American Cement	Pa.	2,000,000	200,000	10	1,288,000	Jan. 1909	.30
American Coal	Md.	1,500,000	60,000	25	2,492,500	Sept. 1908	1.25
Bethlehem Steel, pf.	Pa.	16,000,000	160,000	100	900,000	Nov. 1906	.75
Cambria Steel	Pa.	60,000,000	900,000	50	9,450,000	Feb. 1909	.75
Central C. & C., com.	Mo.	6,125,000	61,250	100	2,696,875	Jan. 1909	1.50
General Chem., pf.	U. S.	1,875,000	18,750	100	1,453,125	Jan. 1909	1.25
Col. & Hock. C. & I, pf.	Ohio	7,000,000	69,244	100	383,818	Apr. 1908	1.50
Consolidated Coal	Ill.	5,000,000	50,000	100	360,000	July 1904	1.00
Consolidation Coal	Md.	10,250,000	102,500	100	10,441,650	Jan. 1909	3.50
Crucible Steel, pf.	Pa.	26,000,000	244,965	100	8,186,228	June 1907	1.50
Empire S. & I., pf.	N. J.	2,500,000	25,000	100	933,033	Jan. 1909	1.50
Fairmont Coal	W. Va.	12,000,000	120,000	100	1,980,000	Jan. 1909	2.00
General Chem., com.	U. S.	12,500,000	74,103	100	2,148,987	Dec. 1908	1.00
General Chem., pf.	U. S.	12,500,000	100,000	100	6,255,000	Jan. 1909	1.50
International Salt	Penn.	30,000,000	182,280	100	911,400	Dec. 1906	1.00
Jeff. & Cl'f C. & I., cm.	Pa.	1,500,000	15,000	100	330,000	Aug. 1905	5.00
Jeff. & Cl'f. C. & I., pf.	Pa.	1,500,000	15,000	100	862,500	Aug. 1908	2.50
Kern River Oil	Cal.	2,000,000	20,000	100	84,000	July 1908	.10
Lehigh Coal & Nav.	Pa.	19,113,000	382,260	50	*15,014,890	Nov. 1908	2.00
Maryland Coal, pf.	Md.	2,000,000	18,850	100	†2,013,497	Dec. 1908	2.50
Monon R. Coal, pf.	Pa.	10,000,000	100,000	100	2,324,000	July 1908	8.00
National Carbon, com.	U. S.	6,500,000	65,000	100	715,000	Apr. 1908	1.00
National Carbon, pf.	U. S.	4,500,000	45,000	100	3,071,250	Nov. 1908	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	3,092,872	Jan. 1909	1.25
National Lead, pf.	N. Y.	15,000,000	149,040	100	17,894,248	Dec. 1908	1.75
Nat'l Steel & Wire, pf.	N. Y.	5,000,000	26,778	100	2,831,551	May 1906	1.75
New Central Coal	N. Y.	1,000,000	60,000	20	390,000	Nov. 1907	.40
New River Coal, pfd.	W. Va.	4,000,000	37,617	100	461,405	Nov. 1908	1.60
Pacific Coast Borax	Cal.	2,000,000	19,000	100	2,086,500	Aug. 1905	1.00
Peerless Oil	Cal.	1,000,000	92,000	10	711,000	June 1908	.06
Penna. Salt	Pa.	3,000,000	60,000	50	15,098,000	Oct. 1908	3.00
Penna. Steel, pfd.	Pa.	25,000,000	166,000	100	8,662,500	Nov. 1908	3.50
Phila. Gas, com	Pa.	36,000,000	664,800	50	‡24,264,640	Feb. 1909	.75
Phila. Gas, pf.	Pa.	8,000,000	120,000	50	2,850,000	Sept. 1908	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas C. C., pf. †	W. Va.	2,800,000	28,000	100	252,000	Jan. 1909	8.00
Pocahontas C. C., cm †	W. Va.	5,000,000	45,200	100	†406,800	Oct. 1908	3.00
Republic I. & S., pfd.	Ill.	25,000,000	204,189	100	6,045,338	Apr. 1908	1.75
Sloss-Sheffield, com.	Ala.	10,000,000	100,000	100	1,885,000	Dec. 1908	1.00
Sloss-Sheffield, pf.	Ala.	10,000,000	67,000	100	4,221,000	Jan. 1909	1.75
Standard Oil	U. S.	100,000,000	970,000	100	623,522,905	Jan. 1909	10.00
Tenn. C. & I., common	Tenn.	22,655,500	225,636	100	3,683,060	Nov. 1907	1.00
Tenn. C. & I., pf.	Tenn.	248,000	2,480	100	390,040	Nov. 1907	2.00
Texas & Pacific Coal	Texas	2,500,000	23,940	100	1,711,710	June 1908	1.00
United Metals Selling	U. S.	5,000,000	50,000	100	5,875,000	Jan. 1909	5.00
U. S. Steel Corp., com.	U. S.	560,000,000	6,088,025	100	81,306,544	Mar. 1909	.50
U. S. Steel Corp., pf.	U. S.	$60,281,100	$,602,811	100	225,280,192	Mar. 1909	1.75
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	14,340,869	Jan. 1909	10.00
Warwick I. & S.	U. S.	1,500,000	148,671	10	617,739	Nov. 1908	.80
Westmoreland Coal	Pa.	3,000,000	60,000	50	8,880,000	Oct. 1908	2.50

*Since 1894. †Since 1907. ‡Since 1890.

Canada, Mexico, Central and South America

Name of Company and Location.	Author-ized Capital.	Shares. Issued.	Shares. Par Val. $	Dividends. Total to Date.	Latest. Date.	Latest. Amt.
Amistad y Conc'rdia.	Mex.	$480,000	9,600	50	$417,070	Apr. 1908	$1.25
Batopilas	Mex.	9,000,000	446,258	20	† 65,784	Dec. 1907	.12½
British Columbia, c.	B. C.	1,000,000	503,000	5	201,200	Sept. 1907	.40
Buffalo, g.	Ont.	1,000,000	900,000	1	307,000	Feb. 1909	.01
Butters' Salvador, g.	Salv.	750,000	160,000	5	600,000	Apr. 1905	.25
Cobalt Central, s.	Ont.	5,000,000	4,761,500	1	95,230	Feb. 1909	.02
Coniagas (Cobalt)	Ont.	4,000,000	800,000	5	720,000	July 1908	.15
Consolidated M. & S.	B. C.	5,500,000	63,552	100	783,885	Nov. 1907	1.25
Crow's Nest Pass	B. C.	4,000,000	160,000	25	2,018,648	July 1907	.62½
Crown Reserve, s.	Ont.	1,750,000	1,750,000	1	350,000	Jan. 1909	.16
Dolores, g. s.	Mex.	2,000,000	400,000	5	540,000	Feb. 1909	.15
Dominion Coal, com.	N. S.	16,000,000	150,000	100	3,150,000	Jan. 1909	1.00
Dominion Coal, pf.	N. S.	3,000,000	30,000	100	‡630,000	Feb. 1908	3.50
Doe Estrellas, g. s.	Mex.	150,000	300,000	0.50	3,780,000	Jan. 1909	1.00
El Oro, g. s.	Mex.	6,750,000	1,080,000	5	4,989,500	July 1908	.34
Esperanza, s. g.	Mex.	2,275,000	455,000	5	9,922,400	Oct. 1908	.87½
Foster Cobalt, s.	Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.06
Granby Con.	B. C.	15,000,000	135,000	100	3,508,630	Dec. 1908	2.00
Greene Con. Copper	Mex.	8,640,000	864,000	10	6,137,800	Mar. 1907	.40
GreenGold-Silv'r, pfd.	Mex.	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato	Mex.	3,000,000	640,000	5	74,250	Oct. 1906	.07
Guanajuato D., pfd. e	Mex.	1,000,000	10,000	100	80,000	July 1908	8.00
Guggenheim Expl.	Mex.	17,000,000	105,000	100	6,010,000	Jan. 1909	2.50
Hinda Con., g. s. c. l.	Mex.	6,000,000	6,000,000	1	100,000	Feb. 1908	.02
Kerr Lake, s.	Ont.	3,000,000	600,000	5	970,000	Mar. 1909	.20
La Rose Con., s	Ont.	7,500,000	1,143,368	5	400,179	Jan. 1909	.20
LeRoi, Ltd., g.	B. C.	5,000,000	200,000	25	425,000	Dec. 1906	.48
LeRoi No. 2, g.	B. C.	8,000,000	120,000	25	831,600	July 1908	.48
McKinley-Darragh, s.	Ont.	2,500,000	2,000,000	1	480,000	Jan. 1909	.05
Mex. Con. M. & S. Co.	Mex.	2,500,000	240,000	10	1,350,000	Mar. 1908	.25
Mex. Mill. & Trans. pfd	Mex.	2,000,000	12,000	100	36,460	Jan. 1908	3.00
Mines Co. of Am.	Mex.	2,000,000	2,000,000	1	3,465,000	Feb. 1909	.02
N. Y. & Hond. Ros.	C. A.	1,500,000	150,000	10	2,467,000	Jan. 1909	.10
Nipissing, s	Ont.	6,000,000	1,200,000	5	2,340,000	Jan. 1909	.26
N. S. St. & Coal, com.	N. S.	5,000,000	49,876	100	1,087,856	Apr. 1908	1.50
N. S. St. & Coal, pf.	N. S.	1,030,000	10,300	100	458,350	Oct. 1908	2.00
Penoles*	Mex.	250,000	2,500	100	8,630,000	Dec. 1907	20.00
Peregrina, pfd.	Mex.	1,000,000	10,000	100	188,666	Sept. 1908	5.50
Pingarron, pfd. e	Mex.	2,000,000	20,000	100	240,000	Oct. 1908	3.00
Platanillo	Mex.	500,000	206,989	1	6,580	Sept. 1906	.00
Reco, g. s. l	B. C.	1,000,000	958,000	1	327,082	Apr. 1906	.02
Securities Corp., pfd.	Mex.	200,000	2,000	100	42,699	July 1908	3.50
Silver Queen, s	Ont.	1,500,000	1,500,000	1	345,000	Nov. 1908	.06
Temiskaming, s.	Ont.	2,500,000	2,500,000	1	375,000	Jan. 1909	.06
Tezuitlan Copper	Mex.	2,000,000	10,000	100	.....	Dec. 1908	1.20
Tilt Cove, c.	N. F.	1,000,000	89,000	2	496,630	May 1908	.55
Tretheway, s.	Ont.	1,000,000	945,450	1	217,463	Dec. 1908	10.
Tyee, c.	B. C.	940,000	180,000	5	201,600	Aug. 1907	.61

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The Coahuila Mining and Smelting Company, Ltd., of Viesca, Coahuila, Mexico, will be interested in receiving descriptive literature on pneumatic ore-separating machinery.

McClintic-Marshall Construction Company, designers, manufacturers and erectors of steel buildings, bridges, etc., Pittsburgh, Penn., has opened an office in 839 Central building, Seattle, Wash. C. F. Boyce is the sales representative in charge.

The Youngstown Car Manufacturing Company, builders of ore and mining cars, has recently moved its Chicago office and is now located at 1603 Fisher building. The office is in charge of Charles B. Owens, formerly of the American Car and Foundry Company.

Wm. Ainsworth & Sons state that they have received an order for three 18-in. precision wye levels and two 5-in. precision transits from the Aqueduct commission in charge of the construction of the Los Angeles aqueduct, awarded chiefly on account of the interchangeability of parts, rigidity and workmanship.

The South Scranton tunnel of the Scranton Gas and Water Company is 4200 ft. long and 7x10 ft. in section. All of the drills (16 in number) used on this extensive piece of work were furnished by the Wood Rock Drill Company, of Paterson, N. J. They were only used after being in active competition with the drills of other manufacturers.

The Dearborn Drug and Chemical Works reports that the general business of the company for the last six months of 1908 was larger than for any other six months in its history, indicating the quick return of prosperous business conditions. The percentage of increase the past six months, and especially for January, in the eastern department of the company, is particularly gratifying.

Robert W. Hunt & Co., consulting and inspecting engineers, has engaged the services of John Cargill, who will make his headquarters at the firm's New York office, 90 West street. He will largely devote his attention to the examination and report upon railway and other corporate properties, for which his experience gained while connected with the Pennsylvania lines, British Westinghouse, Metropolitan Railway Company of London, and other organizations, has prepared him.

The Cyclone Drill Company has rented offices in Chicago. In the past few years the company has secured a large portion of its business from Chicago from mining properties in the North and West. The business from that point having grown to such an extent it was recently decided to open an office there to take care of the trade to better advantage for both the customers and the company. J. F. Munn, who has had charge of the core drill department at the factory for several years, will take charge of the Chicago office. Mr. Munn has had a very broad experience in drill work, covering both core and churn drilling, and his experience will be valuable to the buyers of prospecting machinery. R. R. Sanderson will succeed Mr. Munn at the Orrville office. The Chicago address of the company is 419 Fisher building.

The U. S. Flexible Tubing Company, whose San Francisco establishment has been temporarily located at Beale and Mission streets, has now moved to its permanent location, 63 and 65 Main street, San Francisco, Cal. The new quarters will enable the company to care for the wants of its patrons promptly. The new establishment will afford considerable space required to handle the long lengths of metal hose for installing connections and the testing of same, as the company will not allow metal hose to leave its establishment without being subjected to a thorough test. The popularity of metal hose is ever increasing and with it the company endeavors to meet the demand. The new quarters will also enable it to carry a larger stock of metal hose so as to meet all requirements. A cordial invitation is extended to all the company's friends to call at its new establishment.

A complete line of air compressors as built by the Thos. H. Dallett Company, of Philadelphia, Penn., brings out many excellent and unique ideas in compressor design. The frame is of the open-fork center crank type, and of an especially massive and rigid design to obtain on each size compressor a greater range of capacity by substituting, when desired, a cylinder of the next larger size than the standard to operate at 100 lb. pressure. For example: On an 8-in. stroke compressor the regular cylinder for 100 lb. pressure is 8 in. in diameter, but a 10-in. diameter cylinder can be substituted and still operate at the above pressure, whereby a greater volume of air is obtained with but a slight increase in cost of machine. In the case of duplex compressors with compound steam cylinders, a difficulty has been, if the machine stops with the high pressure side on the dead center, which occurs frequently, it will not start automatically, this being due to the fact that but one side (the high pressure) takes steam from the line. This trouble has been overcome by using a reducing valve of standard make, which reduces the live steam pressure for use in the low pressure cylinder, thus if the high pressure side stops on the dead center, live steam is fed to the low pressure cylinder through the reducing valve, starting the compressor. It is obvious that steam from the boiler is taken into the low pressure side only when starting, otherwise the operation is identical with any compound machine. The cross head is a new-type box pattern, made of semi-steel. Its shoes are adjustable and of large bearing surface. The upper shoe is lubricated by means of a sight-feed lubricator, and the lower shoe runs continually in a bath of oil. One of the features of this design is the side openings, which allow easy access to the cross-head shoe binder bolts. The cross-head pin is tool steel, hardened and ground. It is fitted to tapered seats in the cross-head, drawn tight on the tapers by means of a nut held in position by a pin. Means are provided for turning one-quarter revolution in case it wears flat on the two bearing sides, thus doubling the wearing capacity. The air intake and discharge valves have been given most careful consideration, and are special features of these compressors. The intake valve is of the automatic poppet type, contained in a malleable-iron cage. The cage is one piece, and combines both seat for the valve and guide for the valve stem. The cage is threaded and screws into the wall of the air-intake chamber only, and is simply seated in a recess on the main cylinder wall, using thin corrugated copper gaskets to secure a tight joint. A hexagonal recess has been cast in all cages to accommodate a special cast-steel wrench for use in removing and replacing valve cages. The valve cage cap acts as a lock nut for holding the cage in place after it has been screwed down on its seat in the cylinder. It is provided with a hexagonal projection, and the same wrench can be used here as on the valve cage. In the case of compound machines, corrugated copper gaskets are placed under the valve cage caps on the high pressure cylinder to insure against any leakage, as the discharge pressure from the low pressure cylinder is constantly at these joints. The valve proper is a special alloy-hardened steel, with seat and stem ground to gage. The valve spring is of phosphor bronze and of the right proportion to give the valve an easy opening and a quick closure. Much annoyance and trouble has been caused on certain makes of intake valves due to the spring holder shearing off or working loose. The cause of this trouble is due to the sudden stopping of the valve on its seat, which tends to drive the spring holder off the valve stem. This effect may be likened to driving a hammer on its handle by means of hitting the handle on its opposite end. The principle involved is identical. To eliminate this defect and the trouble caused by threading and pinning the spring holder to the valve stem, solid ends have been employed by some builders, which necessitates a split guide and complicates the valve parts. On the "Dallett" valve the spring holder comprises a split taper ring set in a recess on the valve stem and held together and tight to the stem by means of a solid taper ring slipping down over it. The hammering of the valve on its seat tends to tighten the spring holder on the stem instead of driving it off, due to the action of the taper. The discharge valve is of the automatic poppet type contained in a valve cage of malleable iron. The method of seating in the cylinder and locking in its seat is identical with that of the intake valve. A projection or boss has been provided on the valve cap which acts as a positive stop for the valve when it has reached a lift giving a full opening area, and does away with fluttering. This same projection on the cap also acts as a spring guide for the valve spring. The intercooler plays a very important part in economical operation of a two-stage machine. The "Dallett" intercooler is of large cooling area, employing the return-flow type of water circulation, using baffle plates to deflect the flow of air and aid in its effectual contact with the cooling tubes. This method is very efficient in reducing the temperature of the air between stages to approximately the original temperature, thus tending to reduce the final or discharge temperature and also the horsepower required for a given capacity. The nest of cooling tubes may be removed intact from the intercooler box without disturbing any of the piping, as unions are supplied to obviate this feature. The intercooler is supplied with pop safety valve, pressure gage and drain valve. In a compressed-air plant the demand for air is often of such an intermittent character that automatic regulation of the supply of air in accordance with the demand becomes a necessity. The belt-driven machines are provided with an unloading device which automatically unloads the air cylinder. When a certain determined pressure is reached in the air receiver, one or more inlet valves at both ends of the air cylinder are held open and the load is taken off the compressor, allowing it to run light until the pressure drops in the receiver, upon which the valves are released and air compression is resumed. On the steam machines, a combined speed and pressure governor is used. This governor unloads the air cylinder exactly the same as on a belt-driven machine, and at the same time it controls the speed, allowing a single steam machine to just turn over when unloaded, and bringing a duplex or compound machine to a dead stop. By this means a great saving in steam is effected and the wear and tear on the working parts, as in the case of continuous running machines, is reduced. A complete unloading equipment is furnished with all machines. The compressors described are built in sizes from 8-in. stroke up to and including 16-in. stroke, and give a range of capacity from 79 cu.ft. of free air per min. to 1200 cu.ft. Special machines for any capacity, pressure or service, or any standard machine direct connected to motor, water wheel or gas engine, can be furnished in addition to the standard line.

Trade Catalogs

Lehigh Car Wheel and Axle Works, Fullerton, Penn. Catalog. Fuller-Lehigh pulverizer mill. Illustrated, 45 pages, 9x12 inches, paper.

John V. N. Dorr, Equitable Bldg., Denver, Colo. Catalog. Dorr classifier and Dorr continuous slime thickener. Illustrated, 24 pages, 6x9 inches, paper.

Hunt Filter Company, Metropolis Bank building, San Francisco, Cal. Catalog. Hunt continuous slime filter. Illustrated, 8 pages, 6x9 inches, paper.

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SMELTING & REFINING COMPANY
Smelters and Refiners of Gold, Silver, Lead and Copper Material
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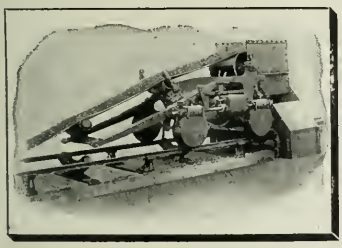

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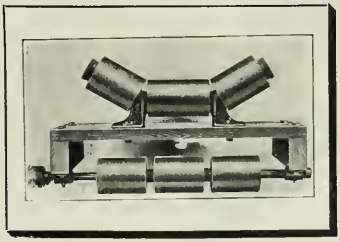

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SMOOTH=ON CEMENTS

"Mining camps should keep *Smooth-On.*" It's the next best thing to a fully equipped foundry. In fact it's often *better*, as it permanently makes repairs *in place* and saves knocking the machinery or piece apart. No long delays, no transportation charges.

Smooth-On Iron Cement is applied as a paste or putty and expands when metallizing. When hard, it stands red heat, steam pressure, water or oil, expands and contracts with the metal and lasts as long as the piece to which it is applied. Use it for *first and final aid* to leaky boilers, tank or pipe connections, cracked pumps and the thousand and one other repairs which are continually springing up.

Write for Instruction Book No. 7—a little volume full of hints and helps on *repairing.*

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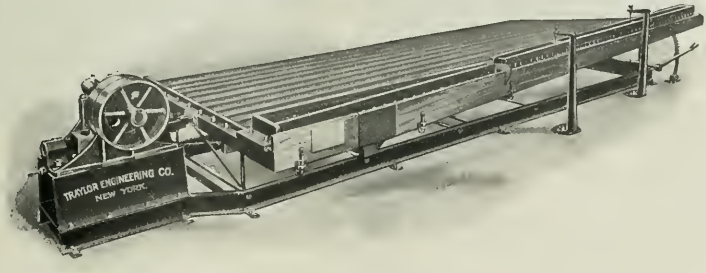

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The Concentrating Table which we are presenting to the users of metallurgical machinery is superior in every particular to those offered by our competitors. We can satisfy you of this fact if you will give us the opportunity. We will not only tell you what we claim for this table, but will give you proof of what our customers think of the Traylor Table.

(EXTRACT FROM LETTER)

"The Traylor Table has run with but few periods of shut-down, and has required repairing to a very much less extent than that required by tables of other make with which the mill is provided. The table appears **best adapted to handle a pulp intermediate in size of grain between that ordinarily treated by tables and vanners.** With that kind of a feed, **the mill men prefer to run the Traylor Table."**

Every one who has used and are using the Traylor Table speak of it in terms as highly complimentary as the mill manager who made the above statement. Give us an opportunity to prove that our claims are justifiable. Write to us for our catalog on the Traylor Table and let us give you prices.

POWER, HOISTING & MINING MACHINERY, Cat. F—79
CONCENTRATING MILLS & MACHINERY, Cat. H—79
STAMP MILLING MACHINERY, Cat. I—79

Catalogs are Free

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PITTSBURG OFFICE—1620 Farmers Bank Bldg. Geo. T. Ladd, 3 V. P.
Agents—Newbury Machinery Co., Century Building, Denver, Colo.
Cable Address—TRAYLORIAN.
Code—McNeill's, W. U. T.

Where the House Organ Falls Down

Being a Sermonette Letter from Our Old Man to a Sales Manager Who Solicited an Advertisement for His Own Pet Scheme

DEAR SIR:—We have your letter soliciting our advertising for your house organ, and in reply submit the following heart-to-heart talk on the whole subject:

We do not advertise in house organs for a great many reasons.

One reason is that if we advertised in one, we should in all, and this would be impossible, because there are too many.

Like the styles, the croup and the pip, the house organ becomes fashionable about once in seven years—it is epidemic now.

The house organ is no more a newspaper than any other of the owners' circulars. It is made to look like one, and those little versed in engineering publications are sometimes fooled—but the publisher most of all.

The trouble with the house organ is insurmountable—*it holds a brief for the concern that publishes it.*

The real trade paper *holds a brief for its readers*, and is published in their interests.

That is why the best men in its line pay for the real paper, read it and trust it.

No house organ, given away in the trade, can ever hope to be more than another piece of advertising for the house, and biased in favor of the products of the house.

If it were not there would be no use in sending it out.

Your paper may attract some attention from the people to whom you give it; but attention is not an offer of marriage, as many another flirt has found out.

We believe that everything in this world is appreciated at about what it costs—house organs cost the reader nothing directly.

A house organ sent free to a busy man responsible for results somewhere in the engineering world is something like an unbidden guest at his daughter's wedding.

The technical paper he takes and has taken for years is an old friend. Invited? Yes, and to supper afterward, and to stay all night, and over Sunday.

The house organ man is not the only one who misunderstands. There are lots of advertisers who think, and say, that they support the papers—and some publishers know no better.

But the truth lies a little farther on. The subscriber pays the publisher directly just about the price of white paper. *But he pays all the advertiser puts up for advertising as well.*

Advertisers expect to get back all they pay for advertising, and more—who can pay it except those who read the advertising and invest their money in the goods advertised?

And this pays the advertiser in more ways than one. Goods that are continuously advertised are better than others, because they could not be kept on the market if they did not give satisfaction. Advertisers make more goods than non-advertisers and it costs them less to sell—all to the buyer's profit.

That's why we keep our hats off to the readers of our papers, and that's why the advertiser should take off his hat to the same good customers.

Very few thinking men believe now that the landlord, and not the tenant, pays the taxes on property—the landlord pays them only when the property is vacant.

When any machine-building concern issues a house organ we are sorry, not so much because it may cut into our revenue, but because it shows that that concern has not yet learned the difference between publicity and advertising—between printing and publishing.

You can get publicity by eloping with the cook—but it isn't advertising.

You can make a house organ that looks just like the AMERICAN MACHINIST, but it is only printing—not publishing.

Publishing is a fruit tree of slow growth, and only begins to bear after years of cultivation and care—not a Johnny-jump-up that blooms every year you scatter some seed.

It takes years to build up confidence in a trade or technical paper to a point where the busy man finally depends upon that paper to sift out the news of his business, or some part of his business, and present it to him, partly digested.

It takes years for him to know that it will find and show up the new processes in his business, the new machines, the new materials, and come to his hand weekly with a condensed catalog of all the machinery and appliances that he needs in his plant.

It takes years to make him feel that it is unbiased, above board and fair, and that if he reads it regularly he need not worry much about something important getting by him that he should have known about.

Every manufacturer, every important man of affairs, depends on some paper in that way.

Some papers deserve and some only partly deserve this confidence, but the house organ never gets there and never can.

It's masquerading as a newspaper is in itself an insinuation to the intelligent man that he doesn't know the difference—he does, and you cannot afford to lose his friendship.

We need say little of those "near" house organs that print a few pages of slush, totally foreign to the subject, sandwiched between a few pages of ads for the owner. Curiosity may cause some of the right people to look at them for a time or two, but with never a thought of business. They only go to show how little some manufacturers know about advertising and how easy they are influenced by their amateur organ grinder.

The same money spent in regular, established papers will insure better returns, and work with the grain, not against it.

The same newsy matter, your shop news, now saved up for the house organ, in your regular space in the real paper will make that space twice as effective.

Why do manufacturers let their advertising men write newsy, interesting stuff in the house organ and have a fit if they see it in their paid-for space?

Some of the house organ publishers are the very people who say that there are too many trade papers now.

Yet they propose to have a paper for every shop—not one or two for every trade.

There are about twenty house organs in the lines of our three engineering papers; most of them less than a year old. If each of these can get an ad. from the other, and all from the trade papers and other manufacturers, the breed will multiply like rabbits, nobody will read any of them, and the trade paper will wish it hadn't kept still so long.

The establishment of a house organ taking ads. from the trade for free distribution is bad enough, but asking those papers that have been built up by years of labor and investment of money to advertise in them is just as attractive a proposition to a publisher as it would be to you if we published article after article advising people not to buy your machines, but to build them themselves.

Any house organ is a circular for the concern that sends it out, masquerading under the guise of a trade paper, and assuming that the people that get it don't know what they are driving at.

Assuming that any customer is a fool, is, we believe, not now taught as "good form" in any school of salesmanship.

When you see our advertising in any house organ, clip it out and send it in and we will give you one just as big.

BRIQUETTING MACHINERY

CONVERT YOUR FINES INTO LUMP ORE.

Chisholm, Boyd & White Company,
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Coal and Ore Briquetting Machinery

Patented process and machinery designed and built to meet American conditions. Low cost of operation. Same equipment will produce different sizes of briquettes. Can use either melted or crushed pitch for binder. No experiment. Complete plants erected.

Mashek Engineering Company,
141 Broadway, New York.

WHAT'S TOO SMALL TO HAND PICK IS TOO LARGE TO LOSE

The McLanahan Ore Jig saves the fines. It's rank folly to lose the values contained in your ore-bearing mud. The McLanahan machinery and Ore Washing Devices will net you a steady income. Write for catalog.

McLanahan-Stone Machine Company,
Hollidaysburg, Pa.

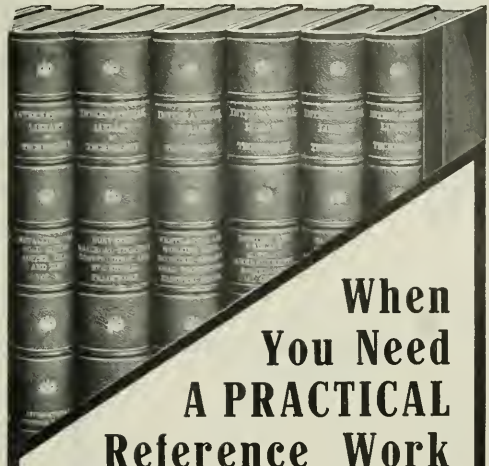
There's A Vast Saving

of gold Values that ordinarily pass out from below your plates and traps.

The PIERCE AMALGAMATOR saves all your flour gold by its installation. Be alert—stop the leaks, it's money in your pocket.

Catalog "F" tells the story. Write for it to-day.

L. S. PIERCE,
Denver, Colo., U. S. A.



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—you need a work that will give you the best up-to-date modern practice—not long-winded obstruse theories, but the every-day practice in use by the best mining experts—clearly stated facts that can be easily and quickly understood, remembered, and applied. There is no other reference mining work in the world that can meet this description so well as the International Library of Mining. This is an epitome of the years of experience of the best mining experts in the country edited in a style that 17 years of experience in publishing home-study textbooks has proved the easiest to learn, to remember, and to apply. The 13 volumes of this Library are part of a series of textbooks that cost $1,500,000 to prepare. They are recommended by the highest authorities and are used in nearly all of our leading universities and colleges. They treat of practical mining and mining methods, starting from the simplest problems and comprehensively covering the whole science of mining both for coal and metal mines. Not only can they be used to great advantage by mine owners, mining engineers, and mine officials, as an authoritative guide in their business, but since they can be clearly understood by all persons having no knowledge of higher mathematics, they can be used by all classes of mine workers who are desirous of advancing their positions and bettering their salaries.

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The Engineering and Mining Journal
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THIS book is devoted exclusively to mining methods. Mr. Mayer covered the most important British and European mining sections, making a comprehensive study of the mining problems and methods with a view to their adoption in America.

Despite the fact that our American methods are clearly traced to foreign origin, little is known of advanced European methods in this country and in the same way there is little intercommunication between different foreign States and countries owing to variations of language and dialect.

The book places the latest information at the disposal of mining engineers and mining men. It is a most valuable piece of work and of the greatest importance to the mining man who seeks more economical and practical methods.

The illustrations from photographs taken in the mines by the author are a striking feature.

Description of Contents

Among many valuable sections, the following deserve special emphasis:

The "caving" system, as employed at its birthplace, Cumberland, England.

The great sea barrier at Hodbarrow, England, by which the Irish Sea is held back and rich iron ore extracted within its area.

The spectacular underground methods employed in Wales, the great heights attained by ladders, supported tent-pole fashion, and the grappling with many hazardous conditions with supreme confidence.

The Longwall system, much neglected in America. The English and French use it extensively and successfully under a great variety of conditions.

Robbing of high pillars with treacherous roofs and without timber accomplished with great skill in many places.

The keynote of the book is the highest efficiency in extraction, with the greatest economy, that valuable material shall not be left in pillars instead of going to the markets.

The Chapter Headings

Part I—Mining in Great Britain

Mining in Great Britain. Parkside Mine, Cumberland. Creator Moor Mine, Cumberland. Ullcoat Mine, Cumberland. Hodbarrow Mine, Cumberland. Longwall Methods of Mining Flat Seams. Seaton-Delaval Colliery, Northumberland. Chopwell Colliery, Northumberland. Kimblesworth Colliery, Northumberland. Watnall Colliery Midland District. Coal Mining in South Staffordshire. Spawood Iron Mine, Yorkshire. Park Pit, Yorkshire. Oakley Slate Quarries, North Wales.

Part II—Mining in Germany, France and other countries

Lead Mining at Mechernich, Prussia. The Flushing System. Coal Mining in Silesia. Flushing System at Gute Hoffnung Lead Mine, Germany. Ilsede Hütte Iron Mine, Peine, Germany. Coal Mines of Carmaux, France. Notes on Mining, Timbering and Lighting.

The Engineering and Mining Journal

VOL. LXXXVII. NEW YORK, FEBRUARY 13, 1909. NO. 7.

Mining and Milling at Rawhide, Nevada

The Mines Have as yet Reached No Great Depth and Are Developed Chiefly by Leasers, but the Camp Has a Promising Future

BY G. E. WOLCOTT*

Rawhide lies just within the northern boundary of Esmeralda county, Nev., and a little north of east from Schurz, 24 miles distant, at the head of Walker lake. Schurz is the nearest railroad station and most freight and express business is done through this town. Automobile lines run to Schurz, to Fallon, 50 miles northeast and to Mina, about the same distance to the south. The automobile fare from Schurz is $10, and from Fallon or Mina, $12.50 for a one-way ticket.

Rawhide has a water-works system, which is, however, rather unsatisfactory and will necessarily be replaced later by a more efficient one. Water is obtained at a depth of 160 ft. in a flat, and about five miles southeast of the town. It is pumped to a wooden reservoir situated on a hill between the pumping plant and the city and then flows by gravity to the water mains. Only the business portion of the town is piped, and when lines are carried to dwelling houses they must be paid for by the owners of the houses supplied. A large part of the water is still hauled from wells near the pumping plant, where it is sold to dealers at 10c. per bbl. At the houses it is retailed at $1 per barrel. The town has as yet no efficient lighting system, and no electric power. A power line is soon to be extended from Yerington. Power for hoisting is of the old reliable "armstrong" type in the early stages of development, and gasolene hoists are used after sinking from 50 to 150 ft. Wood is used in the houses for cooking and heating purposes and costs $22 per cord delivered. Lumber costs $45 per thousand for ordinary lengths and shapes.

Location

The camp lies near the base of an irregular range of hills, the most prominent landmark being Sugar Loaf mountain, about five miles to the westward. This mountain presents an interesting rock formation in the shape of columnar basalt, which forms the entire top of the mountain. Immediately east of the peak are strong evidences of an ancient volcanic crater, while farther to the east and nearer Rawhide are at least two distinct lava flows, the later one being a volcanic breccia from the inclusion of boulders from a previous flow. It is probable that this eruptive center is connected in a way with the formation of the orebodies of Rawhide, although not an immediate cause. Secondary phenomena attendant upon the gradual cooling of the affected area have probably been the immediate cause.

Geology

In the absence of detailed field work a discussion of the geological features of the district must at this time be very meager. Within a radius of five miles of the camp may be found almost all gradations of igneous rock, ranging from granitic to finely felsitic in texture and from basic to extremely acid in chemical composition. The prevailing rock in which the known orebodies occur is a very acid light-colored rhyolite. Grutt and Baloon hills are composed almost entirely of this material, while Hooligan hill has considerable andesite.

The hills to the northwest are almost entirely rhyolite. The basalt intrusions to the westward have already been spoken of. Besides these there are various other intrusions of this same material, but of less extent, breaking through the rhyolite in several localities. Because these intrusions are entirely surrounded in places by rhyolitic material it is probable that they are later than the rhyolite; also the fact that the basaltic flows, before spoken of, lie on top of rhyolite practically proves the correctness of the assumption.

SOURCE OF RAWHIDE WATER SUPPLY

MILL, RAWHIDE QUARTZ MILLING AND MINING COMPANY

*Mining engineer, Rawhide, Nev.

Ore-bearing Area

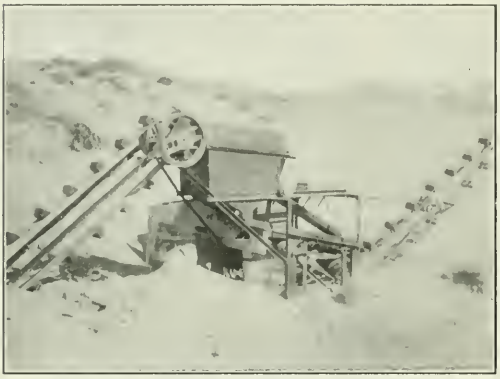
A circle drawn from the main street of Rawhide and embracing Grutt, Baloon, Murray and Hooligan hills will include the main portion of the gold-producing area. Many prospects of more or less importance occur outside of this area, but these are of secondary importance so far as developed. Regent, lying about two miles to the northwest, has two shippers and presents a considerable area of much promise. Royal hill, two miles to the westward also has a producing mine. Favorable quartz veins in rhyolite also occur two miles to the northeast, but they have not as yet shipped any ore. From this it appears that the productive area from which Rawhide will draw its ores is of considerable extent.

Placer Gold

The ravine in which the main portion of Rawhide is situated, as well as those south and southwest of the town, have furnished considerable placer gold and are still being worked to some extent. The lack of water has been a drawback in placer mining.

The dry-washing machine shown in an accompanying illustration ran with some success for a few months. This machine utilizes the principle of the jig except that the water is replaced by a rising current of air. The machine consists of a chain-bucket elevator into which the gravel is shoveled. This elevates the material to a revolving trommel, the oversize from which goes to the dump, while the undersize passes to two iron plates 7 ft. long by 1 ft. wide set at an angle to suit the conditions of operation. These plates have D-shaped openings about ½ in. wide and ½ in. deep, through which the rising current of air passes. Across the bottom of the plate a wire screen is attached, while a sheet-iron trough running the length of the plate serves to catch the concentrates and also to direct the air current which acts as the separating medium. The air current is produced by a belt-driven fan connected to the gasolene engine which furnishes the power for the whole operation. The plates are given a horizontal motion by suitable mechanism. The machine illustrated was operated by a 11-h.p. engine, and is said to have effected a saving of about 90 per cent. of the gold. An installation for wet washing in the lower part of the town is now in operation. This is working from a 70-ft. shaft, the bedrock being at that depth. Water is obtained in this case by connection with the city water main. Several hand rockers are also operated in the small ravines, the water being bought by the barrel.

The gravel deposits below Rawhide are of considerable depth and would seem to offer a good field for dredging operations provided sufficient water could be obtained. So far as I know, however, there has been no systematic sampling to determine its value.



DRY WASHER USED ON RAWHIDE GOLD PLACERS

KERN'S NO. 2 MINE, RAWHIDE, NEV.

The Orebodies

The orebodies consist essentially of quartz gangue, either massive in the vein, or in the shape of a network of quartz veinlets impregnating the country rock. Massive quartz is especially prominent in the Murray lease toward the lower end of Baloon hill, sometimes called Murray hill.

So far as developed most of the veins are either vertical, or only slightly inclined, and show, as a rule, a northeast-southwest trend. The ore carries chiefly gold with subordinate silver, or with silver predominating in some cases.

In the ore channels the rock is usually very hard, due to the presence of quartz. Away from the quartz areas the material is often soft and decomposed, frequently presenting a stratified appearance. Layers of crystallized gypsum also occur in this material. A green gouge is found in places, which is supposed to have some connection with the ore deposits, but which is probably only an alteration product formed by attrition.

The ore has in many cases been of a very high grade; in one or two cases the material sacked contained nearly half of its weight in gold. There is not, however, as much high grade as various newspaper accounts would lead one to believe. Due allowance must always be made for exaggeration. The truth of the reports is, however, sufficient to warrant the assumption that Rawhide will contribute materially to the world's wealth within the next few years.

The Mines

Strictly speaking, there are no large mines in Rawhide. So far as my information goes, there is not a single company owning and operating its own property, although some are planning to do so. The result is a very large number of leasing concerns operating either privately, or as stock companies, and doing business on a comparatively small scale. Many of these companies are short of funds to push development work, and the camp's progress is checked somewhat by this condition. In many cases the workmen are working for stock instead of wages, this being the only currency available. There are at present probably no less than 50 leasing companies operating in the immediate vicinity of Rawhide. Of these a large proportion are shipping or have shipped some ore, and others have low-grade ore blocked out, which is not at present available.

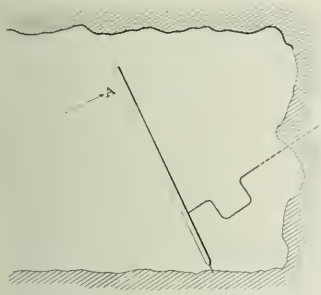
The deepest shaft is that of the Kern's No. 2, which is 400 ft. deep. With the exception of this shaft none is below the 300-ft. mark, and few below 200 feet.

At present only ore of comparatively high grade is available for shipment, very little material lower than $30 being marketed, and this yielding only a small margin of profit. This fact is bound to react favorably to the owning and unfavorably to the leasing interests. In the search for high-grade ore, more or less low-grade material has been and will be developed.

which, with better treatment facilities, will be made available. The owner is thus placed in the enviable position of having his property developed without any risk to himself and of being able to undertake operating on his own account when conditions warrant.

The leaser is certainly the one who has the short end of the bargain, for it is his money that is risked, and under present conditions only high-grade ore will return him any margin. In spite of this, however, any favorably situated property will not look long for a leaser who is willing to take the risk.

Practically all of the mining is still done with hand steel, only one or two small compressors having been installed. The soft, decomposed material previously spoken of frequently admits of working with an auger drill. An accompanying illustration shows an interesting and highly efficient method of using the auger bit observed in some of the mines. It



METHOD OF USING AUGER

consists simply of a wooden lever with an iron point that can be inserted in the floor of the drift. One man applies force at *A* while another turns the bit. A 3-ft. hole can be drilled in fairly gritty rock in about five minutes. The same hole with hand steel would take about 30 minutes. Water is used in drilling down holes.

Milling

The milling facilities of Rawhide are as yet of little economic importance, and will not be for some time. More development work must be done to ascertain with reasonable certainty the possibility of a continual ore supply before any mills of large capacity are justified. Moreover, the process of treatment best adapted to the ores should first be ascertained. At present the deepest shaft is only 400 ft., so that not enough work has been done to determine the character of ore in depth. So far as developed the ore would probably yield good results by amalgamation and cyanidation without concentration. This assumption is, however, based only on a general knowledge of the character of the ore and not on any experimental data. Silver is present largely as ceargyrite, which yields readily to cyanide treatment, while sulphides are not abundant.

The present milling plants are of more interest from a metallurgical standpoint than because of their economic importance. There are two plants at present operating, both situated on the flat lying southeast of the town and from six to seven miles distant. The roads from the mines to the mills are all down grade and ore is hauled in wagons at a rate of $2 per ton. The cost of transportation to the railroad is $6.

At the first mill visited, which is known as the Watt mill, the ore goes first to a Dodge crusher, and is then elevated to a storage line from which it is fed to a single Tadmor mill. From the mill the ground product goes to a single Wilfley table making tails and concentrates. The milling plant is not very elaborate and is hardly worthy of description except as illustrating the application of a new crushing device designed to take the place of stamps. Ore is treated in lots of from 10 to 15 tons at a charge of $10 per ton, the seller receiving the value actually recovered. About 30 to 40 lb. of quicksilver are placed in the mill for each lot of ore, and a clean-up is made before changing lots. The concentrator has so far proved of little value, for the concentrates run only from $10 to $12.

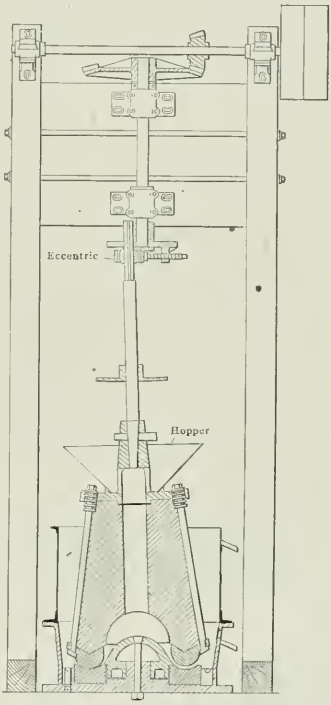
New Mills

The Tadmor mill used at this plant is operated by an overhead eccentric bearing which gives a heavy muller a movement somewhat similar to that of a gyratory crusher. The crushing is, however, done by the weight of the muller which grinds the ore upon the lower die. By this means a continuous grinding operation is secured, the mill at no time doing ineffective work. The machine shown in the accompanying illustration has a muller weighing 8000 lb. and is operated with a power consumption of less than 3 h.p. Crushing from a 1½-in. maximum to from 40 to 60 mesh the mill is said to handle from 20 to 25 tons per 24 hours and crushing to 120 to 150 mesh about 12 tons. These are the figures as given by the mill superintendent, the ore being a fairly silicious one. The fineness of crushing is regulated by the depth of discharge and by the flow of water which carries the ground pulp to the discharge launder.

Objection has been made to this mill because the heavier particles would tend to accumulate in the mill until pulverized to a greater degree than the lighter portions. This would not be a serious drawback where cyanidation follows the crushing as the final operation, but it would be a disadvantage in concentration. This may account in a measure for the low value of the concentrates obtained in the mill.

Rawhide Quartz Mill

The second mill, that of the Rawhide Quartz Milling and Mining Company, locally better known as Swift Water Bell's mill, is situated about two miles east of the Watt mill and is slightly more elaborate in design. A flow of 30,000 gal. of water per hour is obtained here at a depth of 40 ft. The ore is dumped directly upon a ¾-in. screen the oversize going to a 9½x12½-in. Blake crusher. The combined products are then elevated to a storage bin from which they are fed by an auto-



TADMOR MILL

matic feeding device to three Knight cannon-ball mills. The product passes to a 30-mesh screen which returns the oversize to a fourth cannon-ball mill for regrinding.

The 80-mesh product is caught in a stream of water which carries it over riffles containing mercury and then through amalgamators of peculiar design as shown in the accompanying illustration. Both the upper and lower interlocking V's are of silver-plated copper plates. The purpose is to save any fine gold which might float off by causing it to come in contact with the amalgamating surfaces. From these amalgamators the pulp passes

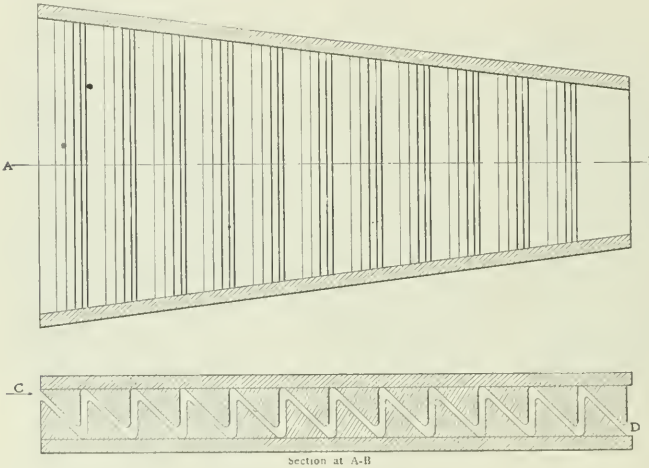
over five amalgamating plates, 4 ft. wide and 12 ft. long, and then to two 9-ft. Pinder concentrators. The concentrators make concentrates and middlings, which are saved, and the tailings which at present go to waste but will later be treated in a cyanide plant.

Other Plants

The cannon-ball mills used in the mill are designed to supersede stamps and are being tried for the first time in actual mill work. They have not been in operation long enough to justify any conclusions as to their probable efficiency. The machine consists first of a horizontal flat iron disk with three rings at increasing distance from the center which is the axis of rotation. Each ring carries a number of chilled-iron balls, uniform in size for each ring but diminishing in size from the inner to the outer ring. This allows of the use of balls worn down in the inner ring in the outer rings. The balls are held in place and under pressure by overhead rings so arranged that the pressure on each ring may be changed separately or together. The ore is fed in the center of the machine and escapes at the periphery, the crushing being done either wet or dry. A capacity of 30 tons per 24 hours from 1 in. to 80 mesh with a power consumption of 8 h.p. is claimed by the inventor. This is for a machine with a 26-in. outer ring and having balls 3¾, 3½ and 3¼ in. in diameter. There are nine balls in the inner ring, 16 in the second and 24 in the outer ring.

Besides these mills there is a 10-stamp mill with cyanide annex in process of construction at Schurz, and also one designed to use Huntingtons for fine grinding and employing amalgamation only, near Rawhide. After the completion of the railroad Schurz will be the natural location of any large milling plant for abundant water is obtainable at this point.

Rawhide has been a boom camp by reason of the fact that high-grade ore was found near the surface. Just now it is passing through hard times. Bank failures and fire have materially crippled its progress as has also the prevailing financial stringency. Besides, Nevada has ceased to be the enchanting word that it was in the time of the Goldfield boom. Nevertheless, Rawhide is on the map to stay. It has, of course, its wildcats and fake promotion schemes and the town has outgrown the mines. The number of men actually employed and the amount of ore shipped do not justify a town of nearly Rawhide's population. Looking at the matter prospectively, however, I am strongly of the belief that Rawhide is destined to be a big producer.



SECTION AND PLAN OF AMALGAMATOR

The temperature of the rock in the Victoria Quartz mine, Bendigo, Victoria, Australia (Donald Clark, *Aust. Min. Stand.*, Nov. 18, 1908), is 113.5 deg. F. The temperature of water issuing from the rock at this depth is 114 deg. F. Ventilation is so good that on the first working level above this depth, the 4254-ft. level, where the rock temperature is almost as high, the air temperature is only 75 deg. F., when the shade temperature at surface is 95 deg. F., and 72 deg. F. When the shade temperature is 60 deg. F., the circulating air soon makes a surface skin of cool rock in the workings so that, provided the fresh air is not saturated, the temperature in the drifts and stopes does not become excessive. On this level the air is heated about 1 deg. F. for every 100 ft. of crosscut or drift that it passes through.

Deep Mining at Grass Valley, California

Special Correspondence

Activities in the Grass Valley district in Nevada county, the most productive quartz-mining section of the State, are such as to give encouragement to miners in other portions of California, where any deep mining is being carried on. The older and deeper mines of Grass Valley are the more productive and prosperous. Whatever barren zones occurred, as they do in most places, have been passed with development, and the ores on the lower levels are proving as valuable in content as those found nearer the surface 50 years or more ago. This fact is being proven in Amador county as well, more particularly in such mines as the Kennedy, where very deep exploration is being carried on. At Grass Valley the Empire, which is the oldest recorded quartz mine in the State, continues to be one of the largest gold producers in California. This vein was discovered in 1850. The company after all these years' work and after having attained a depth in its shaft of 3400 ft., is now about to install an extensive pumping system which will permit still deeper mining. In the same district the North Star Mines Company has attained a depth on the incline of its shaft of 5000 ft. without any diminution in size or value of its fissure. It is expected that this incline may eventually be carried down to 9000 feet.

Both the mines mentioned were supposed at different times to be worked out as barren zones were encountered. In this same Grass Valley district in the Idaho-Maryland the water is now all out from the 1000-level station and new timbers are being put in. Principal operations are just at present confined to the 500 and 700 levels. The ore found is of good quality and the mill is kept running upon it.

The grade of ore worked in Nevada county is higher than elsewhere in California. In 1907 there were 225,830 tons of silicious ore milled yielding an average of $0.06 per ton. From this ore 4140 tons of sulphurets were treated yielding an average of $58.18 per ton. The saving on the plates alone was $7.09 per ton. At the North Star mine in that year there were 78,366 tons of ore milled, yielding an average of $11.06 per ton at an average cost of $5.09 per ton for current operation, and $1.18 per ton for development, making an aggregate cost of $6.27 and leaving a realized profit of $5.68 per ton over all costs of operation and development. Labor strikes stopped operations two months.

Main haulage drifts should be well drained.

Montana Corporations

SPECIAL CORRESPONDENCE

By the laws of Montana all corporations organized within the State, and having a capital stock, are required, within 20 days from the last day of December of each year, to file in the office of the clerk and recorder of the county in which the principal business of the corporation is carried on, an annual report. If such report be not filed, each director of the company failing to make the report becomes individually liable for all the debts of the corporation. The report is required to state the amount of capital stock of the corporation actually paid in, and the amount of corporate liabilities, and must be sworn to by the president or vice-president of the company. The following are the statements filed in the county clerk's office of Silver Bow county in Butte:

Company.	Paid Up Capital.	Liabilities.	President.
Amazon-Butte Copper	$2,500,000	$5,000	A. H. Barrett.
Alliance Copper	400,000	18,961	Donald Campbell.
Bayonne Gold Mines, Ltd	500,000	13,530	John Gillie.
Benton Mining and Milling	43,300	2,500	H. A. Gallway.
Butte-Argenta Copper	3,000,000	40,000	J. E. Oppenheimer.
Butte Copper King Mining	1,500,000	.....	C. E. Behee.
Butte Furnace Range Copper	1,000,000	.....	H. J. McDonald.
Butte & Yerrington Copper	314,000	.....	W. C. Siderfin.
Butte & Basin Mining	207,001	1,165	J. W. Kemper.
Butte Milwaukee Copper	3,000,000	2,000	John F. Cowan.
Butte Corbin Copper	500,000	362	J. D. Slemmons.
Butte & Ely Copper	257,425	.....	R. H. Hodgens.
Butte Continental Copper Mining	1,000,000	2,329	G. E. Blackburn.
Baltimore Copper	2,030,000	10,000	D. J. Charles.
Butte South Zone Mining	1,000,000	.....	John Redlich.
Butte Consolidated Copper	600,000	15,764	C. O. Gerrall.
Butte Curtis & Majors Mining	1,000,000	20,000	James Doul.
Blue Vein Copper Mining	1,000,000	1,300	F. L. Melcher.
Bowery Mining	47,000	45,336	John N. Glass.
Copper Mountain Mining and Smelting	1,000,000	1,375	I. N. Symon.
Corbin-Wicks Copper	550,000	.....	I. N. Symon.
Clara Mining and Supply	750,000	507	T. A. Grigg.
Copper Eagle Mining and Smelting	337,990	2,379	.....
Columbia Mining	140,000	.....	C. P. Drennen.
Consolidated Central Butte Copper	1,200,000	20,300	P. J. Brophy.
Corbin Consolidated Mining	500,000	5,150	J. L. Meixell.
Delta Mining	40,000	.....	W. T. Miller.
Free Gold Mining	100,000	7,500	Frank Boucher.
Goldreed Mines	100,000	12,600	M. L. McDonald.
Green Campbell Consolidated Gold Mining	1,000,000	121,981	E. B. Howell.
Goldfield-Simmerone Mining	500,000	11,880	Malcom McDonald.
Gold Circle Milling	50,000	7,732	C. B. Moase.
Keating Gold Mining	625,250	22,030	Jesse B. Root.
Montana Leasing	10,000	.....	A. P. Nipgen.
Montana Gold Mountain Mining	2,500,000	.....	L. Newkirk.
Montana Cobban Mining	500,000	.....	A. H. Meuller.
Montana Gold Mining	50,000	12,430	J. D. Hains.
Montana Ibex Mining	250,000	.....	John Eckel.
Old Glory Mining	50,000	10,000	J. Benton Leggett.
New Comstock Gold and Silver Mining	3,735	351	T. C. Witherspoon.
Pyreneese Gold Mining	100,000	50,000	Clinton H. Moore.
Python Gold Mining	40,000	2,358	R. E. Davis.
Ramshorn Placer	200,000	1,500	C. R. Leonard.
Raven Mining	630,000	72,000	John Berkin.
Star Silver Lode Mining	1,000,000	1,743	C. F. Booth.
Tuolumne Copper	700,000	.....	Ed. Hickey.
Treasure State Mining	1,000,000	750	C. W. Sammis.
Utah Antimony	262,743	250	H. Hampron.
Venture Exploration	600	280	J. Bruce Kremer.
Western Exploration	13,500	.....	B. E. Calkins.

While fighting an underground fire at the Testasecca mine, Sicily, the men, who used fire-fighting helmets, at first were able to work continuously 2 or 3 hours at a time without great fatigue, but (F. C. Chrambach, *Bull.* No. 50, I. M. and M.) after a time they could not do even easy work for more than ¾ hour at a time. The atmosphere was composed of nitrogen, sulphur dioxide and carbon dioxide without a trace of free oxygen. The fatigue was evidently due to the absorption by the blood of carbon dioxide through the pores of the skin.

Monongahela River Consolidated Coal and Coke Company

This company, known as the river combine, owns a number of coal mines and a large area of coal land in the Pittsburg district. It also owns and works coal lands in Kentucky. Most of its mines contribute to the trade on the Ohio, though it sells much coal in Pittsburg and vicinity. The last annual report covers the year ending Oct. 31, 1908. It shows that the company has outstanding $20,000,000 common and $10,000,000 preferred stock; $8,211,000 bonds; $1,440,000 certificates of indebtedness; $286,000 car trust notes and $172,834 mortgages. The debt was reduced $575,226 during the year by sinking fund and other payments.

The coal lands originally held by the company included 35,194 acres, on Oct. 1, 1899. Since then 4830 acres have been bought, and 7881 acres mined out and sold, leaving 32,143 acres owned; of which 29,630 acres are in Pennsylvania, 2513 acres in Kentucky.

The coal statement for the year is as follows:

	1907.	1908.	Changes.
Pittsburg district	7,321,961	5,985,486	D. 1,336,476
Kentucky	132,196	110,624	D. 21,572
Total mined	7,464,157	6,096,110	D. 1,368,047
Coal sold	8,339,114	6,044,307	D. 2,294,807

The decrease last year in coal mined was 18.2 per cent.; in coal sold, 27.5 per cent.

The income statement for the year is as follows:

Net earnings over working expenses	$1,888,330
Depreciation of mine equipment	$ 207,630
Depreciation of river craft	390,364
Depreciation of coal lands	226,015
Total	$ 824,009
Net balance	$1,064,321
Interest charges	$ 688,355
Dividend No. 14, preferred	350,000
Total payments	$ 938,355
Balance	$ 125,966

Adding $1,975,742 brought forward from the previous year made a total surplus of $2,101,708 at the close of the year.

The report says: "An insurance fund of $200,000 has been accumulated, which with the monthly premiums accruing, has been deemed sufficient by the board of directors to meet all future fire and marine losses.

"Considering the general business depression, which has extended over the past year, and the low-water period over seven months, from June 1, 1908, to Jan. 7, 1909, during which time no coal was shipped, our production and sales have been fairly well maintained. The temporary suspension of mining operations during the month of April resulted in a loss of production of about 400,000 tons. While river conditions during the months of April and May were very favorable for boating, yet we did not have any coal to ship because of the suspension, which rendered our steamboats idle during that time and resulted in a shortage of coal in our Southern markets, which made it necessary to secure supplies by rail from West Virginia, Kentucky, Tennessee and Alabama, to take care of our contracts and trade; this alone diminished the sales of our own coal to the extent of about 400,000 tons.

"The physical condition of our property has not only been fully maintained but has, in the main, been materially improved. Our coal mines are in better condition now than at any time heretofore. As old mines are exhausted, new mines are developed according to modern methods, with a view to increased production at a minimum cost. The physical condition of our river equipment is being fully maintained. As old barges are disposed of, new barges are provided to take their place. At New Orleans, we have, during the past two years, installed modern coal-handling machinery for transferring coal from the river barge to the bunkers of the steamships, at a cost of about $100,000, which has resulted in a material saving over the old method of hand labor and quicker dispatch in delivering coal to the steamships, which is a great advantage to our customers."

In his work, "The Iron Ore Deposits of New South Wales," J. B. Jaquet estimates the minimum quantity of ore to be 59,317,000 tons.

Computing Tonnage from Volume of Ore Removed

By S. L. Lefevre* and Guy C. Stoltz†

The magnetic ore deposits on the eastern slope of the Adirondacks at Mineville, N. Y., are worked by the Port Henry Ore Company and Witherbee, Sherman & Co. The largest deposit now being mined is worked in the "21" mine belonging to the Port Henry company and the Joker-Bonanza mine belonging to Witherbee, Sherman & Co. The property line between the two companies crosses this deposit diagonally making an angle of about 30 deg. with the axis of the anticlinal fold in which the ore occurs. The companies work together harmoniously, each when it becomes advisable to do so mining ore on the property of the other.

The volume of ore in cubic feet mined by either company across the line is computed from surveys of the sides, floor, faces and roof of the stope; the tonnage is determined by dividing this total by the number of cubic feet to the ton.

To illustrate the method followed to determine the tonnage of ore extracted in any trespass, the workings taken are two levels, one 417 ft., the other 472 ft. above Lake Champlain, which have been connected by several raises. The accompanying plan shows the extent of workings across the property line and the position of a few of the points taken from a regular survey giving the elevations of the roof, floor and sidewall of the stope, while the sections accompanying the plan will more clearly show the relations of the two levels.

To make the trespass survey a transit station of known latitude and departure is accurately established at some point, preferably near the central part of the trespassed area. From this set-up numerous side-shots are taken, azimuth, vertical angle and distance being noted in each case. Usually the floor points in the stope are taken first, then points which will determine the slope of the stope and the side walls, finally floor and roof points in the headings. It is possible by using a ladder and a tamping stick, to which is tied a light and the tape, to get all roof and other points that may be essential in determining the volume. In case all workings are not to be seen from one station, perhaps because of a pillar or a bow in the roof or side wall, then temporary stations are located for the transit, from which stations the necessary side-shots are taken.

Obviously to reduce the error in computing volume to a minimum, points should be taken very close together, but in a large area with fairly regular sides and roof probably 5 ft. is close enough together for these sections. A sufficient number of points should be taken so that from the side-shots a wooden model could be constructed, which if put together in the workings would snugly fill the cavity.

Plotting

After the horizontal distance and elevation of the different points has been computed, the points are plotted from the main station within the trespass area by means of a protractor. Plotting is done on coördinate tracing paper, ruled 10 divisions to the inch, on a scale of one inch to ten feet. The number, elevation and location of each side-shot is noted on the plan. When break-throughs make it necessary to determine the volume of two levels together, to avoid confusion the points on the levels are recorded on the plan in inks of different color.

After inspecting the map and studying the character of the ground the location of the sections are so selected that the average area of each two adjacent multiplied by the distance between will give as accurately as possible the volume of ground between the sections. After the sections are located the elevation of the surveyed points that are included in each section together with the elevations of interpolated points are plotted; the horizontal distance of these points from the property line on each section is determined by scaling from the plan. The hight between floor and roof is then scaled or determined by difference of elevation at as many points as necessary to get the area of each section accurately.

After the area of each section and the horizontal distance between sections has been tabulated, the volume in cubic feet between all of the sections is determined by summing the area of each of the two adjacent sections, dividing by two and multiplying by the distance between sections.

Finally the tonnage is determined from the total volume in cubic feet by dividing by 7.85 cu.ft. for this factor has been agreed upon by both companies after a series of specific gravity tests had been made upon lumps of ore of average analysis.

*Chief engineer, Witherbee, Sherman & Co., Mineville, N. Y.

†Mining engineer, Port Henry Iron Ore Company, Mineville, N. Y.

Silver-Lead Smelting at East Helena, Mont.

Special Correspondence

The East Helena smelter has three of its four furnaces running, all on a fairly rich lead charge; i.e., the percentage of lead is about 25, which is considerably above the average. The smeltery is now treating a larger quantity than usual of rich Cœur d'Alene concentrates. The whole battery of 16 long roasters and a complete equipment of Godfrey furnaces and H. H. pots, 12 in number, is roasting these ores and the percentage of lead on the roaster charge is as high as 40. Consequently the pots are delivering a much better product now. The company intends installing several new Godfrey furnaces and accompanying pots; the management prefers the Godfrey and H. H. pot combination to any of the improved roasting machines.

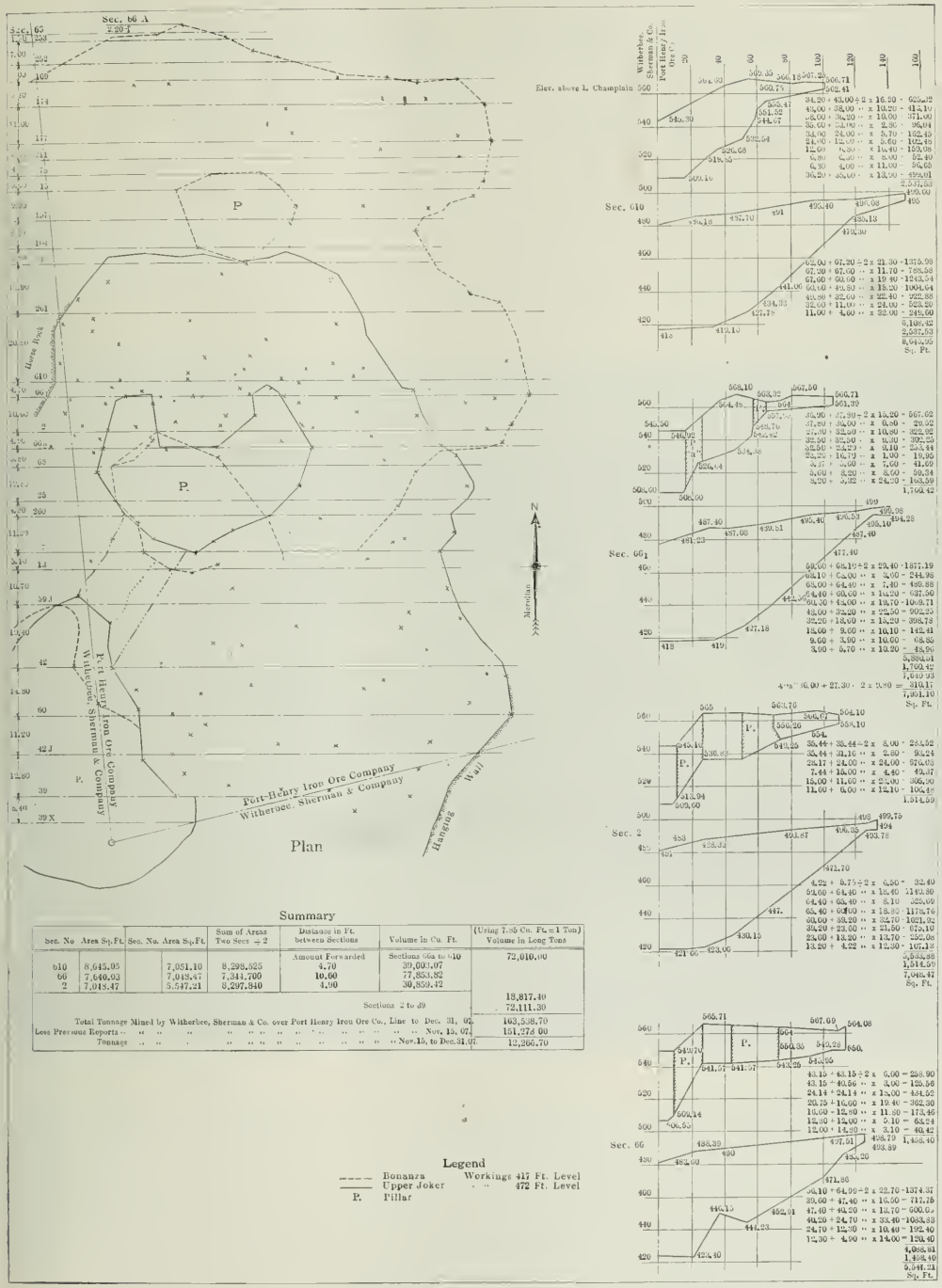
It will be remembered that for about three years, the baghouse was not used at this works. Since it was put in commission again, about 18 months ago, the company seems to have had greater success in the life of the bags. Formerly the bags, 30 ft. by 18 in., made of cotton duck, lasted eight or nine months; now their average life is 18 months. The cost of a bag at Helena is $1.25@1.50. Tacoma's bags, of much lighter duck, cost about 80c., while Selby uses a more expensive woolen bag, for which a longer life is claimed. The company has experimented with a view to lengthening the lives by dipping them in linseed oil, and wringing them dry; also saturating with the theater-curtain kind of fireproof paint, but without favorable result.

Pertusola was the first smeltery, I believe, to use an automatic shaking and collecting device. A shaking device has also been introduced at the United States Metals smeltery, near Salt Lake City. Pertusola also uses a patent asbestos-thread bag.

East Helena has found that by adding a large percentage, about 25 I believe, of lime to the charge in the Godfrey furnace the output is increased, and the resulting roast in the pots is much sweeter.

Everett generally treats the baghouse dust, which runs about 40 per cent. arsenic, and 40 per cent. lead. On account of the present prevailing low price of arsenic, Helena has been compelled to treat the dust itself. This is first burned on the floor of the baghouse, where it sinters and cokes and is freed of some of its arsenic. On adding this burnt dust to the charge, the furnace distilled arsenic heavily, and the bullion resulting contained 0.5 per cent. arsenic. Very little speiss was formed. The use of more than small quantities of raw concentrates on a blast-furnace charge is deprecated, it being claimed that matte-fall is high, and higher in lead when considerable copper is on the charge (decreased reduction), with correspondingly fouler slags. The only explanation offered for the prolonged life of the bags is that for some reason the gases are cooler now than in former years.

A stamp duty of 15 tons per 24 hours is obtained at the Giant mine, Hartley district, Rhodesia (R. C. H. Cooke, *Journ.*, Met., Chem. and Min. Soc. of South Africa, Nov., 1908), where a soft ore is crushed through screens having ⅜ and ½-inch openings, and subsequently tube-milled.



Summary

Sec. No	Area Sq. Ft.	Sec. No.	Area Sq. Ft.	Sum of Areas Two Secs ÷ 2	Distance in Ft. between Sections	Volume in Cu. Ft.	(Using 7.86 Cu. Ft. = 1 Ton) Volume in Long Tons
					Amount Forwarded	Sections 66a to 610	72,010.00
610	8,645.05		7,051.10	8,298.525	4.70	39,003.07	
66	7,640.03		7,018.47	7,344.700	10.60	77,853.82	
2	7,048.47		5,547.21	6,297.840	4.90	30,859.12	
							18,817.40
					Sections 2 to 39		72,111.30
Total Tonnage Mined by Witherbee, Sherman & Co. over Port Henry Iron Ore Co., Line to Dec. 31, 07							163,538.70
Less Previous Reports .. .. ..

The Rotary Blower in Smelting Works

Principles of Producing Blast by Means of Rotating Impellers, Simplicity and Efficiency of Apparatus and Essentials of Successful Operation

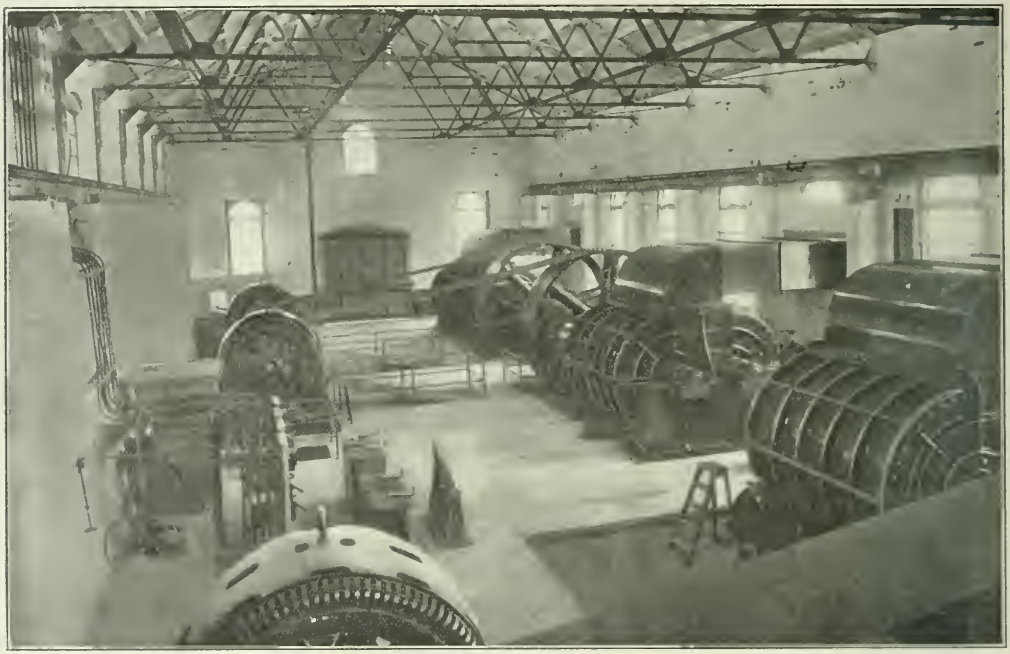
BY GEORGE C. HICKS, JR.*

The rotary blower has won a permanent place for itself in smelting work, both because of its adaptability to the work to be performed and by reason of its all-round efficiency. While the rotary type of blower is fairly well understood, there are a number of points about its operation and management which are not as familiar as they might be.

The principle of operation of the rotary blower is the rotation of two moving parts in definite relation to each other, these two parts being composed of curves of such form that uniform clearance is constantly maintained between the outlines of the respective impellers, the point of contact being either on or contingent to a line joining the centers of the two rotating shafts. The clearance contact at this point prevents the return of the air which has been drawn in by the rotation of the lobe in the case, thus inclosing the air lying between the outline of the two lobes and the case. This volume of air is, therefore, drawn in and discharged twice a revolution for each impeller, making the displacement of the blower equal to four times this amount.

The air is drawn in under the conditions prevailing at the suction and is maintained at this same pressure until the upper edge of the case is reached. The impeller tip then passes the edge of the case and the air between the case and the impellers is immediately raised to the discharge pressure. This sudden rise makes a certain fluctuation in the discharge of the blower by reducing the pressure at the entrance to the discharge pipe, so that the discharge pressure at that point represents a wave line. It also has a tendency to reduce the average pressure against which the blower operates; and while the amount is small, it reduces the horsepower from that given by the square card, the theoretical card for the rotary blower, because the entire discharge of the blower is made against the discharge pressure. The conditions are the same as those which would prevail if in a reciprocating machine the discharge valves were opened at the end of the suction stroke and the piston discharged the total amount of air in the cylinder against the discharge pressure, instead of compressing it adiabatically or isothermally until the discharge pressure had been reached and the discharge valve opened.

This difference between the square card and the adiabatic card is often made use of in comparing the reciprocating compressor with the rotary blower to the disadvantage of the latter. Since the amount of this difference is small at low pressures, and the slip of both the suction and the discharge valves of the reciprocating blower in addition to the excess vacuum and discharge pressures required to open them is considerable, the amount lost in the rotary blower is more than offset until the pressures begin to reach six or eight pounds.



ROOTS BLOWERS, MOTOR AND BELT DRIVEN

Power and Pressure

There is one point that should be thoroughly understood in regard to the rotary

*Engineer, P. H. and F. M. Roots Company, Connersville, Ind.

blower and that is, that it is a positive displacement machine, that the amount of air and the horsepower required are proportional to the speed and pressure under which the machine operates, the increase in horsepower being in direct proportion to the increase in pressure and also, directly in proportion to the increase in speed, or, which is the same thing, the amount of air delivered.

The formula for calculating the horsepower of rotary blowers is h.p. = 0.00436 × displacement per minute × pressure. This is the formula for the square card; while the actual power necessary is less than this, the results given by this formula are close enough for all practical purposes; it is the formula generally used for obtaining the power necessary to drive a blower, or, rather, to move the necessary air. An additional amount must, of course, be allowed for friction.

The simplicity of the rotary machine is in its favor; it has only two moving parts, and while these parts are made up of several pieces, they form, as a whole, only two rotating units; thus, the impeller, shaft and gear comprise one of the two units. This simplicity and the size and strength of these two units is one of the great prints that make the rotary blower so successful and so well able to withstand hard and continuous usage.

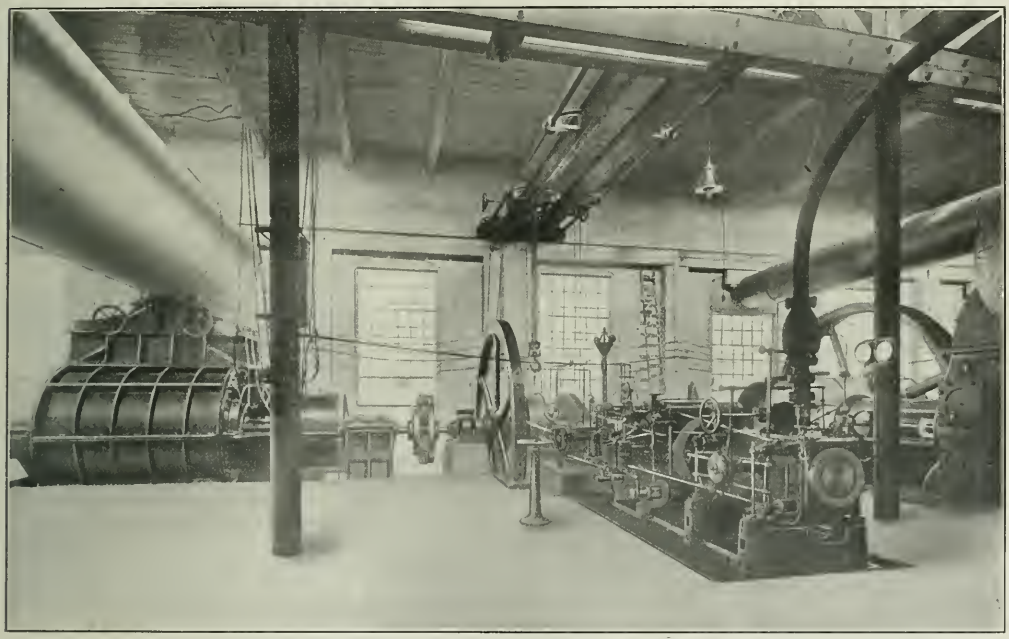
Single or Double Gear

The blower used for smelting work has pretty nearly settled down to two types: the double-geared blower and the machine with single gears, i.e., gears at one end only and double outboard bearing driven from a steam engine by direct connection or from a motor by means of a belt, a single outboard bearing outside of the flywheel supporting the weight and helping to take care of the belt pull. The double-geared type can be used only with motor drives and consists of a machine geared at each end, with single outboard bearing on opposite shafts, the blower being driven by two motors belted to two band wheels, each carried by the bearing of the blower itself and a single outboard bearing. This arrangement has some good features; it relieves part of the load from being transmitted through the gears, and in the case of motors that respond quickly and divide up the load so as to keep the tension on both belts practically equal, the arrangement is successful; but the experience has not been satisfactory where the same arrangement is attempted with belts from a line shaft, the trouble being the impossibility of maintaining the two belts at exactly the same tension. If it is desirable, for some special reason, under these conditions, to drive from both ends, it is better to drive to the same shaft. This also applies to the application of the cross-compound engine to the blower, i.e., the high- and low-pressure sides of the engine should both be applied to the same shafts, not one to one shaft and one to the other, as in the case of the electrical drive. It might possibly be done with an engine, but it would necessitate excessively heavy flywheels, in order to prevent back-lash in the belting.

The double-outboard bearing arrangement has the advantage of furnishing a support on each side of the gear, and makes it comparatively easy to keep the line contact of the gear face touching throughout the entire width of the gear. This keeps the wear uniform and prolongs the life of the tooth.

Speed and Capacity

The speeds of rotary blowers are really determined by the safe, practical and economical working speed of gears. There is no reason why impellers properly balanced should not rotate at a good deal higher speed than rotary blowers are usually run; but it is a well known fact that the limiting speed of gears occurs at a certain point in the neighborhood of 1200 lineal ft. per min., and that above this speed, even the most carefully cut gears begin to pound and hammer, the hammering eventually causing crystallization and the failure of one or more teeth in the gear, bringing on general disaster to the whole machine. It is, therefore, wise to keep the speed, of large machines especially, within reasonable limits. A few hundred dollars extra expended on machines of large size is well invested, as the interest on the extra amount will be much

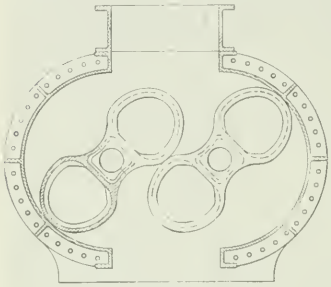


ROOT BLOWER DIRECT-DRIVEN BY CORLISS ENGINE, SHOWING FLEXIBLE COUPLING

less than the depreciation and repairs on blowers not suited to the conditions.

In picking out the proper blower for work under a given pressure, it is always well to consider the relative length in proportion to the gear diameters; the customary method of considering the length of the blower, is to refer to it as so many gear diameters in length, or simply using the words "two gear lengths" or "three gear lengths," for the length of the case. Stated in another way, the pressure on the gear teeth should be practically a constant quantity, no matter what the length of the machine may be. For instance, if the machine is of a certain length for 2 lb. pressure, and the gears are proportioned for that load, if the same amount of air is needed at a higher pressure, it should be obtained by purchasing a blower having a larger gear diameter and a shorter case.

The face of the gears chosen by the different blower manufacturers is usually about a maximum width for that size gear. The shaft strains are also proportioned for what is called a full length machine



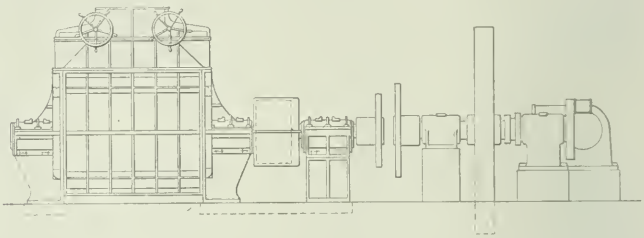
RELATIVE POSITION OF IMPELLERS

and a certain pressure. In order to keep the main parts of the design the same, making changes in length only, it will readily be seen that the most practical and satisfactory way is to shorten the machine as the pressure increases. This tends to uniformity of manufacture and makes the duplication of parts much more simple than with any other system. The short machines are naturally easier to keep in alinement and are favorable to shop production in every way, being easier to machine, better to handle and giving increased stiffness in the machine as a whole. Two pounds is considered about the limit for a machine having a length equal to three gear diameters; above that pressure, the length should be made proportional to the pressure.

Adjustment and Alinement

The important point in all machines of the rotary type is to maintain the centers as close to their original and correct setting as possible. The whole principle of the successful operation of the blower depends upon the continuance of the center of the shaft lines at the one definite point where it was originally set. The rolling together of the curves is sufficient explanation for the importance of this point, and also the fact that the impeller must revolve in the case with a very small clearance. It is not a difficult matter to keep these adjustments at the proper point, for the bearings are large and the pressure per square inch seldom exceeds 100 lb. The adjustments are in such form that the shaft may be moved in any direction, and with a little care and attention, it should be no trouble to keep a machine in perfect adjustment. The life of the gears is thus also increased; for if the shaft is allowed to wear low on one end, or to become misplaced, the line of contact on the gear face immediately changes and the work is thrown on one end of the teeth until the wear has again brought the gear down to contact along the full width of the gear face.

It has been the custom to build large smelting blowers with excessively small clearances; while perhaps the critical stages of competition might have justified this, it is not to the best interests of either the manufacturer or the consumer. A machine built too close is very hard to



ARRANGEMENT FOR DIRECT-DRIVE BY CORLISS ENGINE

keep in proper adjustment, and the chances are that at the end of six months or a year it will not be in as good condition, nor will it have given as good average efficiency as a machine originally built more open. It is not necessary to go to extremes either way. The sacrifice of 1 or 2 per cent. in volumetric efficiency affords a machine with clearances within the easy limits of planer work, makes the assembling easier, allows more latitude for wear, and at the same time makes the adjustment an easy matter, instead of a continual burden on the plant operators.

Efficiency

The question of efficiency is pretty well understood, but there are a few fundamental principles governing it which it will be well to explain. As the openings between the impellers themselves, between the heads or ends and the impellers, and between the case and the impellers have practically a constant area, it necessarily follows that the leak per unit of time, under a given pressure, is also a constant quantity. It is, therefore, possible by closing the discharge, to operate that machine at just such speed as will maintain on the discharge side a test pressure. The displacement of the machine multiplied by the number of revolutions will then give the slip. This quantity is practically constant per unit of time and represents the volumetric efficiency of the blower. The increase of speed is a modifying element in this case, however, as it can readily be seen that the moving of the impeller tip past the case increases the frictional resistance of the air passage. In other words, as the friction is a function of the velocity, and the velocity is a question of relative movement, the higher the speed of the blower the greater, necessarily, will be the relative velocity of the air through the openings between the impeller and the case.

This method of testing, however, gives a good indication of the condition of a machine, and can always be assumed to give 2 or 3 per cent. more than the actual slip, at the normal speed of the machine. There are, of course, several other ways of testing, notably by the Pitot tube and the flow of air through a standard orifice. The latter method is a little uncertain, owing to the fact that measuring and calibrating an orifice for such large quantities of air as those handled by rotary blowers, is a very difficult undertaking and has not yet been successfully done. A number of tests have been made with the Pitot tube method, and some good work has been done in that direction by various engineers throughout the country.

One very clever way of testing the blower with closed discharge consists in taking an indicator diagram from both the suction and discharge sides. In the case in which this method was employed the machine handled gas, and both the suction and the discharge valves were closed. The card, therefore, by indicating the distance above and below the atmospheric line shows clearly the leak through the blower at different points of the revolution; the point where the engine passed over center, slowing down, due to the lack of flywheel capacity, showed very clearly on the card both lines above and below the atmospheric line being nearest at that point.

Rotary blowers can be built for 6 or 7 per cent. slip, at 3 lb. pressure, but it has been my experience that a machine allowing for 8 to 10 per cent. is better for all

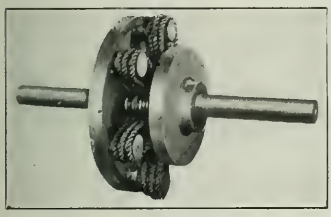
purposes, and that the slight loss in efficiency is more than made up in the saving in expense of extra care and attendance.

Friction and Alinement

The question of friction in rotary blowers is not a serious one, for the percentage of total load consumed in this manner for pressures of 1½ to 3 lb. varies from 6 to 8 per cent., according to the load, i.e., the lowest friction will occur at the highest load.

As the rotary blower is operated usually at a speed not far from that of the ordinary Corliss engine, this engine and blower naturally form a very good combination, and blowers are used with either the simple or tandem-compound engine, the tandem-compound condensing combination being very efficient and extremely simple.

It has become the custom of late years to make the connection between the engine and the blower with some sort of a flexible coupling, which takes up any slight movement of the engine shaft, misalinement or end thrust without transmitting any effect to the blower beyond a purely rotative one. This coupling also allows the blower to be adjusted freely without



FLEXIBLE COUPLING FOR BLOWER

regard to the engine; some types can be disconnected as quickly as the ordinary bolted coupling.

Blowers for smelting works are almost all of the horizontal type, i.e., the two shafts lie in the same horizontal plane, with the discharge either at the top or the bottom. Unless the pressure is excessive, there is no objection to bottom discharge, for the weight of the shafts, impellers and gears is sufficient to keep any undue pressure off the caps. The position of the discharge is, however, rather a question of convenience, although it would seem that the lightening up of the pressure on the bearings in the down-discharge type would tend to increase the life of the machine.

Relief Valves and Foundations

Two things which should always be specified in purchasing a rotary blower are that the machine be equipped with an automatic relief valve set between the blast gate and the blower itself, and also that this relief valve be capable of being operated by hand, or else that another valve to be operated by hand be placed on the machine. The office of the latter is to relieve the pressure while starting a machine, enabling the operator to get the blower practically to speed before opening the blast gate and to close the blast gate before closing the machine down, the automatic relief valve being necessary in case of any sudden stoppage, such as the dropping of the gate valve, or the closing off of an unusual number of furnaces without proper warning to the machine room.

The question of foundations is one that should never be overlooked; foundations should be of such a character that the machine will have no strains induced by settling of the foundation. No rotary blower will operate successfully when the case is sprung or twisted, no matter how slightly, for the length and weight of the machine are such that its mass is bound to follow the settling of the foundation. This is, of course, true not only of rotary blowers, but also of any type of machinery; the better the foundations the better will be the satisfaction and the lower the cost of repairs and wear of the different parts.

It is also important that the suction be properly screened so that nothing of a solid nature can reach the working parts of the machine Machines have at various times been badly injured by carelessness in this respect, and it is often very hard, under such circumstances to find the real cause of the damage; it is a case where "an ounce of prevention is worth a pound of cure."

This remark also applies to the treatment of gear housings and to carelessness in leaving a wrench, nut, or bolt lying between the teeth when the gear cover is off and some work is being done on the machine; this is sure to result in disaster when the machine is started. The curve of the gears to the point of contact makes a very convenient place in which to lay wrenches, nuts, etc., something which should be positively prohibited in the management of the plant. Workmen should not be allowed to use even temporarily the gears as a resting place for tools, for, sooner or later, someone's forgetfulness will be sure to cause serious trouble.

St. John del Rey

Special Correspondence

The latest report of this English company, owning and working the Morro Velho mine in Brazil, covers the first six months of the company's financial year, from March to August, inclusive: It states that 80,200 tons of ordinary ore were crushed, giving a yield of £158,842 or 39.6s. per ton. In addition £4339 were realized from low-grade mineral. The yield of gold shows a decrease of 2s. 7d. per ton compared with the corresponding period in 1007, and there was a falling off in the profit of £7218. The duties and charges on bullion come to close on 2s. per ton of ordinary mineral crushed, the ton being 2240 lb. The working costs in Brazil amounted to 29s. 8d., the developments in the mine to 10½d., and London general expenses to 7¾d., making a total cost, including bullion charges, of 33s. 1½d. per ton milled.

A dividend of 6d. per share on the ordinary shares has been paid, an amount which the chairman thought would be increased to 8d. per share at the close of the next six months' working, as there would be less necessity of devoting so much of the profits to capital expenditures.

In the past large sums have been spent out of profits in erecting and equipping power plant. Advantage has been taken of the water power which exists within reach of the mines, and as much as £240,000 has been spent in the last seven or eight years in hydroelectric power plant. The total electrical power is close on 2000 h.p., distributed as follows: Mine, 990 h.p.; reduction works, 873 h.p.; mechanical and lighting departments, 96 horsepower.

As regards the mine the manager reports that all points were looking well. The ore reserves are 1,000,000 tons, but the grade was below what had been obtained previously.

In addressing the shareholders the chairman, Frederick Tendron, not content with giving his audience a lucid account of the financial position and prospects of the mine, discussed at some length that thorny subject, the genesis of ore deposits, a subject which most mining engineers are cautious about tackling. After studying the works of de Launay and others, Mr. Tendron was quite satisfied that the Morro Velho vein has all the characteristics of a "primary" lode, which is the best sort of lode to have, as it goes down as far as one can follow it, and has a tendency to increase in value rather than diminish with depth. These favorable conclusions will, no doubt, be indorsed by the shareholders, who, whether they grasp what a primary lode is or not, will, at all events, feel confident that their affairs are being looked after by a chairman who has heart and soul in the business, and who, when he has found out exactly how the gold got there, will know all that is worth knowing about the St. John del Rey.

West African Gold

Gold production from West Africa—including the Gold Coast and Ashanti—in December was 24,624 oz. bullion, being 187 oz. more than in November, and 693 oz. more than in December, 1907. For the year ended Dec. 31 the total was 293,218 oz. bullion in 1907, and 297,366 oz. in 1908; an increase of 4148 oz. The bullion reported in 1908 was equal to $5,765,622, or 279,320 oz. fine gold.

New York's Open-Air Stock Market

How Mining Shares Are Bought and Sold on the Pavement in Broad Street and How the Brokers Manage Affairs without an Organization

BY WILLIAM T. ROYCE

According to an estimate based upon a recent average day's sales, fully 95 per cent. of the shares bought and sold in the open-air stock market in Broad street, New York, known as the "Curb," are shares of mining stock. Nearly all the really great mines of Butte, Goldfield, Cobalt and other famous camps of this country and Mexico are represented, especially those huge enterprises which are too heavy for individual exploitation and are not sufficiently long established to have found a place on the Stock Exchange. At present the stocks of 70 mining companies are quoted daily, the transactions varying from 100,000 to 250,000 shares per day, and the shares of 174 mining companies are dealt in with different degrees of activity. It cannot be said, therefore, that the Curb does not play an important rôle in the mining industry.

Contrary to a belief common among practical miners the Curb market performs an actual service for mining. The activities of the men within the roped inclosure are not all devoted to gambling with the fruits of other's skill and enterprise, nor is "pulling off" schemes to fleece the innocent their chief occupation. These are merely diversions which are growing more infrequent as the Curb increases in importance.

Stocks are put upon the Curb to effect distribution among the public; also to create a market for the advantage of the investor. It is an important element in the success of the flotation of a new company by subscription, if the subscribers know that there is going to be a market for the stock.

The Curb has at times had a bad name. It has been the scene of many picturesque swindling operations; for it is no easy matter to keep this free-for-all out-door market clean. The sight of two or three hundred men busily buying and selling stock without regulations or restrictions of any kind is wonderfully attractive to the gambler and the man who lives by his wits. Restrictions imply organization, and the big Stock Exchange on the west side of the street will not permit any formal organization among the open-air brokers. But with the increase of business, especially since the invasion of Cobalt, Goldfield and other camps productive of great volumes of good stocks, the morals of the Curb have improved. Gradually a sort of informal organization, based upon honor and tacit agreement has developed; and it is becoming more and more difficult for the blackleg to gain admittance.

A few days ago an important new regulation was posted on the little bulletin board, which hangs upon a lamp-post, apparently belonging to nobody in particular but recognized by the Curb brokers as their own. In effect it announced that the Curb is no longer a free market, at least not free for all stocks. Stocks which can not bear public scrutiny will hereafter be compelled to go elsewhere. The new rule requires all brokers who have new stock to offer to fill out a blank, giving the location of the property, its productivity according to the latest report, the assets and liabilities of the company and the names of its officers and directors. This blank with its inserted data is to be posted on the bulletin board for public inspection for five days before the stock can be offered in the street

LOOKING UP BROAD STREET, NEW YORK, CURB BROKERS IN THE FOREGROUND, STOCK EXCHANGE ON THE LEFT
(Copyright, 1908, by Underwood & Underwood, New York)

Machinery of the Curb Market

The Curb deals in stocks not sold on the Stock Exchange. Mining companies do not more generally list themselves on the New York Stock Exchange because

the prices of the shares are generally low and the uniform commission of $12.50 for 100 shares required by the rules of the New York Stock Exchange is a damper on trading. On the New York Curb and the Boston Stock Exchange low-priced stocks do not have to pay so large a commission.

To the casual visitor in Broad street nothing can be more confusing and apparently purposeless than the antics of the gesticulating, shouting, seething mob in the middle of the asphalt pavement. As a matter of fact, nothing is more orderly and free from useless fuss than the curb market. Orders are received, executed and returned with surprising celerity, and mistakes are as rare as in any well arranged business house.

Not all of the Curb's machinery is visible in the street. The elaborate system of communication, which renders the brokers in the street accessible from the innumerable brokerage offices in New York and other cities, is hidden behind the windows of the buildings overlooking the center of operations in the street. The fronts of these buildings are cut up into small offices, the requirements of each being a shelf for a telephone and a telegraph instrument and a good window. The operator in the street is in constant communication by an elaborate and interesting system of signals with an assistant at the window, and the wires carry orders and messages to and from the brokerage office around the corner, miles uptown, in Boston or wherever it may happen to be.

Suppose a visitor from Butte, Mont., arrives at the Waldorf-Astoria by a morning train. In looking over his morning paper he finds a change in Cumberland-Ely quotations, and he decides to buy 100 shares of the stock. Without laying down his paper he may step into a stock-broker's office in the same building and complete the transaction in scarcely less time than it takes to light a cigar. The broker, telephone in hand, inquires the number of shares and the price. When the customer finishes speaking the attendant at the window overlooking Broad street is already in possession of the facts. With a few passes of his hands he communicates the figures to the house's representative in the street. The man in the street moves perhaps three paces to a group of which he knows Cumberland-Ely is the center, shouts his figures to the broker who happens to have the stock for sale, receives a nod or a tap on the wrist in acknowledgement, waves his hand to his particular window, and the broker in the hotel informs his patron that the stock is his. It is possible to buy or sell stock on the New York Curb with almost equal facility from innumerable other points in New York as well as in Boston and Philadelphia.

There are as many systems of signaling as there are brokerage houses represented on the Curb. Most of the signs employed are modification of the ordinary deaf-and-dumb alphabet. Brokers vary their signals to suit their own convenience, secrecy being desirable and often necessary especially in communications concerning the rise or fall of prices.

Men used to busy scenes about mines and smelters will invariably wonder at the continual bustle and scurry within the ropes on Broad street. To them hurry and excitement suggest lack of organization and low efficiency. Their first inquiry naturally is, "Why all this excitement? Is something unusual about to happen?" The jostling and shouting is merely a manifestation of the universal eagerness to get things done at once. Speed in executing orders is all important, for the slightest fluctuation in the price of the stock affects the interests of the customer. A rise or fall of an eighth of a cent may alter his plans completely, and on the Curb quotations change and change again in the twinkling of an eye.

Brokers familiar with the market know at once where to go to find the center of activity for any given stock. Each of the more important stocks has a spot of its own, usually marked by a group of busy operators, where its shares are sold. These centers appear day after day upon practically the same square yard of asphalt, by common consent of the brokers. The nucleus of each center of activity is usually some individual broker who specializes in that particular stock. This also is arranged without rule or regulation. The operator merely selects the stock in which he wishes to specialize, and if he knows his business, he soon has the activity in that line centered about him.

Occasionally, when any given stock is unusually active, it will have two or more centers all attracting the operators at the same time. During the excitement in Yukon-Gold, two principal groups both interested in the same stock separated, one moving north toward Wall street while the other wriggling mob whirled and jostled about a point a block lower down An interesting story is told of a quick-witted youngster who cleaned up a thousand dollars in a few seconds on that day. He had no money but he knew the game. From the excited arms, hands and fingers waving above the heads of the crowds he learned that the quotations in the two groups differed by one or more points. Like a flash he disappeared into one crowd, bought a block of stock, disentangled himself and plunged into the other mob and sold the same stock. This is, of course, an exceptional case. Few operators speculative on their own account; they are mostly employees of large firms at a fixed salary.

Wash Sales

Publicity is as the breath of life to the Curb as it is to all stock markets. It is the stock that is quoted in the newspapers and the rising and falling prices of which are as familiar as the landmarks along Wall street to the brokers, that are dealt in from day to day. A stock must become known before it can find a market. A broker may, if he will, appear within the roped inclosure and shout, "Is there any market here for ——?" naming an unknown stock, but he will receive no response. Merely advertising in the Lawsonian way is not sufficient to create a demand on the Curb. The brokers must have quotations before they can begin.

When a stock is listed on the Stock Exchange it already has a certain standing and its backers have complied with certain regulations which bring it to the attention of the brokers. But on the Curb stocks sometimes appear without accredited backers and without a market. To induce the brokers and the public to take any notice of these unknown shares requires some strategy and more or less cash.

In order to secure for a new stock published quotations and a market, fictitious sales or "matched" sales are arranged, one broker being given an order to buy a certain number of shares and another to sell an equal number. These brokers meet on the Curb, and buying begins, as all the world may see and hear. The brokers may be entirely innocent of the trick that is being perpetrated upon their brother operators, the newspapers and the public. They receive their regular commission and are usually unaware of any part they may have played in launching a new enterprise.

Orders of this kind skilfully distributed among a number of brokers soon brings a stock prominently before the market. Of course, someone pays the freight in the form of brokers' commissions, but that is the price that the backers are willing to pay to get the public interested in their enterprise.

When a stock is fairly afloat it still requires considerable nursing in the early stages to keep it at the desired level. Its backers must be prepared to keep the public interested and to buy in shares when the market begins to lose interest and to allow the price to sag, success depending largely upon the skill and the financial strength of the promoters. All these matters are based upon personal honor and gentlemen's agreements, and the interesting stories of treachery are repeated so often as to indicate that occurrences of that sort are rare. Many picturesque tales are told about the Yukon-Gold excitement of last March. One which has gained wide currency ascribes the sudden decline of the shares from 8 to less than 5, to the treachery of one of the promoters. This man could not resist the temptation to unload some of his own holdings when he saw the price climb. While his friends were buying in block after block of the stock to hold up the market, he quietly dumped 50,000 shares into the hopper, with the result that the market was swamped.

It is not to be understood that "wash" or "matched" sales are confined to the Curb or to the introduction of new stock into the market. Balancing orders so as to create an impression of great activity is resorted to for a variety of purposes, for the manipulation of pooled stock and to cause a boom in neglected shares. It is one of the favorite tricks of the powerful operators on the Stock Exchange, and is there carried on on a grand scale in spite of the law which places a tax of $2 per 100 shares upon all transfers. This tax in addition to the commissions paid a score or more of brokers renders these spectacular campaigns extremely expensive.

Curb Brokers

Theoretically anybody can step off the sidewalk in Broad street and begin buying and selling stock on the Curb, but if a stranger were to try it, he would most likely have reason to regret his experience. The open-air market is supposedly free for all, but as a matter of fact its privileges are hedged about by a lot of unwritten regulations which are about as binding as the laws of the Medes and Persians. The 150 to 300 brokers who meet on the pavement from day to day have their own methods of dealing with strangers and with one another. Hazing is a recognized means of enforcing the unwritten law of the Curb.

When a new operator attempts to join the group of traders, he is usually already well informed in regard to the rules of the game. The ranks are recruited chiefly from the army of telephone boys and assistants at the windows along the street. The curb-broker-to-be secures the service of a friend, well known in the street, to introduce him to the other operators. After the novice has been introduced and has satisfied the brokers that his word in a transaction is good, he must submit to a course of hazing. What he is compelled to suffer depends upon the mood and the ingenuity of the mob. After he fancies himself a full-fledged broker he will probably be induced to fill his order book with fictitious sales of stock bearing imaginary names.

The broker on the Curb is intensely alert. All his faculties and all his training are directed toward one aim, to develop speed and accuracy in executing orders. The successful broker must not only be familiar with all the principal stocks but he must also possess a prodigious memory; for, although he carries a little pad upon which all his transactions are recorded in duplicate, commissions will sometimes come so thick and fast that there is no time to make written records. Astonishing tales are told behind the windows overlooking the street of the wonderful prowess of certain brokers, of scores of sales made as rapidly as they could be acknowledged by a nod or a gesture, all completed without the slightest error, although the sums involved represented thousands upon thousands of dollars.

The open-air brokers have at various times attempted to form an organization of some sort, in order to regulate the affairs of the Curb and to secure a building and the other paraphernalia which seem necessary for conducting an enormous volume of business; but on each occasion the Stock Exchange has interposed objections. The curb brokers, therefore, continue to inhabit the open street from 10 a.m. to 3 p.m. in all weathers, in the hot sun in the summer and swathed in coats and furs when the wintry blasts howl down between the tall building from Nassau and Wall streets. They have an unofficial sort of secretary, an unofficial publication for the record of their transactions, an unofficial gong to ring the hour of closing and an unofficial bulletin board for unofficial communications.

It is amusing to watch the bedraggled but animated groups in the street during those driving rainstorms which turn the New York gutters into sluiceways and against which unbrellas are worse than useless. The reaction to natural environment, of which biologists talk so much, seems to be entirely suppressed. A gentle old lady from the country expressed it all very fully. "Why," she said, "they don't seem to know it's raining."

Fleecing the Brokers

Most mining stocks sold on the New York Curb must be paid for in full. Some stocks can be bought on margin, but not generally. This is because the New York bankers, unacquainted even with good mining stocks, will not lend on them to the brokers. In Boston it is different. The bankers there are generally acquainted with the mining stocks listed on the Boston Exchange, and will loan on them to the brokers, who, consequently, are able to accept orders to buy on a margin. Boston brokers, however, do not commonly carry stocks that are dealt in only on the Boston Curb. Stocks are carried on the New York Curb by brokers who are able to finance them in special ways. However, marginal trading on the New York Curb is comparatively limited in volume.

The margin trick is a favorite one with sharpers who wish to enrich themselves at the expense of the Curb. One clever rogue a few years ago realized $75,000 on a "plant" of this kind which cost not more than $25,000. His method was fairly simple. He worked up a fictitious market on some worthless stock of his own manufacture. He then sent confederates to Boston, Philadelphia and other cities to open accounts with careless brokers. The confederates began by trading in good stocks, and after having established a credit, they placed orders for the bogus stock, putting up good margins, as high as 20 and 25 per cent. The out-of-town brokers bought the manufactured stock by telegraph in New York, paying for it in full. The seller in New York was, of course, the arch conspirator. When enough stock had been sold on margin the confederates disappeared and the brokers were "stuck" with the worthless shares.

But it is not easy to catch the Curb brokers napping, and the sharper who succeeds in fleecing them is regarded in the street with respect not unmixed with admiration. In the new rule requiring unknown stock to be posted on the bulletin board the brokers have some protection against shares that are utterly worthless. The blandishments of the schemer of the ordinary sort have no more effect upon them than has the weather.

The Iron Industry in India

At one time the iron-smelting industry was widespread in India as is testified by the slag heaps found scattered throughout the country ("Sketch of the Universal Resources of India," by T. H. Holland). Small furnaces producing highly ferriferous slags which carried away the impurities were used. This was a very wasteful process and serves as no indication of the ore value in the country.

However, in the Raipur district of the Central Provinces in Mayurbhanj State large bodies of iron ore of a superior quality, in the form of small hills standing in relief from the general peneplane are found. The ore in these deposits runs as high as 68 per cent. iron with small percentages of phosphorus, and the deposits offer every facility for the cheapest form of quarrying.

Various attempts have been made to erect smelting plants on European plans the only successful one so far being at Barakar on the Raniganj coalfield. These blast furnaces turn out about 50,000 tons of pig iron annually. Steel making was attempted but proved a failure.

India stands in the front rank of the countries producing high-grade manganese ore. Practically all of the manganese ore produced, amounting in 1907 to 581,036 tons, is exported to the steel works of the world.

Indian Gold Mines

The gold production of the Kolar district in Mysore, India—including also the Hutti mine in the Deccan—in December was 52,759 oz. bullion, being 4480 oz more than in November and 644 oz. more than in December, 1907. For the 12 months ended Dec. 31 the total was 549,731 oz. bullion in 1907, and 560,343 oz. in 1908; an increase of 10,612 oz. The bullion reported in 1908 was equal to $10,424,067, or 504,300 oz. fine gold.

Economy as Related to Mine Accidents

A Fearless Discussion of the Lax Conditions That Exist, Showing That the Coal Operator Eventually Pays a Heavy Price for Present Neglect

BY H. E. COLL*

The relation of economy to mine accidents has not been given sufficient importance in the various articles and discussions concerning the heavy casualty list in the mining industry. Always to be remembered are the words of advice given by an old mine inspector of the Ninth Bituminous district of Pennsylvania in 1901, on the occasion of an examination for mine foremen. He summed up the whole situation in the words: "The safest mine must of necessity be the cheapest." There was no question about the old gentleman's sincerity, and there was no question in the minds of those new-fledged mine foremen as to the truth of his words, as they went about their duties; there also was no question as to the truth of the statement in the mind of the general manager, who hired the new mine foremen, and turned his mine over to them. They all sang the same doxology; they all preached the same gospel; but despite the fact that they were getting out coal at the lowest possible cost, men were still being killed.

Right here we have the nut cracked wide open. That ringing phrase, "the safest mine is the cheapest," becomes transposed in their minds to "the cheapest mine is the safest," and that transposition takes place so gradually, is so insiduously introduced, that before the changed thought takes conscious notice of the change, we are all hustling and bustling and hurrying to knock a quarter cent off the cost per ton. If someone halts us long enough to ask a few questions, we are always ready and able to put up an argument, showing that because the output has increased and the cost decreased, we have a much safer mine than previously.

We point with pride to the well planned haulage-ways, the heavy rails and well drained road-bed. We call attention to the fact that the men are kept off the operating roads in traveling to and from the faces. We can talk ventilation by the hour and show where we have provided considerably more than the law's requirements in amount of air per man. Airways are large and well kept. Overcasts are of masonry or concrete. Landings and turnouts are wide and everything possible is arranged to give quick and safe despatch to the coal. In fact the mine is considered a model one, and furnishes a fine subject for a well written magazine article by a proud official of the company—after being carefully censored by the general manager.

That article, however, will have nothing to say about injuries and deaths during the past year. Of course not; they are accidents, due to the carelessness of the miner or his fellow workman. They are not a part of that splendid system of mining whereby we produce a ton of coal at less cost than we did before spending so much money to make a cheaper and consequently a safer mine. And in this attitude of the operator, the superintendent and the mine foreman, lies the whole secret of the fact that these large output, low cost, well equipped mines, are having a higher injury and death rate than before we attained such skill in the science of mining.

It is not my intention in this article, however, to insinuate that mine officials generally are not anxious at all times for the safety of their men. The outsider does not realize what it means to the superintendent to receive that dreaded message "man killed," over the mine 'phone. The outsider does not know the "boss'" feelings as he gazes on what has been John Smith or Andy Kalenski, and asks himself the question, "am I to blame?" But the superintendent knows. Let us be charitable and not lay the blame on any individual. Let us rather take a lesson from Mr. Lawson and blame the "system."

The Miner is Made Responsible for His Own Safety

Now the chief law of the system is that by improving the general efficiency of a mine, the same number of mine officials can govern a 1000-ton plant that formerly governed a 500-ton plant, and we find the miners backing that law as strongly as the operators. The only one left to fight the system is, as always, the outsider, and he knows nothing about the business. While this law has many ramifications, the dangerous feature about it is that the miner is practically made responsible for his own safety. A few rules and regulations have been passed by various legislatures which are supposed to govern his actions, while working as a miner or other underground employee. To these are added a few additional rules to cover special methods or practices at any particular mine.

The majority of these rules are good and if faithfully followed would no doubt save many a broken bone; however, so long as we have to contend with the vagaries and forgetfulness of 500 different human natures we are certain to have disobedience both intentional and unintentional. A miner may fire shots, put up timber, pull posts or do any one of the many things which yearly levy a heavy toll on human life; however, because he is a contract man it is assumed that he is capable of protecting himself; the miner always says he is capable and prefers not to have any bosses around bothering him as to how he is doing his work. What is the result of this mutual understanding whereby two or three officials are able to handle a mine turning out 1000 or 1500 tons of coal per day?

Let us take the record of the anthracite field for 1906:

Causes of Death.	Percentage.
Falls of roof and coal	47
Premature blasts	12
Explosions of gas	9
Powder explosions	6
Mine cars	15
All other causes	11
Total	100

Note that 59 per cent. of the accidents occurred directly at the working face. Contract work was directly responsible for 74 per cent., and 47 per cent. which were due to falls of stone and roof; are classed as accidents due to the ignorance, inexperience or carelessness of the miner; as the latter is usually dead, he can be safely blamed for the unfortunate occurrence.

Foreigners, a few weeks "over," are hired as miners and sent to the faces without the mine officials knowing whether they are competent or not. Men whose judgment we would not trust in anything else are sent into working places and left to themselves to do work that requires close attention and common sense.

What is to be said of a practice or a system that permits 47 per cent. of its total number of accidents to be caused by lack of precautionary measures at the working face? Every miner puts up the timber for his own safety. The miner puts up the timber he considers necessary, and the company accepts the miner's judgment. The result is—broken backs, crushed heads, and all the long list of things that will kill or cripple a man.

Many Accidents are Caused by the Drawing of Props

In the working of pillars this is usually due to the drawing of the props or supports, and it is here that the bituminous mines run up their long heavy death rate. Chief Inspector Roderick, of Pennsylvania gives the number of deaths due

*Mining engineer, Stellarton, Nova Scotia.

to falls, during 30 years of bituminous mining, as being 60 per cent. of the whole. During 1907 he shows that 41 per cent. of the fatal accidents were due to the carelessness of others and that nearly 20 per cent. were due to unavoidable causes. Now if we get close down to the methods adopted in getting a ton of coal from the face to the surface and consider the various rules and provisions that are supposed to be in force for the protection of the men, it is difficult to understand why we have unavoidably killed a man for every million and a half tons of coal produced.

The report of the Geological Survey for 1907 gives the following statistics in regard to accidents: The total number killed was 3125, and 5316 were wounded. Of these totals, 1122 were killed by falls of roof and coal and 2141 persons were wounded. Powder accidents caused the death of 201 men and injured 416, while explosions from gas and dust killed 947 men and wounded 343. Many of the 3263 accidents from falls of roof and coal could have been prevented by an intelligent supervision of the working face. A large number of the 617 powder accidents would not have burned and scarred their victims had a competent man inspected and fired each shot.

Chief Roderick in his report on the mining industry in the State of Pennsylvania, speaks of the 1907 output as being most remarkable, and Mr. Roderick may well be excused for his pride in a State that can produce more coal than any foreign nation, except Great Britain. But more remarkable than the output is the candid nature of the chief's remarks on accidents. Here we find the head of the Mines Department of the greatest coal-producing area in the world, calmly producing the following:

"However, after the last word has been said regarding the causes of accidents and the best means of prevention, it still remains an indisputable fact that over one-half of all fatalities result from carelessness on the part of the victims or on the part of others, and such being the case, the statement must go unchallenged, that the loss of life, deplorable as it is, will continue until the miners themselves and those in charge of the workmen learn to exercise greater care, or are better fitted for their work." After catching his breath the worthy chief winds up by declaring that "the spirit of recklessness and the ignorance of the workmen add an unusual hazard to an occupation that at best is notoriously dangerous."

Now why does Chief Roderick call an occupation "notoriously dangerous" when over half the accidents are due to lack of discipline on the part of miners and mine officials, lack of nerve on the part of mining engineers, and total lack of capacity on the part of the State of Pennsylvania, for understanding that something more was expected of her than the killing of a man for every 186,000 tons of coal produced?

Particular reference is made to Pennsylvania because being the heaviest producer, that State should show the lowest percentage of deaths. While it is true that anthracite mining is more dangerous than bituminous, it has no result on the death percentage, since we find in 1906 the bituminous rate was almost as high as the anthracite, while in 1907 it exceeded it. Nature has singularly favored Pennsylvania in the laying down of the soft-coal beds. Very productive seams of clean coal, lying almost flat with a light cover, are conditions which allow for a large output being readily obtained at a low cost, but for the same reasons it should mean a low death rate.

If We Levy a Fine for Every Fatal Accident

Because reverse conditions are found to be true, we are forced to the conclusion that something is seriously wrong in the coal-mining industry. In order to ferret out this wrong let us assume a certain condition: Supposing a fine of $3000 be levied on a coal company for every fatal accident, thus making a direct loss to the company for every loss of life. That concern would immediately take up the question of prevention of accidents, and the investigation would at once lay bare three fundamental causes of mine accidents:

1. Lack of discipline owing to there not being a sufficient number of officials to properly oversee the men and their work.

2. The use of open lights or, where used, the improper handling of safety lamps.

3. The use of explosives which will not insure a minimum risk.

The first cry of the operator will be that the coal business cannot stand under any change in these conditions and that his increased costs will eat up the profits of the business. Let us see. In the first place you can't kill a man for nothing. Your accident and property insurance rates are high or if you don't carry accident insurance you are liable to be mulcted in a damage suit by a lot of farmers or business men who have not the least idea of what a mine is. Also your friends the lawyers don't work for nothing. The item, which, outside the loss of life should receive the most consideration, is the damage done to mines and mining property during the past two years by fires, explosions and water. The majority of these can be traced back to some one of the fundamental wrongs of the mining industry, lack of discipline, the misuse or nonuse of safety lamps, and the powder question. This means that accidents have a definite cost per ton, so that if we spend, in accident-preventing measures, a sum equal to the cost of our accidents, we will put a stop to the death rate and at the same time add nothing to our cost, or what is more than likely decrease the cost. For there can be no question but that, if the miner and the laborer are in constant supervision, and if they know their work is going to be inspected and passed upon two or three times in the day, it is going to certainly follow that more efficient and consequently more productive work will be performed.

The discipline question is really the only one which could be a factor in costs since it can easily be shown that safety lamps and powder should have no bearing upon it. As regards the former, no man today is justified in using open lights in any coal mine. The history of the industry in England, Wales, United States and Canada, is full of disasters brought about or aided by the open light. What power is it that still keeps this danger in use? Certainly it is not the man who has become accustomed to safety lamps. There is no comparison to be made in point of safety, comfort, or cleanliness.

The Dangers from Flaming Explosives

Powder bears such an important part in the mining industry, and its use is so extended that it is difficult to understand why it is only at this late day, the proper explosive for mining coal, and the methods to be adopted in its use are being discussed and investigated. The moment you bring any explosive into a mine, the factor of safety of that mine is decreased, proportioned by the nature of the explosive, the condition of the mine and the discipline maintained. Therefore, it follows, that given the necessity of explosives in the mining industry, only such compositions should be permitted as would, after scientific experiment and practical use, insure the highest possible factor of safety. The science of mining has signally failed to rise to the opportunities presented, through the use of explosives, and has caused a consequent delay to the progress of mining coal in a safe, scientific and economical manner.

We find both capital and labor standing shoulder to shoulder, the one prepared to lose his mine, the other his life rather than admit that some other explosive would answer his purpose as well as their beloved black powder. There are three heavy-weight reasons given against the use of high explosives in mining coal:

1. Much higher price per pound.

2. Increased quantity of fine coal.

3. Greater liability to accidents in the handling of high explosives.

As regards price, if the operator will deliver powder at what it costs him in his magazine, the miner can afford to pay for a much higher grade of explosive and mine coal at a decreased powder cost per ton. In any case the profit was a "false profit" for whatever you received in the pound of powder you paid out for the ton of coal. The argument that the high ex-

plosive shatters the coal more than black powder is the strongest one against any change in explosives.

The foregoing argument is surely based upon a mistaken idea. There are explosives manufactured today that are almost as slow as powder, yet they have double and triple the strength. Put in shot-firers, men who understand their business; let them regulate the placing of the shot, depth of hole and weight of charge; allow no shot to be fired which has not been sheared or undercut, or has its equivalent in two open faces, and lastly, fire all shots with a battery, and the operator will find no increase in fine coal. Instead, he will have taken a long step toward cutting down the accidents, and preventing fires and explosions.

Treat Disobedience as a Crime

Such changes as are made should be covered by special rules, approved by the Mines Department and made a portion of each State's regulations. Armed with this, the officials and workmen should be taught that disobedience and evasion of mining laws are to be treated and punished as crimes.

There is one feature that would have more bearing than any other on general conditions and mining practice: that is, the education of miners by mine officials. If there are sufficient officials to keep in touch with the workmen, and exercise a supervision over all the actions of the miner, much better results would be obtained in the use of explosives, timbering, track laying and the quality and quantity of coal produced per miner. Every official should constitute himself a walking instructor, leaving a word of advice here, and commendation there. He should not only be able to answer, but what is more important, he should be able to ask questions.

The writer realizes that in bringing up these questions he is treading upon the corns of almost every coal operator on the continent. It is a noticeable fact that every available feature of last year's heavy explosions has been made the subject of lengthy discussion and dissenting articles. But there is no dissention when it comes to the possible influence that discipline, or explosives may have had on these accidents. The U. S. Government gets into a flutter and consults foreign experts after gas and dust explosions have killed 947 men and injured 343 others, but we find 1122 men killed and 2141 injured by falls, and not until recently were any articles written, or voices raised in protest.

Big explosions appeal to the imagination and excite great discussion as to whether it was gas, dust, or both; but day in and day out they can be crushed and maimed by ones and twos at the "faces." Year after year this has occurred and no mining society has discussed it, no State has said, "this must stop," no jury has said to the operator, "you are responsible, and why? Because these accidents, which cause more deaths, more injuries, more suffering, more poverty, than any other type, occur almost exclusively to contract men, and are accompanied by a small property loss.

Who can estimate the moral loss to the mining industry? The lack of supervision shown by these figures must indicate a lack of mine efficiency, that will affect the output from the time it is mined at the face until it is dropped into the cars. Increase the productiveness of the working face and the costs are bound to come down.

Mine Operators are Indirectly Paying the Price

Surely the time has come when coal operators must open their eyes to the fact that they are indirectly paying the piper for all these accidents. Equip your mine as well as you can, model it after the best and then improve on that, but so long as your officers have not established a just, but withal, an iron-bound discipline, you cannot expect to take the proper advantage of your costly improvements, in a decreased cost per ton. Discipline is to productiveness, what charity is to faith. As St. Paul says, "Without it you have nothing."

It is the operators' fault today that mine discipline is not on the same plane as that maintained by the captain over his crew. The very fact that there are so many foreigners among the miners, would make this easier, since they are naturally amenable so long as there is not imposition. But there is no excuse today for keeping an official who will not give a "square deal." Start in by endeavoring to lessen the casualty list. You may have to change your officials, put in safety lamps, use a powder with a higher factor of safety, and do many other things that apparently are going to cause you an increase in cost, but it will surely follow that as the accident list grows less, the general efficiency of your plant will increase, and at the end of a few years, the accounts will show, that, to economize in blood is to economize in costs, that a safe mine is indeed a cheap mine and that the dark days are over, when this industry, so closely linked with the greatness of our country can be called "notoriously dangerous." The safest mine is the cheapest.

Considerable concentration was done on the Rand, South Africa, before the war, and even for some years after the war at a few properties. But finally it became the general opinion that concentration did not pay in treating the Rand ores; so at present Frue vanners and other concentrating devices have been discarded and, as no concentrates are obtained, chlorination has been abandoned. At present the Rand ores are treated only by amalgamation and cyanidation.

The Coal Production of Oklahoma in 1908

Special Correspondence

The coal production in Oklahoma for the 11½ months ending Oct. 31, 1908, was, according to the report of the State coal mine inspector, 2,724,832 tons; the estimated value of this output was $6,130,872, or $2.25 per ton mine-run. There were 137,909 kegs of powder used, making an average of 19¾ tons of coal mined for every keg of powder used. In producing Oklahoma's output, 14,560 men were employed; of this total 8629 were miners, 3928 were company men employed in the mine, and 2003 were outside men. There were 44 fatal accidents, or one fatal accident for every 61,928 tons of coal mined; there were 128 nonfatal accidents, or one for every 21,287.96 tons mined. For every 1000 employees 4.39 were killed. There was a general cessation of coal mining throughout the entire State from April 1 to May 25, on which latter date a contract was agreed to by the miners and operators.

Gold in the Netherlands East Indies

At the Keta-Loen mine in Celebes, the preliminary report for 1908, according to the *Indische Mercur*, shows that 39,670 tons of ore were mined and crushed during the year. From this ore there was won 25,773 oz. gold and 38,440 oz. silver. The total value of the metals was $536,268, and the estimated profit was $206,000. The ore reserves at the close of the year were 162,000 tons, of an average estimated value of $15 per ton.

The Redjang-Lebong mine, in Sumatra, on the same authority, mined and treated in 1908 a total of 89,760 tons of ore, yielding 82,868 oz. gold and 471,630 oz. silver. About 40 per cent. of the metals was obtained by cyaniding tailings. The value of the metals won was $1,909,000, giving an average return of $21.27 per ton. The estimated profit for the year, after deducting working expenses was $1,287,000. The ore reserves at the close of the year were 308,000 tons, of an estimated value of $20 per ton.

The amalgamation plates in the Bantjes mill on the Transvaal, South Africa, instead of being placed immediately below the batteries, are to be placed in the extractor house.

In stamp-battery construction the tendency on the Rand is to increase the weight of the stamps, to make larger the crushing surface of the stamp shoes, and to enlarge the mortar boxes.

Swinging Chutes for Coal Mines

By Lestelle and Hyve*

The transport of coal from the face of a room down to the entry, in the case of a thin seam of moderate slope, is an expensive and laborious operation. Having had occasion to devise a practicable means for transporting coal down a slope averaging from 15 to 20 deg., we have found a satisfactory method to consist of swinging or oscillating chutes, which are described below.

Construction

The system consists essentially of an iron trough, suspended in such a way as to be free to swing, and subjected, at the end of each swing, to a jar which sends the coal forward and finally discharges it into a car standing in the entry. The trough is made of sheet iron, 1 mm. thick, in sections 2 m. long, and is reinforced near the top of each side, with 40x10-mm. straps, riveted on the outside. Every two sections are joined with a 10-cm. lap, and fastened with pins passing through holes in the ends of the longitudinal straps.

Passing under each section are two stirrups, with a pin at each end, to which the suspension chains are attached by means of hooks which can be caught into any desired link of the chain, so as to adjust the uniform slope of the chute. The upper ends of the chains are attached to the timbering either by nailing them with staples to the caps, as in Fig. 2, or, if the direction of the chute is parallel to the caps, by bolting them to an iron channel, which is then laid across two adjacent caps and wedged, as in Fig. 3.

A swinging motion is given to the trough by a double lever, Fig. 4, in each arm of which is a slot engaging loosely a pin firmly fastened to the lowermost section of the trough. The handle is so bent that the loader can reach it comfortably while standing behind his car.

The jar at the end of each swing is given by a buffer fastened to the bottom of the lower end of the chute. In order to get good results, it is best for the jar to come as nearly as possible at the end of the swing, and also for the lever to vibrate symmetrically with respect to its vertical position; these requirements are attained by making the buffer and the lever both adjustable. As shown in Fig. 5, the buffer is a flat piece of iron with a series of holes 3 cm. apart; it is held between two pieces of angle-iron, the latter being fastened to the bottom of the chute and having two holes corresponding to those of the buffer iron, but 6 cm. apart. By loosening and removing the bolts in these holes, the buffer can be adjusted by amounts of 3 cm. or multiples. The pivot of the actuating lever is carried by a couple of pins with threaded stems; they are inserted into holes bored through the timber props, and can be adjusted by means of the two nuts on the stem.

Remarks on Operation

In order to secure the most satisfactory results from the appliance, the following precautions should be noted.

The trough should be supported at regular intervals and should follow a definite grade and alinement. This will tend to produce a uniform flow from end to end of the chute.

Before beginning to use the chute after a new set-up, it should be tested to prove that it swings freely.

The workmen in the room must feed coal into the top of the chute just as fast and as often as the loader in the entry fills his cars. A continuous flow from the bottom will then be assured and the loader will not be obliged to do a lot of unnecessary pumping on the handle.

For inclinations around 25 deg., when coal begins to slide freely on iron plate, the lever can be dispensed with, and the loader can swing the chute sufficiently with his hands. For large chutes, of permanent character, a small engine can be installed to do the work.

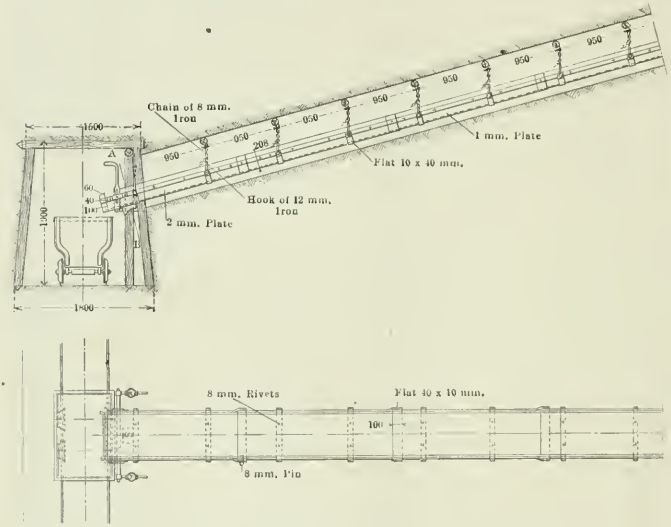


FIG. 1. PLAN AND SECTION SHOWING SWINGING CHUTE INSTALLED AT MINES DE L ESCARPELLE

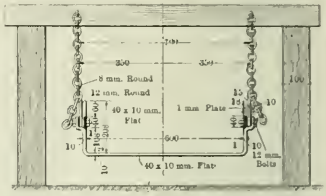


FIG. 2. FRONT VIEW SHOWING MODE OF SUSPENSION

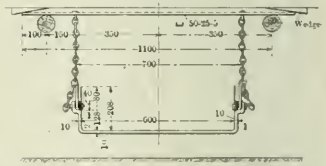


FIG. 3. A COMMON METHOD OF SUSPENDING THE CHUTE

Without following the rather detailed mathematical discussion of the authors, the following may be taken as their theoretical conclusions in regard to the time required to fill a car with coal from one of these chutes. The assumptions are as follows:

Weight of chute, kilograms per meter	19.00
Weight of coal for an average depth of 7.5 cm., kilograms per meter	40.50
Capacity of car, kilograms	475.00
Length of suspension chains, meter	0.60
Amplitude of vibration, meter	0.16
Coefficient of friction (tan 27° 30')	0.52
Work of loader, kilogrammeters per second	9.00
Time for starting vibration, seconds	2.00

With these assumptions, the following table gives the computed times required to fill the car from chutes of various lengths and inclinations:

	15 Deg.		20 Deg.		25 Deg.
	0 m.	33 s.	0 m.	21 s.	8 s.
5 meters	0 m.	33 s.	0 m.	21 s.	8 s.
10 meters	1	9	0	43	15
15 meters	1	49	1	7	23
20 meters	2	31	1	32	32
25 meters	3	16	1	59	40
30 meters	4	2	2	27	49

Note. Abstracted from *Bulletin* de la Société de l'Industrie Minérale, March, 1908.

*Engineers for the Compagnie des Mines de l'Escarpelle.

The computed times were found to be about 20 per cent. less than those observed in practice, the discrepancy being accountable to the friction of chains and lever.

Comparative Costs

Comparing the cost of operating the oscillating chute with the two other means of transporting coal most commonly employed in slopes of 15 to 25 deg., namely, gravity planes and fixed chutes, the authors, in whose collieries all three methods are in use, tabulated the following costs of moving a ton of coal from a room 30 m. long:

Seam.	Inclination.	Gravity Plane.	Fixed Chute.	Oscillating Chute
No. 17 ..	15 deg.	fr. 0 23	fr. 0.220	fr. 0 155
No. 28 ...	25 deg.		0.170	0.075
No. 18 ...	20 deg.		0.176	0 073

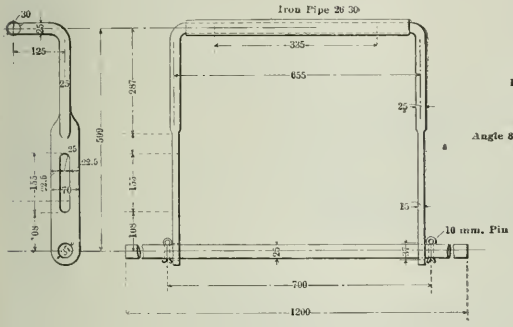


FIG. 4. DETAILS OF LEVER

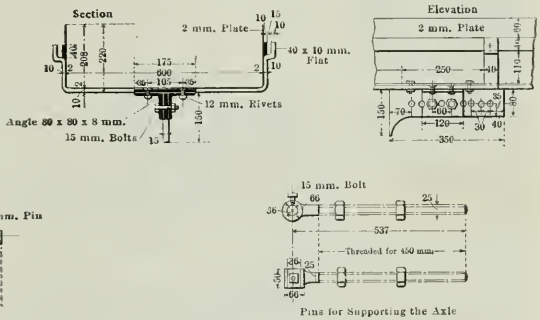


FIG. 5. DETAILS OF BUFFER

Besides the economy of labor, which is pronouncedly in favor of the swinging chute, other advantages are seen in the reduced amount of breakage of the coal, in obviating the necessity and the cost of smoothing out inequalities in floor or roof, and in the fewer tracks that have to be laid and kept in repair.

The Yaqui Peace

Special Correspondence

The period of hostilities which has prevailed throughout Sonora for the past nine years was brought to an end on the afternoon of Jan. 4, 1909, by the signing of a treaty of peace by and with the Yaqui Indians. The ceremony took place at La Pitahaya which is situated several leagues east from Ortiz on the Sonora railroad. There was no telegraphic communication with this place so that the Federal Telegraph Company stretched a temporary line from La Misa a couple of days before the ceremony. On Sunday, Jan. 3, Bule, the Yaqui chief, presented himself at the camp La Pitahaya and asked for three wagons to bring into camp the women, children, and impedimenta.

Monday morning the Indians presented themselves at the camp and the proceedings were begun. That afternoon at three o'clock the treaty was executed in due form by Luis Bule for the Yaquis and by General Luis Torres, governor of Sonora, General Lorenzo Torres, and ex-governor Rafael Ysabel, for the Mexican government. About 300 Yaqui Indians were present to witness the act and afterward delivered their arms and ammunition. Following this, General Torres addressed the Indians who, according to the despatches from La Pitahaya, listened attentively to the words, which seemed to impress them deeply with their significance and meaning, and they renewed their protestations of their desire for peace and unconditional submission.

Following the conclusion of this pact, Governor Torres appointed Bule, the Yaqui chief, the head of a species of *rurales* which were constituted and appointed from the Yaquis themselves to the number of 70, armed by the state and in its pay and under orders of the government. The object of this body is to patrol the country and prevent depredations by any Yaquis who may be inclined to break the treaty or any who have not agreed to the terms. There are a few who have remained out pending the result of these negotiations and these will be brought in and disarmed.

Practically the only concession which the government made to the Yaquis in this treaty was to agree that if in time the Indians showed themselves to be sincere in their desire for permanent peace their families which have been deported to Yucatan will be restored to them.

Effect of the Peace

The terms of the treaty are not of so much importance or interest to the American as the peace itself. That wonderfully rich mineral section of the State of Sonora, into which not a few venturesome Yankees have put considerable capital, has been terrorized for years by these Indians and by renegade Mexicans disguised as Yaquis, and the development of this section has been for the time practically killed. Large equipments of mining and smelting machinery are lying idle for this and no other reason in the very heart of the Yaqui country.

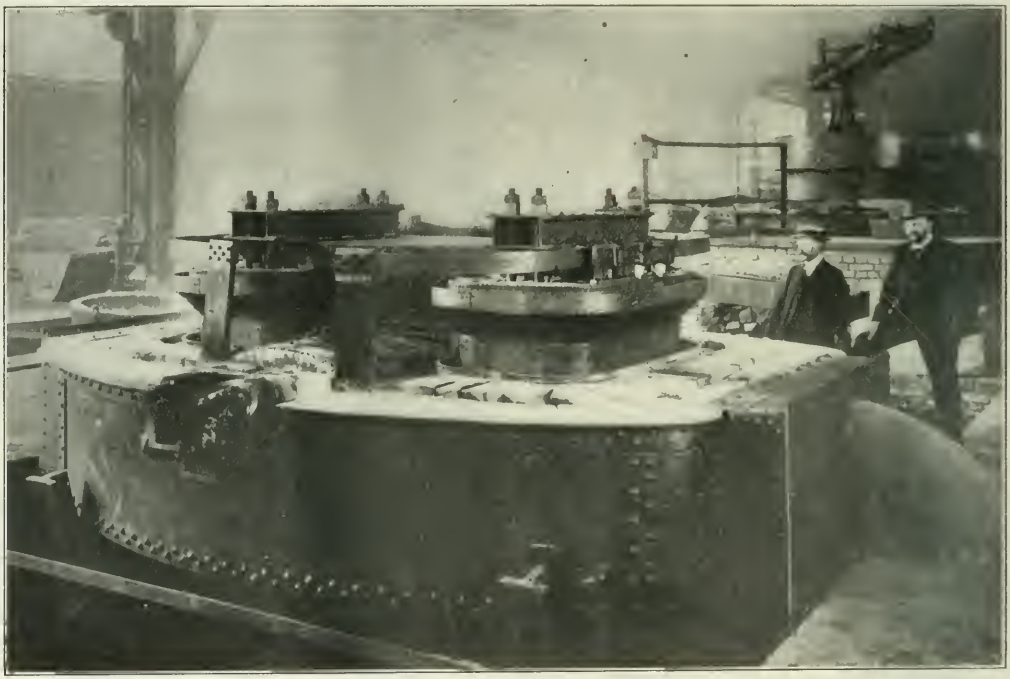
Will this treaty put an end to this long reign of terror which has cost the lives of so many American mining men? The consensus of the best opinion is that it will. There are some squaw men to be met who voice pessimistic opinions that this is only a lull in the storm, but it is not at all unlikely that they voice simply the feeling of a few disgruntled Indians of their own worthless class. The better element of both Americans and Mexicans believe that the trouble is at an end. The State of Sonora is sadly handicapped for labor and everyone admits that the Yaqui as a laborer far excels the Mexican peon. Both Americans and Mexicans who have material interests, especially in the southern part of the State, are exceedingly anxious not only to give employment to the Indians but to have returned to the country all those who have been sent into exile. With ample opportunity for employment and the benefits which it brings, and which are appreciated by the Yaquis more than by the peons, it is probable that the Indians will never revert to the old warfare.

In reporting on the progress of the mineral industry of Tasmania, the Secretary for Mines states that during the quarter ending Sept. 30, 1908, 5899 oz. of gold were obtained from quartz, 158 oz. from alluvial, 1773 oz. by means of the cyanide and cholorination processes, 4735 oz. from blister copper from the Mt. Lyell Mining and Railway Company, Ltd., and 028 oz. from the silver-lead bullion from the Tasmanian Smelting Company's works, Veehan, making a total of 13,493 oz., valued at £56,904.

New Resistance and Induction Furnace

By Dr. Alfred Gradenwitz*

The electric furnaces hitherto designed for the manufacture of iron may be divided into three classes, according as they are based, (1) on the action of the electric arc, (2) on the heating effect of electrical resistances, or (3) on induction effects. A new electric furnace recently installed in some of the German iron works is a combination of the resistance and induction furnaces.



RÖCHLING-RODENHAUSER ELECTRIC FURNACE

In order to explain the working principle of the new furnace the Kjellin induction furnace, designed on the model of an alternate current transformer, will first be briefly described. Fig. 1 is a diagram of two coils of wire, insulated from each other, one of which is traversed by a primary electrical current, inducing in the other coil a secondary current. If a soft-iron core *k*, a bundle of iron wires, is introduced into the primary coil *n* and the current of the latter is interrupted in rapid succession, the effect of the primary coil on the secondary coil *s* will be considerably reinforced. If, then, instead of a continuous current an alternate current is thrown into the primary coil, any special interrupting device may be dispensed with.

The Kjellin Furnace

In order to appreciate the working of induction furnaces it should be understood that, apart from certain unavoidable losses, the flow developed in the secondary conductor, i.e., the product of the amperage by the tension, is equal to the flow traversing the primary coil. However, either of these two factors can be altered at will, by properly designing the number of coils, and the cross-section of each coil. A high-tension current of low amperage thrown into the primary circuit can thus be used to excite a low-tension current of high amperage in the secondary coil, provided that the latter, as illustrated in Fig. 1, is made up of a few windings of relatively large cross-section. By further reducing the number of turns of the secondary conductor, the limit represented in Fig. 2, i.e., a simple ring conductor, is reached, which under proper electrical conditions may be loaded with reduced currents of such volume as to be raised to a white heat and melted. This, in short, is the principle underlying the Kjellin induction furnace, as shown in Fig. 3, *n* being the primary coil, *k* the iron core, and *s* the secondary coil, constituted by a circular bath of molten iron, inclosed within the masonry ring *m*.

The New Furnace

These induction furnaces are very convenient for the melting of steel from pure, raw materials, without any special refining, and are used to great advantage whenever a steel of given composition is to be produced from pure pig and scrap iron, the percentage of carbon in the former being diluted by the scrap, and the finished product being alloyed with any desired metals, such as nickel, chromium, tungsten, etc., to give the steel special properties. If, however, the induction furnace is used for the refining of impure molten material from converters or air furnaces, it is found to prevent some disadvantages which are overcome in the new arrangement. This new furnace was designed by Röchling-Rodenhauser, and is a combination of the Kjellin induction furnace and the resistance furnace.

As shown in the diagram, Fig. 4, two Kjellin furnaces are connected in the form of a figure eight, *n* being the primary coil, and *k* the iron core. In order to allow the central communicating part of the two channels *s'* to be given a width sufficient for convenient operation, the space within the masonry *m* is further

*Berlin, Germany.

heated by electric resistances inserted between the current conductors *c*, which in the present case consist of conductors of the second class. The current used in heating these resistances is supplied by an additional secondary coil *s*, fitted over the core *k*. The accompanying illustration shows a furnace of this type of 3.5 tons capacity.

As regards the details of construction of the new furnace, it may be said that means for completely discharging the furnace had to be provided by designing it as a tilting furnace, to be able to remove any excessive amount of slag, and to be independent of tap holes. The furnace is suspended upon two pivots, and its spout is raised or lowered by tilting the whole in the usual way. All parts had, therefore, to be more substantial than in the stationary Kjellin furnace.

As regards the current consumption of the furnace, this may be said to be rather favorable, about 385 kilowatt-hours per ton being used in a small 300-kg. furnace, for melting pig iron and heating it to about 1200 deg. C., whereas for finishing a scrap charge about 600 kilowatt-hours are required. While the direct melting of pig iron in this furnace would hardly pay in Germany, it is used to advantage in handling molten Thomas or Martin steel, and refining it to the finest grades of steel, which may be said to be the proper province of the electric furnace at present.

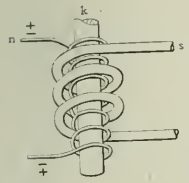


FIG. 1

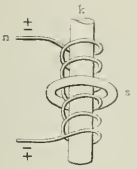


FIG. 2

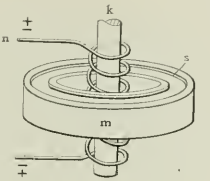


FIG. 3

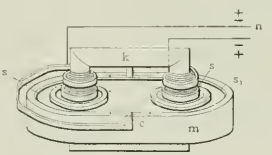


FIG. 4

Coal Miners' Convention

SPECIAL CORRESPONDENCE

The end of the second week of the annual convention of the Mine Workers' Association finds the delegates still inharmonious and little of the legitimate and necessary work of the meeting has been accomplished. These matters are a source of worry to President Lewis who is meeting with strong opposition at every step of his administration by the Walker faction. The convention is costing the association $9000 a day and this reminder has had no effect upon the dilatory work of the various committees and their tardy reports. President Lewis made his annual report early in the week and the committee to which it was referred approved it. This report provoked a heated discussion bordering on threatening trouble. The report of the committee, however, was adopted by the convention. Day after day the delegates anticipated a report from the tellers appointed to count the vote for national officers, but no report was made. It was learned, however, that Mr. Lewis had been elected with 16,269 votes to spare and all interest in the election subsided.

When the miners met January 19, it was expected they would complete their work and adjourn not later than January 30. Now there is some doubt whether they will be able to get through in another week. It is possible, however, if the clashes cease the work will be completed in that time.

Copper Imports and Exports

The movement of copper to and from the United States in the year 1908, as reported by the Bureau of Statistics of the Department of Commerce and Labor, showed an increase of 59.2 per cent. in exports; a decrease of 13.4 per cent. in imports; and an increase of 165 per cent. in the excess of exports over imports.

EXPORTS

The exports of copper for 1907 and 1908 were as follows, in pounds:

	1907.	1908.
Great Britain	81,409,441	117,810,314
Belgium	3,822,551	5,560,366
France	93,075,145	115,690,381
Germany and Holland	164,259,660	333,016,011
Italy	21,192,908	25,512,267
Russia	4,341,386	4,657,077
Other Europe	26,221,024	39,433,674
British N. America	3,747,410	3,977,142
Mexico	362,411	35,895
China	10,003,592	13,735,899
Other countries	493,873	2,447,101
Total	408,929,401	661,876,127
In ore and matte	15,328,500	13,632,300
Total	424,257,901	675,508,427

Germany and Holland are included together because most of the copper reported as shipped to ports in the Netherlands is intended for Germany; railroad connections to many German points being better from Rotterdam than from Bremen or Hamburg. Our custom-houses report, of course, only the seaport to which metal is directly consigned. The copper contents of ore and matte are estimated on the basis of values. The actual tonnages in 1908 were: To Great Britain, 168; Germany, 2; British North America, 55,367; Mexico, 7060; other countries, 552; total, 63,149 tons.

IMPORTS

The imports of copper in metallic form were, in pounds:

	1907.	1908.
Great Britain	25,706,852	5,434,435
France	606,662	168,506
Germany	6,814,338	1,451,370
Other Europe	5,616,261	13,359,117
British N. America	30,902,596	30,895,737
Mexico	76,741,532	43,742,993
Cuba and W. Indies	1,168,769	534,050
Peru	14,945,697	23,646,921
Other S. America	8,349,374	2,418,672
Japan	9,809,569	8,329,896
Other countries	12,239,617	32,242,447
Total	192,901,267	162,224,144

The marked changes were the decreases in receipts from Europe, from Mexico and from South America outside of Peru; the increases from Peru and from the non-enumerated countries.

The copper contents of ore and matte imported were, in pounds:

	In Matte.	In Ore.	Total.
British N. America	2,859,969	8,326,728	11,186,697
Mexico	129,766	15,773,926	15,903,692
South America	.....	9,054,852	9,054,852
Other countries	4,683,272	15,652,830	20,336,102
Total	7,671,307	48,810,036	56,481,343
Total, 1907	.....	.....	59,718,787

In 1907 ore and matte were not reported separately. The actual tonnages in 1908 were: British North America, 3177 matte and 137,603 ore; Mexico, 816 matte and 54,073 ore; South America, 22,790 ore; other countries, 7075 matte and 62,423 ore.

These figures give the following totals for copper imported, reëxports of foreign material being deducted.

	1907.	1907.	Changes.
Metal	192,901,267	162,224,144	D. 30,677,123
In ore & matte	59,718,787	56,481,343	D. 3,237,444
Total	252,620,054	218,705,487	D. 33,914,567
Re-exports	995,555	718,941	D. 276,614
Net imports	251,624,499	217,986,546	D. 33,637,953

A large part of the imports consisted of copper sent here to be refined and put in final marketable form.

COMPARISON OF EXPORTS AND IMPORTS

The total exports and net imports for two years compare as follows:

	1907.	1908.	Changes.
Exports	424,257,901	675,508,427	I. 251,250,526
Net imports	251,624,499	217,986,546	D. 33,637,953
Excess, exp.	172,633,402	457,521,881	I. 284,888,479

In addition to the quantities reported above there were exported manufactures of copper in various forms valued at $5,888,170 in 1907, and $3,162,303 in 1908; a

decrease of $2,725,867. The quantities and forms of these manufactures are not given.

The Guggenheim Exploration Company

The annual report of this company for the calendar year 1908 shows liabilities and assets as follows:

Capital stock	$22,000,000
Bills and accounts payable	1,003,531
Surplus	13,643,689
Total liabilities	$36,647,220
Treasury stock	$ 1,319,900
American Smelters Securities Co. (A)	13,860,000
American Smelters Securities Co. (B)	199,890
American Smelters Securities Co. Common	1
Other properties and investments	17,589,487
Furniture, fixtures and equipment	7,706
Bills and accounts collectible	2,083,436
Cash and demand loans	1,586,800
Total assets	$36,647,220

A detailed statement of assets included under other property and improvements is as follows: Cumberland-Ely Copper Company, $912,808; Esperanza, Ltd., $337,360; Nevada Consolidated Copper Company, $1,671,589; Nevada Northern railroad bonds, $1,050,000; Utah Copper Company, $4,788,648; Yukon Gold Company, $8,222,062; miscellaneous, $7020; total, $17,589,487.

The report says: "Comparison with last annual statement will show decrease in surplus of $100,563. The net income was $57,849 in excess of dividends, but we charged off $158,412 on account of securities disposed of during the year. We continue to carry American Smelter's Securities Company common stock—of which we own $11,249,000, par value—upon our books at a nominal valuation of $1. It is only within a few months that all of the smelters and refineries of the Securities company (six in number) have been completed and in operation. The profits now earned by the Securities company indicate that its common stock will in the course of time be a very valuable asset.

"Calculating the value of American Smelters Securities Company (A) shares, upon which dividends are paid at the rate of 6 per cent. per annum, at $90 per share, and the remainder of our stock holdings, (exclusive of American Smelters Securities Company common) at their present market prices, the book value of Guggenheim Exploration Company stock would be $230 per share, exclusive of good-will. Assuming the present value of American Smelters Securities Company common to be $40 per share, the book value of Guggenheim Exploration Company stock would be $251 per share, exclusive of good-will.

"Last year we stated that in the opinion of our engineers Utah Copper, Nevada Consolidated Copper, Cumberland-Ely Copper and Yukon Gold companies would probably earn dividends during the year 1908. This prediction has been practically realized. Utah Copper Company commenced dividend payments in the third quarter of last year upon a basis of $2 per share. Its present earnings are in excess of $3 per share.

"The Nevada Consolidated and Cumberland-Ely Copper companies were both more or less delayed in the completion of their equipment, but have been making regular shipments since August, and their output and earnings are increasing steadily from month to month. Both give promise of dividend returns to their stockholders beginning in the last half of the year 1909.

"The Yukon Gold Company recently issued to its stockholders a circular letter concerning its operations. It is the intention of the copper companies in which we are interested to inaugurate a system of issuing quarterly statements, copies of which will be mailed to our stockholders."

The Proposed New Testing Machine

A bill is now before Congress to authorize the making of a contract with A. H. Emery, of Stamford, Conn., to construct and erect a great testing machine, on the lines of the well-known machine made by him some 30 years ago for the Watertown arsenal, and still in use. The new machine is to be very much larger than the Watertown machine which has a capacity of 800,000 lb. The proposed machine shall be able to give and weigh loads of tension up to 5,000,000 kg., or 11,000,000 lb., and loads of compression up to 10,000,000 kg. or 22,000,000 lb., on specimens up to 100 ft. or more in length. The main loading platforms for testing bridge-compression members, columns, and so forth, shall be not less than 8 ft. wide and 12 ft. long, and shall be adapted to receive auxiliary holders and platforms.

The machine shall be provided with tension holders, to seize and test to destruction round, square and rectangular bars, with loads up to 1,500,000 kg., or 3,300,000 lb., with lengths up to 100 feet or more.

It shall be provided with a pair of holders for testing bridge links up to 100 ft. or more in length, with all loads up to 5,000,000 kg., or 11,000,000 pounds.

It shall be provided with an auxiliary pair of compression platforms with hardened faces for testing stone, and similar material with all loads up to 10,000,000 kg. or 22,000,000 pounds.

It shall also be provided with a pair of auxiliary platforms, with pins 24 in. in diameter and 8 ft. long, for testing pinended columns with loads up to 10,000,000 kg., or 22,000,000 pounds.

There can be no question that this machine will be of very great service to engineers and bridge-builders, and that it will be worth far more in the end than the $1,750,000 which it is proposed to pay for it. There is no machine now in existence anywhere in the world capable of making the tests of structural members which are proposed, and the exact information which it will furnish will open new opportunities to all who are concerned in the erection and stability of great steel structures.

American Smelting and Refining Company

A statement issued to the stockholders of the American Smelting and Refining Company on Feb. 8 gives the assets and liabilities of the company on Oct. 31, 1908, and earnings for the first six months of the fiscal year, which are in excess of 8 per cent. per annum on the common stock.

President Daniel Guggenheim states: "The business and earnings of the company declined from the beginning to the end of the fiscal year ending April 30, 1908. Since the beginning of the present fiscal year, however, the earnings have been gradually improving month by month. The company has not, in the past, issued reports to the stockholders with reference to the business of the company oftener than at each annual meeting, principally for the reason that it is both difficult and expensive to accurately cut off the business oftener than once a year, on account of the large value of precious metals in process of smelting and refining. The directors believe, however, that the desire of the stockholders for accurate reports as to operations and profits of the company as often as is practicable is warranted."

The profit and loss statement for the six months ending Oct. 31, 1908, follows:

Net earnings from operations		$3,917,684
Construction and improvements		75,923
		$3,841,761
Dividends:		
Preferred, 3½ per cent	$1,750,000	
Common, 2 per cent	1,000,000	
		2,750,000
Net surplus to profit and loss		$1,091,761

Assets and liabilities on Oct. 31, 1908, were

ASSETS:	
Property	$86,845,676
Investments	2,858,617
Metals (refined value)	18,218,785
Material	1,249,561
Cash and demand loans	8,629,550
Total	$117,802,184
LIABILITIES:	
Capital stock	$100,000,000
Bonds (Omaha & Grant Smelting Company First Mortgage)	349,000
Net current liabilities	804,645
Unearned treatment on metals in process	2,148,559
Profit and loss	14,499,979
Total	$117,802,184

Colliery Notes

In using reinforced concrete for construction work about mines, it has been found that in concreting steel posts, the adhesiveness of the concrete is greatly increased by wrapping the posts and struts with iron or steel wire.

The amount of ash that any coal will yield, depends largely upon the rapidity with which the coal is burned. When a coal is burned slowly under the influence of a moderate draft, the ash will remain pulverulent, and will pass through the grate as formed. When coal is used for industrial purposes, however, rapid combustion usually takes place, and under these conditions, nearly all coals will yield ashes which fuse, thus forming clinkers.

From the advance proofs of the tables of fatal accidents in and about the mines of the United Kingdom during the year 1908, we obtain the following figures:

Cause of Accidents.	Total Killed.
Explosions of firedamp or coal dust	128
Falls of ground	586
Shaft accidents	83
Underground haulage	221
Miscellaneous underground	143
Total underground fatalities	1161
Miscellaneous surface	145
Gross total in 1908	1306
Total in preceding year	1245

Many superintendents do not use sufficient discretion in the selection of men to draw timbers when robbing work is being carried on. Only skilled men selected for their coolness, resource and courage should be employed to perform this work. These men should be paid good wages, and under no circumstances should they be put on piece work, for when this latter plan is followed, the men always take risks which otherwise would not be attempted.

Every coal company should carefully experiment so as to have on record the approximate space occupied by the different sizes of coal they produce. As a general rule, 2000 lb. of broken anthracite coal will occupy about 35.5 cu.ft. of space; 2000 lb. of Clearfield bituminous coal will occupy 33.55 cu.ft. of space; 2000 lb. of New River bituminous will occupy 40 cu.ft. of space, while the same weight of Pocahontas bituminous will occupy only 34 feet cubical area.

At one of the larger mines on the continent, where reinforced concrete timbers are used instead of wooden props, it has been found that the concrete supports do not occupy extra space and cost from 10 to 15 per cent. less than ordinary timbers. The concreting of steel headframes has been tried successfully, and it was found that concreting the steel posts not only protected them from corrosion, but put a stop to the constant vibration of the headframe while in use.

Most of the safety catches that are designed to prevent shaft accidents, are correct in theory but disappoint in practice. A recent case occurred where one catch operated on one side of the cage, while the corresponding catch on the other side did not act; as a consequence the cage was overturned. One engineer in discussing this subject says, "it is improbable that four catches—two on each side—could be brought to operate simultaneously; if they did not, their utility was gone."

Only a short time ago, mining experts in England after experimenting with stone dust mixed with coal dust, stated that underground areas so treated would not sustain a dust explosion. M. Barthou, minister of public works in France, now asserts that 40 per cent. of schist dust, mixed with coal dust renders the latter free from the danger of explosion. He further states that deposits of schist dust at intervals in a mine, will make it possible to restrict fires to a limited section of a shaft or gallery.

Coal-cutting machines are subjected to unnecessary strain when they are compelled to cut over an uneven face. If the work is properly blocked out, one machine with three attendants will do as much work as 20 men by hand labor. One great objection to the use of mining machines is the scarcity of suitable men to work the machine. The man who operates a coal cutter should combine the qualifications of a practical miner and a mechanic. It is a fact, however, that those with mechanical ability prefer to work above ground, so that it is necessary to train miners for the work.

In approaching a fault in a coal seam, much care must be exercised if we are to correctly determine the throw of the seam. The majority of faults slope, but in some cases, vertical faults are found. It is usually true that the roof and coal are of poorer quality when a fault is being approached; it also frequently occurs that water and gas are encountered under such conditions. As a general rule, if the coal first terminates at the top, the seam should be looked for lower down, and *vice versa*. Drilling should then be resorted to and an up or down entry only driven after the coal is located or all other cheaper methods of prospecting have been tried.

The construction of rectangular coke ovens in the Connellsville region is becoming more general, and it is probable that the old style beehive oven will no longer be introduced in the newer operations. The labor question is a serious problem in the coke region and if the rectangular oven requires less men to operate it, this style of oven is, therefore, likely to simplify the labor problem. The new-style oven under construction and in operation will average about seven tons, which is an increase over the old-style fashion of burning coal. In these new type ovens, the coal is mechanically ejected at one operation, and is thrown upon a conveyer, continuous along the string of ovens, which dumps directly into the cars. In this oven, extra sprinkling is required but the quality and tonnage of coke is increased and breeze is almost entirely eliminated.

Although electricity is the source of power principally used in underground haulage, it is sometimes necessary in gaseous mines, to eliminate all fire risks. One of the largest and most gaseous mines in western Pennsylvania has recently installed 8 compressed-air locomotives. In this mine, the operating conditions require that heavy loads be hauled up grades as steep as 5 per cent. and around curves of 100 ft. radius. The clearance limits were so restricted that it was found impossible to design a single locomotive capable of meeting the conditions. The locomotives, therefore, were arranged to be operated in tandem, and are coupled together back to back, so that one operator can control the two units by a single throttle lever, reversed lever, brake valve, etc.; by means of a flexible connection between the air tanks, the locomotives can be charged simultaneously. When the locomotives are in operation, this flexible connection is closed, but the auxiliary air tanks are then in communication through a rubber hose coupling, so that the cylinder pressures on the two units are equalized. This pressure is maintained by the reducing valves at 150 lb. per square inch, the initial pressure in the storage tank being 800 lb. per square inch.

Every mine superintendent should be prepared at all times to act with expediency in case of a mine fire. It is most advisable for the officials of the company, in developing a mine, to occasionally formulate fire plans, by dividing the mine into districts and selecting proper locations for dams. It should also be remembered that the selection of a panel system of working is not only for the better protection of the mine in case of an explosion, and for more efficient ventilation, but such a system of working by districts greatly reduces the liability of an underground fire spreading. The underground development should be so planned by the mine engineer that convenient and safe locations will be provided for the erection of fire dams in case of necessity. At least 30 ft. of narrow entry is necessary for the location of a substantial dam. In fighting a mine fire recently, four large dams were built; the longitudinal section of one of these stoppings was as follows: 3 ft. 9 in. small firebrick, 2 in. cement, 3 ft. 9 in. firebrick, 9 in. large firebrick, 12 in. concrete, 2 ft. 3 in. retaining wall, 7 ft. dirt, 3 ft. brick and mortar, 4 ft. 6 in. dirt, 2 ft 6 in. brick and mud. This stopping, therefore, was 28 ft. 8 in. in length, and was found to be no larger than conditions made necessary.

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Copper Statistics

The first report of the Copper Producers' Association is as follows:

	Pounds.
Stock of marketable copper, Jan. 1, 1909.	122,357,266
Production during January	112,135,200
Deliveries for consumption and export, January	90,362,421
Stock of marketable copper, Feb. 1, 1909.	144,130,045

The above figures represent the production by the refiners and the stocks in their hands.

The Situation in Copper

The reduction in the price, last week, of a leading selling agency to 13½c., delivered, 30 days, corresponding to about 13⅜c., cash, New York, had no effect upon the market. Other agencies had previously been selling at the same figure, and even lower. Some had been maintaining a nominal asking price of 14½c., without making any sales, because those offering at lower prices were taking the business. If those holding aloof had entered the market in a competitive way, the result would have been, of course, demoralization.

It is erroneous to believe that there is ever a complete cessation of business in copper. The number of manufacturers requiring it is so large, that some one must be in the market nearly all the time, while the production to be sold, nearly 4,000,000 lb. per day on the average in this market, is so large that someone must sell something. However, when the demand is very light, as it has been for a month back, the business offered is taken by those who are willing to make concessions.

Under these conditions there was nothing particularly to be gained by the interests previously holding aloof in reducing their price only to the current market. If consumers had been of a mind to consider that price a bargain, at which they would have been willing to take over large quantities of the metal, things would have been different. It has now been demonstrated that they were not of that opinion, for very little buying has been done since Feb. 2.

It is no longer to be disguised that the situation in copper is precarious, with a tendency toward lower prices. What the Producers' Association has reported as to stock on hand will not make any great difference, inasmuch as the well-informed, both among producers and consumers, have all along been acting on the belief that the stock on Jan. 1 was about 130,000,000 lb. The exaggerated estimates never commanded any attention except among the outside speculative interests.

Consumers do not buy, but production is going ahead at the largest rate on record, which means accumulation of stock. In the newspapers there is some talk about curtailment of production, but why should there be any such action? Almost all of the big producers can make a lot of money at the present price, or less, and after all their business is to produce copper, rather than to speculate in futures. The present price for copper is not much below the average for the last 10 years; nor is it yet close to the average cost of production. The talk about increased cost of production, respecting which we used to hear a great deal, was chiefly nonsense. Like the iron and steel market, the copper market can, and probably will, go the natural way to stimulate consumption.

Notes about Spelter

On Jan. 9 we reported the organization of the European Zinc Syndicate. The British papers began to hear about it around Feb. 1; the American papers, daily and otherwise, are just awaking to the fact, this week.

There has been a big drop in the price of zinc ore at Joplin. According to our correspondent at that place, the miners lay it to the decision admitting calamine free of duty, while the smelters attribute it to the tariff agitation, which keeps consumers from contracting ahead for spelter. It is strange that no one thinks about the depression in business that still exists.

We hope to be able next week to report our final figures for spelter production in 1908. Probably they will differ from the preliminary figures that we published Jan. 9 by only a few hundred tons. Our estimate of the stock on hand at the end of the year, published at that time, was based on reports of the smelters for Dec. 15. Between that time and Dec. 31 there was apparently a reduction of stock in first hands, and our revised figure for that item is likely to be smaller than previously reported.

However, with respect to the unsold stock there appears to be a peculiar condition. According to our preliminary statistics, the deliveries into consumption in 1907 were 222,404 tons; in 1908 they were 210,868 tons, a comparatively slight falling

off. These figures are computed by difference in the usual manner.

As our readers are well aware, later in the year we collect statistics as to consumption from the consumers themselves. Our reports as to spelter are still incomplete, but we feel that our readers will be interested to know that the same concerns which reported a consumption of 100,057 tons of spelter in 1907, for 1908 report only 75,037 tons. Recognizing the present incompleteness of the statistics, we shall not attempt to draw any inferences. We add only that the statistics received up to date represent chiefly the galvanizing industry.

The Question of Prices

A "New England manufacturer of copper wire" is represented as saying the following: "Now we are asked to buy copper at 13½c., but nothing is said about the copper we purchased at 14½c., nor the advantage over us that has the wire manufacturer who did not take the former advice of the copper people and now buys at 13¼c. Copper is controlled to a greater extent than any other commodity, i.e., half a dozen interests control the bulk of the output, and yet the consumer is assured of less stability than in almost any other commodity. The consumers do not care whether the price is 13, 14, 15, or 16c. If the copper producers would only get together and maintain prices as do the steel people, it would be of great advantage to all concerned."

This shows simply how slow is the light in dawning upon some minds. The consumers *do* care what is the price of copper; the manufacturers, who are often confused with the consumers, may not care; indeed, if they could be assured of stability, they might prefer a high price to a low price. But we have not yet come to the point where middlemen are going to be protected against fluctuations in price.

Just as some producers sell to better advantage than others, so do some manufacturers buy. If producers, merchants and manufacturers must be guaranteed against bad judgment, why not have prices fixed by Congress, or an international tribunal? Of course, they should be established at figures affording a "reasonable" profit to the producers, middlemen and manufacturers, by which is to be understood just stopping short of breaking the consumer's back.

Apropos of the haunting fear among manufacturers that if one buys at 13¼c. today another may cover his requirements at 12¼c. next month, it was misleading news from such quarters in the spring and summer of 1907 that put some of the producers so much astray. In the spring of that year most of the manufacturers covered their requirements up to the end of June. Long before that time the slackening in business was apparent to them, but they tried to keep that a secret until their 25c. copper was consumed, and to some extent succeeded.

It is not the fluctuating market that is vicious, but rather the system of contracting far ahead. There is gambling in a manufacturing business just as there is in Wall Street and Capel Court. Some producers gamble in selling their output and some manufacturers in buying their supplies. But after all there are few who beat those who buy and sell regularly at the market, and the conservative interests, either way, do not need to worry.

Publicity by Mining and Metallurgical Companies

A few weeks ago in speaking of the rights of stockholders to prompt information respecting their companies, and the general superiority of British companies, as compared to American in this respect, we remarked that sooner or later we shall come to the same practice in this country. In this connection, it is particularly interesting to remark that the Guggenheims have just announced that the copper mining companies in which they are interested—the Utah Copper Company, Nevada Consolidated, and Cumberland-Ely—will hereafter make quarterly reports. On top of this, everyone was surprised this week by the appearance of a report by the American Smelting and Refining Company, covering the first six months of its current fiscal year, and we are given to understand that in the future that company will make semi-annual reports. This is high commendable. It is only to be regretted that the reports are not of more communicative character. However, we shall no doubt, in the course of time, find improvement even in that respect.

The copper companies, whose fiscal year corresponds with the calendar (it is a pity that this is not so in all cases) are now beginning to make their reports for 1908. One of the first that we have received is the report of the First National Copper Company (Balaklala). This is an admirable presentation, communicating all of the information that the stockholder needs to know, besides a great deal of important information that is of technical interest and value. The directors of this company are to be congratulated upon their frankness.

So the march of improvement goes on. We have no doubt that we shall see the day, perhaps in the not very distant future, when the Amalgamated Copper Company will make an annual report, perhaps even a quarterly report, that will be as satisfying as those of the U. S. Steel Corporation.

The Conservation of Resources

The President, in a message to Congress, Jan. 22, on the conservation of resources makes the following remarks respecting the mineral industry:

1. "The accompanying reports show that the consumption of nearly all of our mineral products is increasing more rapidly than our population. Our mineral waste is about one-sixth of our product, or nearly $1,000,000 for each working day in the year. The loss of structural materials through fire is another million a day. The loss of life in the mines is appalling. The larger part of these losses of life and property can be avoided.

2. "Our mineral resources are limited in quantity and cannot be increased or reproduced. With the rapidly increasing rate of consumption the supply will be exhausted, while yet the nation is in its infancy, unless better methods are devised or substitutes are found. Further investigation is urgently needed in order to improve methods and to develop and apply substitutes.

3. "It is of the utmost importance that a Bureau of Mines be established in accordance with the pending bill to reduce the loss of life in mines and the waste of mineral resources, and to investigate the methods and substitutes for prolonging the duration of our mineral supplies."

It is evidently destined that the Americans of the beginning of the Twentieth century are to be recorded in history as a wasteful people. Far be it from the idea of the JOURNAL to deny that charge or to minimize the usefulness of the present propaganda. We *are* a wasteful

people; shamefully wasteful. In spite of that the nation is wealthy because of the bounty of nature. But how much more wealthy would it be if Americans should exercise the economy of the French!

However, as the JOURNAL has previously pointed out our wastes are rather of consumption than of production, and it seems as if the President and the Conservative Commission are putting stress upon the wrong side of the balance. We don't mind being called extravagant in our living; indeed we may feel a little proud that we are more liberal in our views than the thrifty French. But when it comes to production mining, manufacturing, etc.—which is *business*, wherein we think we show our heels to every other nation on earth (except when the matter of revising the tariff is before us), we don't like to be called wasteful, because we are not so (except for some oversights that are corrected as we learn how).

Let us look at some of the wastes that we have committed; perhaps are still committing. Possibly the most criminal was the shocking sacrifice of the natural gas of the Eastern States. That was due largely to ignorance. When natural gas was discovered in Kansas we knew more about it and the resources there were well conserved from the outset. However, there are still districts, as in the Caddo field of Louisiana, where there is scandalous waste. Another great loss of potential value is experienced in the manufacture of coke in beehive ovens. This has been recognized for many years. Much progress in the installation of improved coke ovens has been made, but our industrial requirements have not yet developed to such an extent as to take care of all the by-products that it is possible to recover, and capital has not yet seen its way clear to utilize the waste heat at central points for the generation of power to be distributed electrically. But a modified beehive oven permitting utilization of the waste heat is already coming extensively into use. We have wasted much low grade ore as stope-filling and by careless mixture in tailings piles which later improvements would have made valuable; but we are not now generally guilty of that sort of waste. It is true that we still waste immense amounts of coal in the destruction of the seams that cannot now be mined profitably, but this is chiefly a consequence of capitalization, which requires the immediate production of coal that can be won, and there does not seem to be any way to prevent such waste except by State confiscation of propery, which, of course, cannot be considered.

We do not feel quite sure that the preventable waste in coal, lead, zinc, copper, gold and silver mining amounts to approximately $1,000,000 per day, as has been estimated by the National Conservation Commission. However, the President, of course, could do nothing but accept the report of that commission. The figure stated for the loss of structural material through fire also appears somewhat high, although there is no question as to the enormity of the loss experienced in this way, which loss is to a large extent preventable. We recognize also the money value of the appalling loss of life in mining.

As to the second section of the President's remarks, we point out that the mining industry is constantly investigating and seeking to improve methods and to develop and apply substitutes for the simple economical reason that more money can be so made than by standing still. Comparison between mining and metallurgical results of today and those of 10 years ago shows that immense progress has been made. The Conservation Commission and the President do not appear to recognize this. In paragraph 3 the President urges the establishment of a bureau of mines to reduce the loss of life in mines and the waste of mineral resources. We have not the same confidence that a bureau of mines can do anything very useful in either respect.

Steel Production in 1908

The decline in bessemer steel production in the United States in 1908 was much greater than that in pig iron. The complete figures collected by the American Iron and Steel Association give the total make of bessemer ingots and castings in 1908 at 6,116,665 long tons, a decrease from 1907 of 5,550,704 tons, or 47.5 per cent. The output was, in fact, the smallest reported for 10 years, being less than that of any year since 1897. A large reduction was expected, but the decrease extended further than in pig iron and other branches of the trade. A considerable part was, of course, the result of the general depression; but another large part was also due to the substitution of open-hearth for converter steel. This is confirmed by a study of the detailed statistics. Thus the largest proportional loss is found in Pennsylvania, and a very considerable part of this resulted from the substitution of open-hearth furnaces for converters at the Carnegie and some other works.

While the figures for open-hearth steel are not yet available, there is no doubt that the decrease was very much less than in bessemer, and that the production of open-hearth metal constituted a much greater proportion of the total than in any previous year. By far the greater part of the open-hearth make is of basic steel. For four years prior to 1908 the proportion of basic pig iron to open-hearth steel was 1 to 1.9; estimating on this basis the production of open-hearth steel in 1908 was approximately 7,600,000 tons, 1,500,000 tons more than that of bessemer. Last year the prediction was made that the relative positions of the two classes of steel would alter in 1908; but quite so sharp a change was not anticipated.

Heretofore rail production has absorbed a large proportion of the bessemer steel made, but that condition also seems to be changing. The total make of rails in 1908 was 1,921,071 tons, a decrease of 47 per cent. from 1907, and the smallest production since 1897; a result largely due to financial conditions and difficulty experienced by the railroads in providing money for purchases, but in part also to the controversy over the quality of rails. The chief point in the report for the year is that while the decrease in the make of bessemer rails was 60 per cent., there was an increase of 125 per cent. in open-hearth rails. The proportion of the latter to the total make rose from 7 per cent. in 1907 to 29.5 in 1908. It is true that this increased proportion is on a very light production and had some special causes to favor it. On the other hand, the great rail mills at Gary will begin to produce in 1909, and they will use open-hearth steel exclusively.

The open-hearth furnace is clearly the coming steel maker, and its position is assured by the ability it possesses of utilizing pig iron made from varieties of ore which are not adapted to the acid bessemer process. The converter has seen its best days, though a large quantity of bessemer steel will be made for a long time to come.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Some Facts and Corrections Regarding the Diamond Region of Arkansas

The article on an Arkansas diamond mine by John T. Fuller in the JOURNAL of Jan. 16, page 152, contains a reference to me that may be taken as an excuse for correcting some statements in that particular article, and for giving some facts that may have some historical interest in connection with the discovery of diamonds in Arkansas.

We Americans are so fond of our little joke that whenever any good thing is found or developed we must find the man who missed the chance of his life, or who, in one way or another, failed to appreciate the situation. Sometimes this foolish man had the opportunity to buy the land where Chicago now stands for $10; sometimes he owned the land where a great mine is now located, and sold it for a song; sometimes he declared that something could not be done and a few years later it was done. If it can be shown that the "one-gallus" man succeeds in any enterprise when the chemist, consulting engineer, or the geologist declares it to be impossible, then the conditions are all fulfilled, and everybody is happy—except the fellow who missed it, and often enough he is a purely hypothetical character. If it can be shown that several persons overlooked a good thing, it only causes the wisdom and longheadedness of the successful man to stand out in bolder relief.

When diamonds were found in Arkansas a few years ago this desire to bring into relief the picturesque features of the discovery naturally caused people to look about for the man who had missed it. Mr. Fuller, in the article referred to, makes it appear that I am "it" in this case. He says that "no report of any accuracy was made until 1890, when the region, including the volcanic area, was mapped and reported on by John C. Branner, who at that time was State geologist. In this report Branner mentions that the rock resembled closely the diamond-bearing rocks of South Africa, but *scouts the idea of its containing diamonds, due to the absence of any bituminous shales surrounding the 'pipe' or crater.*" The last sentence is italicized in order to call attention to two questionable statements.

THE ORIGINAL DESCRIPTION

The article by Branner and Brackett describing the exposure of peridotite in which diamonds occur was first published in the *American Journal of Science* July, 1889. Vol. XXXVIII, pp. 50-59; the article was partly reproduced in Vol. II of the annual report of the Geological Survey of Arkansas for 1890, pp. 378-391. On page 54 of the first article, and on page 389 of the second one is the following sentence: "Inasmuch as it has been suggested that the South African diamonds may have been generated by the metamorphism of the carbon in the carbonaceous shales penetrated by the peridotite, I should add that no such phenomenon is suggested by observations at this locality, or upon these rocks." In other words no diamonds were found in the rocks.

This is all that was said in regard to diamonds, and this much was said dliberately, and it is all there was any warrant for saying at the time. There is not a word in the original article to show that the writer of it scouted the idea of diamonds occurring there, nor is there a word in explanation of their assumed absence. The existence of large quantities of shales in the rocks through which the peridotites pass was perfectly well known, and these shales are spoken of more than once in the article. On page 51 in the *American Journal of Science* article a small dike is mentioned as containing "a vast quantity of fragments of paleozoic sandstone and shale." On page 52 mention is made of the sedimentary beds that lie to the north of this exposure and through which the dike rock must pass. It is stated that "they are made up of alternations of sandstones and shales, and are highly flexed, the axes of the folds varying but little from due east and west." Again at page 53, second line from the bottom, reference is made to the shale inclusions in this dike. In view of the fact that Mr. Fuller's article reproduces my geologic map (without credit) and repeats most of my geology (likewise without credit), it seems reasonable to have expected him to find some mention of the shales.

WHY THE DISCOVERY WAS NOT PREDICTED

It may fairly be asked, however, why the diamonds were not found, or why it was not predicted that they would be found, since it is evident from the sentence quoted that the idea of diamonds had occurred to the author of the article. Aside from the fact that prediction is no part of a State geologist's duties, there were good reasons for the guarded statement as will appear.

The older geologists of this country will remember that in 1885 Dr. J. S. Diller published a short article in *Science* (V, 65) announcing the discovery of peridotite in Elliott county, Kentucky. In 1886 H. C. Lewis, in speaking of the origin of diamonds, referred to this case and says that it "suggests interesting possibilities" (*Science*, Vol. VIII, p. 347), and Dr. Diller in Vol. VIII, p. 392 says that he considers it "rather improbable that diamonds will be discovered at the locality in question." In spite of Dr. Diller's conservative views the people of the State of Kentucky, under the leadership of the newspapers, went wild on the subject of Kentucky diamonds. The excitement was not confined to the region of the peridotites, or even to Elliott county, but spread into every nook and corner of the State. It was soon pretty generally believed that all one had to do to find diamonds was to cross the line into Kentucky. The amount of time, labor, and money squandered in this wild scramble no one knows. Companies were formed both in and out of the State to buy up diamond lands. I, being acquainted with the geology of the diamond regions of Brazil, was kept busy for months in trying to cool the ardor of people over-anxious to get hold of so-called diamond lands in Kentucky. One company sent me to examine and report upon the chert gravels along the lower part of the Ohio river, on the Kentucky side, with a view to ascertaining their diamond contents. The same gravels on the Indiana and Illinois side were not to be examined.

Shortly afterward, in 1887 I was appointed State geologist of Arkansas. When I went to that State I found in full swing one of the wildest and most uncontrollable mining excitements that ever broke forth in any part of this country. In the region west of Little Rock, and especially in Garland and Montgomery counties, many of the people had actually abandoned their farms to stake off claims and to mine gold, and nearly everybody was buying and selling mine shares and was on the verge of getting suddenly and enormously rich. The official records at Little Rock show that the mining companies organized under the laws of Arkansas alone for working these gold and silver mines were capitalized at more than $113,000,000. Some account of the affair is published in *The Arkansas Gazette* of Aug. 11, 1888 and in the JOURNAL

of Aug. 18, 1888, p. 128; of Sept. 1, p. 168; Sept. 8, p. 189; Oct. 6, p. 278; and of Oct. 20, 1888, pp. 325-327. Anyone who will take the trouble to read the articles referred to will see that the people of Arkansas were not at that time in a frame of mind to have diamond deposits suggested to them. Whatever the State geologist might think of the possibilities of the peridotite, under the circumstances he was certainly not warranted in starting a fresh excitement, especially when there was nothing more than a theory to base it upon. But so far as the theory was concerned, I was quite as well acquainted with it then as I am now. The peridotite was not only recognized as the kind or rock in which diamonds occur in South Africa, but I spent many hours on my hands and knees looking for diamonds in the gullies and over the bare surfaces of the decomposed rocks. But like many others who have gone there since the discovery, I found no diamonds, and as my examination was not in any sense a systematic or thorough one, it only remained for me to refer to the diamond question in a guarded manner.

PRE-DISCOVERY STATEMENTS

After the excitement in Arkansas had subsided I made the statement on various occasions that it was possible that there might be diamonds in this peridotite area. How many persons may have heard this statement I do not know, but the following extract from a letter shows that one man at least remembered it. Before I knew of the discovery of diamonds in Arkansas I received a letter from an Arkansas friend, Col. Henry T. Buie, who wrote from Chicago under date of Sept. 27, 1906, as follows: "I see from the Arkansas papers that diamonds have recently been found in Pike county not far to the southeast of Hot Springs. When you were at Buffalo, (Marion county, Ark.) I remember you told me there was a geological formation in that section of the State that would justify the presence of diamonds, but it does not seem to me that you spoke of Pike county, and it must have been some other locality." My letter book shows that I replied to Col. Buie Oct. 2, 1906, as follows. "Your letter gives the first intimation I have had of the discovery, and you do not mention the locality. The place I referred to in the conversation you mention is on the Little Missouri river about 1¾ to 2 miles below (down stream from) Murfreeshoro in Pike county" in other words, the peridotite area in which the diamonds occur.

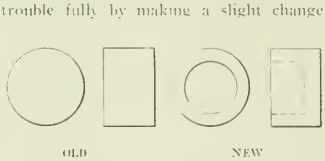
It may be worth adding that the statement made by Mr. Fuller in the foot-note on page 152 of his article to the effect that "diamonds have never been found in South America in the true matrix," is not correct. Certain washings near Diamantina in the state of Minas Geraes took their material entirely from itacolumite decomposed in place. This locality I have visited and I make this statement from personal observations. The late James E. Mills stated to me that he had seen a diamond in place in the itacolumite. Recently Prof. O. A. Derby, the director of the Geological Survey of Brazil, has seen a diamond from Bahia in the original quartzite. JOHN C. BRANNER.

Stanford University, Cal., Jan. 26, 1909.

The Gordon Drill

In a recent issue of a technical journal a Johannesburg correspondent mentions the failure of the Gordon drill, and states that it was due almost solely to the failure of the hammer block, but that the ratchet teeth caused some little trouble and expense by breaking. The correspondent goes on to say that the hammer block would swell, i.e., upset and stick in the barrel of the drill. If the piece was tempered hard enough to prevent upsetting it would break, and in doing so would cause serious injury to the machine.

The makers of another drill, which I shall refer to later on as the X drill, had the same trouble with their hammer blocks that the Gordon drill is said to have had. The makers of the X drill overcame the trouble fully by making a slight change



in the hammer block and the use of vanadium steel. The accompanying sketch shows the change made in the hammer block.

I found it to be impossible to get the temper to the center of the solid block, even when made of vanadium steel, but by making the simple change shown, absolutely satisfactory results were obtained. No matter what shape the blocks were made, with steel, other than vanadium steel, they would either upset or go to pieces. So far as the Gordon ratchets are concerned I presume vanadium steel would do the work without breaking.

The makers of the X drill have claimed a very high efficiency for their drill, *with 100 lb. air pressure at the drill.* Now, under actual working conditions, it has been found *impossible* to make a drill steel that will stand when 100 lb pressure is used at the drill. In every instance the drills snap off at or near the shank, say within 3 or 4 in. of it. The cutting edges stand well.

The Crucible Steel Company of America made a special drill steel for the manufacturers, containing 0.10 per cent. vanadium. This steel proved to be about eight times as durable as the ordinary drill steel, but it cost 15c., while the ordinary steel costs 8c. per lb. Anyway, it was found to be more economical to operate the drill under 80 lb. air pressure, for under higher pressure the vanadium steel could not be depended upon. It would break in the same way as the ordinary steel, but not so frequently.

At the present time the capacity of the hammer drill is the ability of the drill steel to withstand the blows of the hammer. There is little to choose between the several makes of hammer drills so far as their drilling efficiency is concerned.

Denver, Colo., Jan. 4, 1909. W.

The Turquoise Mining District, Arizona

In my short article on the Turquoise district, which appeared in the JOURNAL of Jan. 23, 1909, p. 213, I note an error, possibly my own, but a notable one. In mentioning ores of the Leadville Mining Company, the article as published reads "3 per cent. to 5 per cent. *lead*;" this should be "*copper*." This gives an entirely erroneous idea of the whole camp, as I find that copper is not mentioned again in the article. All of the chief mines of the camp are copper strictly.

JAMES M. PLATT,
Superintendent Guadalupe Mine
Zacualpan, State of Mexico, Mex.,
Feb. 2, 1909.

Steel Ore-Pass

A steel ore-pass, invented by D. P. Mitchell, general manager in Australia for Bewick, Moreing & Co., is now largely adopted by that company in the South Blocks mine at Broken Hill. This ore-pass is made up of cylindrical sections of boiler iron having a collar at one end, so that one fits into the other below, the pass being built up as stoping progresses. The top of the chute is fitted with a funnel in which is placed a grizzly so that boulders must be broken before they can enter the ore-pass. The advantages of an iron pass are that there is no wearing out before the stope is completed (therefore no dangerous and expensive repairing to be done as in the case of a cribbed ore-pass), and that there is no wood to wear away and get into the ore giving trouble in the mill.

Although India imported more than $4,500,000 worth of copper in 1907 none of the many known deposits of the country was worked to any extent (Geological Survey of India). Extensive prospecting of the copper deposits is, however, now in progress. The manufacture of sulphuric acid as a smelter byproduct will also give a new lease of life to many of the minor industries.

The H. C. Frick Coke Company

The statement was published last week on the strength of a Pittsburg despatch that "the Frick Coke Company has abandoned work which was to cost $3,700,000 on 1700 additional coke ovens at Uniontown, Penn., and will substitute for the proposed beehive ovens an enormous by-product coke plant at Gary, Ind." This is pronounced incorrect by authority. No coke ovens in the Connellsville region have been abandoned, and though work on a number, which had been planned, has been suspended owing to the dullness of the past year, it is intended to proceed with the plans as soon as conditions warrant. The only by-product coke plant at Gary is a small one, intended chiefly for testing purposes, on Indiana, Illinois and other coals which may be offered. The Frick company has some land at Indiana Harbor, but it was acquired only to provide for contingencies which may arise in the future. For the present, at any rate, it appears more advantagous to make coke at the mines and to ship that coke, than to carry raw coal nearly 500 miles to the ovens.

Goldfield Consolidated Mines Company

The following items are taken from the annual report of the Goldfield Consolidated Mines Company for the year ending Oct. 31, 1908. The company now controls and operates claims having an acreage of 380.627 acres besides holding a 25 per cent. interest in the C. O. D. Consolidated; by agreement it is to receive one-half of all ore found in the Vinegorone and Poleverde claims of the Jumbo Extension Mining Company in veins apexing on the Consolidated ground.

Surface Improvements

On the old Jumbo property a central compressor plant, electric distributing station and machine shop have been installed. The two Nordberg two-stage air compressors, each belt driven from a 200-h.p. electric motor, have a joint capacity sufficient to operate two hoists and all the necessary machine drills. At the Mohawk shaft a hoisting plant capable of being operated by either steam or compressed air, capable of raising about 500 tons of ore per day has been installed. The electric hoist formerly at the Mohawk shaft has been moved to the Combination shaft, where a second hoisting compartment has been completed to the bottom of the shaft. This hoist has a capacity of about 300 tons per day. A standard-gage railway about two miles in length has been built with branches to connect all the working shafts of the property with the new mill and all the railroads entering Goldfield. The railroad is equipped with a locomotive, six steel hopper cars of 50 tons capacity each and one flat car. Reservoir facilities consist of 10 tanks placed conveniently to the mill, having a capacity of 1,000,000 gallons or sufficient supply for 10 days, in case of stoppage of the water supply. A new 100-stamp mill with an estimated capacity of 600 tons per day has been built.

Underground Work

At present the Mohawk, Combination, Clermont and Red Top shafts are in commission. During the present fiscal year development work has been carried on continuously on the Mohawk, though little ore was mined owing to inadequate milling facilities. On the 250 level old workings were repaired and new drifts driven under the Hayes-Monette, Frances-Mohawk and other lease stopes, thus making them accessible from the main shaft On the 600-ft. level, the lowest of the mine, an orebody 20 ft. wide has been crosscut and connected by raises with the same orebody on the 450-ft. level. A crosscut from the 600-ft. level will soon connect with the Clermont shaft.

The Combination workings have been connected with the Mohawk on the 280-ft. and 380-ft. levels; with the Reilly workings on four levels and very good ore is exposed to the bottom, 380 ft. In the central part of the property a greater amount of ore than was suspected has been opened up. The 130-ft. and 230-ft. levels now connect with the January and good ore has been developed in the continuation of the January vein on Combination ground. Very recently rich ore has been discovered on the 230-ft. level, north and west of the older workings. A drift on this vein shows an orebody 6 ft. in width and already exposed 60 ft. in length which averages higher than $100 per ton.

Recent development work from the Red Top shaft has traced ore on the 260-ft. level, 50 ft. north of the older workings, and a very promising orebody has been followed more than 150 ft. south on the Lucky Boy claim, in territory where no ore was heretofore supposed to exist. In the Mushett lease a small ore shoot has been proved to extend to a depth of 480 ft. below the surface, and about 130 ft below the deepest level of the Red Top. On the Jumbo, the Clermont shaft has reached a depth of 850 ft. and very recently a strong ledge which shows very promising values has been cut.

During the past year 32 leases operated at various times on the property performing in all 20,463 ft. of underground exploratory work, producing 25,539 tons of ore.

Mining Statistics

In all 17,460 ft. of development work was performed on company account at an average cost of $17.60 per foot and 20,463 ft. by leasers at no cost to the company, making a total of 37,923 ft. of exploration work at $8.10 per foot. There was hoisted on company account from stopes 25,374 tons; from development work 19,562 tons, total 44,936 tons. Of this ore there were milled

	Tons.	Gross Value.	Average per Ton.
Milled	29,180	$1,164,246	$39.89
Shipped	3,575	195,593	54.71
Total by Co.	32,755	$1,359,839	$41.51
By lessees	25,540	945,196	37.01
Total	58,295	$2,305,035	$39.55

Below is a statement of mining and milling costs at the Combination, the only property from which ore has been continuously mined during the year, including every item properly chargeable to the operation, maintenance and administration of that property.

	Tons.	Average per Ton.	Total.
Mining:			
Ore production	22,831	$1.51	$34,461
Development, 6926 ft. @ $16.34	11,891	9.51	113,136
General expense			22,223
Total	34,722	$4.89	$169,820
Milling:			
Milling	28,462	$5.60	$159,367
General expense		0.78	22,224
Total		$6.38	$181,591
Total Cost:			
Ore mined and milled	28,462	$11.27	$320,765
Ore broken and mined	16,998	2.40	40,722
Total	45,460	$7.95	$361,487

Mining and milling costs for the previous fiscal year were as follows: Mining, $6.147; milling, $7.142; total, $13.289. It is estimated that the mining and milling costs on ore treated at the new mill will be reduced to $6 per ton, including transportation and general expense, for the ensuing fiscal year.

The item of general expense for the past year is necessarily high by reason of the small production and the large items of expense superinduced by strike conditions early in the year.

Refunds of Duties on Coal

Special Correspondence

The Senate has just passed and sent to the President a bill passed by the House on May 12 last providing, among other features, for refunding duties on anthracite coal imported into the United States from Oct. 6, 1902, to Jan. 15, 1903. It will shortly be signed and become a law.

Success is responsible for the following: Professor (at chemistry examination)—Under what combination is gold released most quickly? Student—Marriage.

New Publications

LABORATORY NOTES ON INDUSTRIAL WATER ANALYSIS. By Ellen H. Richards. Pp. 49. 6x9 in.; cloth, 50c. New York, 1908: John Wiley & Sons; London, Chapman & Hall, Ltd.

THEODOLITE SURVEYING AND LEVELING. By James Park. Pp. 216, illustrated. 5¼x8 in.; cloth, $2. London, 1908: Charles Griffin & Co., Ltd.; Philadelphia, J. P. Lippincott Company.

A MANUAL OF PRACTICAL ASSAYING. By H. Van F. Furman. Sixth edition revised by William D. Pardoe. Pp. 497, illustrated. 6x9¼ in.; cloth, $3. New York, 1908: John Wiley & Sons; London, Chapman & Hall, Ltd.

COMMISSION D'ENQUETE SUR LA DUREE DU TRAVAIL DANS LES MINES DE HOUILLE. Données Statistiques Recueillies Par L'Administration Des Mines. Pp. 252. 8¼x11 in.; paper. Bruxelles, 1908: Goemaere, Imprimeur du Roi.

THIRTY-THIRD ANNUAL REPORT OF THE CHIEF INSPECTOR OF MINES OF OHIO FOR THE YEAR ENDING DECEMBER 31, 1907. By George Harrison. Pp. 430, illustrated. 6½x9¼ in.; paper. Columbus, 1908: F. J. Heer, State Printer.

LABORATORY EXPERIMENTS IN METALLURGY. Part I—General Metallurgy; Part II—Metallurgy of Iron and Steel. By Albert Sauveur and H. M. Boylston. Pp. 73, illustrated. 8x10¼ in.; cloth, $1.25. Cambridge, Mass., 1908: Published by the Authors.

THE CHIEF COMMERCIAL GRANITES OF MASSACHUSETTS, NEW HAMPSHIRE AND RHODE ISLAND. By T. Nelson Dale. U. S. Geological Survey, Bull. No. 354. Pp. 228; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

GEOLOGY AND WATER RESOURCES OF A PORTION OF SOUTH CENTRAL OREGON. By Gerald A. Waring. United States Geological Survey, Water-supply Paper No. 220. Pp. 86, illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

ANNUAL REPORT OF THE SECRETARY FOR MINES OF VICTORIA, INCLUDING STATISTICS, REPORTS ON GEOLOGICAL SURVEY, FORESTS, SLUDGE ABATEMENT, INSPECTION OF MINES, DREDGING, PROGRESS OF MINING, BORING OPERATIONS, ETC., FOR THE YEAR 1907. Pp. 232, illustrated. 8½x13¼ in.; paper. Melbourne, 1908: J. Kemp, Government Printer.

NEW ZEALAND. PAPERS AND REPORTS RELATING TO MINERALS AND MINING. Pp. 190, illustrated. 8½x13 in.; board covers. Wellington, 1908: John Mackay, Government Printer.

Contents: Statement by the minister of mines. Report on the goldfields. Report on coal mines. State coal mines. Features of special interest and electrical installations at mines in New South Wales and Victoria.

METALLIC ALLOYS: THEIR STRUCTURE AND CONSTITUTION. By G. H. Gulliver. Pp. 254, illustrated. 5¼x8 in.; cloth, $2. London, 1908: Charles Griffin & Co., Ltd.; Philadelphia, J. P. Lippincott Company.

Contents: Methods of investigation. The solution theory, and the chemical equilibrium of mixed substances. Binary alloys in which no definite chemical compounds are formed. Binary alloys which show evidence of the formation of definite chemical compounds. Equilibrium conditions in metallic mixtures. The bronzes, the brasses and the steels. Alloys of more than two metals.

FOUNDRY PRACTICE. Third Edition, Revised. By James M. Tate and Melvin O. Stone. Pp. 234; illustrated. 5x7½ in.; cloth, $2. New York, 1909: John Wiley & Sons, London, Chapman & Hall, Ltd.

Contents: Green sand molding. Dry sand molding. Molding sand, molder's tools, molding machines and equipment. Cores, core boxes, core machines and dry-ovens. Cupolas, blowers, and melting furnaces for iron. Chilled castings. Malleable castings. Cleaning castings. Compressed air for foundry purposes. Steel castings. Brass founding. Cast-iron alloys. Glossary of foundry terms.

THE MECHANICAL APPLIANCES OF THE CHEMICAL AND METALLURGICAL INDUSTRIES. By Oskar Nagel. Pp. 307, illustrated. 6x9½ in.; cloth, $2. New York, 1908: Published by the author.

Contents: General. Steam and water power. Gas power. Electric power. Transportation of Solids. Transportation of liquids. Transportation of gases. Grinding. Mixing machines. Firing and furnaces. Separating. Purification of gases. Evaporating, distilling and condensing. Drying appliances. Measurement of temperature. The works chemist as engineer.

This is a useful book. It is of descriptive character, rather than analytical and critical.

WHO'S WHO IN MINING AND METALLURGY. Founded by George Safford. Pp. 194. 5½x8¼ in.; leather, $6. London, 1908: The *Mining Journal*.

This is a collection of brief biographical sketches of mining geologists and mining and metallurgical engineers. Although published in London, we find that American engineers are quite as well represented as are the British. The work, which is of undeniable usefulness, consequently has an international character. We hope that some day its scope may be extended so as to be completely international and take in the engineers of France, Germany, and other countries. The book, which is very good for a first attempt, has some defects which will doubtless be corrected in subsequent editions. The chief of these are (1) omission of some of the most prominent engineers, and (2) an absence of editing of the biographical sketches, of course furnished personally, which sometimes leaves them to recite insignificant appointments, such as "delegate to the American Mining Congress."

REPORT ON THE MINING AND METALLURGICAL INDUSTRIES OF CANADA, 1907-8. Pp. 972; illustrated. 6½x10 in.; paper, $1. Ottawa, 1908: Government Printing Bureau.

This volume, giving fuller information concerning the mining and metallurgical industries of Canada than any hitherto published, is based upon data furnished by a special staff of investigators, with a view to meet the increasing demand for accurate and authoritative details as to these important interests. It is arranged by provinces and embraces reports and in many cases detailed descriptions of all producing mines and those approaching the productive stage and of metallurgical plants in active operation. Its value is materially enhanced by the illustrations, giving representations of the equipment and methods of operation of leading mines and industrial plants. Specific descriptions of known mineral deposits of value are also given, with maps of the different provinces showing their location. Among the prominent geologists and engineers, whose knowledge of particular localities renders their contributions specially instructive are Dr. R. W. Brock, director of the Canadian Geological Survey, Charles Camsell, Osmond E. Le Roy, J. C. Gwillim, S. S. Fowler, Joseph G. S. Hudson and H. Mortimer Lamb. The report embodies a large amount of historical and statistical information in regard to all branches of the mining and allied industries. Not the least valuable feature is the list of mineowners and companies together with the capitalization and the officers of each company. The index gives some 1500 names of mineowners and corporations. As a matter of arrangement it might have been better had these details, instead of being given in connection with each enterprise throughout the volume, been embodied in a separate section, as owing to the frequent changes in company organization these particulars will be inaccurate and misleading before long, whereas a separate list could be easily corrected for the next annual report and the necessary changes made from time to time. The book will be much appreciated by investors, mining men and others requiring accurate information as to Canadian mining undertakings and mineral resources.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Colombia as a Mining Country

Is it true that Colombia at the present time offers the best opportunities for new mining enterprises?

R. M. S.

Comparisons are always odious. Colombia undoubtedly is a promising mining country. We should hesitate to say that it offers the best prospects. A good account of the mineral resources of Colombia is to be found in the bulletin of the American Institute of Mining Engineers, September, 1908.

Brass vs. Iron for Safety-lamp Gauzes.

Will copper or brass wire offer the same degree of safety on the safety-lamp gauze as does iron?

Miner.

Iron gauzes in safety lamps are cheaper than those made of brass; for this reason the former are more generally used. The brass gauze, however, has its particular advocates who advise its use in wet mines where dampness would be likely to corrode iron. There are also many miners who claim that the brass gauze is safer than iron. Safety-lamp manufacturers will supply either brass or iron gauzes according to the wish of the purchaser.

Standard Copper

Please explain for the benefit of the readers of the Journal what is meant by "Standard" copper, as dealt in on the London exchange and quoted in the Journal. One Western copper producer who was once associated with a London firm is under the impression that "Standard" copper is now a fictitious commodity, the term having originated before the days of electrolytic refining. It is his understanding that whenever the holder of a warrant calls for delivery of the metal, the seller is entitled to deliver electrolytic copper and to demand a premium at the rate of £1 per 2240 lb., but he is not sure of this. I have asked the same question of other men engaged in producing and selling copper, and all confess ignorance on the subject.

G. W. R.

The term "Standard" copper is a substitute for the former "good merchantable brands," or "G. M. B.'s" and is the standard basis of treading on the London Metal Exchange. The committee of the latter prescribes an official list of the brands of copper that are good delivery under the rules and regulations. Sellers have the option to deliver each 25 tons either in:

Class A—Refined copper not less than 99 per cent. and below 99.30 per cent., at contract prices;

Class B—Refined copper assaying not less than 99.30 per cent. and below 99.80 per cent., and tough cake with certificate of quality as per Rule 1, at 10s. per ton over contract price;

Class C—Refined copper assaying not less than 99.80 per cent., at £1 per ton over contract price;

Class D—Rough copper subject to a rebate of £1 10s. per ton from contract price (see also Rule 1).

The rules referred to appear in the standard form of contract and are as follows:

Rule 1. All warrants for refined copper (other than tough cake) shall be accompanied by a certificate stating the produce which shall in no case be less than 99 per cent. All warrants for tough cake shall be accompanied by a certificate that the copper is of good merchantable quality, and fit for rolling. The cakes shall not weigh less than 1 cwt., or more than 2 cwt., each. For rough copper the standard of produce shall be 97 per cent., but no excess shall be paid for. A pro rata allowance based on the settlement price shall be made for deficient produces below 97 per cent., down to and including 96 per cent. and a double pro rata allowance on the same basis for deficient produces below 96 per cent., down to and including 94 per cent. Produces below 94 per cent. shall not be a valid tender. All certificates for rough copper shall state that the quality has been passed by the assayers as good merchantable. Warrants for rough copper warehoused previous to October 1, 1904, with certificates of assay by the Cornish method shall constitute a valid tender under this contract; the Cornish assay to be translated into the wet assay by adding one unit.

Rule 2. Sampling and Testing. The sampling of refined copper shall be effected at the public warehouse by drilling one piece for every five tons, in the case of tough cake one piece in every five tons being taken for testing as prescribed, and of rough copper by drilling sufficient pieces to constitute not less than 10 per cent. of the weight of the parcel, each brand to be sampled and assayed or tested separately. In the case of refined copper one sample only shall be drawn from the drillings and the produce determined by a public assayer, but for rough copper three samples shall be taken from the drillings, and one sent to each of two public assayers, who shall agree as to the produce, and if they are unable to agree, the third sample shall be sent to a third public assayer chosen by the other two whose report shall be final and binding. If the sale be made prior to sampling, buyers shall have written notice of seller's intention to sample not later than 3 p.m. on the day previous to the day of sampling, specifying the place and hour at which sampling will commence and whereat buyers shall be at liberty to be present or to be represented. The entire cost of sampling and assaying, or testing, shall be borne by the sellers. The assaying, both of refined and rough copper, shall in all cases be done by the wet method.

Rule 3. Warrants tendered shall be those of a public warehouse in London, Liverpool, Birkenhead, Swansea, Birmingham or Newcastle-on-Tyne, the name of which shall appear in the official list of the committee. The copper shall have been weighed in drafts of 10 cwt. each, except Chile bars, which shall have been weighed in drafts of five bars each. Standard copper shall be, as far as possible, in warrants of 25 tons each, and each parcel of 25 tons, whether rough or refined, shall be of the same form and class, and shall be in one of the above-named places; and if the warrants be tendered against a contract for a multiple of 25 tons they shall be capable of subdivision into parcels of 25 tons each.

Rule 4. Certificates of assay or quality, in the form settled by the committee, shall be attached to all warrants deliverable under this contract, and the certificates shall be those only of experts, assayers, or analysts, approved of by the committee. Warrants for Standard copper shall be a valid tender, even without certificates of assay or quality, but buyers need only pay a sum on account, say, within 3 per cent. of the invoice value, and the balance on production of the certificates, which must be delivered within one month from the date of the warrant. The payment of buyers of a sum on account shall not invalidate their right of rejection should the certificate subsequently prove that the copper is not a valid tender under the preceding rules.

Rule 5. Should any Standard copper, subsequently to tendering, prove to be of such quality or produce as not to constitute a valid tender under these rules, buyers shall be entitled to call upon sellers (by giving notice to them in writing, as soon as possible) to substitute a similar quantity of Standard copper, of the quality or produce stipulated for by these rules, and such substitution shall be made not later than 3:30 p.m. on the first working day following the notice of rejection of the original parcel or parcels. Should the contract be for a special brand, or brands, sellers shall, if possible, substitute the same brand, or brands, and of the proper quality of produce fixed by the rules; but if unable to thus substitute, or in cases where it becomes a question of special damages, and they are unable to agree with buyers the question of damages shall be settled by arbitration, according to general rule B, and the costs of arbitration shall be borne by sellers.

Personals

J. R. Finlay has returned to New York.

C. S. Herzig is still at Matagalpa, Nicaragua.

Dr. R. A. F. Penrose, of Philadelphia sailed for Europe, Feb. 6.

Dr. Joseph Struthers has been elected secretary of the Engineers' Club, New York.

G. L. Norris has been appointed engineer of tests for the American Vanadium Company.

John W. Dunn, president of the International Steam Pump Company, has resigned on account of ill health.

John N. Steele has been elected a director of the Cumberland-Ely Copper Mining Company, in place of George E. Gunn.

Robert T. Hill has gone to Nevada to spend a month in the study of conditions at Alunite. He is accompanied by F. B. Irvine.

S. W. Eccles, president of the American Smelting and Refining Company, was recently at El Oro, Mexico, looking over some mines.

F. N. Flynn, recently at Denver, has opened an office and reëstablished his headquarters as a mining engineer at Globe, Arizona.

Ellard W. Carson, of Los Angeles, Cal., has been appointed superintendent of the Picacho Basin Mining Company, near Yuma, Arizona.

Anton Gronningsater, formerly chief chemist of the Deloro Mining and Reduction Company, has gone to Norway on professional business.

William C. Freeburn, of Britannia Beach, B. C., has gone to Alaska, to start up the Mt. Andrews mine near Ketchikan for Mr. Lichtenstein, one of the owners.

Frederick H. Brainard and J. Phillips Furbeck have opened an office at Benton, Wis., as consulting mining engineers, under the firm name of Brainard & Furbeck.

Dr. Henry S. Washington, of Washington & Lewis, New York, mining geologists, has returned to Brazil, where he will spend three or four months in professional work in the diamond fields.

Edward C. Westervelt has been elected president of the Santa Fe Gold and Copper Mining Company in place of J. H. Susmann, resigned. Mr. Westervelt is secretary of the Tennessee Copper Company.

S. E. Bretherton is now consulting mining and metallurgical engineer, at San Francisco, Cal. He continues to act as general manager for the Great Western Gold Company but is also consulting metallurgist for several other companies.

Edward Flynn, former president of the United Mine Workers of America in Alabama, has been appointed chief State mine inspector, of Alabama, Robert Neill, of Dora, has been named assistant State mine inspector, taking the place of Mr. Flynn, who was promoted. James Hillhouse is the other assistant inspector.

Obituary

Col. Joseph A. Andrews, who died in Newport, Ky., Jan. 26, aged 69 years, was founder and president of the Andrews Steel Company, whose works were built under his charge. He was also president of the Newport Rolling Mills Company, and had been for many years engaged in the manufacture of iron and steel.

Socities and Technical Schools

American Peat Society—A meeting of the New York section was to be held Feb. 13, at which there was expected a paper on the peat resources of the United States, and a discussion on the manufacture of gas from peat.

Anglo-American Club—This club, at Freiberg, is urgently in need of the addresses of old members. They are requested to send their present addresses to B. A. Johnson, honorary secretary, at Freiberg, Saxony, Germany.

Stevens Institute of Technology—The Alumni of the institute will have their annual dinner on Friday, Feb. 19, at the Hotel Astor, New York. A large attendance is expected, and among the speakers will be President Alex. C. Humphreys, of Stevens Institute; Alfred Noble, Col. H. G. Prout and others.

Massachusetts Institute of Technology—Doctor Jaggar, of the geological department, announced recently that money had been subscribed for a geophysical laboratory, which will be erected somewhere in the vicinity of Boston. It will be earthquake proof, and will contain modern apparatus for the study of earth movements. Professor Jaggar hopes that this will be the beginning of a movement to establish similar laboratories in other parts of the country and of the world.

University of California—With over 240 students enrolled in the College of Mines at the University of California it became necessary to provide S. B. Christy, professor of mining, with an associate and Edward B. Durham has been selected. He will have charge of the field work in mine surveying and mapping, which is a course open only to such mining students as have complied with the duties of the first year work in surveying. Professor Durham will also have charge of the course in explosives, rock drilling and blasting. This enlargement of the mining staff will be of great advantage to the many students now at work.

Scranton Mining Institute—At a meeting held in Scranton; Penn., Jan. 18, the following officers were elected: Hubert D. Johnson, president; P. J. Moore, vice-president; J. P. Jennings, secretary. The following papers were read and briefly debated: "Electricity in the Mines," E. M. Walthall, electrical engineer, Pennsylvania Coal Company; "The Effects of Example and Discipline in the Government of Mines," P. J. More, State mine inspector; remarks, William Allen, superintendent Scranton Coal Company. Apart from the technical papers, M. J. Martin delivered an interesting address on "Legal Responsibilities of Employer and Employed." Mine Inspector H. O. Prytherch delivered an address on "Hidden Dangers and Invisible Enemies."

Appalachian Engineering Association—The annual meeting for 1909 was held at Morgantown, W. Va., Feb. 6. After the election of officers the following papers were then read and discussed: "Municipal Shortsightedness," by Prof. D. C. Weller, Waynesboro, Penn.; "Methods Used and Results Obtained in Triangulation of the Fairmont Region," by John G. Smyth, chief engineer, Fairmont Coal Company; "Reinforced Concrete Construction," by President A. Wagner; "The Surveyor vs. The Engineer," by Guy B. Hartley, of Morgantown, W. Va. At the evening session the program included a stereopticon lecture on "Machine Mining with the Electric Puncher," by L. F. Crawford, of Pittsburg, followed by E. A. Schubert, and short talks by Professors Morris and Boughton, C. McC. Lemley, Dr. I. C. White and others.

Montana Society of Engineers—The annual meeting was held at Great Falls, Jan. 7-9. Two days were occupied in visits to plants near Great Falls, including the Boston & Montana smelters. At the business meeting the following officers were chosen: President, Charles H. Bowman; first vice-president, Frank M. Smith; second vice-president, Fred W. C. Whyte; secretary and librarian, Clinton H. Moore; treasurer and member of the board of managers of the Association of Engineering Societies, Samuel Barker, Jr.; trustee for three years, Theodore Simons. The reports of the secretary and treasurer were read and approved and referred to the trustees. At the afternoon session the address of the retiring president, Archer E. Wheeler, was read. A thesis by Joseph H. Harper, entitled "Hydraulic Tables," was read by the secretary, followed by others from Theron M. Ripley, S. B. Robbins and F. W. Blackford. The meeting closed by a general discussion of several engineering topics.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Goldfield, Butte, Salt Lake City and Denver

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 3—The rain storms continue throughout the State and more particularly in the mining regions. At Nevada City, for example, 31.85 in. of rain fell in January, which is nearly as much as fell during the entire rainy season last year. Most of the mines are having trouble with surface water, and those with electric pumps are handicapped by lack of full supply of power. The water- and electric-power plants in all sections are having trouble. Considerable work is being done in the way of tracing croppings as the floods have cleared ravines, etc., so that experienced miners have a good chance to look over the ground. The storm has also afforded many mines chances to sluice off pieces of ground which have remained unworked through lack of water, and ground sluicing is going on among the placer miners to a larger extent than has been the case in years. Even in places where the water runs down as soon as it stops raining, work is pretty steadily carried on as the rains appear almost ceaseless. The warm rains have washed off the snow up to the timber line, but in the higher altitudes the snow is piling up at a great rate, much to the delight of the mining communities, as there is now no fear of any water shortage the coming season. The rivers are all bank full with the rains and melting snows. At places on the summit of the Sierra the snow is now 30 ft. deep and still falling.

A suit involving magnesite deposits in Sonoma county has been brought by George Madeira and the Western Carbonic Acid Gas Company against the Sonoma Magnesite Company. An injunction is asked against the defendants to prevent them from interfering with mining work and a decree is also asked to quiet title to the magnesite mine in question.

The miners of Tuolumne county and the Chamber of Commerce of that county do not like the present plan by which San Francisco expects to get a water supply from lake Eleanor and the Hetch-Hetchy valley. They want the intake of the water to be above the mining belt. They demand that the water in the proposed reservoirs shall be diverted from the Tuolumne river at or above a point a mile below the confluence of Jawbone creek. They insist that the diversion of such water at any point below will paralyze all mining in Tuolumne county and render worthless mining property valued at millions of dollars.

About eight miles east of Paradise Springs and 24 miles northeast of Otis—the borax camp—some rich gold ore has recently been uncovered in San Bernardino county. There is a rush from other parts of that county and adjoining ones to this new mining section.

The copper camp of Greenwater, in the Funeral range of Inyo county, is again showing signs of activity and numbers of men are going in there.

There is a law in Nevada county which forbids the owners of abandoned prospect holes and shafts to leave them unfenced. It has not, however, been enforced with much vigor and as a result several fatal accidents have occurred by men falling into such holes. Now the district attorney of the county has published a notice that he will enforce the law.

Goldfield, Nevada

Feb. 2—The total output of the Tonopah mines for the week ending Jan. 30 was 4608 tons. The Tonopah Mining Company mined 2500 tons; Belmont, 600; Midway, 100; West End, 100; Jim Butler, 300; MacNamara, 300; and Montana-Tonopah 708 tons.

The fire that started in the Sutro tunnel near where it joins the vein was confined by bulkheads to a space of 200 ft. and has now been put out; a few miners were slightly injured.

The Pioneer strike continues to be the chief topic of conversation in mining circles. The town of Pioneer is experiencing an old-time boom and now has a population of between 400 and 500 inhabitants. Frame buildings are being erected as rapidly as the lumber can be hauled and every line of trade is well represented; both the Tonopah and Tidewater and the Clark railroads have made preliminary surveys to the camp, and a telephone route is now being surveyed. It is reported that the Nevada California Electric Power Company will extend its lines to the town in the near future; over 50 applications have been made for leases on the Pioneer and adjoining grounds. The permanence of the camp greatly depends on the striking of ore in the crosscut from the 210-ft. level; the latest reports from this level are favorable, as the crosscut now 60 ft. long is apparently approaching a footwall.

The Pioneer Oil Company, of Nevada, composed of Goldfield men, and holding about 50,000 acres of supposed oil land near Indian Springs in the southern part of the State, is making preparations to drill on two different sections of its ground.

It is reported that the Western Pacific has arranged for the purchase of the Nevada-California-Oregon Railway a narrow-gage road extending from Reno to Madeline and which crosses the Western Pacific 30 miles north of Reno.

J. W. Durfee, the contractor who sunk the shaft at February Premier lease on the Consolidated Company's ground 300 ft. in 48 days, was the recipient of a gold watch presented by the directors of the leasing company. This is claimed to be the record for rapid sinking in the camp.

Among the many bills to be presented before the Nevada legislature at its present session which began Jan. 18, several have a direct bearing on the mining industry. A bill regulating mining operations and calling for the appointment of a State mining inspector will be introduced. Organized labor will demand the enactment of law providing for the liability of employers in loss of life and for accidents occurring in and around the mines; also the enactment of a law giving laborers a first lien upon a building where construction may involve an action for wages, the expense of collection in both cases not to borne by the plaintiff. A bill making eight hours a day's work at gypsum mines will also be introduced, and also one providing that no powder more than six months old shall be sold or used in any property, as powder in time changes and becomes dangerous to handle.

The Western Ore Purchasing Company, which is already operating three samplers in Nevada, will build a fourth this year in the southern part of the State. While the location has not been decided upon, it will been settled as the MacNamara has ated at the junction of the Clark road from Goldfield and Tonopah with the Salt Lake route between Los Angeles and Salt Lake City.

The fight between the MacNamara and the Tonopah Extension companies involving the question of extralateral rights has surrendered all claims to the vein beyond its north side line which divides the two properties. The action was commenced four years ago by the Tonopah Extension securing an injunction restraining the MacNamara from entering its premises on that vein. As a result of this adjustment and that with the West End involving the same vein, the MacNamara is now bounded by vertical lines from the two properties mentioned, at least as far as this vein is concerned.

Salt Lake City

Feb. 5—The shaft at the Ohio Copper Company's property is now about 920 ft. deep, and the raise is 225 ft. above the tunnel level. It is expected that connection will be made by the end of February. This will greatly facilitate ventilation. Twenty men are now at work installing machinery in the new 2400-ton mill, and it will be ready for operation in a short time. Mr. Graves, president of the company, announces that the Bingham Mines Company will resume work on its Dalton & Lark property at once. The Dalton & Lark is a lead-silver producer, and will ship ore to the American Smelting and Refining Company. The Commercial property, owned by the same company, contains a copper-sulphide ore. It is expected that before long a contract with the Garfield smelter will be drawn up; as soon as smelting arrangements can be made work at this property will be started. The Bingham Consolidated smelter, formerly operated by this company, has been closed by the courts, and for the present will remain idle. At the Eagle & Blue Bell mine in Tintic, which is also owned by the Bingham Mines Company, work is being carried on by leasers. The company expects to start a winze from the 1600-ft. level within a short time.

At the Bingham-Butte mine the underground shaft from the lower-tunnel level will be sunk 200 ft. deeper. This shaft is now almost 200 ft. below the tunnel, and has exposed considerable ore.

The Centennial-Eureka, the greatest mine in Tintic, shipped approximately 112,000 tons during 1908. The output was considerably smaller than in 1907, on account of the shutdown of the United States smelter at Bingham Junction, which lasted several months. During this shutdown some ore was shipped to the company's California smelter. The company is said to have more ore blocked out now at this mine than at any period in the history of the mine. The shaft is now below the 2200-ft. level and will be sunk to a depth of 3000 ft. At present the pumps are handling about 12,000 gal. of water in 24 hours.

Ore shipments from the Tintic for the week ending Jan. 29, were as follows: Centennial-Eureka, 42 cars; Eureka Hill, 2; Eagle & Blue Bell, 1; May Day, 4; Yankee, 2; Ajax, 1; Sioux Consolidated, 12; Dragon Iron, 32; Colorado, 39; Brooklyn, 1; Beck Tunnel, 5; total, 141 cars. The May Day mill shipped two cars of concentrates. The Tintic smelter received 84 cars of ore from Tintic mines and shipped four cars of bullion to Eastern refineries.

On Feb. 1 the United States assay office, at 52 Post Office place, opened its doors. The first bullion to be received came from the Consolidated Mercur Gold Mines Company. The office is one of the most complete and uptodate in the United States, and is maintained by the Government for the assay and purchase of gold bullion. The bullion is shipped to the mints and there refined and coined. J. U. Eldredge is assayer-in-charge.

The annual report of the Utah Copper Company will be issued some time during the current month.

The Garfield smelter is treating nearly 2800 tons of ore per day, and its capacity will be increased until about 3500 tons per day can be taken care of. At the Murray smelter five lead furnaces are running full blast, and the sixth will be blown in as soon as the snow goes away so that ore can be shipped from Alta and other snow-bound camps.

Work at the Transportation tunnel of the Bingham Metals Mining Company has been going ahead so quietly that few persons have taken note of it, or appreciate what this tunnel will mean to Bingham. The tunnel is now nearly 2500 ft. long and being driven ahead at the rate of 60 ft. a week. Operations are now under way to increase the advance to 90 ft per week.

Butte

Feb. 4—The annual meeting of the Montana Mining Association was held in Helena on Feb. 1. The following were elected officers: President, T. L. Greenough; vice-president, W. G. Conrad; secretary-treasurer, F. B. Linderman. The executive committee is composed of the following: E. A. Spriggs, Dr. P. S. Mussigbrod, C. E. Morris, Owen Byrnes and J. A. Rowland. The report of the executive committee showing progress made during the past year states that the association smelter at Ponderay, Idaho, has been in operation for several months and has been successful in every way. The ultimate purpose of the association is to build a smelter within the State of Montana at some central point, should conditions warrant it. It is further stated that considerable reduction in freight rates has been accomplished through the association representative who appeared before the State railroad commission. A committee was appointed for the purpose of securing legislation, State and national, which it is deemed will be helpful to the mining industry in general.

A default judgment in favor of Alonzo W. Evans and against the Lake Shore Gold Mining Company for the sum of $10,123, was recently granted in the local district court. The action was brought by Evans and a number of other stockholders for the purpose of recovering the amount they had paid for stock in the company, they claiming that misrepresentations had been made to them regarding the value of the company's property in Madison county.

In the case of the United States against the Northern Pacific Railway Company and its several subsidiary companies, brought in the United States Circuit Court for the purpose of securing for the Government certain coal lands for which patents have been issued to the railway, arguments were heard and submitted before Judge Hunt at Helena the latter part of January. The case arises out of a grant to the railway from the Government. In the act granting to the company certain lands, the provision was made that the company might exchange its original lands for any other lands nonmineral in character. At the time that the railway made its exchange, the lands it took were classified by the Government as nonmineral in character. Since that time the lands have been proved to be highly valuable for their coal deposits and the Government now seeks to regain them, basing its action on the claim that the classification by the Government engineers was not necessarily conclusive, and that upon the discovery of the mistake the Government has the right to retake the lands in question.

At a recent meeting of stockholders of the Butte-Montana Mining Company, held in Butte, the following were elected directors for the present year: John P. Browne and W. H. Lindsay, of Butte; J. G. Bennett, John B. Chapman, W. B. Chapman and M. K. McMillan, of Pittsburg; R. A. Kerr, of Duluth. At a meeting of directors held immediately subsequent J. P. Browne was made president, J. G. Bennett vice-president, and W. H. Lindsay secretary and treasurer. A plan of reorganization was considered by the directors in which it was proposed to increase the capitalization from $1,000,000 to $2,000,000 and to change the par value of the shares from $1 to $10. No definite action was taken however.

In a circular letter to stockholders the directors of the Raven Mining Company have offered each stockholder an opportunity to purchase one share for every 10 now held by him, at the rate of $1 per share. The purpose of the offer is to create a fund for continued development work. The Montana Iron Works, a Butte corporation, has begun an action against the Reins Copper Company for the purpose of foreclosing a materialman's lien upon the Combination claim of the latter company.

Denver

Feb. 6—In the Cripple Creek district, the report of the Portland Gold Mining Company shows that the total gross value of ore produced by the mine since the first shipment by the company in April, 1894, amounts to $28,409,442. Four dividends, amounting to $480,000, were paid during 1908. The total dividends disbursed to date are $8,277,080. The cash balance on hand is $260,000. Other interesting features in the report are that the mine now has 40.25 miles of under-

ground workings, and the statement that there are millions of tons of low-grade ore exposed that will pay to mine and mill. Further it appears that, following the example of Stratton's Independence, a 300-ton or 500-ton mill is to be built at the mine for the treatment of these ores, and the immense dump, and at a cost of from $200,000 to $400,000. It is further stated that good ore is being found at the 1500-ft. level, but that the high-grade ore, which is known to exist at the 1600-ft. level, cannot be mined until the deep drainage tunnel unwaters the district. This tunnel has now covered a distance of 5000 ft., and is expected to tap the chief water course at 14,637 ft. from the tunnel portal. The progress is at the rate of from 10 to 12 ft. per day.

The Vindicator Consolidated, whose mines are on Bull hill, holds its annual meeting on Feb. 11. The report states that the mine produced 33,035 tons last year, of a bullion value of $942,643, and dividends were paid amounting to $225,000.

Reports, apparently well authenticated, are at hand today from Leadville, that the Bald Mountain tunnel has intersected the great Sunday fissure, which produced its millions in the past, but which ceased to pay owing to the great cost of pumping and of transportation of its ores. The strike was made 780 ft. below the surface, about 300 ft. below the old workings, and 2600 ft. from the tunnel portal. It is stated that the entire breast is in lead ore, carrying silver and gold.

It is also just reported that the upraise which is being driven from the main Dinero tunnel, in Sugar Loaf mountain, has penetrated a big shoot of high-grade silver ore, supposed to be the same as that from which the old Dinero shaft produced its millions 20 years ago. This mine is in the granite which underlies the Leadville mines, and this discovery accentuates the belief which is held by many that there may be pay veins in the granite below the sedimentary deposits of the Leadville district.

The Denver, Laramie & Northwestern, from Denver, northward, with its projected terminus at Seattle, is under construction, as is also the Laramie, Hahns Peak & Pacific, with 38 miles in operation, 18 under the construction, and it is said with the money ready to build to the coal beds of North Park. Here is a seam 40 ft. thick in one place and 60 ft. thick at another, and both exposed on the surface. This is a fine lignite, low in ash, and about 44 per cent. fixed carbon, and 14 to 16 per cent. moisture—not a stocking or carrying coal, however, as it slacks rapidly on exposure to the air, but for power purposes at the mine most excellent. This line has its northern terminus at Laramie, on the Union Pacific. The Saratoga & Encampment railway, built from Walcott on the Union Pacific, south to Encampment by the Penn-Wyoming Copper Company, is said now to be controlled by the Chicago & Northwestern, and that 25 miles more has been let for construction, its objective point being the coal of the Yampa Field in Routt county. This is more than probable, as the Chicago & Northwestern, with its 8000 miles of track, has about 1200 miles through a country practically devoid of coal. Three surveys have been made, and the plats filed, for a line from Wamsutter, on the Union Pacific, to Craig, in the center of the Yampa coalfield, and on the projected line of the Moffat road—also reaching for coal for the great Union Pacific system. The Denver, Northwestern & Pacific is running daily trains to Steamboat Springs, and shipping coal to Denver from the same field, and will be pushed on westward through its center to Salt Lake City.

A bill has been introduced in the Colorado Legislature providing for the appointment of an ores commission, which shall have the same powers over the smelters within the State as the Interstate Commerce Comission has over railways. The bill provides for the return of ores to the vendor in case the net price be not mutually agreed upon, and provides that should the ore have been mixed with other ores so that it is impossible to return it, the smelting company shall be liable for twice the value of the ore. The bill further provides penalties for rebating or any discrimination in the purchase or treatment of ores. The commission is to consist of three members, one of whom shall be the State assayer.

Indianapolis

Feb. 8—Albert A. Sams, assistant State mine inspector, has occasioned the arrest of Patrick Bartley, superintendent of the Menden coal mine, near Chandler on three charges. The affidavit charges Bartley with wilfully neglecting to have the Menden mine examined last August by a competent firebess before the men entered for work, and with acting as his own fireboss Aug. 8, while superintendent of the mine and without license. There is much feeling over the matter.

Miners and operators appeared before legislative committees during the past week to discuss the bills introduced affecting mines and mining. The Bland bill, which would widen the space at the sides of the tracks in coal-mine entries; the Higgins bill, which would compel the mine operators to sharpen 3¼-in. drills if the miners demand it; the Mugg bill, providing for the construction of hoists in escape shafts in all mines in the State; the Kayser bill, providing for the creation of an examining board of miners in each county and for licensing miners, and the Bassett bill prohibiting coal-mine operators taking out indemnity insurance against judgments at law in case of injury or death to an employee. These are hard problems and have provoked spirited arguments before the committees by the miners, the operators and their attorneys. None of the bills has been recommended for passage as yet.

The judgment of the lower court quashing an indictment against C. E. Barrett, secretary of the Vandalia Coal Company, for failure to comply with the statute requiring that in entries to mines there shall be a space of 2 ft. outside the rails of all car tracks, was reversed by the Supreme Court on Feb. 4. The statute contains an exception as to strata 3 and 4, in the block coalfields. Barrett's men were working vein No. 4, but it was not in the block-coal district, and bituminous coal was taken out. The Supreme Court holds that this classification of coal mines is constitutional, by reason of physical differences between the two sections of the coalfields. Additional legislation is now pending in the legislature on the same subject which provides that the entries to all mines must provide 2 ft. of space on each side of the width of the car used.

Toronto

Feb. 6—Dr. Eugene Haanel, director of mines, has returned from a trip to Dumnarfvet, Sweden, undertaken to witness the operation of the new electric furnace for iron smelting. The plant resembles a blast furnace in which the tuyeres are replaced by electrodes, a three-phase current being employed. The charge passed down through the shaft gradually and uniformly, the electrodes needing no regulation, not being moved for five days. In another furnace at the Dumnarfvet works, a three-phase current and two electrodes are used, the bottom of the furnace furnishing the third electrode. The special advantage of this arrangement is that the three-phase current produces a rotation of the bath in a vertical plane, bringing new material continually into the slag line for purification.

Doctor Haanel, when in Europe, also made investigations into the production of gas from peat and in pursuance of this object the Canadian government has appropriated $15,000 for the erection of a fuel-testing plant at Ottawa, the machinery for which is on the way from Germany. It will test the qualities of Canadian peat as a gas producer from which electricity can be generated. An appropriation has also been made for the purchase by the government of a peat bog, on which machinery can be set up for demonstrating the best methods of making peat fuel for electrical purposes.

The new route to Gowganda via the Canadian Northern Railway to Sellwood, north of Sudbury, and thence by sleighs was regularly opened on Feb. 2. The following day an official party left to make an inspection of Gowganda camp.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Upon the petition of unsecured creditors Judge Jones in the Federal court has appointed James Bonneyman, former general manager of the company, and A. W. Smith, president of the Birmingham Trust and Savings Company, as receivers for the Birmingham Coal and Iron Company. The receivers have taken charge of the properties, instructions being given that there is to be a continuation of operations. The property consists of two furnaces, coal and ore mines, coke ovens and limestone quarries. The officers of the Birmingham Coal and Iron Company, H. M. Atkinson, of Atlanta, Ga., and others, are also officers of the Atlanta, Birmingham & Atlantic railroad, which corporation is also in the hands of receivers.

Arizona

CONCHISE COUNTY

Grading has begun, and the right of way is reported to have been secured for the Colorado & Mexico railroad from Douglas to Courtland.

Calumet & Arizona—The production of copper for January was approximately 5,000,000 pounds.

Copper Queen—The smelter broke all previous records and produced 9,500,000 lb. of copper during January.

GILA COUNTY

Globe—Despite the brief shut-down at the mines on account of labor troubles, the January output of the smelter is estimated at 3,000,000 lb. of copper.

Black Warrior—Regular shipments of ore are being made to the Old Dominion smelter.

GRAHAM COUNTY

Arizona Copper—Repairs, due to the recent fire at the smelter, are being completed. The output for January is estimated at 1000 tons of metal.

Arizona Power and Water Company—The company proposes to build two large dams above Clifton for the manufacturing of power for the various companies of the district. The first dam, which will be 100 ft. high, is to be built across the San Francisco river.

The incorporators of the company are Dell M. Potter and Geo. F. Reed, well known men of the district, but foreign capital will largely assist in the undertaking. It is capitalized at $1,500,000

Gold Belt Development and Reduction Company—A new board of directors was recently elected and $50,000 secured for development work and machinery.

Morenci Southern Railroad—Morenci is connected with Guthrie, a point on the Arizona & New Mexico road by this narrow-gage road which belongs to the Phelps-Dodge interests. It has ample equipment for its enormous freight traffic. Because of the increasing importance of Morenci and the district the company intends to increase its passenger equipment.

New York-Arizona—The Lillian tunnel has cut one shoot of ore showing free gold, but as the objective point is only about 100 ft. from the present face, it has been determined to drive that distance before proceeding with the development of the orebody already exposed. The gasolene engines have been installed and the hoists and compressors are in operation. Lower down the mountain the company has a 70-ft. shaft with a 50-ft. drift showing a promising vein of copper sulphide, but the water necessitated the abandonment of work until pumps can be installed.

YAVAPAI COUNTY

Monark—Plans are being made for the erection of a 100-ton stamp mill.

California

AMADOR COUNTY

Argonaut—The ore being mined at this property, Jackson, carries more sulphurets than formerly and more concentrators have been added to the mill.

Bunker Hill—The ore is averaging $7.50 per ton and in the last six months has yielded $125,508, of which $42,000 was paid out in dividends.

CALAVERAS COUNTY

Hayston—This mine in Fischer district, W. W. Dunlap manager, now has ore in its shaft averaging $10 per ton. The mine is a south extension of the Blue Jay where men are now being set at work.

EL DORADO COUNTY

Alpine—Nixon & Wingfield being unable to secure an extension of their option so as to sink 200 ft. have given up this mine to the company represented by D. C. Lane, of Los Angeles, which is now expected to work it

HUMBOLDT COUNTY

Klamath River Mining Company—This company owns the Miller placer mine on the Klamath river, three miles from Weitchpec, where a sawmill, flumes, etc., are to be put up. There are 300 acres of mining ground in the property.

INYO COUNTY

Graphite—W. G. Scott, manager of the Inyo Mines Syndicate, has located some promising graphite claims.

Gray Butte—At this mine, seven miles from Casa Diablo, a tunnel is being opened. A Marks quartz mill is about to be placed on the mine.

Key Gold—This company at Greenwater is reported to have bought from "Death Valley Scotty" and his partner, Wm. Keyes, the mine from which they have taken gold.

MARIPOSA COUNTY

1909 Mining and Milling Company—This company has been organized to work the old Enterprise or Barcroft mine near Hornitos. G. P. Cummings, of Fresno, is secretary, and Ed. Mahoney, of Hornitos, manager. There is an eight-stamp mill and a new air compressor is being installed.

NEVADA COUNTY

Golden Gate—A new turbine pump has been installed and as soon as the water is removed operations will be resumed

Midas—At this mine, owned by Grass Valley men, they have started drifts on both sides of the shaft. There will soon be ore enough out to start the mill

PLACER COUNTY

McGeachen Gravel Mining Company—This company operating the Jupiter and McGeachen drift mines at Iowa Hill, has purchased the Big Dipper claim at that place which will permit the opening of valuable mining ground lying east of the Big Dipper J. E. Rose is superintendent

SHASTA COUNTY

Gladstone—A new electric line to carry ore from mine to mill is being put in and 10 stamps are to be added to the mill

Midas—This company at Knob has 100 men at work and the 20-stamp mill is running steadily The old ledge on the lowest level continues rich

SIERRA COUNTY

Forest Green—This mine, at Forest, is supposed to be an extension of the Tightner and Red Star mines. The shaft is to be continued to 500 ft. A 10-stamp mill and cyanide plant are to be installed. J. C. Chandler is president of the company.

Twenty-One—The tunnel is now in 500 ft. Surface equipment will be installed when the weather permits.

SISKIYOU COUNTY

Grouse Creek—This placer, operated by Welch & Sons, has started up with three giants at work, there being plenty of water.

Shebo—A contract has been let at this property at Indian Creek to sink deeper. A new hoist is being put up.

TUOLUMNE COUNTY

Black Oak Mining Company—The mine is unwatered to the 600 level and the mill is kept at work on the old dump. Roger Knox is superintendent in place of M. A. Knapp.

Draper Mining Company—The tunnel has been partly cleaned out and retimbered and the shaft retimbered down to where the ground is safe.

Colorado

ADAMS COUNTY

A vein of anthracite is reported found near the Weld county line, at a point about 20 miles from the Union Pacific and 12 miles from the Chicago, Burlington & Quincy road. A number of locations have been made.

LAKE COUNTY—LEADVILLE

Bald Mountain—A little over eight months ago this company started to drive a tunnel 2200 ft. to the Sunday vein on Bald mountain at the head of California gulch. The edge of the mineral zone has now been reached. The tunnel has been driven into solid mineral for a distance of 12 ft. and the footwall has not, as yet, been reached. The ore in the vein is a lead sulphide carrying some silver and gold. The mineral was encountered at a depth of 950 ft. from the surface. When the footwall is encountered, the work of developing the orebody will be started, and this will be carried on for 3000 ft., the length of the vein. Before the whole length of this ground is opened it is the intention of the management to start and make connection with the shaft on the surface, which is down 450 ft. This is the most important strike made this year, as it is in virgin territory.

Rosse Tunnel—A fair body of ore has been opened in this adit, St. Kevin, and shipping will start in a few days. The company that is working this tunnel is also driving the Birdella tunnel and making good progress with the work.

Result—The lessees on this mine, Stray Horse gulch, are shipping three carloads per week of an excellent grade of oxidized iron, and this could be doubled if the roads were in better shape. In the meantime the ore is being broken and held in the bins.

Robert Emmet—From this mine, Iron hill, the lessees are shipping regularly a good grade of iron, and at the same time prospecting in new ground.

SAN JUAN COUNTY

Joe & John—These claims in Prospect basin have been sold to the Allerton Mining and Milling Company, which proposes to begin development as soon as the weather will permit.

TELLER COUNTY—CRIPPLE CREEK

Portland—The annual meeting of the stockholders of this company was held in Cheyenne, Wyo., and the following directors were reelected: Frank G. Peck, Thos. F. Burns, Dr. D. H. Rice, Irving Howbert and Carl Chamberlin. The board was elected by about 2,000,000 shares while the minority vote, which was cast by James F. Burns, was less than 500,000 shares. The report of President Peck shows that the gross production of the mine for the past year was 94,311 tons of ore of the gross value of $19.45 per ton making $1,834,081. The total receipts for the year were $1,836,869; total expenditures $1,278,030, leaving a profit of $588,839. Cash on hand at the beginning of 1909, $269,193. Dividends paid in 1908, $480,000. Some new strikes of importance have been made in the lower levels. A large amount of experimenting has been done with the low-grade ores and it is proposed to build at an early date a mill. Some litigation has also been settled during the year. The output of this property up to Jan. 1, 1909, is 949,381 tons of ore of the gross value of $28,469,423. F. M. Kurie, of Victor, is general manager of the mine.

Vindicator—The annual meeting of the stockholders of this company will be held in Denver Feb. 11. The production of the property for the past year amounted to 33,035 tons of ore of the gross value of $942,643; $225,000 were paid in dividends. E. J. Trevarrow is superintendent of the property.

Mabel M—This property, owned by the Gold Dollar Consolidated company, is making a heavy production from the lease operated by the Union Leasing Company. C. G. Jackson, of Cripple Creek, has charge of operations.

Isabella—At the annual meeting of the stockholders of this company held recently in Cheyenne, Wyo., the old board of directors was elected for the ensuing year, as follows: J. A. Hayes, president, Irving Howbert, vice-president, G. D. Kilborn general manager and W. T. Doubt secretary and treasurer. The production for the year amounted to $391,177. After deducting mining, transportation and treatment charges and payment to lessees the net profit at the mine was $82,324. General office expenses and payment of some debts amounted to $46,856 and the net profits of the company for the year were $35,468. The mine is worked both by leasers and on company account. G. D. Kilborn, of Colorado Springs, is general manager.

Indiana

DAVIES COUNTY

The discovery of a vein of cannel coal on the farm of J. P. Cavanaugh five miles east of Washington has been made at a depth of 110 ft. A second vein of bituminous coal 3 ft. in thickness underlies the same farm. Plans are being made to develop the find and to secure a spur railroad to ship the product of the shaft when completed.

Michigan

COPPER

Seneca—A depth of 230 ft. has been reached in the shaft, and a crosscut is well under way to intercept the Kearsarge lode. The shaft is in the footwall and approximately 60 ft. from the lode. A hoisting engine of sufficient capacity to serve this shaft during the development stage has been delivered and will soon be ready to run.

Copper Range—Work has been discontinued on the Globe tract which has been held under option for some time. A shaft was sunk to a depth of 1000 ft. to intercept the Baltic lode, but when found the lode material was not of commercial grade. Considerable drifting was done at that depth, but nothing was found to warrant further explorations, so the shaft will be abandoned. Diamond drilling in search of the Atlantic and other lodes continues on sections 7 and 8. Conditions at the Trimountain are improving with depth.

Ojibway—No. 1 shaft has reached the second or 650-ft. level and should soon cut the lode. The lode where intersected at the 500-ft. level a few feet from the shaft, was of good grade, and consisted of two beds separated by about 14 ft. of trap rock. A crosscut is also being driven from No. 2 shaft on this level; this should cut the lode in a few days. The orebody where opened from No. 2 shaft was not as rich nor as uniform as at No. 1, but as the second level at No. 1 shaft showed a decided improvement over the first, probably as depth is obtained the shattered condition will disappear.

Superior—Sinking has been resumed below the 10th level at No. 1 shaft; with the enlarged equipment faster progress will be made. The fifth lot, about 3000 tons, has been put through the mill,

showed a saving of about 30 lb. of copper to the ton. More concentrating tables have been added to the Atlantic mill to handle the tailings, and probably a better saving will be made.

Calumet & Hecla—The first of the four units in the regrinding mill, each unit of which contains 12 Chilean mills and 48 Wilfley tables, has been in service some time, and most encouraging results are being obtained. Within a few months this entire plant, which will treat about 1500 tons of tailings per day, will be in operation. The new electrically driven centrifugal pumps at No. 5 shaft have been started. These pumps will take care of all the water from the northern portions of the mine and well eliminate the hoisting of water through the Red Jacket shaft.

Allouez—The lode where cut by No. 2 shaft at a point about 15 ft. below the 14th level is highly mineralized. This shaft has been sunk in the hanging wall at a depth of 80 deg., but will now be changed to conform with the pitch of the formation.

King Phillip—The crosscut on the sixth level from the No. 2 shaft has cut the Winona lode; the lode looks much better than where opened at the fourth level.

Lake—The shaft has reached a depth of about 400 ft.; a station is being cut at that depth and driving on that level will soon begin. The north drift from the second level has cut the lode formation.

Quincy—The January output in tons of mineral for 1909 was 1300, compared with 1310 for that month in 1908, 1200 in 1907, 1215 in 1906, 1130 in 1905, and 601 tons in 1904.

Montana

BUTTE DISTRICT

Amalgamated—The mines of the Boston & Montana, Butte & Boston, Anaconda, and Washoe companies are now producing at their normal rate, the adverse weather conditions which have interfered with transportation facilities having abated.

British-Butte—The new Risdon gold dredge was put in operation by the Governor of the State on Jan. 30. The dredge has been put in shape for continued working and it is expected that regular operations will begin the first of the coming week.

North Butte Extension—The plans for reorganization of the company are still unsettled. It is reported that A. M. Andrews and R. J. Horner, who have been active in refinancing the company, have severed their relations with the management.

Tuolumne—The shaft is down 1250 ft., and sinking is progressing steadily. No further cross-cutting will be done until the 1400 ft. mark has been reached. The boiler plant on the property is practically completed and the compressor plant is in process of construction. It is expected that both will be ready for operation by March.

Copper Eagle—A new shoot of ore was encountered the first of the week at a point about 180 ft. east of the shaft on the 350-ft. level. The shoot is more than 18 in. wide, and according to the management a sample taken across the face shows 4½ per cent. copper and $8.50 in gold and 1030 oz. silver per ton. This is the same shoot that was encountered on the 250-ft. level at about the same distance east of the shaft.

Davis-Daly—At the Colorado shaft the new engine is in place and the steel gallows frame is nearing completion. By Feb. 15 it is expected that both will be in operation. Of late the principal development work has consisted of diamond drilling on the 1400-ft. level.

La France Copper Company—At the Lexington mine development work is being done on the 1450-ft. level. On some of the levels above, leasers are working steadily, and most of them are making regular shipments.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Consolidated Red Top—Last week two new oreshoots were opened up. One is on the 150-ft. level almost directly over the orebody from which the ore produced last month was obtained. The other is in a raise from the 300-ft. level, south of and below the big stopes. In both places the ore averages about $90 per ton. Under the terms of the lease the company was required to sink the shaft to a depth of 500 ft. on or before Aug. 1, 1909, but the development work being carried on and the raising of ore have so taxed the capacity of the hoist, that an agreement has been made whereby the leasing company pays the Goldfield Consolidated company $5000 in lieu of sinking the additional 200 feet.

Kalfus Lease—J. L. Kalfus, operating this lease on the Great Bend Annex property, has been granted an extension of time. A crosscut 300 ft. long has been run from the bottom of the shaft, 185 ft. deep, and should shortly cut the Great Bend vein.

Daisy—A gasolene hoist has been placed on the Detch-Brewer lease on the Daisy ground and a systematic search will be made for the oreshoot from which several shipments have been made.

Imperial Goldfield—This company, owning two fractional claims adjoining the Blue Bell on the east, is making preparations to resume work after an idleness of more than a year. There are a number of promising veins outcropping on the property and these will be prospected at depth.

Combination Fraction—This company has leased the Nevada Goldfield Reduction Company's mill, and will treat its own ore in the future. A new strike was made recently in the company workings on the 600-ft. level.

ESMERALDA COUNTY—RAWHIDE

Murray Mill—This mill started Jan. 24 and has run continuously since. Apparently the ore treated is yielding well to amalgamation. It is reported that the owners of the Murray lease are to add 10 more stamps to this mill.

Kearns No. 1 Lease—This lease on the Rawhide Queen property is working 22 men on the two shifts. Ore is being sacked for shipment.

Victor Lease—On the 250-ft. level of this lease on the Coalition property, good milling ore has been found. The vein appears to be widening in depth.

Grutt Hill Mint Lease—The shaft on this lease is now 320 ft. deep. The shaft will be continued deeper as the lease extends for several years. In the winze considerable shipping ore has been found, but of course, most of the ore is of milling grade.

Murray Lease—The main quartz vein has been discovered on the 200-ft. level; where found the vein contains a narrow streak of rich ore along with milling ore of usual grade.

NYE COUNTY—TONOPAH

Tonopah Mining Company—During the week ending Jan. 30, 510 ft. of ground was broken. The mill dropped an average of 98 stamps during the week, 3145 tons of ore having a value of $22.70 per ton were crushed, and 38 bars of bullion valued at $34,200, together with 44,000 lb. of concentrates valued at $10,780 were shipped, making a total production for the week of $44,980.

Montana-Tonopah—Last week 115 ft. of new ground was broken in the various levels. The ore in the different stopes showed practically the same value. The mill crushed 964 tons of ore, 256 of which came from the MacNamara mine.

Belmont—Development work on the 1000- and 1100-ft. levels has proved the existence of a large orebody in this property. The ore now blocked out by a number of raises and winzes from these two levels shows for 250 ft. on the 1000-ft. and for 100 ft. on the 1100-ft. level and averages 6 ft. in width; all this ore is of a good milling grade.

WHITE PINE COUNTY—ELY

Giroux—Actual transfer of control of Giroux Consolidated Mines Company to the Cole-Ryan interests was accomplished Feb. 2 at the annual meeting when Thomas F. Cole and three other new directors were

elected. Joseph L. Giroux was re-elected president. The balance sheet, brought up to Feb. 1, 1909, and covering 13 months, showed $442,383 from ore sales; $1,500,000 from bond sale; $3,955,867, property account; $1,689,660, development account; $293,355, capital charges. Cash in bank is $431,771, while $572,000 was due from sale of bonds. The issue of $1,000,000 6-per cent. ten-year bonds secured by second mortgage on the Nevada properties of the company has been authorized. It has been decided to transfer the executive offices from New York to Duluth. In addition to authorizing $1,000,000 ten-year second mortgage 6-per cent. bonds, stockholders have also authorized an increase of stock by 200,000 shares to permit of the conversion of the new bonds. There are in the treasury of the company $500,000 of the first mortgage bonds of the original issue of $1,500,000. The company's authorized capitalization now stands at $7,500,000 stock and $2,500,000 convertible bonds. Notwithstanding the actual transfer of control to the Cole-Ryan interests the five-year pool which does not expire until the middle of 1910 is still in force. There are in the pool 465,000 shares, and the entrance of the Duluth interests was brought about by a "partnership" agreement between the members of the pool and Thomas F. Cole and associates.

Cumberland-Ely—At the annual meeting of the stockholders at Augusta, Me., John N. Steele was elected a director in place of George E. Gunn, retired.

Utah

Beaver County

Frisco Contact—D. P. Rohlfing is in Boston consulting with officials of this company, and it is expected that work will soon be resumed at the mine. The development consists of a two-compartment shaft 500 ft. deep, and about 800 ft. of drifts and crosscuts, which have exposed milling ore.

Nabob Consolidated—A short time ago this company started a tunnel to intersect the vein at a depth of 130 ft.; this work is being vigorously advanced. The property is near that of the Cedar-Talisman company.

Golden Reef—The shaft on this property is in ore assaying high in lead and carrying some gold. Three carloads are ready for shipment.

Black Hawk—In the Black Hawk winze about 40 ft. from the tunnel mouth a cave containing good sand carbonate ore has been opened.

Commonwealth—The west crosscut has followed an ore stringer for nearly 100 ft.; the stringer is widening as work advances.

Cedar-Talisman Consolidated—The Cedar and Talisman properties have been consolidated, and the danger of litigation averted. The new company is capitalized for 1,000,000 shares, par value $1 each. The Cedar company gets 350,000 shares the Talisman 300,000 and the balance is placed in the treasury. There is a shaft 500 ft. deep on the Cedar and the company is well equipped with hoisting machinery and a compressor. Some ore has been developed on the Talisman claims. The consolidated holdings comprise about 285 acres.

Juab County

Uncle Sam—Development work is under way to determine the extent of the oreshoot just discovered. The ore appears to be making at the bottom of the drift.

Millard County

Utah Mine Company—This company at Fish Springs declared a dividend of 2c. per share, or $2000, payable Feb. 10. The usual dividend has been 3c. This was reduced in order to purchase additional ground.

Salt Lake County

Bingham Copper—J. P. Graves, president and H. N. Sweet, director of the Bingham Copper and Gold Mining Company have been conferring with Duncan McVichie, the managing director. It is understood that the company will soon resume operations. This is the first Utah property of which Heinze acquired control. To date the property has never paid, but with the opening of the Mascotte tunnel the shipping facilities of the mine are greatly increased.

Central Standard—Three shifts will be started at once in the Mountain Maid tunnel. This should strike the extension of the Bingham-New Haven orebody within 250 to 300 ft. Development work on the Saginaw vein will also be resumed.

Utah Copper Company—In December the production was 4,174,859 lb. of copper. The total output in 1908 was 43,689,875 lb. The production by quarters has been as follows:

July-Sept., 1907	5,305,368
Oct.-Dec., 1907	7,716,712
Jan.-March, 1908	8,527,939
April-June, 1908	11,568,390
July-Sept., 1908	12,000,925
Oct.-Dec., 1908	11,592,621

The Garfield mill did not attain full operations until December, 1908. Plans are said to be under contemplation for a further addition to the milling capacity. The company is paying dividends at the rate of 50c. per quarter, or $2 per annum, but is earning nearly twice as much. However, dividends will not be increased until an adequate surplus has been accumulated. The company hopes to reduce the cost of production to the neighborhood of 7c. per lb., direct operating charges, which will probably mean 8@8½c., including maintenance, etc.

Tooele County

Boston-Sunshine—On the first of the month this company started work again at the mine; the mill is being remodeled.

Utah County

Mineral Flat—At this property, in American Fork cañon and controlled by Jesse Knight, ore is being opened up near surface. The tunnel, now about 650 ft. long, should catch the ore within 500 ft. This will give a depth of 400 ft. on the vein.

Utah County

Dutchman Lease—This lease reports a body of high-grade carbonate ore about 7 ft. wide.

Mary Ellen—In this property a vein 3 ft. wide carrying seams of galena has been struck. Work has been discontinued for the present, owing to danger from snow slides.

Miller Lease—During the six months that this lease has been running considerable ore has been shipped. One of the largest orebodies ever discovered in these claims is now being opened up.

Blue Rock—High-grade ore is being mined steadily. A carload of good ore was shipped last week.

Wisconsin

Zinc-lead District

Platteville—The new shaft at the Grant County has gone through 10 ft. of rich ore ground between the depths of 130 and 140 ft., sheets of jack measuring 5 and 7 in. in thickness.

Enterprise—Since resuming operations a great sheet of jack, averaging 2 ft. in thickness, has been uncovered in the floor of the old works.

Mitchell Hollow—A discovery of rich sheet jack has been made at this property by the Wisconsin Zinc Company.

Graham-Stevens—New York and Rochester parties have purchased a controlling interest in this mine; milling will be resumed as soon as an incline shaft is sunk.

Homestead—This company has foundations laid to install the roaster equipment obtained from the Hazel Green.

Broadway—This company has started drilling within the city limits of Platteville, west of the Grant County lease.

Hotel Mining Company—This company is prospecting by drill in the south east end of the city of Platteville.

Canada

British Columbia—Fernie

Crows Nest Pass Coal Company—At a meeting of the directors in Toronto Feb. 1 it was decided to omit the usual dividend for the past six months, owing to the heavy loss sustained in the Fernie fire.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Jan. 29 were as follows: Crown Reserve, 160,700 lb.; Cobalt Central, 41,238; City of Cobalt, 155,840; La Rose, 320,700; McKinley-Darragh, 121,500; Nipissing, 525,090; Temiskaming, 130,000; Temiskaming & Hudson Bay, 60,000; total 1,515,068 pounds.

Alexandra—The shaft is down 135 ft. on two promising calcite veins and will be put down to 285 ft. Crosscutting will be undertaken to reach No. 2 vein of the Bailey, about 60 ft. distant from the shaft, which has been struck by trenching.

O'Brien—The Ontario treasury has received $49,518 being the 25 per cent. royalty on the output of this mine for the last three months of 1908.

Temiskaming & Hudson Bay—The main shaft is down 220 ft., with four levels. The shaft will be put down farther and another level started at 250 ft. A carload of high-grade ore was shipped from the 200-ft. level, the ore showing improvement with depth. The value of the high-grade ore reserves of the mine is estimated at $1,500,000 in addition to the low-grade ore.

Crown Reserve—No. 1 shaft, now down 100 ft. will be sunk to the 200-ft. level. No. 2 shaft will be deepened from 145 ft. to the same level and the two connected at that depth. A rich vein 1 in. wide has been encountered in No. 2 crosscut running in the direction of the Kerr Lake property.

Hyland—At the 100-ft. level the vein, which assayed 225 oz. at the surface, has increased in value to 2000 oz. to the ton and is 6 in. wide. A contract has been let for sinking to 150 ft. A compressor plant has been ordered.

Little Nipissing—Work on the new shaft adjoining the Hudson Bay and Right of Way has been temporarily discontinued at a depth of 50 ft. owing to water. A promising vein shows on one side of the shaft.

Nipissing—In the Fourth of July shaft three new veins have been encountered at a depth of 135 ft. They carry 4000 oz. silver to the ton, in addition to leaf silver along the veins.

Progress—A shaft is down 30 ft. on a new vein near the Gifford extension, at which depth the vein shows 3 in. of ore carrying native silver. A compressor plant is under order.

ONTARIO-MONTREAL RIVER DISTRICT

Elk Lake Discovery—Two 60-h.p. boilers and a large compressor have been installed and the drills are showing good ore at depth.

Moose Horn—Camp buildings have been erected and a boiler and hoist installed, but the mining work is being done by hand. The shaft is down 85 ft., and when the 125-ft. level is reached drifting will be undertaken to tap veins traced on the surface.

ONTARIO—LAKE MINNETAKIE

Northern Pyrites Company—A trial shipment of six carloads of pyrites has been sent from this mine to the Austin Manufacturing Company, Harvey, Ill., and to the Detroit Chemical Works.

NOVA SCOTIA

Dominion Coal Company—This company has closed contracts for the delivery during the present year of about 600,000 tons of coal to the Canadian Pacific and Grand Trunk railways and for 40,000 tons to the Laurentide Pulp and Paper Company.

Mabon—This mine, Inverness county, owned by a Cincinnati syndicate headed by W. P. Deppe, has been flooded from the sea owing to a fault in the strata. It is entirely submarine and is now full of water. The property, on which about $500,000 has been expended, has been in the hands of the Provincial government since October last on account of arrears of about $7000 for wages.

Mexico

CHIHUAHUA

Parral Output—The production of the Parral camp for the week ending Jan. 29 amounted to 5840 tons of milling ore and 2580 tons of smelting ore, a total of 8420 tons.

Sierra Plata—This company has suspended productive operations at its Los Muertos mine in the vicinity of Minas Nuevas in the Parral district. T. F. Treweet is temporarily in charge.

Chihuahua Copper Mining Company—This company, which has been until lately successfully operating in the eastern part of the State along the line of the Orient railroad, has suspended work. It is probable that the shut-down will not be of long duration.

Conchos Power Plant—It is stated that Paul Ginther and associates are perfecting a heavily-financed company which plans the erection of a 40,000-h.p. electric-power plant, to be located along the Conchos river, near Santa Rosalia. The power will be sold to mining companies near Chihuahua and Parral, as well as used for irrigation purposes. Among Mr. Ginther's associates are Juan Creel and Joaquin Cartazar, of Chihuahua.

Greene Gold-Silver—It is reported that this company, through its manager, C. C. Chase, has settled in full its labor claims at Ocampo, and that payment in part will shortly be made on its large indebtedness at Chihuahua and elsewhere.

San Francisco del Oro—It is now given out that plans had been perfected and officially approved for the early erection of a large milling plant at this property reached from Parral. W. S. Harrison, who has been at the property for some time, lately departed for London to consult with the directorate, and it is expected that construction work will be started on his return within three months.

Hinds Consolidated—The directors of this Cleveland-organized company are said to have recently reported in favor of the early erection of a 500-ton milling plant at its Clarines mine in the Santa Barbara camp. Howell Hinds, of New York City, is the president and managing director. The manager at the mine is Ross B. Matkins.

Bullion Shipments—Recent bullion shipments passing through Chihuahua are the following: Republica, 40 bars of silver worth 40,000 pesos; Candemana, 6 bars silver, 6000 pesos; Batopilas, 199 bars silver, 202,000 pesos; Watterson, 9 bars gold-silver, 22,000 pesos; Lluvia de Oro, 24 bars gold-silver, 60,500 pesos. The Rio Plata company also sent out concentrates of a value of 57,500 pesos.

Promontorio—This old silver mine in the Cusihuiriachic camp was recently acquired by the Potter Palmer estate of Chicago at a stated consideration of $125,000, of which $25,000 has been paid. Potter Palmer, Jr., took possession of the mine on Jan. 16 and has begun work under the direction of W. M. Crosette.

JALISCO

Amparo—A dividend of 2½c. per quarter has been declared, a total of $63,000 on an issued capital of $2,520,000. The mill treated 3949 tons of ore last month.

Queen Sabe—A body rich in gold and silver has been encountered on this property on the northern shore of lake Chapala. The ore will be shipped from Ocotlan.

OAXACA

San Carlos—The mine has been entirely unwatered and sinking on the shaft has been resumed. Only the upper levels were worked during last year.

Victoria-Tepada—The company has decided to erect a mill and cyanide plant on the property in the Totolapam district. This is the first mill in the district and will do custom work.

SONORA

Greene-Cananea—The January production of copper was 3,848,000 lb., the largest monthly output since operations were resumed last July.

Arizpe—At a recent election, the resident officials elected were: J. H. Kirk, vice-president and general manager; George Young, secretary, and V. R. Walling, assistant treasurer.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 10—The coal trade in the West remains quiet, with little or no change from last week. If anything, there are some signs of over-shipments at the leading centers and consequently lower prices forced by the desire to get rid of demurrage coal.

The report that a consolidation of a number of coal mines in southern Illinois had been arranged, which was current nearly two years ago, has been revived. Options on a number of the mines in question were given at that time to Walter J. Holbrook, but the completion of the deal was prevented by the financial stringency. It is now said that arrangements have been made to carry the plan through. The mines in the proposed merger shipped chiefly to the St. Louis market.

The Seaboard bituminous trade continues quiet and without special incident. No revival is yet apparent in the business.

Anthracite trade is dull and steady as usual. The demands of the anthracite miners, which were formulated at Scranton some time ago, have been slightly amended and approved by the general convention of the United Mine Workers at Indianapolis. They will shortly be presented to the companies by a delegation headed by President Lewis of the Union; there is little doubt that they will be rejected.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 1, 1908, and Jan. 30, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	465,252	433,647	D. 31,605
Bituminous	2,781,830	2,867,510	I. 85,680
Coke	597,841	847,342	I. 249,501
Total	3,844,923	4,148,499	I. 303,676

Average daily tonnage, 120,154 in 1908, and 138,283 in 1909; increase, 18,129 tons.

Coal tonnage originating on the Southern Railway for the year 1908 is reported as follows: Tennessee district, 1,098,623; Alabama district, 1,896,283; total, 2,994,906 short tons.

Coal and coke tonnage of Pittsburg & Lake Erie road, year ended Dec. 31, 1908, short tons:

	Coal.	Coke.	Total.
Pittsburg district	8,089,120	.....	8,089,120
Wampum district	26,904	.....	26,904
Connellsville district	13,605	3,019,216	3,032,821
Other districts	.....	37,179	37,179
Total	8,129,629	3,056,395	11,186,024
Total, 1907	10,891,062	4,925,396	15,816,458

Decrease in coal, 2,761,433 tons, or 25.4 per cent.; in coke, 1,869,001 tons, or 37.9 per cent.; total decrease, 4,630,434 tons.

Anthracite coal shipments in January are reported as follows, in long tons:

	1907.	1908.	Changes.
Reading	1,099,480	1,056,104	D. 43,376
Lehigh Valley	1,011,436	895,401	D. 116,035
N. J. Central	722,965	630,085	D. 92,880
Lackawanna	842,953	762,636	D. 80,317
Del. & Hudson	569,129	566,052	D. 3,077
Pennsylvania	514,820	484,682	D. 30,138
Erie	611,032	548,077	D. 62,955
N. Y., Ont. & West	246,524	240,308	D. 6,216
Total	5,618,339	5,183,345	D. 434,994

All the companies showed decreases; the total loss this year, as compared with January, 1908, was 7.7 per cent.

New York

Anthracite

Feb. 10—The hard-coal market continues unchanged, with about the usual amount of business, but no signs of activity. The rumors of a possible strike of the miners in April do not seem to affect consumers. Most buyers probably believe that the companies have coal enough stored to carry them over some time with little inconvenience.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

While the general market continues very quiet, there is beginning to be some talk about contracts. As most of these date from April 1, this talk will doubtless increase. It is noticeable that everyone wants lower prices, a reduction of 25c. from last year being the only proposition they are inclined to listen to.

Otherwise business is on a hand-to-mouth basis. Producers are not pressing coal for sale and are carrying very small stocks at tide. As a rule coal is not started from the mines until an order is received.

There is still a demand for gas slack, which is really bringing a higher price than run-of-mine. It has been scarce owing to the light sales of lump and ¾-in., so that little slack has been made. The present quotations are about 65@70c. at mine.

New York harbor is very dull. Coal of good quality can be had freely at $2.50@2.60, with ordinary coals a little lower and run-of-mine gas $2.25. The Sound is taking some coal, though its purchases are rather irregular. In the far East business is practically dead and there is no buying. This has rather surprised dealers who know that consumers' stocks are exceedingly low.

All-rail trade is again a little better than tidewater, and seems to be taking more coal. Car supply is abundant. Transportation is nearly up to schedule, cars taking from a week to 10 days to come through.

The Coastwise trade is quiet. Rates are still pegged on the basis of 75c. from the lower ports to around the Cape, and captains prefer to tie up rather than take less. The quoted rates for large vessels from Philadelphia are: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Newburyport, 95c.; Portsmouth, 80c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Feb. 8—A quiet market and no prospect of an early improvement have brought about a curtailment in the coal mining section of Alabama, is equal to about 5 per cent. so far. The weather this winter has not been conducive to a big demand for coal, and coke has been stacking up. Exactly how long this will be on cannot be stated.

Chicago

Feb. 8—The coal market has weakened again with the passing of another cold wave and shows not only notably lessened demand for domestic coals, but also for the larger sizes of Illinois and Indiana. Screenings are unusually strong for the time of the year and nearly all western lump is subject to forced sales to escape demurrage charges because of too large shipments, the consequence being cuts in prices ranging from 10 to 25c. There is a good deal of cutting also on bituminous from mines east of Indiana.

Illinois and Indiana bituminous bring $1.75@2.40 for lump, $1.60@1.75 for run-of-mine, and $1.35@1.60 for screenings. Smokeless, as for several weeks, is in much too large supply as regards the lower grade especially, run-of-mine selling for $2.80@2.95—75@90c. at the mines. Hocking Valley also is weak from overshipments, bringing 10 to 20c. below the circular price of $3.15 on many sales. Youghiogheny is quoted at $3.15 for ¾-in.

gas, and Pittsburg No. 8 at $2.75 for the same size.

Anthracite is ragged, some dealers having a fair volume of trade in small lots, but no heavy shipments occurring anywhere. There is a general complaint that there is too much coal on hand to be disposed of before spring, unless the unexpected shall happen in the weather.

Cleveland

Feb. 9—Cold weather and snow have started up the domestic trade to some extent, but with little effect on prices. Steam-coal demand shows very little improvement.

Much interest is taken here in the protest of the Pittsburg operators against irregularities in the rates on coal to Lake ports. They claim that the West Virginia operators have an undue advantage, though their mines are farther from the ports than the Pittsburg district. The question has an important bearing on the Lake coal trade. It is understood that the Pittsburg people will urge an early hearing before the Interstate Commerce Commission.

Indianapolis

Feb. 9—The advance of 10c. a ton in the freight on coal from the Indiana coalfields to Chicago has thus far been prevented. The matter has been postponed until next week by the representatives of the several roads interested. The Chicago & Eastern Illinois with its Evansville & Terre Haute connections has a direct route from the mines in western Indiana. Perhaps no other railroad is so well prepared in terminals at the mines and at Chicago to haul coal at the lower rate.

Pittsburg

Feb. 9—Production of coal at the railroad mines is not more than one-third capacity. But few mines are going in the Panhandle field, the largest producing section in the Pittsburg district. Prices continue on the basis of $1.15 for mine-run coal at mine and slack is around 70c. Some independents are shading these prices. The rivers are at a coal-boat stage again and over 5,000,000 bu. loaded in coal boats and barges had been brought down from the pools. Most of the tow boats are still down the river and it was impossible to send out more than 1,200,000 bu. today. If the navigable stage continues all will get out this week.

Connellsville Coke—The coke market continues dull and prices for spot shipment are low. A few sales of prompt furnace coke were made yesterday around $1.00. The majority of the producers are holding firmly for $1.75 for spot and $1.90@2 on contract. Foundry coke on contract continues firm at $2.25@2.40, but for spot as low as $2 has been done. The *Courier* gives the production in the Connellsville and lower Connellsville fields for the week at 265,514 tons. The shipments were 9663 cars as follows: To Pittsburg district, 3365; to points west of Pittsburg, 5450; to points east of Connellsville, 848 cars.

Foreign Coal Trade

German Coal Production—Production of coal in the German Empire, year ended Dec. 31, metric tons:

	1907.	1908.	Changes.
Coal	143,222,886	148,621,201	I. 5,398,315
Brown coal	62,319,802	66,450,144	I. 4,130,342
Total mined	205,542,688	215,071,345	I. 9,528,657
Coke made	21,938,208	21,174,956	D. 763,252
Briquets made	16,114,478	18,222,667	I. 2,108,189

More than two-thirds of the briquets are made from brown coal, or lignite.

Belgian Coal Trade—Imports and exports of fuel in Belgium, year ended Dec. 31, metric tons:

	Imports.	Exports.	Excess.
Coal	4,756,118	5,381,165	Imp. 625,047
Coke	1,203,433	376,591	Exp. 826,842
Briquets	444,796	165,090	Exp. 279,706
Total	6,404,347	5,922,846	Exp. 481,501
Total, 1907	6,251,289	5,899,791	Exp. 351,498

The principal exports were to France and Luxemburg; the chief imports from Germany and Great Britain. Exports and imports nearly balance.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Jan. 30, a slight reduction being shown from the previous report: Best Welsh steam, $3.42; seconds, $3.30; thirds, $3.18; dry coals, $3.54; best Monmouthshire, $3.12; seconds, $3; best small steam, $2.04; seconds, $1.74. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 10—The iron and steel markets seem to have settled down into a waiting condition. Business remains exceedingly quiet and very few new orders are being placed. In some quarters this is attributed to the tariff agitation; in others the cause given is the general anticipation of a lower range of prices. While both of these have some effect, the expectation of lower prices is undoubtedly the strongest cause of the present situation. In fact, the price discussion is the main topic in the trade, and one hears of very little else.

In pig iron there have been a few transactions in basic iron, but the current business is limited chiefly to the purchase by foundries of iron sufficient for their immediate needs. Judging by what has been done, these are not at all large except in the case of the pipemakers, who seem to have considerable business on hand. Sellers are very reticent about prices, and it is quite probable that a good round order could secure pretty low figures.

The finished-material markets show very little signs of activity, and even the structural market is quieter than it has been. Some building orders continue to be placed, but more seem to be held back. There is no longer any concealment as to the cutting of prices; it is done openly, thus confirming what has been pretty well known for some time. The consequence is, that nearly all current business is going to the independents and smaller concerns. How soon this state of affairs will be recognized is still uncertain, but there is no doubt that it will be met before long.

The Lake Superior Corporation, it is understood, will arrange as soon as the financial plans can be completed for the erection at the Sault of a large blast furnace in addition to the two now in use; one or more open-hearth steel furnaces and a rolling mill to make structural steel, plates and merchant steel.

Pig Iron Production—The reports from the blast furnaces, as collected by the *Iron Age*, show that on Feb. 1 there were 233 coke and anthracite furnaces in blast, having a total weekly capacity of 414,500 tons. This is 12,500 tons more than was reported Jan. 1, and is the largest weekly capacity shown since Nov. 1, 1907. The approximate production of pig iron in January, making allowance for the charcoal furnaces, was 1,821,000 tons.

Birmingham

Feb. 8—The Southern pig iron and steel market is very quiet. There is but little business being transacted as far as can be learned. There has been no curtailment of the pig iron or steel production as yet. There is a healthy outward movement of pig iron from this district on old orders. It is stated that some of the consumers have halted their shipments a little, but there has been no accumulation of iron. Quotations are given at $13 per ton No. 2 foundry but rumors prevail of a lower price.

The home consumption is holding up better than in other sections. The cast-iron pipe plants are in full operation.

There has been some depression felt at the steel plant of the Tennessee company at Ensley and rumors prevail that unless there is an immediate improvement in conditions the curtailment will be more pronounced.

Chicago

Feb. 2—Sales of pig iron continue light and there is no prospect of speedy increase. In general, however, there is probably a slight increase over last week; the disappointment about market conditions comes from the enthusiasts who looked for a boom.

Deliveries in 30 to 60 days are the requirements of the melter in nearly all contracts now being signed. Occasionally a buyer is willing to contract six months ahead and for a requirement of 100 tons or more. But in general he wants a carload to 200 or 300 tons and does not want to dip much into the future.

Prices nominally remain $17 for Northern and $13 Birmingham ($17.35 Chicago) on Southern, No. 2. Any good-sized contract would cut these prices—especially Southern—25 or 50c. a ton.

Iron and steel products are generally quiet. Railroad supplies are more active. Coke is very quiet at $4.75@4.85 for the best Connellsville with large supplies

Cleveland

Feb. 9—Vessel men are trying to figure on the movement of iron ore for the coming season, but it is chiefly guesswork The only thing certain is that it will be light early in the season. The movement from docks is slow, and May will open with large stocks on hand, unless there is an unexpected change. There is talk about ore prices for the season, but nothing has been done yet. The general opinion is that there will be no change from last season.

Pig iron has been dull, with only small orders for quick delivery going. An inquiry for a round tonnage of basic, which was out last week, has been withdrawn.

Finished material is a little better, and some business has materialized in bars and plates, but mainly in small lots.

Philadelphia

Feb. 10—Unfavorable conditions in pig have been emphasized by further shading on the part of some makers without leading to business worthy of mention, except basic, in which a fair business has been quietly done. The business, however, was simply the ordering of material according to previous understanding. Further shading on Virginia and Alabama irons induced some little selling for immediate delivery. A few Pennsylvania furnaces have also shaded 25 to 50c. without inducing consumers to order beyond actual needs. The bar mills continue buying forge for actual necessities. Pipe iron is perhaps better sold up than any other kind.

Steel Billets—While work involving steel billets is gradually increasing there has been a shutting off of inquiries.

Bars—Business has fallen off within a few days, notwithstanding some fractional concessions by a few mills.

Structural Material—No large orders have been placed but there are evidences of considerable business in fabricated material before the end of the month. Requirements for small lots in this territory are increasing.

Scrap—The scrap dealers have allowed some of their stocks to go at concessions, but they claim there is no general cut, and that scrap will bring more money in 30 days. Railroad scrap is held at the shops at figures which forbid buying at present. The lower grades have weakened about 50c., but even at that, very little is taken.

Pittsburg

Feb. 9—Conditions in the iron and steel industry have grown worse rather than better. If anything, the hesitating tendency is more pronounced, and buyers are giving another exhibition of how long they can wait before buying. There is a great deal of talk about price cutting, and some of the large interests, particularly the leading interest, do not hesitate to charge their competitors with cutting quotations on a liberal scale. This is most marked in structural shapes, plates and sheets, but there are also some concessions on a number of other products.

Pig Iron—It is a dull market, showing even less life than a week or two weeks ago. There has been a notable absence even of carload buying. It is stated that consumers are taking deliveries on their old contracts much better than might be expected, but it is admitted that the current consumption, particularly in foundry iron, is not up to the basis called for by contracts on books, and that if consumption does not increase some consumers are likely to begin to ask for postponements. There has been some inquiry for basic iron, but the prospective buyers have not been quoted sufficiently attractive prices, and the deals are held up. Basic is quoted nominally at $15.50, Valley, bessemer being $16, Valley, on the basis of recent light sales, although some leading producers quote $16.50; No. 2 foundry iron is $15, Valley.

Steel—Deliveries of billets and sheet-bars on old contracts are about the same, while new buying continues light. Prices are well held in this district, two or three eastern and western mills, which would make slight concessions not being able to get into this territory on account of the freight. Billets are $25, Pittsburg, and sheet-bars $27.50. Plate specifications continue good on steel-car contracts, this movement being heavier than for many months. In the open market prices are subject to considerable irregularity, particularly on the narrower sizes, but concessions generally do not run more than $1 to $2 a ton from the official price of 1.60 cents.

Sheets—There is considerable complaint of cutting in sheet mill products, the deepest cuts being made in corrugated roofing, and running to 10c. a square or more. In flat black and galvanized sheets the cutting is less, while in specialties the market is fairly well held. Mill operations continue about as formerly, most interests running at about 50 per cent. of capacity, while some are doing better. Official prices are 2.50c. for black and 3.55c. for galvanized sheets, 28 gage, Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the year ended Dec. 31, are valued by the Bureau of Statistics of the Department of Commerce and Labor at $197,066,781 in 1907, and $151,113,114 in 1908; a decrease of $45,953,667, or 23.3 per cent. Leading items of export were, in long tons:

	1907.	1908.	Changes.
Pig Iron	73,703	46,696	D. 27,007
Billets, ingots & blooms	79,991	112,177	I. 32,186
Bars	98,208	52,105	D. 46,103
Rails	338,906	196,510	D. 142,496
Sheets and plates	122,696	104,993	D. 17,703
Structural steel	138,442	116,878	D. 21,564
Wire	154,080	136,167	D. 17,913
Nails and spikes	56,791	38,906	D. 17,885
Pipe and fittings	176,832	114,371	D. 62,461

The total quantities of iron and steel reported were 1,301,979 tons in 1907, and 964,266 tons in 1908; a decrease of 337,703 tons. For some articles, however, only values are given.

Iron and Steel Imports—Imports of iron and steel, including machinery, into the United States for the year ended Dec. 31, were valued at $38,789,857 in 1907, and $19,957,261 in 1908; a decrease of $18,832,390, or 48.5 per cent. The leading articles of import were, in long tons:

	1907.	1908.	Changes.
Pig iron	489,475	92,202	D. 397,273
Scrap	27,652	5,090	D. 22,562
Ingots, blooms, etc.	19,333	12,112	D. 7,221
Bars	39,746	19,672	D. 20,074
Wire-rods	17,076	11,208	D. 5,868
Tinplates	57,773	58,320	I. 547
Sheets and plates	3,748	2,629	D. 1,119

The total quantities of iron and steel, so far as reported, were 662,470 long tons in 1907, and 206,955 in 1908; a decrease of 455,575 tons, the greater part of which was in pig iron.

Iron Ore Movement—Exports and imports of iron ore in the United States for the year ended Dec. 31 are reported as follows, in long tons:

	1907.	1908.	Changes.
Exports	278,608	309,099	I. 30,491
Imports	1,229,168	776,898	D. 452,270

Of the imports in 1908 Cuba furnished 579,608 tons.

Imports of manganese ore were 209,021 tons in 1907, and 178,203 in 1908; a decrease of 30,818 tons.

Foreign Iron Trade

French Blast Furnaces—On Jan. 1 there were 107 furnaces in blast in France; this number comparing with 111 on Jan. 1, 1908, and 112 on July 1 of the same year.

Metal Market

New York, Feb. 10—The metal markets are still generally quiet and in rather a depressed condition.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1908..	$ 7,358,707	$ 5,122,538	Exp. $2,235,169
" 1907..	1,004,441	44,448,515	Imp. 43,444,074
Year 1908..	71,215,456	50,246,099	Exp. 30,969,357
" 1907..	55,216,681	143,398,072	Imp. 88,182,391
Silver:			
Dec. 1908..	4,726,289	4,382,290	Exp. 343,999
" 1907..	4,413,698	4,222,036	" 191,662
Year 1908..	51,837,671	42,195,966	" 9,640,705
" 1907..	61,625,866	45,912,360	" 15,713,506

Exports from the port of New York, week ended Feb. 6: Gold, $250,000, to Argentina; silver, $1,237,680, to London and Paris. Imports: Gold, $146,763; silver, $80,964, both from the West Indies, Central and South America.

Gold movement in Germany year ended Dec. 31, reduced to dollars:

	1907.	1908.
Imports	$50,390,000	$91,028,000
Exports	55,450,000	14,185,000
Excess	Exp.$5,060,000	Imp.$76,843,000

The year 1908, therefore, showed a total net gain of $81,903,000 over the previous year.

The movement of gold and silver through the port of San Francisco for the year ended Dec. 31 was as follows:

Imports:	1907.	1908.	Changes.
Gold	$3,505,557	$4,386,133	I. $ 879,576
Silver	3,336,378	2,724,806	D. 611,572
Exports:			
Gold	21,592	20,480	D. 1,112
Silver	3,676,655	5,760,289	I. 1,083,634

Gold exports in 1908 included $1,759,222 coin and $2,625,911 bullion; silver, $34,939 coin and $2,689,867 bullion. Gold exports included $18,577 coin and $1903 bullion; silver, $7829 coin and $5,752,460 bullion.

Gold—The current price of gold in the open market in London has remained unchanged at 77s. 9d. per oz. for bars and 76s. 4d. for American eagles. The Bank of France seems to be entirely out of the market for the present, and nearly all the gold taken this week went to the Bank of England. No gold was shipped from New York this week to Europe but $500,000 went out to Argentina on London account.

Platinum—Business is reported very quiet, with sales even fewer than are usual at this season. Prices remain unchanged at $23.50@24.50 per ounce for refined metal, $26.50 for hard and $19@21 for scrap. There is some difference of opinion about the market, and dealers seem to anticipate a slight decline before long.

Silver—The market has ruled fairly steady this week, fluctuating between 51⅞ and 52⅜c. in New York; and it closes quiet at 23 15/16d. in London.

SILVER AND STERLING EXCHANGE

Feb.	4	5	6	8	9	10
New York....	52	52	52⅜	52¼	52⅛	51⅞
London.....	24	24	24⅛	24 1/16	24	23⅞
Sterling Ex..	4.8760	4.8713	4.8725	4.8713	4.8713	4.8713

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Jan. 28, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India	£ 398,900	£ 438,110	I. £ 67,210
China	281,400	80,000	D. 201,400
Straits	.....	61,000	I. 61,000
Total	£ 680,300	£ 597,110	D. £ 83,190

Imports for the week, £3000 from Mexico and £211,500 from New York; total, £214,500. Exports, £240,000 to India.

Copper, Tin, Lead and Zinc

	Copper.			Tin.	Lead.		Spel'r.
Feb.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.
4	13⅝ @13⅞	13⅛ @13¼	58 7/16	27½	4.02½ @4.07½	3.87½ @3.92½	5.00 @5.02½
5	13⅜ @13⅝	13⅛ @13¼	58½	27⅝	4.00 @4.05	3.85 @3.90	4.97½ @5.00
6	13⅜ @13⅝	13⅛ @13¼	....	27⅝	4.00 @4.05	3.85 @3.90	4.97½ @5.00
8	13⅜ @13⅝	13⅛ @13¼	58⅜	27⅞	4.00 @4.05	3.85 @3.90	4.95 @4.97½
9	13⅜ @13⅝	13⅛ @13¼	58⅝	28	4.00 @4.05	3 85 @3.90	4.90 @4.95
10	13⅜ @13⅝	13⅛ @13¼	59	28½	4.00 @4.05	3.85 @3.90	4.87½ @4.90

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium. Spelter prices at St. Louis, Feb. 4-10, were 0.15c. below New York.

Copper—The markets on both sides of the water have drifted along listlessly throughout the week. The business placed at the ruling quotations was not sufficient to make much impression one way or the other. Most of the selling agencies are quoting 13⅜c., delivered, 30 days, equivalent to about 13¼c., cash, New York, and are taking business at a little less than that, but no one is aggressive in forcing sales. The close is uncertain at 13⅜@13⅝c. for Lake copper; 13⅛@13¼c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 12⅞@13 cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb., base Copper wire, 15¼c. base, carload lots at mill.

The London market seems to have reached a state of equilibrium, and fluctuations were narrow throughout the week, with a fairly strong undertone. The close is firm at £59 1s. 3d. for spot, £59 18s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £63; best selected, £62@63; strong sheets, £74@75.

Exports from New York and Philadelphia for the week are reported at 2622 long tons copper. Our special correspondent states the exports from Baltimore at 1142 tons.

Exports of copper sulphate from the United States for the year 1908 are reported at 7,663,882 lb. This carries the equivalent of about 1,915,000 lb. of metallic copper.

The American Smelting and Refining Company and affiliated concerns produced 187,544,000 lb. of refined copper in 1908, against 94,600,000 in 1907, and 85,810,000 in 1906. The Ely production in 1908 was about 12,000,000 lb. About 25,000,000 lb. came from Cerro de Pasco. Production of the Garfield smeltery was about 75,000,000, including 43,000,000 from Utah Copper Company and 15,000,000 from Utah Consolidated. The product of the two Utah companies was sold by the United Metals Selling Company; otherwise the Smelting company is now selling its product on its own account.

Tin—The demand which the lower prices brought about from dealers on this side has had its effect on the London market, which became firmer from day to day. Prices advanced in consequence, and the close is cabled at £128 15s. for spot, £130 10s. for three months.

The demand in this market, of which mention is made above, emanated principally from dealers, while consumers have not yet taken hold. In sympathy with the London market, prices here have also advanced and the close is firm at about 28½ cents.

Lead—The market continues dull and weak. When the American Smelting and Refining Company came out last Friday with the quotation of 4.10 New York, other sellers promptly cut under, and in the absence of a market for the available supply, particularly from Missouri, prices have eased off still further, and the close is weak at 4@4.05c., New York.

The market in London is firmer, the close being cabled as £13 1s. 3d. for Spanish lead, £13 3s. 9d. for English lead.

Spelter—Absence of buying on the part of galvanizers and brass manufacturers, on the one hand, and the sharp break in the Joliet ore market, on the other, have made sellers very anxious to dispose of their metal, and in their efforts to find a market, prices have slipped away from day to day so that the market is bordering on demoralization at the close, which is quoted at 4.72½@4.75c. St. Louis, 4.87½@4.90c. New York.

The close in London is cabled as £21 5s. for good ordinaries, £21 10s. for specials.

Base price of sheet zinc is 7c., f.o.b. La Salle-Peru, Ill., less 8 per cent

Other Metals

Antimony—The market is exceedingly quiet with sales only of a retail character. There is no change in prices, which continue nominal at 8⅛@8¼c. for Hallett's; 8@8⅛c. for Cookson's; 7½@7¾c. for ordinary brands.

Aluminum—Offers of foreign metal are still heard of at 22c., and even lower, but it is difficult to trace actual sales. Efforts are being made abroad to secure a new agreement among manufacturers, but so far without success. The Aluminum Company of America continues to quote 24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—New York quotations are still $45@46 per flask of 75 lb. Business is dull, with few sales. San Francisco quotations are nominal at $45@46 for domestic orders, with $2 less for export. The London quotation is £8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 6—The base price paid for 60 per cent. zinc ore this week was $38@40 per ton; no premium is reported paid. For 80 per cent. lead ore, $50 per ton was paid.

SHIPMENTS, WEEK ENDED FEB. 6

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	997,240	.....	389,000
Benton	573,250	.....	.....
Hazel Green	517,600	82,800	.....
Galena	261,800	.....	.....
Livingston	228,000	.....	.....
Strawbridge	220,700	.....	.....
Cuba City	51,000	.....	.....
Rewey	.....	60,000	.....
Total	2,849,590	142,800	389,000
Year to Feb. 6	11,165,206	202,800	1,161,400

Highland, Linden, Harker and Mineral Point are not reported. The shipments given above are for two weeks, the report for the preceding week having been omitted. There was shipped during the last two weeks to the American Zinc Ore Separating Company, 332,800 lb. and to the Joplin Separator Works, 332,700 lb. zinc concentrates.

Joplin, Mo., Feb. 6—The highest price paid for zinc sulphide ore was $40.50, the assay base ranging from $38 down to $36 per ton of 60-per cent. zinc, coarse ore, with slimes sold on a $34 base price. As high as $24.50 was paid for zinc silicate, the base per ton of 40-per cent. zinc ranging from $19 to $22. The average price, all grades of zinc, was $35.10 per ton. The highest price for lead ore was $54 per ton, for settlements on ore purchased the previous week, but the high offering of this week was $53, ranging down at the week-end to $52. The average price, all grades of lead ore was $51.95 per ton. Lead ore is now being largely sold on a basis per ton of 80-per cent. lead. Considerable ore in the district will run this high, a little over 80 per cent., and the district will average very close to the base.

Sharp falls have prevailed in the price of zinc ore during the past three weeks, aggregating $6 per ton. Some mines have shut down, nearly all have reduced wages, and it is rumored that others will close down soon, unless there is an upward change in zinc prices. The producers lay it on the decision admitting calamine free of duty, and the smelters charge it onto the tariff agitation, which keeps spelter consumers from contracting ahead for metal.

SHIPMENTS, WEEK ENDED FEB. 6

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,024,890	1,439,360	$110,670
Joplin	1,470,610	250,620	33,947
Duenweg	848,130	39,970	15,130
Galena	682,180	90,950	14,662
Prosperity	426,480	217,270	13,324
Spurgeon	762,070	78,670	12,235
Badger	450,430	8,990	9,243
Alba-Neck	462,720	.....	8,328
Quapaw-Baxter	396,260	36,700	7,987
Aurora	377,950	.....	6,349
Granby	458,900	3,000	5,678
Carthage	216,210	10,470	4,162
Zincite	153,610	.....	2,919
Oronogo	143,340	2,220	2,597
Cave Springs	84,770	.....	1,695
Ash Grove	.....	36,470	948
Totals	10,958,550	2,214,690	$249,874
Six weeks	60,910,950	9,138,950	$1,387,819

Zinc value, the week, $192,338; six weeks, $1,150,475
Lead value, the week, 57,636; six weeks, 237,344

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	....	34.92	.....	49.72	.....
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Feb. 10—The same lack of animation in trade conditions that has existed for several weeks still prevails.

Copper Sulphate—Demand is fair and conditions unchanged. Quotations are steady at $4.75 per 100 lb. for carload lots and up to $5@5.50 per 100 lb. for smaller parcels.

Arsenic—The market is dull with few sales, and prices are a little lower. Quotations current are 3@3⅛c. for white arsenic; 2.90c. per lb. for Canadian.

Nitrate of Soda—Statistics of nitrate in the United States Feb. 1 are reported as below, in long tons, by Mortimer & Wisner, New York:

	1907.	1908.	Changes.
Stocks, Jan. 1	5,900	9,140	I. 3,240
Imports for month	25,800	14,800	D. 11,000
Total Supplies	31,700	23,940	D. 7,760
Deliveries for month	28,945	18,890	D. 10,055
Stocks, Feb. 1	2,755	5,050	I. 2,295
Afloat for U. S.	70,600	99,300	I. 29,300

Quantities afloat include all cargoes due to arrive at United States ports by May 15 next.

Trade is fair. Current quotations, however, are a little lower, spot selling for 2.15c., with 2.12½c. asked for futures.

Phosphates—Exports of phosphate rock through the port of Savannah in December are reported by J. M. Lang & Co. as follows: Italy, 1685; Germany, 5165; total, 6850 long tons.

Minimg Stocks

New York, Feb. 10—The general stock markets have been rather inactive during the week, but prices have been fairly well maintained, on the moderate amount of business done. Some special strength was developed in American Smelting and Refining, on the publication of the semi-annual statement.

On the Curb also transactions were not on a large scale, but prices were generally well sustained. Ohio Copper was the leader among the copper stocks, and rather liberal selling failed to break the quotation more than a fraction. Dealings in the Cobalt stocks were on a fair scale. The Nevada gold stocks were quiet, as a rule.

Boston, Feb. 9—The so-called Bigelow stocks have been the local features the past week. The drop in the price of copper had a temporary depressing effect in mining stocks, but this in a measure, had been discounted. The air has been full of rumors of a settlement between the Calumet & Hecla and Bigelow people, but nothing definite has yet transpired, although it is believed that some agreement will be reached. At one time the matter of $200,000 was said to be the only difference in an amount said to involve $8,000,000 at least.

Isle Royale benefited by rumors that in the case of a settlement this company would also come into the agreement. The Bigelow interests are believed to have a greater ownership in this property than any of the others. The stock, on heavy

trading, spurted from $26.25 to $30. The final tonight was $28.75. North Butte has been persistently offered and the price fell from $76.25 to $73.25 with substantial recovery. Allouez rose $3.25 to $41, losing partially, and Centennial touched $33.75.

East Butte has come in for a share of popularity and the price rose sharply from $8.25 to $12. Good reports are coming in from the mine. Adventure rose $1 to $9, but lost it, and Atlantic advanced $1.25 to $16. Boston & Corbin is up $1.50 to $20.62½, and Franklin rose $1.50 to $16.50, with subsequent setback. Over 60,000 shares of Rhode Island stock have been deposited under the plan of taking it over by the Franklin, one of the latter for three Rhode Island. Osceola spurted $4.50 to $134.50, but did not hold it, and Tamarack rose from $75 to $83, losing $3 of it.

American Zinc has taken on activity and the stock has advanced $4.25 to $27.75. United States Coal and Oil sold up $2.62½ to $31.62½. This company made its largest shipment of coal in its history during January—128,000 tons. Amalgamated has held from about $75 to $76 during the week and Copper Range from $78.50 to $73.50.

The Winona Copper Company has levied a $1 assessment, payable March 9 for the purpose of continuing development. This will make $17 paid in to date.

On the Curb Raven broke 20 to 59c. Stockholders did not subscribe for the stock offered at $1 in sufficient amount, and the mine has been closed down.

STOCK QUOTATIONS

NEW YORK	Feb. 9
Name of Comp.	Clg.
Alaska Mine	¼
Amalgamated	75⅞
Anaconda	45⅝
Balaklala	12⅝
British Col. Cop.	7¾
Buffalo Mines	3½
Butte Coalition	24½
Colonial Silver	7/16
Cum. Ely Mining	8½
Davis Daly	2⅞
Dominion Cop.	15/16
Douglas Copper	2¼
El Rayo	3½
Florence	4
Foster Cobalt	.56
Furnace Creek	.12
Giroux	8⅝
Gold Hill	¾
Goldfield Con	8
Granby	101
Greene Gold	¼
Greene G. & S.	7
Guanajuato	†1¾
Guggen. Exp.	181
Hancock	.15
Kerr Lake	8⅛
McKinley Dar.	1
Miami Copper	14
Micmac	17½
Mines Co. of Am.	⅞
Mitchell Mining	1⅝
Mont. Sho. C.	1¾
Nev. Utah M. & S.	3¼
Newhouse M. & S.	5
Nipissing Mines	9¾
Old Hundred	1/16
Silver Queen	.83
Stewart	⅞
Tennessee Cop'r	40⅝
Tri-Bullion	½
Union Copper	1 1/16
Utah Apex	6⅛
Utah Copper	43¼
Yukon Gold	4⅛

BOSTON	Feb. 9
Name of Comp.	Clg.
Adventure	8
Allouez	39½
Am. Zinc	27⅛
Arcadian	3
Arizona Com	35½
Atlantic	15¾
Boston Con	14¼
Calumet & Ariz.	105
Calumet & Hecla	†650
Centennial	32
Con. Mercur	2.30
Copper Range	74¼
Daly-West	10
East Butte	11⅝
Franklin	16
Greene-Can	10⅝
Isle Royal	28½
La Salle	14
Mass	5⅞
Michigan	‡10⅝
Mohawk	163
Nevada	18⅜
North Butte	74⅞
Old Colony	‡1.60
Old Dominion	51½
Osceola	132
Parrot	28⅞
Quincy	†89
Rhode Island	4¾
Santa Fe	2¼
Shannon	15
Superior	38½
Superior & Pitts.	15¾
Tamarack	80
Trinity	15
United Cop., com.	113¾
U. S. Oil	31
U. S. Smg. & Ref.	41½
U. S. Sm. & Ref., pd.	45
Utah Con.	40⅝
Victoria	4¼
Winona	5⅛
Wolverine	†145
Wyandotte	2⅞

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38
Am. Smelt. & Ref	86¾
Am. Sm. & Ref. pf.	103⅞
Colo. Fuel & Iron	39⅛
Federal M. & S., pf.	†84
National Lead	79¾
National Lead, pf.	108
Pittsburg Coal	11⅞
Republic I. & S.	24
Republic I. & S., pf.	85⅞
Sloss-Sheffield	79
Standard Oil	650
U. S. Steel	52¾
U. S. Steel, pf	113
Va. Car. Chem	46⅛

BOSTON CURB	
Ahmeek	‡164
Black Mt.	‡2½
Chemung	‡18
Globe Con	16⅛
Hancock	112½
Helvetia	‡4
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	‡14
Superior & Bost.	‡14¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS		Jan. 30
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Conter Cr'k	1.90	1.50
Cent. C. & C.	78.00	76.00
C. C. & C. pd.	81.00	80.00
Cent. Oil	120.00	110.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	120.00	110.00
Gra. Bimet.	.20	.18
St. Joe	14.00	12.00

LONDON	Feb. 10		
Name of Com.	Clg.		
Dolores	£1	16s	0d
Stratton's Ind.	0	3	3
Camp Bird	0	16	0
Esperanza	2	17	6
Tomboy	0	18	9
El Oro	1	3	9
Oroville	0	9	9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 10.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.08
Belcher	.36	St. Ives	.17
Best & Belcher	.37	Triangle	.02
Caledonia	.08	BULLFROG STOCKS	
Chollar	.11	Gibraltar	.03
Comstock	.30	Homestake King	.07
Con. Cal. & Va.	.47	Mont. Shoshone C	1.87½
Crown Point	.40	Tramp Cons	.09½
Exchequer	.28	MISCELLANEOUS	
Gould & Curry	.05	Bonnie Clare	.04
Hale & Norcross	.21	Lee Gold Grotto	...
Mexican	.70	Nevada Hills	1.37½
Ophir	1.22	Nevada Smelting	1.00
Overman	.07	Nevada Wonder	.35
Potosi	.11	Nevada-Utah	3.25
Savage	.20	Penn-Wyoming	.08
Sierra Nevada	.25	Pittsburgh S. Pk.	.78
Union	.27	Rawhide Con	.44
Utah	.02	Round Mt. Sphinx	.07
Yellow Jacket	.39	Quotations not received on account of storm.	
TONOPAH STOCKS			
Belmont	.80		
Extension	.48		
Golden Anchor	.01		
Jim Butler	.15		
MacNamara	.32		
Midway	.22		
Montana	.70		
North Star	.03		
Tono'h Mine of N.	6.00		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.13		
Booth	.22		
Columbia Mt.	.12		
Comb. Frac	1.14		
Con. Red Top	.12		
Cracker Jack	.03		
Dia'ffeld B. B. C.	.06		
Goldfield Belmont	.05		
Goldfield Daisy	.74		
Great Bend	.19		
Jumbo Extension	.14		
Kendall	.07		
Lone Star	.06		
May Queen	.04		
N. Y. C. O. D.	.04		
Oro	.10		
Red Hill	.11		
Roanoke	...		
Sandstorm	.15		

COLO. SPRINGS	Feb. 5
Name of Comp.	Clg.
Acacia	6¼
Black Bell	....
C. C. Con	3½
Dante	6¾
Doctor Jack Pot	8½
Elkton	71½
El Paso	47½
Findlay	16
Gold Dollar	9¾
Gold Sovereign	3
Isabella	25½
Index	....
Jennie Sample	6½
Jerry Johnson	....
Mary McKinney	34½
Pharmacist	3¼
Portland	1.05
Un. Gold Mines	4¼
Vindicator	78
Work	‡7

Assessments

Company.	Delinq.	Sale.	Amt.
Addie, Utah	Feb. 15	Mar. 6	$0.004
Alpha, Nev	Feb. 2	Feb. 23	0.05
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
East Hercules, Wash	Feb. 15	Mar. 15	0.001
Gould & Curry, Nev	Feb. 15	Mar. 9	0.10
Ingot, Utah	Feb. 1	Feb. 20	0.01
Lucky Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
National, Mich	Mar. 15		0.40
Oreano, Idaho	Jan. 25	Feb. 27	0.001
Overman, Nev	Feb. 18	Mar. 11	0.10
Seven Bros.-Pioche, Nev	Feb. 1	Feb. 27	0.001
Sierra Nevada, Nev	Feb. 12	Mar. 5	0.10
Silver Eagle, Ida	Feb. 1	Mar. 1	0.001
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Surprise, Ida	Jan. 26	Feb. 26	0.001
Temple, Ida	Feb. 22	Mar. 15	0.005
Utah-United, Utah	Feb. 15	Mar. 1	0.01
Zelbright, Cal	Feb. 15	Mar. 6	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	....	25.855	....
March	55.365	....	25.570	....
April	54.505	....	25.133	....
May	52.795	....	24.377	....
June	53.663	....	24.759	....
July	53.115	....	24.514	....
August	51.983	....	23.858	....
September	51.720	....	23.877	....
October	51.431	....	24.725	....
November	49.647	....	22.933	....
December	48.760	....	22.493	....
Year	52.864	....	24.402	....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	....	13.098	....	58.786	....
March	12.704	....	12.875	....	58.761	....
April	12.743	....	12.928	....	58.331	....
May	12.598	....	12.788	....	57.387	....
June	12.675	....	12.877	....	57.842	....
July	12.702	....	12.933	....	57.989	....
August	13.462	....	13.639	....	60.500	....
September	13.388	....	13.600	....	60.338	....
October	13.354	....	13.646	....	60.139	....
November	14.130	....	14.386	....	63.417	....
December	14.111	....	14.411	....	62.943	....
Year	13.208	....	13.424	....	59.902	....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month	1908.	1909.
January	27.380	28.060	July	29.207	....
February	28.978	....	August	29.942	....
March	30.577	....	September	28.815	....
April	31.702	....	October	29.444	....
May	30.015	....	November	30.348	....
June	28.024	....	December	29.154	....
			Av. year.	29.465	....

Prices are in cents per pound

LEAD

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	3.691	4.175	14.469	13.113
February	3.725	....	14.250	....
March	3.838	....	13.975	....
April	3.993	....	13.469	....
May	4.253	....	12.938	....
June	4.466	....	12.600	....
July	4.447	....	13.000	....
August	4.580	....	13.375	....
September	4.515	....	13.425	....
October	4.351	....	13.375	....
November	4.330	....	13.538	....
December	4.213	....	13.156	....
Year	4.200	....	13.439	....

New York, cents per pound London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	....	4.638	....	20.875	....
March	4.665	....	4.527	....	21.075	....
April	4.645	....	4.495	....	21.344	....
May	4.608	....	4.458	....	19.906	....
June	4.543	....	4.393	....	19.008	....
July	4.485	....	4.338	....	19.031	....
August	4.702	....	4.556	....	19.350	....
September	4.769	....	4.619	....	19.563	....
October	4.801	....	4.651	....	19.750	....
November	5.059	....	4.909	....	20.875	....
December	5.137	....	4.987	....	20.625	....
Year	4.726	....	4.578	....	20.163	....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Authorized Capital	Shares. Issued.	Par Val.	Total to Date.	Dividends. Latest. Date.	Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 5	$2,112,381	Jan. 1909	$ .40
Alaska Treadwell, g.	Al'ka	5,000,000	200,000	25	10,385,000	Jan. 1909	.75
Alaska United, g.	Al'ka	1,000,000	180,200	6	468,470	Jan. 1909	.25
Amalgamated, c.	Mont	155,000,000	1,538,879	100	69,249,554	Feb. 1909	.50
Am.Sm.&Ref.,com.	U. S.	50,000,000	500,000	100	15,500,000	Jan. 1909	1.00
Am. Sm. & Ref. pf.	U. S.	60,000,000	500,000	100	29,750,000	Jan. 1909	1.75
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	3,710,000	Mar. 1909	1.50
Am. Smelters, pf. B	U. S.	30,000,000	300,000	100	5,625,000	Mar. 1909	1.25
Am.Zinc,Lead&Sm.	Kan.	3,750,000	80,000	25	280,000	Nov. 1907	.50
Anaconda, c.	Mont	30,000,000	1,200,000	25	43,650,000	Jan. 1909	.50
Arizona, c.	Ariz	3,775,000	1,682,620	....	6,182,381	Apr. 1906	.05
Atlantic, c.	Mich	2,500,000	100,000	25	990,000	Feb. 1905	.02
Bald Butte, g. s.	Mont	250,000	250,000	1	1,354,648	Oct. 1907	.04
Beck Tunnel, g's.l.	Utah	100,000	1,000,000	0.10	675,000	Oct. 1907	.02
Bent'n M.&D.,pf.,l.z.	Wis.	500,000	196,507	1	10,949	Nov. 1908	.01½
Boston & Montana.	Mont	3,750,000	150,000	26	52,950,000	Jan. 1909	3.00
Bull,Beck.&Cham.g	Utah	1,000,000	100,000	10	2,728,400	July 1908	.10
Bunker Hill & Sull.	Ida	3,000,000	300,000	10	10,821,000	Feb. 1909	.25
Butte Coalition,c.a.	Mont	15,000,000	1,000,000	15	2,450,000	Dec. 1907	.15
Calumet & Arizona	Ariz	2,500,000	200,000	10	10,300,000	Dec. 1908	.50
Calumet & Hecla,c.	Mich	2,500,000	100,000	25	107,850,000	Dec. 1908	5.00
Camp Bird, g., a.	Colo	5,000,000	820,000	5	5,510,400	Feb. 1909	.24
Carisa, c.g.	Utah	500,000	500,000	1	56,000	Nov. 1906	.01
Colorado, l. g. s.	Utah	200,000	1,000,000	0.20	1,100,000	Jan. 1909	.08
Columbus Con. c.	Utah	1,500,000	283,540	5	226,832	Oct. 1907	.20
Combi'tion Co.G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.15
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	3,385,313	Dec. 1906	.02½
Continental, z. l.	Mo	550,000	22,000	26	231,000	Dec. 1908	.25
Copper Range Con.	Mich	40,000,000	384,185	100	7,683,700	Jan. 1909	1.00
Creede United, g.	Colo	2,000,000	1,625,000	1	214 053	July 1906	.00½
Daly Judge, g. s. l.	Utah	300,000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. s. l.	Utah	3,600,000	180,000	20	5,877,000	Dec. 1907	.30
De Lamar, g. s. l.	Ida	500,000	80,000	5	835,200	Sept. 1908	.24
Doctor Jack Pot	Colo	3,000,000	1,000,000	1	277,000	June 1906	.02½
Doe Run, l.	Mo	10,000,000	59,062	100	1,755,000	Dec. 1908	1.50
Elkton Con., g.	Colo	3,000,000	1,500,000	1	2,191,961	Nov. 1908	.01½
El Paso, g.	Colo	2,500,000	1,460,000	1	1,315,845	Sept. 1908	.01
Fed. Sm., com.	Idaho	10,000,000	60,000	100	2,708,750	Jan. 1909	1.50
Federal Sm., pf.	Idaho	20,000,000	120,000	100	4,121,250	Dec. 1908	1.75
Findley, g.	Colo	1,250,000	1,250,000	1	337,500	Sept. 1906	.01
Florence, g.	Nevada	1,250,000	1,050,000	1	420,000	Nov. 1908	.10
Francis-Mohawk,g	Nevada	1,000,000	910,000	1	546,000	Dec. 1908	.05
Gemini-Keystone	Utah	500,000	5,000	100	2,000,000	Aug. 1907	10.00
Gold King Con.	Colo	5,750,370	5,750,370	1	1,407,593	May 1905	.01
Goldfield Con., g.	Nevada	50,000,000	1,632,471	10	706,494	Nov. 1907	.10
Grand Central, g.	Utah	250,000	250,000	1	1,321,250	Dec. 1907	.04
Gwin Mine, Dev., g.	Cal	1,000,000	100,000	10	496,000	Apr. 1905	.05
Hecla, s. l.	Idaho	250,000	1,000,000	0.25	1,650,000	Dec. 1908	.01½
Homestake, g.	S. D.	22,000,000	218,400	100	25,827,400	Jan. 1909	.50
HornSilver,g.a.c.z.l	Utah	10,000,000	400,000	25	5,542,000	Sept. 1907	.05
Imperial, c.	Ariz	5,000,000	500,000	10	300,000	June 1907	.20
Inter'l Nickel, pf.	N. Y.	12,000,000	89,126	100	1,737,957	Feb. 1909	1.50
Iron Silver	Colo	10,000,000	500,000	20	4,100,000	Oct. 1907	.10
Jamison, g.	Cal	3,900,000	390,000	10	339,300	Jan. 1909	.02
Jerry Johnson.	Cal	2,500,000	1,500,000	1	86,700	Jan. 1908	.01
Kendall, g.	Mont	2,500,000	500,000	5	1,275,000	Oct. 1906	.02
Liberty Bell,g. s.	Colo	700,000	130,551	5	130,440	Jan. 1907	.15
Lightner,g.	Cal	125,000	102,255	1	253,081	Oct. 1906	.05
Lower Mammoth,g	Utah	190,000	190,000	1	67,000	Sept. 1907	.07½
Mammoth, g. s. l.	Utah	10,000,000	400,000	2.50	2,220,000	Mar. 1908	.05
Mary McKinney, g.	Colo	2,500,000	1,309,252	1	841,093	Dec. 1908	.02
May Day, g. s. l.	Utah	800,000	800,000	1	108,000	Sept. 1908	.01½
Mohawk, c.	Mich	2,500,000	100,000	25	1,850,000	Feb. 1909	2.00
Mont. Ore Purch.	Mont	2,500,000	80,833	25	9 437,274	Jan. 1907	15.00
Nevada Hills, s.g.	Nevada	5,000,000	746,000	5	373,000	Dec. 1907	.10
New Century, z., l.	Mo	300,000	300,000	1	213,000	Dec. 1906	.01
New Idria, q.	Cal	6,000,000	600,000	10	300,000	Sept. 1907	.50
New Jersey Zinc	U S	500,000	100,000	5	1,080,000	Jan. 1909	.30
North Butte	Mont	10,000,000	100,000	100	12,000,000	May 1908	4.00
North Star, g.	Cal	6,000,000	400,000	15	5,400,000	Dec. 1908	1.00
Old Dominion, c.	Ariz	2,500,000	250,000	10	1,911,988	Dec. 1908	.75
OldDominion,M&Sc	Ariz	8,750,000	293,245	25	720,710	Dec. 1908	.50
Ophir, g. s.	Nevada	5,000,000	152,000	25	364,500	Dec. 1908	1.00
Osceola, c.	Mich	604,800	201,600	3	1,815,360	May 1908	.10
Parrot, c,s.	Mont	2,500,000	96,150	26	7,420,250	Jan. 1909	2.00
Pennsylvania, g.	Cal	2,300,000	225,850	10	6,807,649	Sept. 1907	.25
Pitts. L. & Z., l.z.	Mo	5,160,000	51,600	100	284,925	July 1908	.10
Portland, g.	Colo	1,000,000	1,000,000	1	2,000,000	July 1907	.02
Quartette, g. s.	Nevada	3,000,000	1,000,000	1	8,227,080	Jan. 1909	.04
Quincy, c.	Mich	1,000,000	100,000	10	376,000	July 1907	.20
Rocco Homest'k,l.s	Nevada	3,750,000	110,000	25	18,450,000	Dec. 1908	1.00
Sacramento, g. q.	Utah	300,000	300,000	1	112,000	Dec. 1905	.02
St. Joseph, l.	Mo	1,000,000	1,000,000	1	255,000	Nov. 1906	.02½
Silver Hill, g. s.	Nevada	20,000,000	1,000,000	10	6,158,357	Dec. 1908	.15
Shannon, c.	Ariz	108,000	108,000	1	81,000	June 1907	.05
Snowstorm, a. l.	Utah	3,000,000	150,000	20	11,187,500	July 1907	.33⅓
Standard Con., g. s.	Ida	3,000,000	300,000	10	918,402	Jan. 1909	.30
Stratton'sIndepend	Cal	1,600,000	1,500,000	1	450,000	July 1907	.50
Swansea, g. s. l.	Colo	2,000,000	1,500,000	1	645,000	Jan. 1909	.03
Tamarack, c.	Utah	5,500,000	178,394	10	6,194,130	Dec. 1908	.10
Tennessee,	Mich	1,500,000	1,000,007	5	4,895,865	Apr. 1906	.12½
Tomboy, g. s.	Tenn	500,000	100,000	5	329,500	Mar. 1907	.06
Tonopah of Nev.	Colo	5,000,000	200,000	25	9,420,000	July 1907	4.00
Tonopah Belmont.	Nevada	1,750,000	300,000	6	2,056,250	Sept. 1908	1.25
Tonopah Ext'nsion	Nevada	1,000,000	1,000,000	1	2,016,000	Dec. 1908	.48
Tonopah Midway.	Nevada	1,000,000	1,000,000	1	4,250,000	Jan. 1909	.25
Uncle Sam, g.s.l.	Utah	2,000,000	1,500,000	1	600,000	Apr. 1907	.10
United States, com.	Utah	1,000,000	928,433	1	283,030	Apr. 1906	.15
United States, pfd.*	Utah	500,000	500,000	1	250,000	Jan. 1907	.05
United Cop. com.	Mont	37,500,000	350,933	50	1,798,099	Jan. 1909	.50
United, c. pf	Mont	37,500,000	485,845	50	4,881,377	Jan. 1909	.87½
United, z. l. pf	Mo.	75,000,000	450,000	100	5,962,500	Aug. 1907	1.75
United Verde, c.	Ariz	5,000,000	60,000	100	1,500,000	May 1907	3.00
U.S. Red. & Ref. Pf	Colo	500,000	19,556	25	312,782	Jan. 1908	.50
Utah, g.(Fish Sp'ga)	Utah	3,000,000	300,000	10	21,060,322	Feb. 1909	7.50
Utah Con., c.	Utah	4,000,000	39,468	100	1,005,504	Oct. 1907	1.50
Utah Copper	Utah	1,000,000	100,000	10	323,000	Feb. 1909	.02
Victoria, Utah.	Utah	1,500,000	300,000	6	7,350,000	Jan. 1909	.50
Vindicator Con., g.	Colo	7,500,000	725,950	10	725,950	Dec. 1908	.50
Wolverine, c.	Mich	250,000	250,000	1	177,500	Mar. 1907	.04
Work, g.	Colo	1,500,000	1,500,000	1	1,980,000	Jan. 1909	.03
Yankee Con.	Utah	1,500,000	1,500,000	1	5,100,000	Oct. 1908	5.00
Yellow Aster, g.	Cal	1,000,000	1,000,000	1	172,500	July 1908	.01
		1,000,000	1,000,000	1	182,500	Jan. 1907	.03
		1,000,000	100,000	10	958,789	Aug. 1907	.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Authorized Capital.	Shares. Issued	Par Val. $	Total to Date.	Dividends. Latest. Date.	Amt.
Allis-Chalmers, pf.	U. S.	$25,000,000	151,500	100	$3,108,875	Feb. 1904	$1.75
Amer. Ag. Chem., pf.	U. S.	20,000,000	181,530	100	9,547,342	Oct. 1908	3.00
American Cement	Pa.	2,000,000	200,000	10	1,288,000	Jan. 1909	.30
American Coal	Md.	1,500,000	60,000	25	2,492,500	Sept. 1908	1.25
Bethlehem Steel, pf.	Pa.	15,000,000	160,000	100	900,000	Nov. 1906	.75
Cambria Steel	Pa.	50,000,000	900,000	50	9,450,000	Feb. 1909	.75
Central C. & C., com.	Mo	5,125,000	51,250	100	2,536,875	Jan. 1909	1.50
Central C. & C., pf.	Mo	1,875,000	18,750	100	1,453,125	Jan. 1909	1.25
Col. & Hock. C. & I,pf.	Ohio	7,000,000	69,244	100	383,818	Apr. 1908	1.50
Consolidated Coal	Ill.	30,000,000	182,280	100	911,400	Dec. 1906	1.00
Consolidation Coal	Md.	10,250,000	15,000	100	830,000	Aug. 1905	5.00
Crucible Steel, pf.	Pa.	25,000,000	244,365	100	8,186,228	June 1907	1.50
Empire S. & I., pf.	N. J.	2,500,000	25,000	100	933,033	Jan. 1909	1.50
Fairmont Coal	W. Va.	12,000,000	120,000	100	1,980,000	Jan. 1909	2.00
General Chem. Com.	U. S.	12,500,000	74,103	100	2,223,090	Mar. 1909	1.00
General Chem., pf.	U. S.	12,500,000	100,000	100	6,255,000	Jan. 1909	1.50
International Salt	Penn.	30,000,000	182,280	100	911,400	Dec. 1906	1.00
Jeff. & Cl'f C. & I., cm.	Pa.	1,500,000	15,000	100	830,000	Aug. 1905	5.00
Jeff. & Cl'f. C. & I.,pf.	Pa.	1,500,000	15,000	100	900,000	Feb. 1909	2.50
Kern River Oil	Cal.	2,000,000	20,000	100	84,000	July 1908	.10
Lehigh Coal & Nav.	Pa.	19,113,000	382,260	50	*15,014,890	Nov. 1908	2.00
Maryland Coal,pf.	Md.	2,000,000	18,850	100	12,013,937	Dec. 1908	2.60
Monon R. Coal, pf.	W. Va.	10,000,000	100,000	100	2,924,000	July 1908	3.50
NationalCarbon,com.	U. S.	5,000,000	55,000	100	715,000	Apr. 1908	1.00
National Carbon, pf.	U. S.	4,500,000	45,000	100	3,071,250	Nov. 1908	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	3,092,872	Jan. 1909	1.25
National Lead, pf.	N. Y.	15,000,000	149,040	100	17,894,248	Dec. 1908	1.75
Nat'l Steel & Wire,pf.	N. Y.	5,000,000	25,778	100	631,561	May 1906	1.75
New Central Coal	Md.	1,000,000	50,000	20	390,000	Nov. 1908	.40
New River Coal, pfd.	W. Va.	4,000,000	37,617	100	451,405	Nov. 1908	1.50
Pacific Coast Borax	Cal.	2,000,000	19,000	100	2,066,500	Aug. 1905	1.00
Peerless Oil	Cal.	1,000,000	92,000	10	711,000	June 1909	.06
Penna. Salt	Pa.	8,000,000	60,000	50	15,098,000	Oct. 1908	3.00
Penna. Steel, pfd.	Pa.	26,000,000	165,000	100	8,662,500	Nov. 1908	3.50
Phila. Gas, com	Pa.	36,000,000	664,800	50	*24,264,600	Feb. 1909	.75
Phila. Gas, pf.	Pa.	6,000,000	120,000	50	2,850,000	Sept. 1908	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas C. C., pf.	W. Va.	2,800,000	28,000	100	252,500	Jan. 1909	3.00
Pocahontas C. C.,cm†	W. Va.	45,000,000	45,000	100	†406,800	Oct. 1908	3.00
Republic I. & S., pfd.	Ill.	25,000,000	204,169	100	6,045,338	Apr. 1908	1.75
Sloss-Sheffield, com.	Ala.	10,000,000	100,000	100	2,008,000	Mar. 1909	1.25
Sloss-Sheffield, pf.	Ala.	10,000,000	67,000	100	4,221,000	Jan. 1909	1.75
Standard Oil	U. S.	100,000,000	970,000	100	629,522,905	Dec. 1908	10.00
Tenn. C. & I., com.	Tenn.	22,553,600	225,536	100	3,689,960	Nov. 1907	1.00
Tenn. C. & I., pf.	Tenn.	248,000	2,480	100	390,040	Nov. 1907	2.00
Texas & Pacific Coal	Texas	2,500,000	23,940	100	1,711,710	June 1908	1.00
United Metals Selling	U. S.	5,000,000	50,000	100	5,875,000	Jan. 1909	1.00
U. S. SteelCorp.,cm.,	U. S.	360,000,000	5,083,025	100	81,306,544	Mar. 1909	.50
U. S. Steel Corp., pf.	U. S.	360,281,100	3,602,811	100	225,280,192	Mar. 1909	1.75
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	14,340,869	Jan. 1909	2.00
Warwick I. & S.	U. S.	1,500,000	148,671	10	517,739	Nov. 1908	.30
Westmoreland Coal	Pa.	8,000,000	60,000	50	8,880,000	Oct. 1908	2.50

*Since 1894. †Since 1907. ‡Since 1890.

Canada, Mexico, Central and South America

Name of Company and Location.		Authorized Capital.	Shares. Issued.	Par Val. $	Total to Date.	Dividends. Latest. Date.	Amt.
Amistad y Conc'rdia.	Mex	$480,000	9,600	50	$417,070	Apr. 1908	$1.36
Batopilas	Mex	9,000,000	446,268	20	† 55,784	Dec. 1907	.12½
British Columbia, c.	B. C.	3,000,000	503,000	5	201,200	Sept. 1907	.40
Buffalo, s.	Mex	1,000,000	900,000	1	307,000	Feb. 1909	.01
Butters' Salvador, g.	Salv	3,000,000	150,000	20	600,000	Apr. 1905	.25
Cobalt Central, s.	Ont.	5,000,000	4,761,500	1	95,230	Feb. 1909	.02
Coniagas (Cobalt)	Ont.	4,000,000	800,000	6	720,000	July 1908	.15
Consolidated M & S.	B. C.	5,500,000	53,552	100	781,885	Nov. 1907	1.25
Crow's Nest Pass	B. C.	4,000,000	160,000	25	2,018,648	July 1907	.62½
Crown Reserve, s.	Ont.	1,750,000	1,750,000	1	350,000	Jan. 1909	.16
Dolores, g.	Mex.	2,000,000	400,000	5	540,000	Feb. 1909	.15
Dominion Coal, com.	N. S.	15,000,000	150,000	100	3,150,000	Jan. 1909	1.00
Dominion Coal, pf.	N. S.	3,000,000	30,000	100	1630,000	Feb. 1908	3.50
Doa Estrellas, g. s.	Mex	150,000	300,000	0.50	3,780,000	Jan. 1909	1.00
El Oro, g. s.	Mex	5,750,000	1,080,000	5	4,989,500	July 1908	.36
Esperanza, a. g.	Mex	2,275,000	455,000	5	9,222,400	Oct. 1908	.87½
Foster Cobalt, s.	Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.05
Granby Con., c.	B. C.	15,000,000	135,000	100	3,508,630	Dec. 1908	2.00
Greene Con. Copper.	Mex.	8,640,000	864,000	10	6,137,800	Mar. 1907	.40
GreenGold-Silv'r,pfd.	Mex	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato	Mex.	3,000,000	540,000	5	74,250	Oct. 1906	.07
Guanajuato D., pfd.	Mex.	1,000,000	10,000	100	30,000	July 1908	3.00
Guggenheim Expl.	Mex	17,000,000	105,000	100	5,010,000	Jan. 1909	2.50
Hinda Con., g.s.c.l.	Mex	5,000,000	6,000,000	1	100,000	Feb. 1908	.02
Kerr Lake, s.	Ont.	3,000,000	500,000	5	970,000	Mar. 1909	.20
La Rose Con.	Ont.	7,500,000	1,143,268	5	400,179	Jan. 1909	.20
LeRoi, Ltd., g.	B. C.	5,000,000	200,000	25	425,000	Dec. 1906	.48
LeRoi No. 2, g.	B. C.	3,000,000	120,000	25	831,600	July 1908	.48
McKinley-Darragh, s.	Ont.	2,500,000	2,000,000	1	480,000	Jan. 1909	.05
Mex. Con. M. & S. Co.	Mex.	2,500,000	240,000	10	660,000	Mar. 1908	.25
Mex.Mill.& Trans.pfd	Mex.	2,000,000	12,000	100	35,450	Jan. 1908	3.00
Mines Nac. of Am.	Mex.	2,500,000	2,000,000	1	3,505,000	Mar. 1909	.02
N. Y. & Hond. Ros.	C. A.	1,500,000	150,000	10	2,477,500	Jan. 1909	.10
Nipissing, s.	Ont.	6,000,000	1,200,000	5	2,340,000	Jan. 1909	.25
N. S. St. & Coal, com.	N. S.	5,000,000	49,876	100	1,087,856	Apr. 1908	1.50
N. S. St. & Coal, pf.	N. S.	1,030,000	10,300	100	458,350	Oct. 1908	2.00
Penolee*	Mex.	260,000	2,600	100	8,630,000	Dec. 1907	20.00
Peregrina, pfd. a.	Mex.	1,000,000	10,000	100	188,656	Sept. 1908	3.50
Pingueco, pfd. s.	Mex.	2,000,000	20,000	100	240,000	Oct. 1908	3.00
Platanillo	Mex.	800,000	206,989	1	5,500	Sept. 1908	.00
Reco, g. s. l.	B. C.	1,000,000	968,000	1	327,082	Apr. 1906	.02
Securities Corp., pfd.	Mex.	200,000	2,000	100	42,699	July 1908	5.50
Silver Queen, s.	Ont.	1,500,000	1,500,000	1	345,000	Nov. 1908	.06
Temiskaming, s.	Ont.	2,500,000	2,500,000	1	375,000	Jan. 1909	.05
Tezuitlan Copper	Mex.	1,000,000	10,000	100	.....	Dec. 1908	1.20
Tilt Cove, c.	N. F.	1,000,000	89,000	2	495,630	May 1908	.55
Trethewey, s.	Ont.	1,000,000	945,450	1	217,463	Dec. 1908	.10
Tyee, c.	B. C.	940,000	180,000	5	201,600	Aug. 1907	.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The Hammond Iron Works, Warren, Penn., has established an office at 5 de Mayo 32, Room 222, Mexico, D. F., in charge of Francis E. Pratt, recently of New York.

The Wellman-Seaver Morgan Company has just made arrangements for F. H. Bostwick, of Denver, Colo., to represent it in the western field. He will be the manager of the western office, located at 611 Ideal building, Denver, Colo.

Charles T. Malcolmson has recently accepted a situation with the Roberts & Schaefer Co., Old Colony building, Chicago, Illinois. He will have charge of its recently organized briquetting department. With the added facilities which his new connection offers for designing and building this class of structures, we may look forward to some very interesting results in the briquetting of coal and lignites.

Warren Wood, of the Wood Drill Works, Paterson, N. J., and Robert J. Wood, manager of the Chicago branch, will leave the United States on February 19 for a three weeks' visit to the Panama canal zone for the purpose of inspecting the work done by Wood rock drills, and upon their return the Wood Drill Works will publish a booklet containing valuable cost data and comparisons, with some interesting views along the canal.

The large order for the complete fuel equipment of the Coronet Phosphate Company, of Coronet, Florida, has been awarded to the Tate, Jones & Co., Inc., Pittsburg, Penn. It consists of the celebrated "Kirkwood" oil system, comprising burners, pumping, heating and regulating equipment, etc. The great economy of oil (by the Tate, Jones method) over the other fuels, together with its simplicity and perfect control at all times, led to the placing of this contract with the Pittsburg concern.

The Deming Company, Salem, Ohio, has issued a handsome catalog giving full details of its spray pumps, nozzles and appliances. The catalog contains a very complete 12-page spraying chart; also shows sectional and detail views of several of the pumps, and illustrates many of them in action. It is printed in two colors, with shaded illustrations, making a very fine appearance. The Deming Company also manufactures a very complete line of hand and windmill pumps, hydraulic rams and triplex and deep-well power pumps for various duties and for operation by any power. Interesting literature will be sent to any parties desiring information on Deming pumps.

The Northern Electrical Manufacturing Company, Madison, Wis., announces the enlargement and removal of its St. Paul district office to 1046 Security Bank building, Minneapolis, Minn. This betterment of its sales office facilitates closer relation with its valued customers in the twin cities and improves its office surroundings. T. E. Drohan, who has been representing the company in the St. Paul office, will continue in charge of the Minneapolis office. His experience as superintendent of the Northern works makes it possible for him to serve customers in his territory to excellent advantage, as his sales interest is coupled with an intimate knowledge of manufacture and design.

The Wagner Electric Manufacturing Company has placed on the market a portable polyphase wattmeter, which gives in a single indication the total power consumed in two-phase or three-phase circuits, or the power consumed in a single phase. This instrument has the same accuracy on an unbalanced as on a balanced circuit. The Wagner line of switchboard, and portable instruments is said to be the most complete that the American market affords, including ammeters, voltmeters, wattmeters, power-factor indicators, frequency meters, ground detectors and synchronism indicators, together with current and potential transformers for all capacities, voltages and frequencies and any character of service.

The Burnite Machinery Company, with Thos. B. Burnite as manager, has succeeded the Burnite-Leonard Engineering Company, of Denver, Colo. The company has moved into a more commodious office and storeroom at 17th and Glenarm streets and is nicely fitted up. Mr. Burnite has been a machinery man all his life, having been connected with the engineering department and shops of several well known concerns. He has been identified with Colorado machinery interests for the past three years. The company represents the Hardsocg Wonder Drill Company, the Erie City Iron Works, the Bury Compressor Company, the Krogh Centrifugal Pump Company and various other lines, making a complete equipment for mine, mill or power plants of all descriptions. A large line of Hardsocg wonder drills and accessories are carried in stock for immediate delivery, the smaller sizes of Bury compressors and Erie boilers will also be carried, as well as a line of Krogh centrifugal pumps. The company is equipped to design, furnish and install mining, milling, power and pumping plants complete.

The Dayton Globe Iron Works Company, Dayton, Ohio, has issued an 80-page catalog describing and illustrating the New American turbine. It is printed on 100-lb. high grade coated paper, which brings out every detail of the many half-tone illustrations. The cover is of dark gray stock with a light gray flyleaf, and is highly embossed with the company's name and the name of the product. A very pleasing effect is obtained by the use of a tint block in a delicate shade which overcomes the high gloss of the paper stock and makes the illustrations more attractive by having the high lights cut away and bringing them out in white. Not only the tables of power of the various types of New American turbines but other tables of value to those interested in water power development are contained in this book. Taking all points into consideration it is undoubtedly one of the most attractive and valuable catalogs yet issued for the water-wheel trade and speaks very well of the business methods which have made the Dayton Globe Iron Works Company one of the foremost manufacturers of water-power equipment.

The Western Electric Company has recently designed a magneto telephone set for satisfactorily meeting the most exacting requirements of mine telephone service above ground. Anyone who has had to do with mining operations knows how important it is that mine telephone sets must be constructed so as to render the most efficient and reliable service under the most exacting conditions and with the lowest maintenance expense. These newly designed telephone sets are very compact and reliable, and the woodwork and all the working parts are constructed of the very best materials. Each part of the equipment is mounted so as to be readily accessible. Each set is complete and ready for use with the exception of the dry cells. The battery compartment is large enough to hold three standard size dry cells. A writing shelf mounted below the transmitter is convenient in making notes of orders received over wire. Improved Blue Bell dry cells are specially recommended for mining telephone work. Tests have shown them to have long life and high efficiency. A special feature of these magneto telephone sets is the location of the main binding posts inside the cabinet. This prevents trouble from tampering with the connections and accidentally short-circuiting a set at the main terminals. All the binding posts are fitted with screw connections. The permanent connections are soldered and terminals attached to flexible leads are provided for the battery. All apparatus in these sets is of standard Western Electric quality, the same quality which has been maintained by this company for over thirty years for local and long distance telephone work. Equipment of good quality with ordinary care means low maintenance charges and low maintenance charges are as important in a small mining telephone system as in a large one.

The problem of mine pumping is so vitally important and so difficult to solve satisfactorily that it requires the most careful consideration on the part of mining engineers, and special pumps must be designed by experts who have had many years' experience in this field. The Jeanesville Iron Works Company, being located in the heart of the anthracite coalfields and therefore having the benefit of a vast and varied experience in the territory where the pumping problem is the most complex, has justly earned the name of being one of the foremost and most expert manufacturers of mine pumping machinery in the country. Its shops, which were originally located in Jeanesville, Penn., were moved in 1904 into new buildings situated at Hazleton, Penn., and equipped with modern machinery and appliances. Its specialty is heavy mine pumping machinery, and although it has suffered somewhat from the business depression, it has never been entirely idle, and is reported to be running day and night at the present time in order to meet the demand for a number of large mine and water-works pumps that are promised for quick delivery. The company does not confine itself to the manufacture of mine pumps exclusively, but is branching out into other directions. A seven-million gallon crank-and-flywheel pumping engine for South Bethlehem, Penn., has just been completed and is pronounced by the testing engineer to be a most economical pumping engine of this type. Two large mine pumps have been shipped to the Leon Mining Company, of Mexico, for its gold mine and are now being installed. Three large compound mine pumps of 36-in. stroke are under construction for the coal mines owned by the Delaware, Lackawanna and Western Railroad Company, and also one triple-expansion engine of 48-in. stroke for the same party. This is claimed to be the largest pumping engine for mine service ever contracted for. The lift is 1000 ft. and the capacity from 2000 to 3000 gal. per min. In addition to these, many smaller pumps are being built, as well as a number of turbine pumps of the company's improved multi-stage type. The company is now competing for the pumps required in the phosphate mines of Florida, and has been successful in securing contracts for the most up-to-date pumping plants.

Trade Catalogs

Wood Drill Works, Paterson, N. J. Pamphlet. Wood rock drills. Illustrated, 3½x6 inches.

Avery Co., Peoria, Ill. Catalog. Engines, threshers, steam plows. Illustrated, 64 pages, 8½x11½ inches, paper.

Dayton Globe Iron Works, Dayton, Ohio. Catalog. New American turbine. Illustrated, 80 pages, 6x9 inches, paper.

American Brake Shoe and Foundry Company, Chicago, Ill. Pamphlet. Manganese steel castings. 14 pages, 4x7 inches.

Bausch & Lomb Optical Co., Rochester, N. Y. Catalog. Engineering instruments. Illustrated. 68 pages, 8x10½ inches, paper.

Dean Bros. Steam Pump Works, Indianapolis, Ind. Catalog No. 74. Condensing machinery. Illustrated, 56 pages, 6x7 inches, paper.

The Ohio Brass Company, Mansfield, Ohio. Catalog 0-B. HI-Tension porcelain insulators. Illustrated, 102 pages, 6x9 inches, paper.

Northern Electrical Manufacturing Company, Madison, Wis. Bulletin No. 58. Electric rock drills. Illustrated, 28 pages, 8x10½ inches.

Joseph Dixon Crucible Company, Jersey City, N. J. Pamphlet entitled, "Lubricating the Motor." Illustrated, 24 pages, 5½x8½ inches.

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An Ore-handling Plant in New Caledonia

An Elaborate System of Suspension Tracks and Cables, Comprising Four Main Lines, for Carrying Ore, Coal, Merchandise and Passengers

SPECIAL CORRESPONDENCE

The development of the ore resources of the island of New Caledonia has hitherto suffered severely from the lack of suitable transportation and handling facilities between the sea and shore. Owing to the rocky and treacherous nature of the coast, approach is difficult, the difficulty being accentuated by the heavy surf which prevails. Such conditions militated against vessels, except those of the small, and shallow-draft coastal type, and prevented their coming sufficiently near the mainland to ship the ore from the barges which brought it from a small jetty, through the surf. Such methods, being not only tedious and slow but expensive as well, handicapped the expansion of the export trade, more especially so since vessels of heavier tonnage were precluded from securing consignments of this freight for their return voyage to Europe.

Under these circumstances the mining interests concerned decided to lay down a complete modern plant replete with every facility and convenience for the expeditious handling between ship and shore not only of the ore but also miscellaneous freight such as stores, coal, and even passenger traffic. As a solution of the problem Adolf Bleichert & Co., of Leipzig, Germany, suggested the construction of a large landing stage about 1000 yd. from the shore provided with every appliance for the rapid discharging and loading of vessels, and to connect this isolated landing stage with the mainland by means of a wire ropeway, over which the whole of the traffic between the ship and shore would travel.

Such an arrangement offered complete independence of the state of the tide, currents, rocky character of the shore; and the contemplated site, being sheltered by a peninsula jutting into the sea, offered complete protection from storms, thereby enabling even the largest vessels that would call at the island to ride in perfect safety and beyond the surf. The construction of such a landing stage, as the engineers pointed out, offered no insuperable difficulties, while the necessary piers

ROPEWAY FROM CENTRAL STATION TO LOADING BRIDGE

for supporting the ropeway required only a small base width, so that they would offer only the minimum of resistance to currents which might lead to the accumulation of silt, while the carrying ropes could be carried at such a hight as to be beyond the reach of the waves during the heaviest storms.

Requirements of the System

Under these circumstances the mining authorities decided upon this system and the contract was placed with the firm named at the end of 1902. In this decision not only were the mining interests impressed by the lower cost and the expedition with which such a project could be consummated with complete satisfaction, so far as their requirements were concerned, but it entailed the readjustment of their existing facilities on the island to the minimum. Such a cableway accomodated itself easily to the conditions prevailing.

The mines are situated on the Thio plateau and the ores are transported from Bornet to the seaboard station at Mission bay over a surface railroad. The drop to the shore, however, is somewhat rapid and steep, and to continue the railroad from its existing terminus to a point where it was decided to establish ore stock dumps would have been impossible owing to the heavy nature of the grades while breaking bulk, and transference to other types of transport would have been too expensive. At the same time the supplies of ore thus brought down by the railroad to the stock dumps are supplemented by cargoes from the neighboring islands carried in small coastal vessels. These latter had to discharge into lighters which brought the ore to the shore, whence it was carried to the dumps, a similar process having to be repeated in loading these vessels with coal and stores.

Again the configuration of the country prevented the formation of a high tip such as was required at the dumps. A bank 65 ft. high was contemplated in order to carry large stocks of ore, and as in any event this phase of operations would have necessitated the construction of an aërial cableway, it was realized that considerable saving in time and expense would attend a complete rope-driven suspension railroad over the whole district to be served, and it offered the further advantage that the varying differences in level could be more easily negotiated by the guide-driven ropeway and would enable the working of the whole to a very great extent to be carried out with an automatic drive.

A comprehensive idea of the varied and heavy nature of the work which this cableway was designed to perform may be gathered from the following:

(a) Discharge of ballast or coal from arriving vessels.
(b) Discharge of ore from small steamers arriving from contiguous islands.
(c) Piling ore brought from vessels at the seaboard dumps.
(d) Removing and storing sand brought as ballast on incoming ships.
(e) Transfer of coal from incoming vessels to seaboard coal depot.
(f) Transportation of ore arriving from up-country per railroad from terminus of latter to the dumps.
(g) Transfer and load ore arriving from inland vessels moored at the landing stage.
(h) Remove ore from dumps to vessels at landing stage.
(i) Transport coal from depot to bunkers of incoming vessels.
(j) Negotiate all passenger and other traffic between vessels and shore.

The heaviest and most important work, however, is that under *g* and *h*, which occurs every day.

Plan of the Installation

In view of the fact that the whole plant was to be carried out as a rope-driven suspension railroad, it was decided, owing to the advantages offered, to establish a central station at a suitable point, whence all the lines for the various operations could be converged and the driving movements could be controlled and directed. Selection fell upon a small area close to the sea, and in close proximity to the terminus of the existing railroad coming from Bornet. At this point the road runs with a moderate gradient up a bank to such a hight that by opening the bottom traps of the cars the contents can be shot into huge hoppers, underneath which is situated the terminus of the overhead cable railroad, so that the hoppers can be discharged quickly and easily as rapidly as they are filled from the railroad cars.

The cableway system is divided into four sections, each of which performs a distinct function, though all effect a junction at the central station. Line No. 1 is that which handles the ore between the railroad stations and the ore dumps. Immediately upon receiving its charge of ore at the railroad-station hoppers the car is carried over lofty steel supports to a return station where it turns automatically and returns toward its starting point where the ore dumps are placed. In order to negotiate this section the line makes a sharp ascent in order to give the requisite hight for the formation of the dump. As the car passes over this latter it is caught by a movable adjustment appliance which tips the car without arresting its forward progress and the contents are discharged upon the dump beneath without the slightest interruption of the traffic.

Considering the fact that the dumps are intended to attain a size of 50,000 tons, it is necessary to tip to a hight of 65 ft., so that the towers or supports carrying the overhead railroad, and having a hight of 80 ft. will be buried in the ore up to the level of the protection rollers of the carrying ropes. In order that these supports may not suffer any damage from the falling ore by the pressure from the bank becoming higher on one side than the other, or its integral parts becoming blocked with the mineral, the usual profile in iron design is superseded by a cone-shaped support of sheet steel which affords a higher factor of stability and rigidity.

DRIVING STATION WITH COAL DEPOT

CENTRAL STATION, SHOWING SWITCHES AND CROSSINGS

Consignments of ore, intended to be transported direct from the railroad cars to the ships moored outside the landing stage, are also carried over this line and to line No. 2, the section connecting the landing stage with the mainland, the cars discharging their contents upon arrival at the landing stage into traveling hoppers, from which in turn the buckets of the loading cranes are filled and emptied into the vessel's hold, the cableway cars turning automatically and running back to the central station. Line No. 1 has a carrying capacity of 40 tons per hour. The cars are spaced 390 ft. apart, and have a traveling velocity of 6½ ft. per second.

Cable Lines of the System

Line No. 2, which is the most important of the whole system, inasmuch as it connects the landing stage with the mainland, is about 1000 yd. long, and effects a junction at the central station with the other three sections. Its duty is somewhat heavy, and for this reason its handling capacity is considerably increased in comparison with the other stretches; it can deal with 100 tons per hour in either direction. The car speed is the same, 6½ ft. per sec., but the cars are spaced only 175½ ft. apart. Over this line all traffic between ship and shore, irrespective of character, is maintained.

Line No. 3 conveys ore from the dumps over line No. 4 to the central station or landing stage, coal and sand from the central station to the coal depot and sand hopper, respectively. This line is laid at a great hight, for not only has it to cross line No. 4, but also three surface-railroad tracks extending between the central station and the ore dumps. As it approaches the central station it descends sufficiently to come level with line No. 1. Indeed, the whole system is designed so that at this point the four sections are at a uniform level, to facilitate handling and switching, approximately 8 ft. above the ground. Its handling capacity is 100 tons per hour, with a car speed of 6½ ft. per second and with the cars spaced 175½ ft. apart.

This line serves a variety of purposes. The northern stretch serves on the one hand to form the connection between the "taking-up" line and the sea, and on the other hand the connection between the coal depot and the sea. At the same time at a point, about midway in this northern stretch above the three side tracks of the railroad which the line crosses, there is a large hopper for the accommodation of sand ballast transferred from incoming ships. This sand is loaded from the vessel by grabs, dumped into cableway cars which convey it over line No. 2 to the central station, where it is taken up and dumped.

The sand is in turn discharged from these hoppers into railroad cars and used for building up railroad embankments, or for filling depressions in the ground. This arrangement has the advantage that on one side of the line supplies of ore can be obtained for conveyance to waiting vessels, while ballast can be brought back on the return trip. Consequently, the cars need not return empty, and both sides of the cable way are thus turned to profitable account. Again, the whole of the coal traffic is maintained over this section. The coal unloaded from the incoming vessel is despatched over the sea section, or line No. 2 to the central station, switched on at that point to line No. 3, whence it is carried to an angle station, pushed upon the southern stretch of this section and sent to the coal depot into which it is discharged automatically without stopping the car, the latter then returning to the ship.

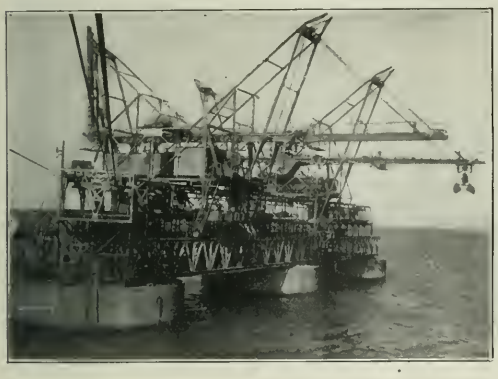
Method of Operation

In handling coal two operations can be carried out at the same time. A steamer discharges this freight into the cars which have brought their consignments of ore out to the landing stage and discharged it into the crane hoppers. The coal-laden cars travel back to the coal depot, deliver their contents, are pushed over from line No. 3 to line No. 4, which extends along the ore dump, recharged, pushed back again off line No. 4 to line No. 3 and sent back to the ship.

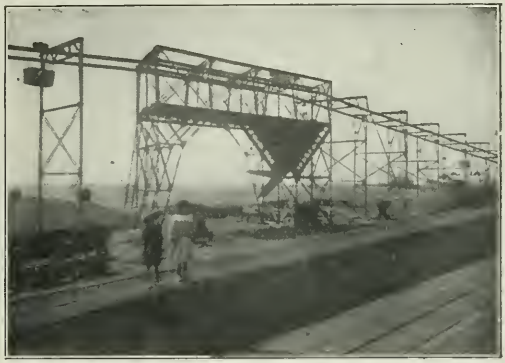
Line No. 4 is a low-level section, and its function is to convey ore from the dumps to line No. 3 for transportation to the landing stage, thereby supplementing the through direct line between the railroad and the sea stations. It is a double-rope-driven line and extends along the ore dump at the low hight of 6½ ft., connecting with a traveling cross-bridge spanning the whole dump and also carried at a hight similar to that of the cableway in conjunction with which it works.

On this traveling bridge are two hoppers from which the cars of the cableway are filled, and these hoppers in turn are charged by two cup elevators running along the dumping site on a track. In the area of the dump, however, are the two conical steel towers supporting line No. 1, and in order that the cross-bridge may not be obstructed in its operation, it is constructed in two separate parts connected in the center by swing rails. In passing one of the towers the cross-bridge is divided by swinging these connecting rails outward and the parts thus pass the obstruction separately, being reconnected upon the other side. If necessary the bridge can be used at half-length in order to pick up the ore near the supports, at least on one side, there being a return rail in the center of the cross-bridge for this purpose.

The cars are pushed over the bridge by hand; at the extremity is a coupling joint where the cars are attached to the traction rope of the cableway. The cars, charged with ore by the cup elevator, run along the dump on the inner side of the framework carrying the cableway to a return station and then toward the center of the cableway framework. From the pre-



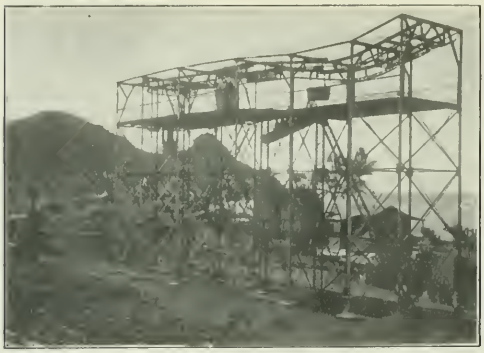
LOADING CRANES IN THE HARBOR



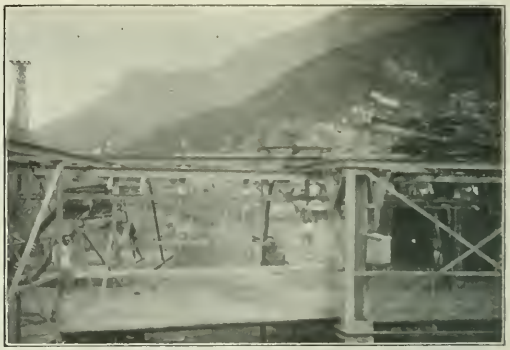
SAND HOPPER AT CROSSING OVER SURFACE LINE

vailing low level the line now has a sharp upward grade continuing until a hight of about 33 ft. is gained at the junction and angle station, which branches off on one side to the central station and thence to line No. 2 through switches and crossovers; on the other side it goes to the coal depot which is of 1500 tons capacity. The cars have now reached the level of line No. 3 upon which they are pushed by hand, run over this section to its junction with line No. 2 and thence direct out to the sea station. This fourth line has also a handling capacity of 100 tons per hour, but the car speed is increased to 26 ft. per second while the spaces between the cars is reduced to 71½ feet.

For the sea section of the line and that extending over the ore dumps the track is of locked carrying-ropes of long span. Over the ore dumps the spans are consecutively 195 ft., 227½ ft., 179 ft. and 162½ ft.; on the sea section the spans are 390 feet.



RETURN AND TENSION STATION, LINE NO. 1



ANGLE AND JUNCTION STATION

Difficulties of Construction

In laying out the cableway the number of curve returns that had to be dealt with constituted an important feature. It was imperative that they should be negotiated automatically without detaching the cars from the traction rope, as this would have caused interruptions in traffic owing to the comparatively rapid sequence of the cars. Further, although there are four different traction ropes for various purposes it was essential that they should work together in such a manner as to enable the cars to be switched over from one line to the other without any difficulty.

With four different traction ropes subject to varying tensions the difficulties of the problem may be realized, especially as the disadvantage of different rope diameters due to differences in strain have to be neutralized. All the traction ropes are of the same diameter, but this does not remain constant; the shrinkage in diameter aggregates as much as 27 per cent. after prolonged use, according to the strain imposed. This difficulty was overcome by the utilization of the Bleichert automatic gripping apparatus with underhung rope which admits gradients up to 45 deg. and at the same time is absolutely unaffected by any variations in the diameter of the rope arising from the causes named.

The work of erection offered no serious difficulties. The only precautions necessary were in connection with the construction of the more elevated portions of the ironwork against the severe storms and typhoons common in the locality. In regard to the sea section, however, constructional work was of a more difficult character. The sea bed is of a varying nature being rocky and level close inshore giving way to silt farther out and offering no stable foundation. For the former sites suitable rocky ridges were selected and upon these cement piers were built to high-water level with the usual type of iron profile towers constituting the superstructure for carrying the cableway. Where sand was encountered piles were driven and strengthened by concrete, this work being carried out by divers, and the whole finally covered with heavy stones. Upon this mass an iron frame was built supporting a platform above water upon which was placed the iron supporting towers about 49 ft. high. This part of the work completed, the cables were soon placed in position.

Landing Stage

The construction of the landing stage comprised the most difficult part of the whole undertaking. It was imperative that it should be placed sufficiently far out to sea to provide a minimum depth of 33 ft. of water, so that vessels could come, moor and go at any state of the tide. The most serious part of the work was in connection with the piers for carrying the superstructure. The strong currents, the rough character of the sea, and the muddy water prevented submarine building by divers, while similarly piling by means of an air-lock could not be undertaken, since a single storm would have sufficed for the complete destruction of this preliminary work. Moreover, the nature of the sea bed was but indifferently known. Consequently it was decided to build huge caissons or tuns on land for inclosing the masonry work, and then to take them out to sea and sink them in the desired position.

At first, however, the sites were extensively dredged to remove the upper layer of mud and silt, and to gain access to the underlying gravel for a firm foundation. These areas were then covered with large stones to a depth of about 17 ft. to protect the sites from becoming covered with silt and partly to afford a suitable foundation for the caissons.

The design of caisson adopted comprised two timber cylinders, one inserted within the other. The inner was of 32½ ft. and the outer of 45½ ft. diameter, leaving an annular space 6½ ft. wide to be provided with a substantial flooring. These cylinders were built on shore. The floor was first laid and to this the iron frame around which the planks were to be secured was placed in position. The planking was erected in the same way as the staves of a barrel with iron rings of U-shape pointing upward. Finally the cylinders were rendered water-tight with roof-felting and tarred sail-cloth. Upon completion they were launched, towed out to the site, and sunk into position by the simple admission of water. Despite the numerous difficulties that had to be overcome in connection with this part of the work, it was rapidly and successfully accomplished, and the masonry was soon filled in and completed ready for the superstructure.

The landing stage is built in two sections, the outer extremities resting on the outer piers and meeting on the central pier. Each section is 114 ft. long giving a total length from end to end of 228 ft. The clear span length of each section is 90 ft. Again each section consists of two main carriers with parallel bracing of

simple construction with a hight of 9 ft. 9 in. The main carriers are spaced 36 ft. from one another. The lower chord of these main carriers is of angle iron with intermediate riveted vertical steel sheets, and the upper chord is composed of two U-irons with the webs turned to each other; the upper flanges with the help of cross-irons serve to take up the rails for the traveling cranes.

On the middle pier the landing-stage sections have their extremities on a fixed bearing, the two outer piers carrying suitable roller bearings to allow necessary play. The cross bracings of the landing stage also consist of parallel girder carriers above which are the bracings for the working platform and the cableway. These are also longitudinally strutted with U-irons, the longitudinal U-iron binding together the top cross U-irons also forming the main girder for taking up the cableway shoes.

The working platform is 6½ ft. above the upper chord of the main carriers along which a second platform 3¼ ft. wide extends, but which is intended only for attendance on the traveling drive of the cranes. On the side facing the shore the landing stage has an extension somewhat resembling a balcony joining the main structure at an obtuse angle and which carries the saddles for the carrying ropes of the cableway as also the tension-weight rollers, the weights hanging in a recess in the pier. The saddles of the carrying rope are faced on the sides with cast-steel plates at the point where they transfer the traffic to the fixed overhead rails of the landing stage in order to protect the carrying ropes from damage as they are particularly subject to wear and tear at the deflection points owing to the passage of the cars. The carrying ropes from the shore to the landing stage are firmly anchored in the central station and stretched by weights on the landing stage with the aid of flat strand tension ropes running over large cast-iron tension rollers.

The Cranes

The two cranes are of the double-jib type with raising jibs and with two rope trolleys which permit hoisting and lowering as well as stopping at any point of the track. Both cranes span the superstructure of the bracing of the landing stage on which the cableway is carried. Just over the superstructure is the engine house providing the power for the cranes complete with steam engine and boiler. It was decided to be more satisfactory to select an independent steam drive on the landing stage for its own requirements since, although electric operation would have been possible, the expense of laying a cable for the purpose from the shore was considered too heavy, while at the same time any breakdown at the electric generating station would paralyze loading and unloading on the landing stage.

Owing to the exposed position of the cranes (they travel on a track 162½ ft. in length, while the jibs when raised are nearly 100 ft. above the water level) it was necessary to secure a high factor of stability, especially when the heavy wind pressure incidental to the heavy storms and typhoons is borne in mind. The wheel base of each crane is 32½ ft., while the width of the engines houses is 16 ft. For further protection against storms the cranes can be brought up side by side and anchored together forming one complete structure with an extensive ground area. The outer parts of the jibs can be raised for a length of 40 ft. to enable ships to moor alongside without recourse to cross-towing.

The cranes can be worked with both grabs and buckets. A so-called drum-grab has been selected, the closing chain winding on the drum axle while the hoisting chain unrolls from the drum in tightening. The gearing lies in the difference between the diameters of the drum-axle and the drum. These grabs have the advantage that they can be quickly changed for buckets without taking out the hoisting ropes, a point of no little importance as frequent changes from grabs to bucket and *vice versa* are necessary.

The trolley, which carries the grabs and buckets and which can traverse the whole track, is driven by the triple-drum winch coupled direct to the steam engine. The trolley traveling rope coming from one of the two traveling drums, which are free on the main winch axle, is fastened at its end on one side of the trolley. On the other side of the trolley the end of the rope going to the second traveling drum is fastened. This rope coming from the trolley first winds around a roller on the extreme end of the jib and thence passes to the opposite jib point. It here lies on a return roller from which it goes to the second traveling drum. The hoisting rope for hoisting and lowering the grabs or buckets is made double to procure a smaller diameter. At the extremity of the jib it is fastened with a spring buffer, runs downward over a return roller in the trolley, winds round the double-rilled steel block, which carries the bucket or grab, and then passes over the second return roller of the trolley to the extremity of the opposite jib. Here it is again wound around a return sheave whence it passes to the hoisting drum provided with symmetrical grooves running in opposite directions. The two traveling and the hoisting drums are mounted on the main winch shaft with which they are connected by friction couplings, the latter being provided with band brakes.

Details of Operation

For raising the jib two winches are built in above the engine house driven by the steam engine of the main winch by Ewart driving chains. From the winches by means of special guide rollers the wire ropes pass over the end of the fixed jib frame to the extremity of the movable jib which is held in its level position by joint rods.

The steam engine is of the non-reversible twin type, hoisting, lowering, and reversal of the trolley traveling movement being effected by suitable motions of the drums assisted by band friction couplings. Steam is raised by a fire-tube boiler, and the water is brought from the shore in special cableway cars.

Each crane is fitted with four hoppers and charging funnels, one of the latter being built in on each side of the crane at the hight of the working bridge. The cableway cars arriving from the shore with ore, dump their contents into these funnels, while beneath the latter are chutes through which the ore gravitates and fills the buckets of the crane, there being flaps in the chutes operated from the engine house controlling the delivery into the buckets.

For discharging vessels there is a further hopper built on each side of the crane on the level of the engine-house platform into which the buckets or grabs discharge their contents. At the bottom of these hoppers is a funnel which conveys the material into the cableway cars below and in such a manner that the cars can be filled without difficulty from the inner side. On the landing stage there are several short sidetracks and switches radiating from the main cableway system, so that it is not necessary for the cars to traverse the whole length of the landing stage. The suspension rails in the upper parts of frame are hung directly by means of cast-iron shoes on the cross braces of the bridge carrier, the chords being made to project for this purpose.

Owing to the design of the plant it is always possible to carry out several operations simultaneously. Two ships can be loaded or unloaded at the same time, one on each side, while one can be loaded as the other is being discharged. As the cableway on the sea section has a capacity of 100 tons per hour each way this gives a total capacity, when used to its fullest extent, in either direction of 200 tons per hour. The cranes have a capacity of 100 tons of ore loading, and 60 tons of sand and 40 tons of coal unloading, giving a total capacity for both cranes of 200 tons per hour. A ship of 3000 tons which formerly required about 30 days to take in her freight now accomplishes the operation in two or three days, while at the same time the system has dispensed with the extensive fleet of barges and some hundreds of workmen occupied in transporting the ore from the shore to the ship at anchor in the roadstead. As work is often maintained day and night continuously, the whole of the plant is electrically lighted including the supporting standards of the sea section of the cableway.

Mining at Grass Valley and Nevada City

The Veins Dip about 30 Degrees from the Horizontal and the Ore Is Lowered in Cars down the Stopes. Inclined Shafts Are Used

BY G. E. WOLCOTT*

Grass Valley is an old camp. It was discovered even before the days of the famous Comstock in Nevada, the rush to which at one time almost depopulated this California camp. The Empire mine, the second largest producer today, was first opened up in 1853. Grass Valley is as good a camp today as ever in its history, and will doubtless be a gold producer 100 years from now. The distinctive feature of the deposits which makes a discovery in the district of especial importance is the fact that deposits can usually be depended upon to continue to a great depth. There are, of course, exceptions to this rule, or, at least, apparent exceptions, yet the camp as a whole is remarkable for the continuity of the veins. The Empire vein has been worked to a depth of 3500 ft., and the North Star vein, which has been worked for nearly half a century, has this year been opened up to a depth of 5400 ft., and appears as strong at this depth as nearer the surface.

EMPIRE MINE

CENRTAL SHAFT, NORTH STAR COMPANY

The Camp and Its Mines

Nevada City and Grass Valley may be roughly considered as forming one mining camp. While lying four miles apart they are closely connected by an electric-car line, and from a mining point of view the distinctive features of the one are the same as those of the other. The veins are largely of the same form, the ore of the same general character, and mining and milling conditions are largely the same. The distinctive mining features arise from the fact that nearly all of the veins, as far as worked, have been found lying nearer the horizontal than the vertical. The North Star vein has an average dip of only 26 deg. from the horizontal, while 30 deg. may be taken as a close approximation to the general dip. There is, however, no general direction of dip. The North Star vein dips east, the Empire to the west, the Maryland to the south, and the Golden Gate to the north. Many of the veins are at times almost horizontal and have even been known to dip in two opposite directions.

The chief producers in the vicinity of Grass Valley in the order of their production are: The North Star, the Empire, the Pennsylvania Consolidated, the Prescott Hill, the Idaho-Maryland, and the Golden Gate mines. The North Star has two 40-stamp mills in operation, the Empire one of 40 stamps, the Pennsylvania Consolidated one of 20, the Prescott Hill one of 20, and the Idaho-Maryland one of 40 stamps, which have not been operating for some time. At present (Nov. 10, 1908), the mining and milling plants of the Idaho-Maryland are being overhauled, and the mine promises to be rejuvenated by the discovery of a new vein parallel to one which has before produced millions of dollars. The new vein has been opened up at 600 ft., and carries very high-grade material in places. The Golden Gate mine has only a 4-stamp mill, but it is of considerable prospective importance because of the fact that considerable ore has been opened up in recent development work. The Grass Valley Dana Company, which has just started operations under a bond and lease on the Christopher Columbus and Dana claims, has excellent prospects and has already opened up a 7-ft. lode carrying pay ore.

In the neighborhood of Nevada City the principal producers are: The Champion with a 40-stamp mill; Murchie, 20 stamps; Ousteamah, 10 stamps; and Mountaineer, 10 stamps. Most of these mills are run only intermittently, or at part capacity. As a gold producer, Nevada City is behind its neighbor. The Champion has been a great producer, and has been worked to a depth of 2400 ft. in the vein. It is known that there are bodies of ore below this depth, but with present pumping and hoisting facilities greater depths cannot be attained. The ground is now being partly worked by tributors. The company furnishes everything necessary for mining, and the tributors get one-half the gold obtained from the amalgamation plates. All the concentrates go to the company.

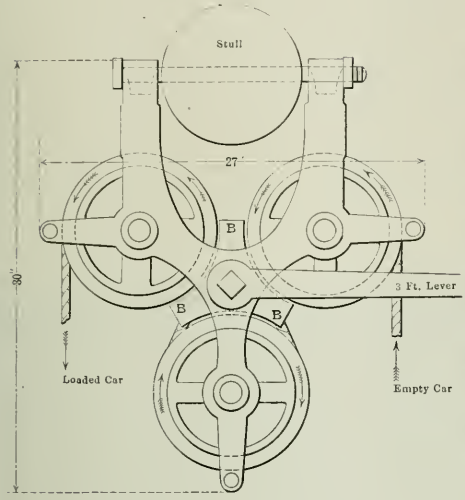
Methods of Mining

On account of the flatness of the veins it has been found necessary to adopt stoping methods differing from those usually employed in Western metal mining where the veins are more nearly vertical. The conditions approximate those found in the Rand, the stopes being too flat for the broken rock to run down the stope by gravity. Owing to this fact a system of mining has been evolved, particularly adapted to meet the conditions, and has been brought to a gratifying state of perfection. Shafts are in nearly all cases sunk on an incline to follow the vein, and hoisting is usually done in skips which automatically dump into receiving bins at the surface. Skips are loaded from bins built at the levels just below the level tracks and discharging by bottom gates into the skips below. The station bins are

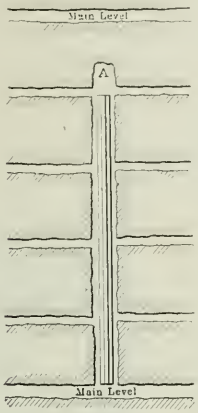
*Mining engineer, Reno, Nevada.

usually made in two compartments to accommodate waste and ore.

In earlier days levels were usually run rather close together so as to prevent excessive shoveling of material down the stopes. With present methods levels are usually from 300 to 400 ft. apart, and the rock is taken down the stopes by gravity tramways running up into the stopes. The system followed at the Empire mine is shown in an accompanying illustration.



"GO-DEVIL," FOR LOWERING BY GRAVITY



METHOD OF WORKING

The main level having been run, a raise is made near the center of the orebody and put through to the next level, or to within from 75 to 100 ft. of it. Auxiliary drifts are also started along the vein at intervals of from 75 to 100 ft. At a point just above the last intermediate drift is placed the mechanism which serves to raise and lower the cars in the stope. This consists essentially of two drums upon which the cables are wound and a brake wheel, the friction being regulated by means of a post brake. One drum is so arranged that it may be revolved in the shaft, or keyed to it as desired. This allows the length of rope to be regulated to suit the auxiliary levels.

A double track is laid down the raise and turn sheets placed at the intersection of the drifts and raises. Stoping is carried on simultaneously at the different drifts, and the ore is loaded into cars and trammed to the turn sheets, where it is lowered by the gravity tram. Short lengths of rails are placed over the turn sheets when lowering from drifts higher up in the stope. The cars on the tramway dump automatically into chutes at the main level.

By another method the driving of intermediate drifts is dispensed with, and stoping is carried on only at one face. The lowering drum may in this case be placed nearer the lower level. As the stope progresses the drums are carried farther up the stope, or may remain stationary, the cables being carried over pulleys just above the turn sheet. In this case the lowering drums must either be to one side of the track or high enough for the cars to pass under them.

The North Star System

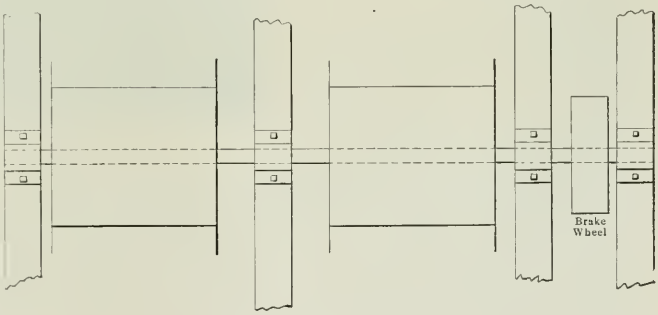
The method used at the North Star differs from that employed at the Empire. Raises are not run, except for ventilation, and work proceeds at one breast only. The cars are lowered in the stope by a device called a "go-devil." The accompanying sketches show, without much explanation, the system used. Above the level for from 30 to 50 ft., according to the pitch, the rock is shoveled directly into cars or into chutes from which the level cars are filled. The ore is rough-sorted in the stopes, and the waste is used for filling in behind as the stope advances.

At intervals, as desired, space is left in the filling for the placing of a double track extending up into the stope; chutes are placed at the bottom and arranged so that the stope cars in descending dump into them automatically. At a convenient distance above the level, depending upon the slope, a turntable is placed and tracks are laid to the chute. Tracks also extend in each direction from the turn sheet, the rails being so placed as to maintain the proper inclination for tramming in the stope. End-dump cars holding 1000 to 1500 lb. are used on these tracks, the ore being shoveled into the cars and the waste stowed below the tramway. The full cars are trammed to the turn sheet and then lowered by means of the go-devil, which is attached to a single stull directly above the turn sheet.

After the stope has advanced 30 or 40 ft. the auxiliary track and turn sheet are taken up and moved up the stope to make another auxiliary level, and stoping proceeds as before.

The North Star Go-devil

The go-devil, here spoken of, is the invention of Manager Foote, of the North Star mine. It is a patented article and is manufactured by the Taylor Foundry and Engineering Company, of Grass Valley. An acompanying sketch shows its construction and method of operation. The lowering cable passes around all these pulleys in the direction of the arrows. A central brake block is arranged to apply friction to all three of the wheels on which the rope winds. In lowering a car one man applies the brake by means of the lever arm which draws it against the wheels at *B B B*.



DRUMS FOR LOWERING BY GRAVITY

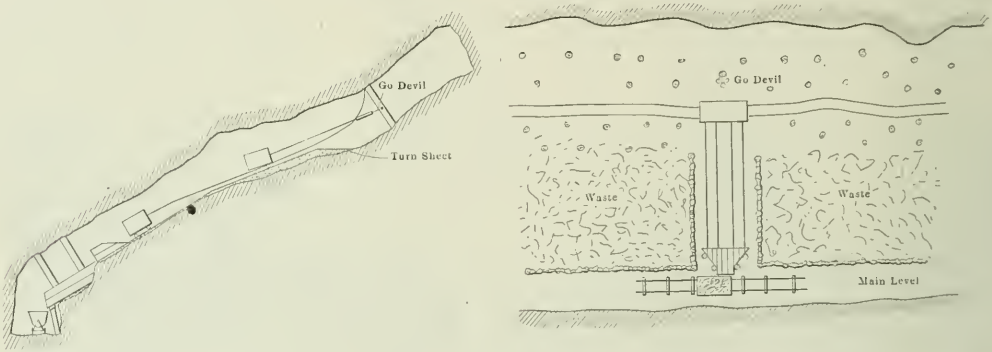
This contrivance has certain advantages over the drums previously described. It is less cumbersome, it occupies little space in the stope and requires only one stull for a support. The machine is so light that in changing from one auxiliary level to the next, one man can carry the whole thing. It has the disadvantage that in changing levels the rope must either be spliced or exchanged for a longer rope. If a long rope is used to start with it must be coiled up near the ends attached to the cars and is apt to be in the way.

BREAKING GROUND

Stoping is usually done with 2¼-in. piston machines. The veins are too flat to allow the general use of air-hammer drills without hollow steel.

At the North Star mine shooting is done only once each day, this work being performed by blasts after the regular shifts have quit work. The first shift starts at 7 a.m., and works until 3:30 p.m. The second works from 4 p.m. to 12:30 a.m. After this the blasters come in and shoot the holes. Two shifts are taken to a drift round, a one-man 2¼-in. machine being used. By this method the smoke nuisance is largely overcome, for men do not have to go to work directly after firing, and time is allowed for clearing the atmosphere.

The mines, as a rule, have to contend with considerable quantities of water, especially during the rainy season when much surface water finds its way under ground. Cornish pumps are generally employed, usually driven by water power. Aside from the original cost of installation and the amount of room occupied, they have given better satisfaction than the more modern types of pumps.



METHOD OF LOWERING ORE IN STOPES

The bill for the organization of a State Geological Survey in Massachusetts, introduced in the legislature of 1908, was referred to the legislature of 1909. Inasmuch as Prof. T. A. Jaggar, Jr., is about to start on a voyage, which will take him away from Boston for about eight months, the chances are that nothing will be done about the matter this year.

The precipitation of copper from its solutions by means of aluminum or zinc is not recommended in assaying low-grade ores by A. C. Claudet (*Bull. No. 50* I. M and M.) owing to the great difficulty of precipitating the last traces of copper. In rich ores this does not matter much, but in low-grade ores the obtaining of the last 0.01 per cent. becomes important.

An Important Amalgamation of Transvaal Mines

SPECIAL CORRESPONDENCE

The terms of a large amalgamation scheme, involving some of the more important and best known mines of the Central Rand, were announced on the eve of Christmas. A new company, to be called the Crown Mines, Ltd., is to be formed on July 1, 1909, to embrace the present Crown Deep, Crown Reef, Langlaagte Deep, and Robinson Central Deep, all producing mines, together with a large area of adjoining and deep-level claims. The new company will have a nominal capital of £1,000,000, divided into 2,000,000 shares of 10s. each, the market quotation for which is now nearly £7 per share. The nominal capital, therefore, will be curiously out of proportion to the real capital, which, according to the present market valuation, is in round figures £14,000,000. It is estimated that the company will own some 2000 intact mining claims together with the freehold of 2587 *morgen* of land. The present milling plant of the combined properties is equal to 137,700 tons a month, and an additional plant is to be erected, so as to increase the production to 150,000 tons a month. The prospectus of the scheme anticipates that profits to the extent of 130 per cent. or 13s. per share will be distributed annually, equal to 9 per cent. on the present market value.

The Crown Reef, Crown Deep, Langlaagte Deep and Robinson Central Deep will, of course, receive the bulk of the new capital, about 70 per cent. being allotted to the shareholders in these mines. The South Rand, a company owning ground to the south of the Crown Deep, and which is being developed through the shafts of that company, is to take 14 per cent. The Paarl Central and Langlaagte Royal take about 5 per cent., while the balance of 11 per cent. will go to the deep-ground owners and to sundry other interests.

An amalgamation of companies in this section of the Rand has been talked of for some time. The Crown Reef and the South Rand companies own detached claims lying on the dip of the Crown Deep and Langlaagte Deep, and it was obvious that to enable this ground to be worked economically some combination of forces was necessary. But it was not generally known that the amalgamation scheme would include such deep-level ground as that owned by the new Vierfontein mines and the South Deep, Ltd.; ground which, lying wholly outside the broken up area, was on a different footing. The necessity for the inclusion in the scheme of these very deep claims is not so apparent as in the case of the ground above. A compact block with a long life ahead could have been formed without them.

That criticism would be specially directed to this feature of the scheme seems to have been anticipated as the announcement of the terms of the amalgamation calls attention to the fact that for this very deep ground only 8.1 per cent. of the proposed stock issue is to be paid. As a percentage the figure seems small, but has a more important appearance when computed as cash. Inquiry will doubtless be made, if the information is not given officially, as it should be, as to what interest the promoters of the scheme and their friends held in this deep ground, and on what grounds this speculative property is being offered to the shareholders in the producing mines. It ought not to be lost sight of that the proposed scheme will extricate the owners of the deep claims from an embarrassing position. They obtain securities, which will be readily marketable and worth about a million of money, for property which costs a considerable sum in licenses to hold, and which will require a large expenditure and a long wait before any profit can be earned. A strong case must be made out

for the necessity of throwing these claims in with the better known ground above. It is not suggested that the claims are being put in at a figure beyond their value. No doubt the valuation put upon the ground is supported by professional opinion. The point is, are these claims necessary and would their inclusion be advocated if the promoting house or its friends were not interested?

This is not the first case where deep-level ground of speculative value, which carried heavy financial responsibility, has been tacked on to producing claims. It was only a short time ago that the East Rand producing mines were made to absorb a large area of ground of speculative value—ground upon which the development work done had been anything but encouraging. Another amalgamation of the same character is that now proposed for the South Nourse and Nourse mines. Shareholders in dividend paying mines take in a partner owning claims which, on account of the depth of the reef and the absence of development, are necessarily of uncertain value. Owing, however, to the conditions that prevail on the Rand the shareholders have in practice very little say in the matter. Amalgamation schemes are arranged for them by one or other of the financial groups, who, although occupying the position of trustees of the shareholders in the producing mines, are at the same time sellers, at a price which they themselves decide, of property in which they may be the sole or main proprietors.

The policy of amalgamation, now so much in vogue and in favor of which there is much to be said has created an unhealthy, if not dangerous situation, as it opens the door to an unfair disposal of unmarketable property. Amalgamation schemes, therefore, require the most careful scrutiny from the shareholders

MINERS IN TRUCK READY TO DESCEND, NORTH STAR MINE

may be pardoned for being suspicious that the reasons which the promoters urge so vigorously in behalf of their amalgamations, namely, long life and reduced costs, are not the sole reasons that inspire these proposals. It does not seem harsh criticism to suggest that the amalgamations are not always promoted entirely in the interests of the producing mines, but that they find favor because they release a financial house from a difficult position; and make marketable property which would otherwise be a white elephant. It is difficult to imagine, for example, the Nourse mines shareholders being particularly anxious to purchase the South Nourse property, the development of which has so far been disappointing. Neither would one expect a shareholder in the Robinson Central Deep or Crown Deep to be keen to acquire Vierfontein or South Deeps claims. Such shareholders would probably prefer to keep what they have to themselves rather than to in the producing mines, especially in cases where deep-level claims, which have no chance of being productive for a long period ahead, are proposed for absorption.

The main arguments used in favor of amalgamations are those of long life and reduced costs—all sound arguments, but arguments that can be overdone. The great plan in the argument of long life is the assumption that values will continue much as they have done in the past. There are few mines with ore reserves developed more than three years ahead of the mill. Beyond that the values are to some extent problematical, yet the continuance of payable ore is assumed with composure, and estimates of production made for 20 or 30 years ahead.

The principle underlying all these amalgamations is that the shareholders in the mines with short lives and with profits that can be closely estimated, will receive an equivalent dividend or annuity spread over a longer period with the advantage of enhanced profits due to economy gained by working on a larger scale. As pointed out above, the calculation of the profits over the long period is not based on data of the same reliability as in the case of the mine with a short life, and consequently the reconstruction of the investment carries with it the element of speculation In making this criticism on amalgamations, it must not be understood that the writer wishes to attack the Crown mines' scheme. With the exception of the inclusion of the very deep claims—the necessity for which seems doubtful—the scheme appears to have been fairly prepared. When the reports of the engineers are published—they are due to arrive in February—further criticism may be necessary. But from the information available a good case for amalgamation appears to have been made out and a fair valuation put upon the various interests involved. A scheme of this magnitude must have been difficult to arrange, and the promoters are to be congratulated on their success. It may be assumed that they have obtained the approval of the principal shareholders and there is little reason to doubt that the scheme will be carried out, although, of course, it has still to be formally confirmed by the shareholders of the different companies concerned.

Refunds of Payments for Surveys

SPECIAL CORRESPONDENCE

On Jan. 28 the House of Representatives passed with some minor amendments the Englebright bill for the relief of applicants for mineral surveys. The bill reads as follows:

"Be it enacted, etc., That the Secretary of the Treasury be, and is hereby, authorized and directed to pay, out of the moneys covered into the Treasury from deposits made by individuals to cover cost of work performed and to be performed in the offices of the United States surveyors-general in connection with the survey of mineral lands, any excess in the amount deposited over and above the actual cost of the work performed, including all expenses incident thereto for which the deposits were severally made. Such repayments shall be made to the person or persons who made the several deposits, or to his or their legal representatives, after the completion or abandonment of the work for which the deposits were made, and upon an account certified by the surveyor-general of the district in which the mineral land surveyed, or sought to be surveyed, is situated and approved by the Commissioner of the General Land Office."

It is estimated by the Land Office that the total amount payable under this measure will be about $60,000. This sum will

go in small amounts to a considerable number of persons who have heretofore been unable to collect owing to lack of power in the administrative authorities to make payment.

The Gold Deposits of French Guinea

For some years the goldfields of French West Africa have attracted considerable attention in France; this was especially so in 1908. The administrative division of French Guinea consists of the following colonies: Ivory Coast, Dahomey, Guinea, Sénégal, Upper Sénégal and Niger, and Mauritania; viz., the colonies of the west coast, Congo alone excepted.

The deposits of Upper Guinea, which are practically all located in the district of Siguiri, have been examined by many mining companies. This mining camp may be easily reached from Bordeaux, via Dakar. From Dakar the traveler goes by rail to St. Louis in Sénégal (264 km.); thence by steamboat up the Sénégal river to Kayes (900 km.), a journey of 5 to 6 days; again by rail to Bamako (496 km.) and then by boat on the Niger river to Siguiri (300 km.). The total distance between Bordeaux and Siguiri, which is 6200 km.—4300 on sea, 760 on rail and 1200 on river—may be covered in 20 to 25 days at the time of high water; August, September and October.

The gold deposits of that part of the world were lately described in a lecture given in the hall of the Société de Géographie, of Paris by Commandant Villiaume, who examined much of this area during the years 1905 to 1908. According to him, the gold deposits of eastern Guinea have, generally speaking, many features in common with the gold veins of Rhodesia and some other African goldfields, the conglomerates of the Rand, of course, being excepted.

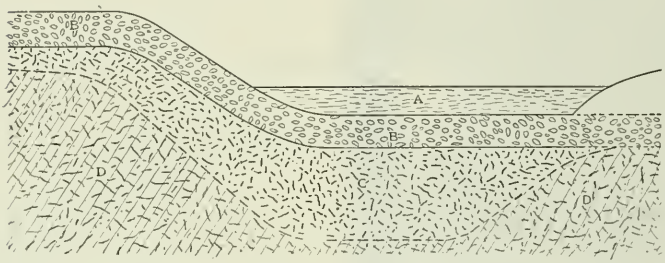
Most of the region is underlaid by old clayey sediments changed by an intense general metamorphism into banded crystalline schists and slates that dip at a high angle. The strike of the rocks which is about northeast-southwest is quite uniform throughout the goldfields. The deposits are closely related to the eruptive rocks, such as granulites and diabases, which have the same direction as the schists and slates and which can be followed for more than 1000 km. Probably the eruptive rocks are the source of this gold and the deposits were formed by circulating waters that collected the gold. In fact the closer the deposit is to the eruptions, the richer it is.

All the rocks, especially the crystalline rocks and slates, down to permanent water level are decomposed into an earthy and brittle material called laterite. These shales are protected against complete destruction by a ferruginous conglomerate which covers immense areas characterized by extremely poor vegetation.

The country is very flat but presents some depressions which owing to the concentration of gold in them are of special interest from the mining view-point.

The accompanying ideal cross-section, as presented by Commandant Villiaume, gives a fair idea of these auriferous depressions. Stratum *A* consists of barren clay; excellent bricks are made from this and used for building houses for the European staff. *B* is the ferruginous conglomerate which is always water-laden. The section shows how it connects with the part exposed at surface by erosion. The conglomerate varies in thickness from 1 to 10 m. It is very hard at surface where it has been dried by the tropical sun, but below surface it is much softer. It was lately found to be auriferous in the depressions or close to them. The soft portion proved to be the richest part, containing in places as much as 12 grams per cubic meter (about $6 per cubic yard). *C* is the auriferous laterite, saturated with water. Its thickness varies from 1 to 16 m. The gold is distributed fairly regularly through it. *D* is barren laterite.

The width of these depressions generally varies from 30 to 150 m. The main valleys or depressions are 25 to 60 km. long, while the secondary ones are only 2 to 10 km. long.



IDEAL CROSS-SECTION OF AURIFEROUS DEPRESSION IN FRENCH GUINEA

A is barren clay; *B*, ferruginous conglomerate; *C*, auriferous elaterite; *D*, barren elaterite.

Among the many others who sent prospectors to Guinea, two companies—the Compagnie Minière de Guinée and the Compagnie des Mines de Siguiri—have begun to work their properties and are installing machinery to ascertain the best way of treating this auriferous clay. They have done considerable work in drilling or sinking small pits to test their property, in preparing roads for transporting the heavy machinery and in getting wood for burning under the boilers. They have also had to provide the necessary supply of water for washing the auriferous laterite.

In Kobako valley the Compagnie Minière de Guinée will dig the laterite with two excavators of the ladder type each having an estimated capacity of 500 cu.m. per day of 10 hours. One excavator will dig out the ferruginous conglomerate while the other will work on the laterite proper. Ore will be delivered to a movable washing plant consisting of a big revolving screen of special design for completely disintegrating the material, a 10-in. centrifugal pump delivering water inside the screen, a 12-in. centrifugal slime pump, a 100-h.p. vertical engine and a water-tube boiler of the portable type. This plant is placed on a platform mounted on eight wheels, and will follow the excavators as the work progresses. The oversize from the screen, which consists mainly of gold quartz, is loaded into cars and trammed to the milling plant, equipped with a Dodge crusher, a Huntington mill, 3 ft. 6 in. diameter, and silvered copper plates. The undersize is elevated by the 12-in. pump to a sluice box. At the head of the sluice, for experimental purposes, are placed two gold-saving tables of the Turner type fitted with cocoanut matting and expanded metal.

The Compagnie des Mines de Siguiri is to work its Fatoya hill property. Small canals fed by a centrifugal pump will transport the ore to a system of sluices with undercurrents. The quartz separated by means of grizzlies will be crushed and amalgamated in two milling plants, both similar to the one erected by the Compagnie Minière de Guiée. These plants are expected to be ready to run early in 1909.

The H. W. Johns-Manville Company, of New York, is introducing a chemical compound, called Leak-No, which resembles powdered iron, and when mixed with water and applied like putty to cracks, or other defects, in iron or steel articles, metallizes and becomes a permanent part of the article to which it is applied. When hard it much resembles iron in color. The manufacturers offer to refund the purchase price in case it fails to stop any ordinary leak in anything made of iron or steel against any pressure of oil, steam, gas, air, ammonia or water; and to stand any heat or chemicals that iron will stand, when applied according to directions.

The East Tennessee Zinc Mining District

The Dolomite in Which the Mineral Is Found Is Abundant and Easily Worked, but It Is Too Low-grade for Small Operations

BY SAMUEL W. OSGOOD*

The zinc district of east Tennessee was mapped in the years 1896 to 1901 and is described in folios issued by the U. S. Geological Survey at the time. The maps gave the district in general three nearly parallel zinc belts extending through Tennessee for 40 to 50 miles and about 20 miles apart. These belts are each only a few hundred feet wide and extend in a northeast-southwest direction, following the general strike of the Appalachian system of folds and faults.

The ores are contained in the Knox dolomite, a soft, easily broken rock, lying between Silurian and Cambrian strata In places local disturbances have given rise to cross-fissure zones of fracture. In these zones are the richest orebodies. The ores are sulphides and they occur in the filling of the fracture zone or breccia continuous with calcite and dolomite and not in the rock. No barytes is present in these ores in the rocks. Where the clay and sand of the surface is 20 to 30 ft. thick, carbonates and silicates are found to overlie the sulphide ores.

The central belt occupies the valley of the Holston river, and is called the Holston Valley zinc belt. This belt has ores containing zinc with no lead and less than 0.5 per cent. iron. The more northerly orebodies near the Powell river and the southerly belt near the French Broad river carry both iron and lead.

The Straight Creek mine and "Lead Mine Bend" mine are two properties on the northern belt, only one of which, the Straight Creek mine, is now operating. It is with the central belt that this article is principally concerned, for on this belt are the most extensive operations owing to accessibility to the railway, and to the simple nature of the ores which are more easily treated.

The Holston Valley zinc belt is about 40 miles long in a northeast-southwest direction and from 50 to 700 ft. wide. Knoxville is about in the center of the belt. The Southern Railway's double-track line between Washington and Chattanooga traverses almost the entire length of the belt, hauling large amounts

BLENDE QUARRY, VALLEY ZINC MINE

JOLLY FARM MINE

CONCENTRATING MILL, HOLSTON ZINC COMPANY

HOLSTON ZINC COMPANY GRAVITY TRAMWAY

*Consulting mining engineer, Chicago, Ill.

of Tennessee coal from near Knoxville to the coast.

Character of Ore

Carbonate ores have been shipped from the district for many years. They occur in a bed of red and yellow clay overlying the dolomite containing the yellowish blende. The shipments of carbonates have been spasmodic and the future of the district will no doubt depend largely on the success of treating the sulphide ores.

The east Tennessee zinc ores, while remarkable for their chemical purity and freedom from the undesirable iron and lead minerals usually found in zinc ores, have never until recently been of much commercial importance owing to the low grade of the ore and the methods of milling. Actual results show that the cause for the lack of success was the small daily capacity of the plants, the hand-sorting of the ores bringing the cost per ton of ore treated to an abnormally high figure. The crude method of building the mills also made steady, daily operation over long periods impossible because of frequent and costly repairs.

The blende, while in large bodies of a brecciated rock, occurs in bunches or small seams as a filling in the breccia, of the fissure zone. The ore has in the past always been hand-sorted to give a mill feed assaying from 8 to 12 per cent. zinc Recently, however, it is thought to have been demonstrated by large commercial operations that the entire brecciated mass can be mined and milled on a large scale in a modern concentrating mill, maintaining a fair grade of product.

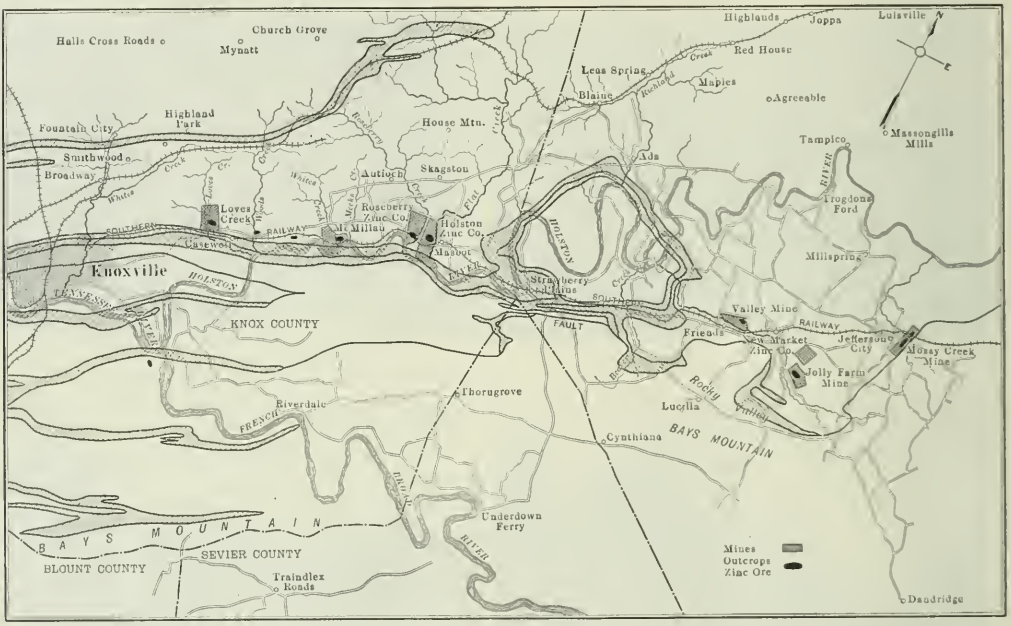
Methods of Working.

The first mining and milling of the zinc blende ores on any considerable scale was undertaken by the Edes, Mixter & Heald Zinc Company, in 1883 at Mossy creek Jefferson City. This first mill was erected to wash the dumps of blende cobbed from the carbonate ores, and was so successful that in 1885 an 80-ton mill, including crusher, rolls and jigs was erected. This mill treated hand-sorted ore from a large quarry for several years. It was closed in the panic of 1893, but was re-opened by the John Weir Lead and Zinc Company in 1900 and operated for a few months. The small daily capacity and the crude equipment brought the costs per ton so high that the mill was closed after a few months.

The second of these small, unsuitable mills was erected by the Ingalls Zinc Company, about 1½ miles southeast of New Market in 1898. The ore was quarried from near the surface. Here again the ore was hand-sorted, the capacity of the mill being small like that on Mossy creek. The ore was hand-sorted to about a 12-per cent. zinc before milling, and a high-grade concentrate was shipped, but the operating costs were very high per ton of ore mined, the cause being simply the inconvenient methods for handling too small a daily tonnage.

The third of these small mills was built by the Roseberry Zinc Company, about 1½ miles west of Mascot in 1900. This mill was an advance on former plants, but the ore was still hand-sorted in the quarry, one car of waste being secured for each car of ore. It was one of the inefficient, old-style Joplin mills of small capacity; but it shipped many carloads of high-grade zinc concentrates. The capacity was low, the mill inefficient and poorly built for continuous operation; consequently the costs per ton were again too high for commercially economic results. The ore was mined in a quarry at first and later a shaft nearly 200 ft. deep was sunk and mining in stopes was begun.

The fourth of the small mills was built by the Holston Zinc Company about ¾ mile west of Mascot in 1903, and this was another advance, especially in the development of a more elaborate jigging system. This mill was, however, of small capacity, and the ore was still hand-sorted in the quarry. In 1905 the shaft was sunk to 180 ft. and underground stope mining was started and milling done with no hand-sorting, which showed another advance. At this time a few slime tables were also added to the mill equipment. The daily capacity of the mill was small, the operation not in experienced hands and the costs per ton relatively high.



MAP OF KNOXVILLE ZINC BELT

The Holston Zinc Company's mill was partially re-equipped in 1907 along lines suggested by A. M. Hewlett, the president of the company, and operated under my management. Mr. Hewlett's untimely death in 1907 had much to do with the Holston Zinc Company's failure to complete the re-equipment of this mill. However, the plant was operated in its incomplete state for several months, and shipments of concentrates were made on a scale not possible before that time in the east Tennessee zinc districts. This showed at once the correctness of Mr. Hewlett's judgment in demonstrating on a commercial scale that all it required to make a success of the Tennessee zinc ores was large capacity to reduce the "per ton" cost, a mill elaborate enough to save the zinc in the ore and of a sufficiently stable construction for continuous daily operation.

The last year's operations on the Holston zinc belt include, besides those of the Holston Zinc Company, the shipments of carbonate ores and prospecting of its blende ore deposits by the New Market Zinc Company and prospecting on the Ingalls or Jolly Farm mine southeast of New Market.

Operations in the District.

At the Holston property the ore is mined at a depth of 160 ft. in large stopes 50 or 75 ft. wide and carried to a hight of 40 ft. Another level has been started above, and drifts have been started to allow of stoping at a considerable distance from the shaft. This will allow the use of a caving system making it unnecessary to strip the 70 ft. of clay and soil on the surface to get at the ore where it comes to the top of the rock below the soil. Mining is done by machine drills.

In this mine all rock is taken from the stopes for the entire width, no hand-sorting being done. All ore is dumped into the crushing plant and sent from there to the mill. The mill has three departments, a rougher department from which a large amount of the waste rock formerly picked out by hand is sent to the tailings dump, and both a coarse and fine finishing department.

The New Market Zinc Company operates on a large tract of land southeast of New Market on Lost creek where it has developed what appears to be one of the largest bodies of zinc-carbonate ores in the district. The company started operations about two years ago and after extensive development work began shipments last fall.

The Roseberry Zinc Company started operations in 1900. Ore was quarried, hand-picked or sorted and sent to the crude Joplin mill. In 1904 the company made the first successful attempt to develop the Tennessee orebodies by drilling as had been done in Joplin. The drill disclosed a large orebody which was opened by sinking a shaft 200 ft. deep. The ore was mined in large stopes with machine drills. The ore was only roughly sorted as fed to the mill.

During the last year on the Ingalls or Jolly Farm property a new orebody has been prospected about one-half mile northeast of the old works.

A quarry or open pit has been made 165 ft. long and 40 to 50 ft. wide. The orebody was found at the surface, and over the area it has been opened 10 to 15 ft. deep. The orebody has a slight dip, being nearly horizontal, and is said to be 600 ft. wide. The ore is in a brecciated zone and several seams of blende of a foot to several feet in width will average high in zinc, although no doubt the entire orebody will average much lower, probably about the same as the rest of these ores when mined on a large scale.

The old works of this property consist of an open pit or quarry where the blende was mined for treatment in a small concentrator. The ore was mined and sorted in the quarry and hauled up an inclined track by a small hoisting engine. It was dumped upon a platform to be again hand-picked and then fed to the crusher. There were two quarries, 80 ft. wide by 100 ft. long and about 50 ft. deep. An old mill run shows that 500 tons of hand-sorted ore yielded 52 tons of concentrates assaying 53 per cent. zinc, which is very fair considering the crude equipment of the mill.

The Valley mine is the best looking of the partially opened but inoperative mines of the belt. This mine is at Friends on the Southern Railway, 14 miles from Knoxville. The orebody is opened by an open quarry, about 50 ft. long, 15 ft. wide and 10 ft. deep. The quarry is near Lost creek and the blende appears at the surface of the ground where the creek has washed away the soil. The ore occurs in a brecciated fissure zone and is in appearance identical with the Mascot and New Market ores. Carbonate ores have been shipped from the clays of the subsoil on adjoining properties, which seems to indicate a large orebody on this property.

The Loves Creek Mine

The Loves Creek mine at Loves creek five miles from Knoxville was partially explored several years ago and good ore was found. A 50-ft. drill hole showed ore all the way to the bottom. There is a good mill site with ample water for milling and good surface indications. This is at present among the inoperative properties, but the owners expect to develop it into a mine.

Improved Methods Necessary

Throughout the entire length of the zinc range from Knoxville to Jefferson City, wherever a creek has washed its way through the soil in crossing the ore zone good blende may be seen in the bed of the creek. The commercial possibilities of the district have been proved by the many carloads of high-grade blende concentrates carrying from 50 to 56 per cent. zinc and the carloads of high-grade carbonate ores which have been shipped. That the milling of these ores has been successfully accomplished has been shown in the case of the Holston mill; it remains but to provide sufficient capacity in the mill as designed to eliminate overcrowding of the individual machines. Overcrowding causes loss because the ore as it flows automatically through the mill by gravity after being ground and mixed with water must remain on each machine long enough for that machine to get the concentrates out of it. If the machine is crowded the ore stream flows across too quickly for this to be accomplished and losses occur which reduce the total efficiency of the mill as well as the grade of the concentrates.

From 100 tons of ore assaying 3.7 per cent. zinc, 3.7 tons of concentrates assaying 52 per cent. zinc were produced, representing a 52-per cent. mill efficiency. The efficiency of the coarse departments was 65 per cent. and with added capacity in the fine department it should be easily possible to increase the efficiency to above 65 per cent. which is a high efficiency for a zinc-concentrating mill on these ores. The efficiency on all sizes up to 60 mesh was above 65 per cent. and frequently as high as 81 per cent., but on the sizes below 60 mesh the losses were great.

The Remodeled Holston Mill.

During seven months after the mill was overhauled in 1905, 239.5 tons of concentrates were shipped assaying from 49 to 59 per cent., and averaging 56 per cent. zinc. Since Holston zinc ores contain no lead or iron they are very desirable for use in making high grades of spelter.

While the grade of concentrates produced during the seven months' run of the mill was highly gratifying, the daily capacity was not satisfactory. The tonnage treated during this period averaged 38 tons per day, at the rate of 6 tons per hour for 6⅓ hours per day. The faulty construction of the mill required frequent stoppages, giving an average of only 6 1-3 hours operation per day out of a possible 12 hours. The efficiency of the mill was low because of the lack of the proper facilities for treating the large proportion of fines made in the rolls. There were four Card tables, but owing to the lack of other accessory apparatus and the lack of experience in the use of them, a low percentage of savings was made on the fine sizes. A large proportion of the

concentrates consisted of very coarse sizes.

The machines required for each 100-ton capacity were from a study of this mill found to be as follows: one bull jig, six finishing jigs, three coarse concentrating tables of Wilfley type, and one slime table. This is allowing 10 tons per day per jig capacity for the coarse sizes, 10 tons for the moderate sizes and 8 to 10 tons for the finer jig sizes; also allowing 12 tons per day capacity for two Wilfley tables and one table extra to retreat the middlings; also allowing one slime table of a capacity of 10 tons.

In short, a detailed study of the practical operation of milling Tennessee zinc ores based on the actual performance of this mill when treating ore at the rate of 175 tons per day shows that it can be made commercially successful. On the same basis of machine capacity, jigs are to be added to bring the total capacity of the mill up to 300 tons per day. Such a mill will make at least 11.1 tons per day of concentrates from a 3.7-per cent. ore, and of a grade at least 56 per cent. and more probably 58 to 60 per cent. Based on the actual cost of operating a 125-ton plant, it is estimated that the operating costs will be $312 per day for a 300-ton mill and mine.

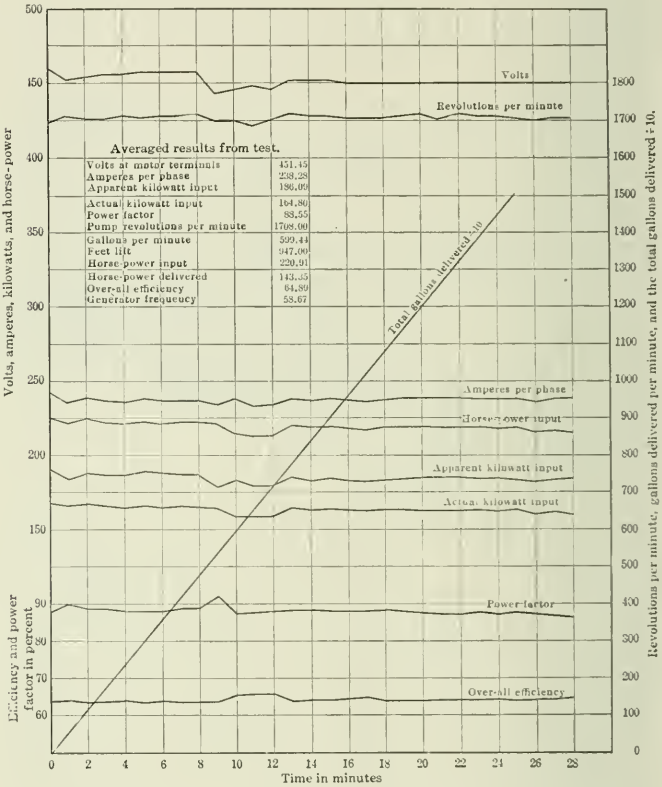
Motor Driven Centrifugal Pump for Mine Use

By Cyrus Robinson*

Many mine superintendents have a strong prejudice against centrifugal pumps for underground work. The troubles that have arisen with centrifugal pumps have been very frequently the selection of low-volume, high-head turbine pumps, and of motors not specially designed to work under the varying voltage usual at mines. A turbine pump is quite sensitive to changes of speed, and unless properly designed, a great deal of trouble is experienced in losing the water column whenever there is a sudden drop in speed due to a change in voltage. On account of this prevailing prejudice against centrifugal pumps for mine use I am giving in this article the results of some tests made upon a Sulzer pump at the Ojuela mine of the Compañia Minera de Penoles at Mapimi, Mexico.

In placing the order for this centrifugal pump in July, 1907, I made provision for the conditions to be met with for I specially emphasized the varying voltage, the hight of lift, volume of water to be delivered and the efficiency to be guaranteed under these conditions in the following specifications: The pump shall be a six-stage Sulzer pump directly connected to the motor. The permissible variation in speed shall be between 1750 and 1770 r.p.m. on account of fluctuating voltage which may vary between 400 and 460 volts. The total lift including suction, pressure and pipe losses, against which the pump must work, is 1020 ft. The amount of water to be raised shall be from 600 to 760 gal. per minute, according to the speed. The motor shall have an output of from 223 to 290 h.p., according to the amount of water delivered. The pump shall be built for direct connection to the motor, and shall be made of special cast iron, while the impeller and the guide wheels shall be of bronze, and the shaft of special nickel steel. This pump shall be delivered complete with foundation plate and bolts, pressure gage, priming funnel, elastic coupling, air and drain cocks, complete set of wrenches, one water gate, 7 in. in diameter equipped with a bypass, one check valve 7 in. in diameter, and one strainer with foot valve 7 in. in diameter.

The motor shall be of the slip-ring induction type, manufactured by the Allgemeine Electricitäts Gesellschaft, and directly connected to the pump. It shall be so designed that the speed shall not fluctuate more than from 1750 to 1770 r.p.m. when the voltage varies between 400 and 460 volts. It shall use a three-phase, 60-cycle current and shall deliver 300 h.p. under the voltage stated. This motor shall be delivered complete with foundation plates and bolts, slide rails and ratchets to facilitate mounting and dismounting, as well as elastic coupling for connecting it with the pump. A rheostat shall also be furnished, as well as a switchboard panel (a marble slab with iron frame), on which shall be mounted a bracket with a lamp and shade, one ammeter, and one three-pole switch, with fuse holders and three fuses. The pump shall be guaranteed to work at an efficiency of 70.5 per cent. when the total lift is 1020 ft. and the pump is delivering 600 gal. per minute; and an efficiency of 68.5 per cent. when delivering 760 gal. per minute, against a lift of 1020 ft.; or in other words, with a voltage fluctuating between 400 and 460 volts, and delivering



TEST NO. 6 OF SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO

*Consulting engineer, 82 Beaver street, New York City.

volumes of water between these limits, the pump shall work with an average efficiency between 69.5 and 70 per cent.

The Pump Tests

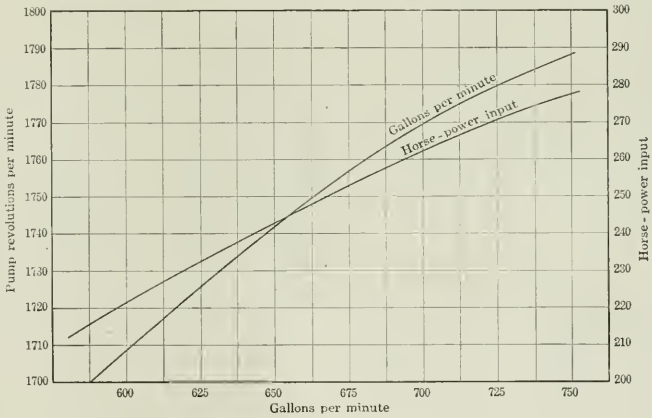
After this pump had been in operation for some time, C. C. Hoke, mechanical engineer at Mapimí, made several tests on it. The water was measured by noting the fall in tanks having a regular cross section and whose capacity was 508.7 gal. per inch of depth; the suction of the pump was connected to these sumps. The delivery head was calculated from the pump pressure gage, and to insure accuracy the gage was calibrated between tests No. 5 and No. 6 and further checked against the actual head plus calculated friction of delivery. The results of these tests are given in an accompanying table, and a curve of test No. 6 is given as that test is representative of the general conditions. In another curve the variation of pump delivery at different speeds is shown. The accompanying illustration shows the pump that was tested, but as finally installed a more flexible coupling than the one shown was used so as to give a certain elasticity between the motor and the pump.

The temperatures of the motor and bearings were as follows: Stator laminations, 60.2 deg. C.; stator windings, 61.4 deg.; rotor winding, 54.5 deg.; bearings (oil temperatures), 65.5 deg.; temperatures of air, 29.1 deg. Centigrade.

The efficiency obtained compares favorably with the best type of triplex, geared pumps, including motor, and if the volume of water handled were increased with the same head, using, of course, a larger pump, the efficiency would be still better, but conversely if the volume of water is smaller, the efficiency would decrease. As illustrating this point, tests on a similar pump delivering 200 gal. per minute against a head of 600 ft. showed an efficiency of less than 45 per cent. Consequently, in deciding upon the type of pump to install it is evident that careful consideration must be given to the volume and the head. Failure to do this and to include in the specifications a provision that the pump must be designed to work under a varying voltage has been a source of a great deal of the difficulty met with in using centrifugal pumps for mine work.

TESTS OF SIX-STAGE ELECTRIC-DRIVEN SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO.

Number of Test.	Date, 1908.	Duration of Test. Min.	Duration of Test. Sec.	Pump Revolution per Minute.	Water Delivered in Gallons.	Water Delivered per Minute in Gallons.	Head in Feet.	Theoretic Delivery in H.P.	Current in Each Phase in Amperes.	Voltage at Motor.	Generator Frequency.	Apparent Input in Kw.	Actual Input in Kw.	Power Factor.	Iuput in H.P.	Efficiency of Pump and Motor Combined in Per Cent.
1	Sept. 14	24	43	1784	18,189.8	735.98	948.5	176.27	283.13	467.27	60.06	228.88	203.92	89.08	273.26	64.47
2	Sept. 14	25	53	1770	18,183.2	702.50	948.0	168.17	286.70	452.90	60.33	224.65	198.23	88.24	266.67	63.05
3	Sept. 15	15	0	1766			957.0		289.40	417.87	60.00	209.21	184.91	88.39	247.87	
4	Sept. 15	26	30	1765	18,181.6	690.44	948.0	165.28	288.48	429.77	60.00	214.91	192.62	89.80	258.12	64.04
5	Sept. 15	26	2	1769	18,183.2	698.45	948.0	167.20	307.38	411.18	60.00	218.64	196.12	89.71	262.80	63.62
6	Sept. 28	25	15	1708	15,176.0	599.45	947.0	143.35	238.28	451.45	58.67	186.09	164.80	88.55	220.91	64.89



TESTS OF SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO

Curves showing relation between revolutions per minute and gallons per minute, and horsepower required to motor terminals at various deliveries against head of 948 feet.

The Anthracite Miners' Demands

The demands of the anthracite miners, as formulated at their district convention, and now amended and approved by the general convention of the United Mine Workers at Indianapolis, are as follows:

"First—That an agreement shall be negotiated between the representatives of the miners and the operators of the anthracite region, and all disputes arising under the contracts shall be adjusted as provided for in the said agreement.

"Second—We demand the complete recognition of the United Mine Workers of America as a party to negotiate a wage contract, and that the United Mine Workers of America shall be recognized in our right to provide any method we may adopt for the collection of revenues for the organization.

"Third—That we demand an eight-hour day with no reduction in wages.

"Fourth—That all coal shall be mined and paid for by the ton of 2000 pounds.

"Fifth—That we demand a definite and more uniform scale of wages and prices for all classes of labor at all collieries in the anthracite region; and that all employees paid $1.50 or less per day shall receive a 10 per cent. advance, and all employees paid more than $1.50 and less than $2 per day shall receive a 5 per cent. advance.

"Sixth—That the system whereby a contract miner has more than one job, or employs more than two laborers, be abolished.

"Seventh—That the employers be required to issue uniform pay statements, designating the name of the company, the name of the employee, the colliery where employed, the amount of wages, and the class of work performed.

"Eighth—That the contract shall be made for a period of one year."

The convention authorized the levying of such assessments as may become necessary to assist the anthracite miners, in case a strike should follow rejection of these demands.

It is understood that they will be presented to the anthracite companies shortly by a delegation headed, or accompanied, by President Lewis of the United Mine Workers. This will bring up at once the question of a full recognition of the union. It is not at all probable that these demands will be accepted by the companies, and a prolonged discussion will certainly follow. Whether terms can be made by April 1, when the present agreement will expire, is not by any means certain.

Disposal of Phosphate Lands

SPECIAL CORRESPONDENCE

How to dispose of the phosphate land question is proving exceptionally troublesome to Congress. Two distinct plans for settling the issue have been proposed. One is that of retaining the lands in Government ownership, leasing the phosphate mining rights to individuals, while the other is that of restoring them to private ownership subject to distinct provisions as to the law under which they may be patented. At a hearing before the House Committee on Public Lands, the latter idea has been urged by Judge S. E. Payson in behalf of owners of 36 or 37 locations under the lode land law upon the phosphate territory in Utah and Wyoming. When the rock was discovered, geologists were sent out by capitalists to determine its condition and extent, and at the outset a serious question presented itself to the legal advisers of locators. This related to the form of the location, whether it should be under the lode law or under the placer law since all mineral lands come within the scope of one or the other classification. Attorneys for some of the locators advocated a resort to the lode location system while those representing other locators came to the conclusion that the placer location was the proper form and thereupon proceeded to locate, some as placer and some as lodes. The first case which came before the Interior Department for decision was one known as the Waterloo placer and it was decided that a placer location was the proper form. The Waterloo claim, therefore, went to patent as a placer claim for some of the phosphate land. Later a formal opinion was rendered by the land office that a lode location was the proper method. Then a number of claims went to patent. Everything has been suspended by reason of the action of the President under his order withdrawing these lands last December. Local land offices are refusing to issue patents for land until further orders from the Department of the Interior. The argument of the original locators is that existing law ought to be continued with reference to all these deposits and that the patenting of each deposit should depend upon the character of it as that is made to appear where an application for patent is made. It is their contention that nobody is harmed by a continuation of existing law. As to the locations heretofore made, they have recommended a curative statute designed to protect the original discoverer no matter what the form of his location may be.

It is argued that there is no difficulty in determining whether a given prospect must be treated as a placer or as a lode location. When a lead of underlying rock is found which carries a mineral worth mining and reducing and under that a rock of the country the location must be taken as a lode. In mining the phosphate rock, the process is not carried on for the rock itself but for the mineral which is contained in it. Hence, it is argued, under the old statute passed 40 years ago, which provided that wherever any rock in place carries with it a mineral of value it must be taken under the lode location while a distinction must be drawn between phosphate rock and marble and limestone or any kind of building stone. The latter may be taken as placer because there is no mineral included.

The real question for discussion is recognized as being whether a change is now advisable, taking into account the facts that the law of extralateral rights has been in force for over 40 years and also for many years previous as a part of the miners' rules and customs, that all metal mining except iron in the western States is carried on under it, and that no extralateral rights acquired during that period could be abrogated by any changes but must continue to exist according to the law at the time of their initiation.

Senator Flint, of California has introduced a bill (Senate 8804) for the same purpose as that suggested some days ago by Senator Smoot but containing a number of new provisions. The bill directs that the Secretary of the Interior shall, after examination and classification of any public lands heretofore withdrawn because of deposits of phosphates supposed to exist thereon, restore to entry, selection, and location any such lands as may be found not to be valuable for the deposits of phosphate. In cases where the lands are actually valuable for their phosphate deposits the Secretary of the Interior is directed to clear the title of all invalid mineral entries, claims, and locations. He is then to issue to citizens of the United States or those who have declared their intention to become such, leases or licenses to work the phosphate deposits belonging to the United States, on such terms and conditions as he may deem proper, or as may from time to time be directed by Congress, provided that the leases or licenses shall be on such terms as will insure the proper development of the deposits, prevent monopoly, and secure disposition of the output at reasonable prices, and that none of such leased deposits, or of their products either in their original or manufactured form, shall be exported from the United States. Any violation of this provision by the lessees or licensees, their assignees or grantees, shall work an immediate revocation and forfeiture of the leases or licenses, and the person or persons so violating the proviso may, upon conviction be fined not over $1000 for each offense.

In all patents for lands henceforward to be issued there is required to be a reservation of all deposits of phosphates, together with the right on the part of the Government to enter upon or mine under the land in accord with such rules and regulations as will insure surface owners from loss or damage, or will reasonably compensate them. An important provision relating to the application of the placer and mineral lode law is set forth in section 6 which requires that "where lands containing deposits of phosphates have heretofore been located under the placer laws, or laws providing for the entry of mineral lode claims, said locations may be perfected under the provisions of said laws, but no title acquired to lands containing such deposits under the mineral lode laws shall give the locator or entryman any right beyond the perpendicular limits of his claim: Provided, that in case of any conflict between locators under the placer laws and the mineral lode laws no locations heretofore made of lands containing valuable deposits of phosphate or phosphate rock the respective claims of the locators shall be determined as though location of said lands under either of the was valid when made.

Coal Land Locations

SPECIAL CORRESPONDENCE

The House Committee on Mines and Mining on Jan. 29 reported favorably the Mondell bill relating to the patenting of coal lands. The bill as now before the House reads as follows, amendments being in italics:

"That any person who has in good faith heretofore located, selected or entered under the nonmineral-land laws of the United States, any lands which subsequently are classified, claimed or reported as being valuable for coal, may, if he shall so elect, and upon making satisfactory proof of compliance with the laws under which such lands are claimed, receive a patent therefor, which shall contain a reservation to the United States of all coal in said lands, and the right to prospect for, mine and remove the same. (*The coal deposits in such lands shall be subject to disposal by the United States in accordance with the provisions of the coal-land laws in force at the time of such disposal.*) But no person shall enter upon said lands to prospect for, or mine and remove coal therefrom without previous consent of the owner under such patent, except upon such conditions as to security for, and payment of, all damages to such owner caused thereby as may be determined by a court of competent jurisdiction. Provided, that the owner under such patent shall have the right to mine coal for use for domestic purposes on the land, prior to the disposal by the United States of the coal deposit. Provided further, that nothing herein contained shall

be held to affect or abridge the right of any locator, selector or entryman to a hearing for the purpose of determining the character of the land located or entered by him, and to a patent without reservation if the land shall be determined not to be chiefly valuable for coal, or to abridge or deny the right of any entrymen who has earned a title to the land covered by his entry to a patent without reservation."

Homestead Patents on Coal Lands

Representative Marshall has introduced a bill to provide for the issue of homestead patents in certain instances. The main provision is that wherever an entry has been made in good faith on lands subject to homestead entry in the State of North Dakota which were afterward classified as containing coal, such entry shall be deemed valid, and upon proof of full compliance with the homestead laws as to residence and improvements a full patent shall be issued to such entryman.

The Copper Mines of Katanga

At the annual meeting of Tanganyika Concessions, Ltd., in December last, Robert Williams, the managing director, made the following statements to the stockholders:

I have the assurance of George Pauling, the well-known railway contractor, whose surveyor has been over the entire route, that he will have the rails through to the Star of the Congo mine in 18 months from the date of signing the contract for construction; and Mr. Gibb, my mining engineer, has also guaranteed to have plant ready at the Star mine in 18 months to produce from 1000 to 3000 tons of copper per month; and I am personally confident that within three years from date the Katanga mines will be producing 5000 tons of copper per month from the eastern section of the copper belt owned by the Union Minière Company, in which we own 45 per cent. of the shares. The cost of the copper from the Star in Katanga will not exceed £15 per ton on the spot, although we believe a considerably lower figure will be nearer the mark, when the Kambove and other mines are producing, but even at £15 per ton the cost would not exceed £25 per ton delivered in Europe via Beira.

The Kansanshi Mine

The Kansanshi mine has been producing from 80 to 90 tons of copper per month at a cost of £15 per ton, at the works, and we are sending up a larger furnace, which will produce from 200 to 250 tons per month at a cost of about £12 10s. per ton. We have about £30,000 worth of bar copper in stock at Kansanshi and have entered into a contract to bring the copper to rail-head, and the first shipment of 40 tons has arrived there by this time. Within a year I expect we shall have the railway so close to Kansanshi that we will bring down the whole of the present stock by traction engines to the rail-head, as well as the regular monthly output, and land it in England at £30 per ton. Certainly we should have landed in England within two years from this date 3000 tons of copper from Kansanshi at a cost of £30 per ton. These conditions will steadily improve; costs will go down as the railway goes north.

Railway Agreements

Last July, I carried through the railway agreements, which I will now explain: A.—The Benguella railway will continue the construction of its line from Lobito bay to the frontier separating Angola from the Congo state between the 11 deg. and 12 deg. parallels south. B.—The Lower Congo railway will construct the section from Ruwe mine to meet the Benguella railway as soon as the lines of approach enable it to do so. C.—The Katanga Railway Company will construct a line from the frontier of Rhodesia to the Star of Congo mine as soon as the Southern railway reaches that frontier. The Katanga Railway Company will extend its line from the Star of Congo mine to Ruwe, and eventually to a navigable point on the Lualaba, as and when circumstances justify that extension. These agreements provided for a "pooling" of gross earnings between the Benguella railway, the Lower Congo railway and the Katanga Railway Company, revisible every to years. D.—The Chartered Company agrees to form a company with sufficient funds to construct a line from the present terminus of its railway at Broken Hill to the Congo state frontier. The Chartered Company gives rates for all mineral and other traffic to and from Beira and the frontier of the Congo state and also for all the material for the construction of the Katanga railway from the Rhodesian frontier to Ruwe, and the construction of the railway connecting Ruwe with the Benguella railway on the Portugese frontier. It is also provided that the agreement between the Chartered Company and the Belgian companies shall continue in force until 10 years after the line to the Star of Congo is completed and open for traffic. This agreement may, however, be terminated when the Benguella railway and the extension thereof to Ruwe shall have been completed, or when more economic rates can be offered by the two northern railways and water routes of the Congo state. These agreements were signed on July 14 last.

Advantages of the Benguella Route

It is evident that when our own Benguella railway is completed it will take the traffic which it ought to get by reason of its being 500 miles shorter to the sea than any other line; in fact it would take most of the traffic even if the length to the sea were the same as other routes. Only by having our own route can we ever control our copper costs. The Chartered Company advised me on Sept. 8 that it was unable to finance its section, and I wrote Dr. Jameson, with whom I had conducted all the negotiations, that I would endeavor to raise the money myself for this section, provided the Chartered Company gave this company the concession to build and own this section, reduce its interest on Kansanshi, and grant me large mineral concession for coal and other minerals, and also provided that Pauling & Co. guaranteed £250,000 of the money required, on condition I got that firm the contract to construct the whole job to the Star at a fixed rate per mile. In reply to this letter Dr. Jameson wrote me that Lord Winchester and Mr. Birchenough were appointed a committee to deal with my suggestions. We soon came to terms, and an agreement was signed between this company and the Chartered Company on Nov. 4, giving this company full power to form a company before Jan. 31, 1909, and provide the necessary funds for construction of the line from Broken Hill to the frontier in terms of the agreements of July 14 last. This was a great point gained, because it gave this company, for the first time, an opportunity to finance the line itself, for which this company got all it wanted in mineral and other concessions, provided we find the money for the line before Jan. 31 next.

Financial Arrangements

Out of the total amount required to construct the line from Broken Hill to the Star mine, about £1,200,000 has been guaranteed by this company and the Belgian companies we are affiliated with, and the balance is guaranteed by the railway contractors and others connected with them. The Belgian section is to be financed by Belgian capital, and the British section by British capital. All arrangements have been made to form a new company to build the British section, to be called the "Rhodesia Katanga Junction Railway and Mineral Company," and to sell to that company the railway concession to construct and work a line from Broken Hill to the frontier of the Congo state; also the Kansanshi mine and the whole of our coal concessions and rights in Rhodesia. These coal areas are of enormous importance, as they are about 350 to 400 miles nearer the reduction works than any other coal deposit, and a ton of coal will cost 30s. less on railway rates alone, taking 360 miles at 1d. per ton per mile; and Mr. Gibb informs me we can use about 600 tons per day of

this coal for our treatment of the Katanga copper ores. Your company will own shares and debentures in the new company nominally worth about £700,000.

The Interest Guarantee

Your company guarantees the interest on the debentures of the new company for 20 years, but the Kansanshi mine itself is producing far more than will cover this interest, and will start with a stock in copper bars amounting to £30,000, which is equal to the first year's interest on all the debentures when the railway can take it away. You are thus in an excellent position—the first line to the great mines of Katanga is assured, and that railway passes close to Kansanshi. We will go on with Benguella railway construction to the plateau, another 80 miles, when that line, according to the report of our resident manager, will commence to have a profit, over all expenses, of £30,000 a year. When the 80 miles are completed the line will be the property of the Benguella Railway Company for 99 years and we should be in position to finance it with ease.

If we have raised, as we have done, upward of £4,000,000 for railways south and west to get at these great copper mines, the Benguella Railway Company will not fail to raise another £1,500,000 to complete the line to the Congo frontier, after we have got at the mines and get profits from our copper. How many companies are there in the world today that have raised £4,000,000, without any returns at all, against every conceivable difficulty, for railways through three different countries and constructed under different governments? We have done this by convincing the different governments, banks and financiers of the value of our assets. Until our own line is completed we shall be paying about £7 more per ton for our copper delivered in Europe than it would cost us by our own line, and we shall be greatly assisting the British South Africa Company; but when our line is completed from the mines to Lobito we shall get the full benefit, and we shall control rates and cost of copper as we please.

We have brought about a powerful combination of finance on clear and well-defined agreements to the accomplishment of a gigantic enterprise. Your capital will be £768,000 issued, with £2,000,000 of 5-per cent. debentures and about £1,000,000 issued with £600,000 worth of debentures if £1,400,000 worth of debentures are converted. If the debentures are not converted we do not pay interest in cash on them for another three years, and even then it will require only £100,000 per annum to pay 5 per cent. on them, whereas if they are converted they would rank as shareholders entitled to a proportion of your profits at any time. With an issued capital of £768,000 and £2,000,000 debentures, you own 90 per cent. of the Benguella railway, represented by about 2,500,000 fully paid shares, 45 per cent. of the Union Minière Company, and you will also own 700,000 shares and debentures in the Rhodesia-Katanga Junction Railway and Mineral Company.

Black Eagle Falls, Montana

The accompanying illustration of Black Eagle Falls appeared in the program of the 22d annual meeting of the Montana Society of Engineers. These falls are about three miles below the city of Great Falls, where the meeting was held. The power development at this place includes a dam 746 ft. long, placed a short distance above the crest of the falls and giving an effective head of from 42 to 44 ft. There are power houses on both banks, those on the south bank belonging to the Great Falls Water Power and Townsite Company, and to the Great Falls Electric Properties. The water is led from the dam to these power houses through sheet-iron penstocks, and the water wheels are of the turbine type, and of various sizes.

BLACK EAGLE FALLS, MONTANA, 54 FOOT FACE

The power houses on the north bank of the river belong to the Boston & Montana Consolidated Copper and Silver Mining Company. The water is here carried from the dam to the power houses by an open canal or head race, the walls of which are of concrete. This head race is 100 ft. wide at the widest point. The available head was originally less than 40 ft., but this was increased by means of a tail-race wall separating the tail race from the main river and delivering the tail water to the river at a distance below the power houses, thus taking advantage of the fall in the river below the shear fall at Black Eagle.

About 12,000 h.p. is developed, the Great Falls Water Power and Townsite Company and the Great Falls Electric Properties taking about 2000 h.p., and the Boston & Montana company the balance.

The Transvaal Stope Drill Competition

Special Correspondence

The final list of entries for the £5000 prize stope-drill competition in the Transvaal shows that fewer applications have been received from non-British makers than previous correspondence and inquiries led us to anticipate. Twenty-three drills have been entered, and it is significant to note that the Gordon hammer drill, which won the competition of last year so easily, is not among them. Nevertheless, hammer drills figure largely on the list. America is represented by only two competitors, in the companies running the "Murphy" and "Waugh" drills; while Germany enters five machines and England 11. The other five are of local production.

British Guiana Mines

Exports of gold from British Guiana for the year ended Dec. 31 were 70,676 oz. bullion in 1907, and 73,089 oz. in 1908; an increase of 2413 oz. The bullion reported in 1908 was equal to $1,280,948, or 62,407 oz. fine gold.

Exports of diamonds from the colony for the year 1908 were 4008 carats, valued at $40,872; an increase of $23,322 in value over the preceding year.

Historical Resumé of the Copper Queen Mine

Bonded at One Time for Twenty Thousand Dollars; Now Valued at Many Millions. The Story of Its Early Struggles and Difficulties

SPECIAL CORRESPONDENCE

Following is a synopsis of an address recently delivered at Bisbee by Dr. James Douglas, president of the Copper Queen Consolidated Mining Company.

In 1876 I was introduced to a gentleman named Riley who had sold a mine in Nevada and was very anxious to come down into Arizona, attracted by the stories he had heard of the famous Ajo mines. I succeeded in helping him to get rid of his Nevada mine, and for some time we kept up a considerable correspondence. Finally, visiting Arizona, the Ajo disappointed him and he went through four years of arduous work looking for something else. At last I heard from him that he had struck a wonderful mine in the Mule mountains. By that time my friend, who was a lawyer of some note, was worn down to where there were hardly any soles to his feet, and he had to borrow money from our friend Zeckendorf in order to go to San Francisco to float this mine in the Mule mountains, on which he had obtained a bond. Zeckendorf had the courage to lend him the money; he went to San Francisco and came in contact with the firm of Bisbee, Williams & Co., who knew a firm of engineers by the name of Martin & Barrett. I believe that Martin & Barrett had had some rather ill-luck in railroad contracts and Mr. Martin had been a sworn enemy to all mining speculation; but driven by necessity, determined that they would put what money they had left into the Copper Queen mines. At that time, you know, mines were not valued by millions and the Copper Queen mine was really bonded at $20,000, on which Martin & Barrett made first payment, taking my friend Mr. Riley as partner.

The mine was opened by a surface cut in August, 1880. The men who started the open cut acted the fool, as most prospectors do; they ran through rich ore at the end of the open cut, and thought it wiser to stop and get what they could rather than spoil the prospect altogether and get nothing, and therefore, the Copper Queen mine was sold for $20,000.

Mr. Martin came here and employed Lewis Williams, as superintendent, who recommended that he buy the mine. He was subsequently, as you know, succeeded as superintendent by his brother, Ben Williams, whom most of you undoubtedly knew intimately.

At that time, where Main street is now, there was a little spring on what was known as the Malvina claim. I presume the spring dried up many years ago, though for a time it supplied the only drinking water the town had. The Malvina spring did not yield water enough to supply the 36-inch furnace, and occasionally the furnace had to be shut down. Mr. Martin went east with the view of buying pipe to get a supply of water from the San Pedro river. However, before they got down three hundred feet they struck more or less water in the mine, and that solved and yet solves, the water question.

I came out to Arizona at the end of that year to look at what has since proved to be the Verde mine. At that time the claims were one hundred and eighty miles from the nearest railroad station, and we therefore could not do profitable work; and being disappointed in my visit to the Verde mine, I came down to see my friend Riley at the Copper Queen. That was in 1881, and the Copper Queen was the only mine actually open in the district. It continued from August until January to yield between 20 and 25 per cent. ore and there were no signs of its abating. I could not have thought well of it at that time, because we professional men thought that the limestone was invariably a fake and was simply placed there by Providence in order to delude us. Somehow or other, I have a certain faith in Providence and feel that he does not play jokes, and whenever you find anything that pays as that open cut did it means something very substantial. I took quite a liking to the Copper Queen and told my friend Martin I thought that such an orebody was not going to be isolated in that fashion, and he said, "We can get it for $10,000," and I said, "If I were you I wouldn't hesitate to pay the price."

Mr. Martin had made such an admirable strike in the Copper Queen that his whole ambition was to sell the mine for a million dollars—if he could only get a million dollars that was all he wanted, but to buy $10,000 worth of limestone was simply throwing that much away, and therefore he didn't buy the claim.

Buys the Queen

The following year I came out on business, and some one said to me, "You know the Copper Queen," and I said "Yes." Then he said, "Yes, they want to sell it for $25,000." I replied, "I don't think I can sell it, but if I find a purchaser I will let you know." The following summer Phelps, Dodge & Co., for whom I had done some work, asked me to come out and examine the property. This I did and I gave them the opinion that if they were poor men and it would likely impoverish them to buy it, they had better leave it alone; but if they were in a position to throw their money away, to take it. They took my advice and bought it. The Queen went on working and they got down to the second level, and the third level, and at last got down to the fourth level from the open cut.

When they got there they cut out absolutely clean; there wasn't a trace of ore left on the 400 level. That occurred towards the end of 1884, after they had been working four years. Mr. Martin called in an expert and measured the ore that remained. There was only about three months' supply. The men in the Queen mine, in the meantime, had gone through a most trying time; there were little bits of ore here and there; a few bushels of it on the surface, and that was all, but that didn't mean anything in particular. We tried the west end, went down and found little streaks of ore; then we came to the east end and we followed a streak there which was barren; then we drove a tunnel. The engineers thought they laid that tunnel out correctly, and after we had driven the tunnel we found that it was in clean ground.

By that time the Queen had got us into deep water. There was no more ore, no more money and my friends in New York insisted on going ahead, and asked me if there was anything to go further for; and while I say there was nothing, there was one little, what we called a "joker," leading across the side line of the Copper Queen, and Mr. Williams did not think we had any right to follow it, and I concurred with him. We did not follow it. We were then mining the Atlantic claim, and my friends wanted to know if there was absolutely nothing in it, and I told them that there was one streak of ore that crossed the line, and that it wasn't worth anything itself, but heaven knows what it may lead to. They trusted several thousand dollars more to reach the "joker" and in the meantime after sinking two hundred feet (I expected to go down about four hundred) we struck another glorious body of ore, and just at the same time the Queen ran into the same body.

Formed Present Company

Then the question arose as to who

owned the ore, and after some discussion of the matter among us, we came to the conclusion it was best to unite our forces, so instead of the Copper Queen Mining company, we formed the Copper Queen Consolidated Mining company in August, 1885, which was a very wise thing, as it has since turned out. There remained to all intents and purposes nothing more in the Queen claim; everything rested in the ground lying south of it. But that was only the beginning of further discouragement.

After the amalgamation, prices dropped, dropped, dropped steadily. We went on working in the same old rattletrap way underneath the open cut. We had two furnaces, each 36 in. in diameter, and as the price of copper dropped profit absolutely disappeared. The value of the ore in the open cut had fallen to about 12 per cent. before they got to the bottom of the first orebody; the average of the other orebody was lower still; somewhere about 10 per cent. but when bar copper dropped to under eight cents it was perfectly clear that there wasn't very much money to be made in working two old 36-inch furnaces. The Queen at the time was very heavily in debt, and I went to my friends in New York and suggested that if we did more economical work we certainly would be able to make a little with copper at eight cents per lb. They were brave enough in the face of all these difficulties to advance the Copper Queen $150,000 to put up a larger and more economical plant. This was begun in the fall of 1886, and completed in May, 1887. I left New York shortly after we had the meeting to finance the Queen. We were making a trifle, although copper was selling at about eight cents, and I thought that within three or four years we could pay the Queen's debts. Of course, the new works were making considerable more copper and we had to find an outlet for our product.

Just then a Mr. Secretan came to us to make contracts for the whole of our output for three years, we undertaking to give him a certain minimum per month. Mr. Secretan was very generous and offered us about 13½c. per lb. for our copper. We had been getting 8c., and, therefore, we proceeded to make a bargain with him. With copper at 13½c., the Copper Queen debts began to vanish at a very rapid rate and by the following year we were able to pay about $100,000 dividends; that was a large dividend because we had not received anything for about three of four years. Under Mr. Secretan's regime that dividend increased to $300,000 a year. But it was later considerably decreased when our production was diminished. However, the Secretan syndicate, as we called it, was a great impetus, and from that time on we began producing ten to twelve million pounds per year. For three years after the amalgamation virtually the whole of the copper came from the Atlantic orebody as we called it. That body dipped in the opposite direction from the original orebody, but there did not prove to be anything like as much ore as in the original Queen. In 1886 following that same famous "little joker," which I was aiming at in 1884, we came upon what has proved undoubtedly to be the largest continuous orebody that we have ever found in the Arizona country. The stopes of this orebody fed the furnaces for about three years. (Possibly ten or fifteen per cent. of the ore was mined from the Queen.) Meanwhile, we had found an orebody in the west end, so that by the time the southwest stope was exhausted we were finding considerable ore at a greater depth further to the southwest, when an unfortunate change took place in the character of the ore. Sulphide came in and our copper began to seriously deteriorate. It became extremely difficult to sell the 96 per cent. bar copper which we were taking out. Again Providence came to our assistance in the person of a Frenchman, who applied the same treatment to copper which had previously been applied in the making of steel, and that solved the question.

When we commenced mining copper in Arizona, if we had had sulphide ore it would not have paid at all and we would have been forced to abandon it. Since the advent of the new treatment we are re-smelting the old slag dumps that were thrown away in those days.

In 1899 we began handling mixed sulphide and oxidized ores in the first converter, which some of you may recollect. This of course opened up large areas of our ore-bearing ground which we had been prohibited from touching previously by our inability to handle sulphide. From that time the production of the Copper Queen mine rose rapidly to two and three million pounds per month. There was also a little silver in the ore; some of our ores were found to be richer in silver than others and therefore when the Bessemer treatment was inaugurated we devoted one furnace and one converter to the smelting of silver-bearing ore.

All these things, in the process of development from small days to days of large events and larger quantities compelled us to move our smelters out of Bisbee. It became impossible to extend the plant in proportion to the expansion of the mines and the mines had expanded by the absorption of other property.

I was telling you about the hard times in the Queen's history. During that period they were offered two claims called the Holbrook and the Cave. They were owned by a Mr. Garnett, who at one time intended to work, but decided to sell them for what he thought the property was worth. Mr. James and Mr. Dodge bought them. We worked the Holbrook and the Cave for quite a number of years as independent operations, in fact, until the year 1892. They used to produce about sixteen to seventeen million pounds.

Col. Herring's Claims

There was a member of the bar, Colonel Herring, who had the mining fever, and located a group of claims on the other side of the mountains. He had the Dividend, the Neptune and several others. When I came out early in 1881 I found a certain man who was a mineralogist and geologist, who was superintendent of those claims. He was more than half-hearted about them. He was absolutely pessimistic. He said the ore was in limestone and simply worthless. Anyhow, the Dividend company put up their furnace at Helfa and hauled their ore down there to smelt. The company, however, came into existence through our friend Colonel Herring. Colonel Herring's brother, who located the claims, died and the colonel started in to wind up his estate; he gave up the profession of law in New York, went back again, organized a company, and came out here as the manager of it. When I came out here in 1881 I found Colonel Herring living in what was called the "Castle," a great big *adobe* house down the cañon.

They spent the whole of their capital stock and about $80,000 of bonded indebtedness; the people who owned it got sick of it, and put it up at sheriff's sale. We bought it. However, the Holbrook, Cave and Dividend were turned over in 1892 for a slight increase in the capital stock of the company. Originally, the capital stock of the Copper Queen was two million dollars; and when the consolidation was effected, instead of adding a few million more, Mr. Dodge, who was very peculiar about those matters, thought that the capital ought to be cut down to one million four hundred thousand. When this other property was bought, including the Holbrook, Cave and Dividend, the whole group was turned in for $600,000, so the capital of the company was again up to two million dollars. However, after the amalgamation and after the introduction of Bessemer treatment, we moved the works down to Douglas, because there wasn't room to expand up here in the narrow quarters which were assigned to the works.

It became at once evident that it would be difficult for us to carry on a large enterprise without transportation facilities. We therefore built a railroad from Benson to Bisbee, and later this was extended to Douglas. Our railroad would probably have ended there, if it hadn't been that we bought a mine from the Guggenheims at Nacozari. Afterward it was decided, on account of some difficulties which we were compelled to surmount, and in order to afford us a better outlet for our products, to build our line in to El Paso

Mine Explosions as Related to Earthquakes

A Discussion Favoring the Theory That the Danger from Explosions in Deep Mines Is Augmented During Periods of Seismic Unrest

BY W. A. SPALDING*

In the JOURNAL of June 1, 1907, Prof. James T. Beard discussed the subject of mine explosions, and their connection with seismic distrubances. Every observer must have noted that disastrous explosions in mines seem to come in series, and when one occurs in any field several others in various parts of the world are apt to follow in close succession. Then may come a cessation of such disasters for a considerable time, to be followed by another series. Have these intermittent seasons of mine explosion a sort of periodicity? That is, are the antecedent conditions of gas accumulation which invite disaster, periodically recurrent, and if so, has this condition any connection with seasons of seismic and volcanic activity?

Professor Beard believes that internal pressure is the cause of larger, spasmodic emissions of gas. He states that even in districts producing large quantities of gas and which, therefore, appear to furnish a constant emission, there is a very perceptible ebb and flow, causing periods of fluctuations in the gaseous condition of the mine. He says:

"In other districts and mines, there are corresponding periods in which much gas is given off, followed by intervals when there is almost an entire absence of gas in quantities to cause alarm. Often these periods of the ebb and flow of gas from the strata are quite local; that is, restricted to a limited area or district, and at times appearing in a single mine or portion of a mine only. Several instances have recently occurred where the flow of gas increased in a portion of the mine so rapidly that the men were withdrawn from that district and not permitted to return for nearly a month, when the flow ceased almost entirely."

INTERNAL AGENCIES

Such observations as the above induced Professor Beard to turn his attention to internal agencies, and seismic and volcanic action naturally came in for consideration. Again quoting from his article:

"We possess very little exact knowledge of the condition of the interior of the earth, but the evidence of volcanoes in action and our knowledge of the agency of heat and pressure makes it certain that tremendous activities are in constant operation within the earth's sphere. It is both natural and reasonable to suppose that the pressures in subterranean channels that will discharge molten material under a great head, can make themselves felt in other quarters, and incidentally augment the outflow of gas from strata already pregnant. No one familiar with underground conditions and who has listened with awe to the mysterious 'poundings' in the overburden of a mine, caused, as is well known, by the working of gas in the foliations of the strata, can study the phenomena of earthquake waves and shocks without being convinced of the close relationship of the different phenomena. The conclusion is fairly certain that gas generated by the chemical and physical activities within the earth plays an important part in all these phenomena.

"The theory of spasmodic or irregular earth breathings, as just explained, if true, would give rise to periods of frequency of mine explosions, more or less closely associated with volcanic activity. That such is the actual fact is shown to be highly probable by the remarkable coincidence in their occurrence. That there are isolated or errant mine explosions occurring in a period of rest and entirely disassociated from seismic disturbances, does not argue against the theory, since it is not claimed that all mine explosions are the result of such disturbance. The causes producing explosive conditions in mines are too numerous to invite such an expectation. But when periods of marked seismic troubles are almost invariably accompanied by the appearance of gas in increased quantities in mine workings, and the occurrence of one or more mine explosions, the fact is significant of something more than mere chance."

THE VALUE OF A STATISTICAL STUDY

Professor Beard then gives a list of concurrences between seismic and volcanic action on the one hand and mine explosions on the other. At first glance such a statistical comparison would seem to be somewhat unscientific and far from convincing. To institute a satisfactory comparison, we must have a basis of similarity in the things compared. Earthquakes and volcanic eruptions are purely natural phenomena. Mine explosions are only natural insofar as they depend on the antecedent collection of gas in subterranean cavities; the ignition of the gas is accidental, and depends on human agency. Every reasonable precaution to prevent such accidents has been adopted by mine operators; chief of which are the frequent inspection of deep workings, to detect the presence of gas in dangerous quantities; the ventilation of such workings by proper openings and forced draft, and the use of safety lamps. But these precautions, while theoretically correct, are not perfectly executed; hence an occasional explosion occurs involving loss of life and destruction of property.

If we could have for the purpose of our comparison full statistics of the ebb and flow of gas in mines, it would be far more satisfactory than to deal with those exceptional and largely accidental cases involving disaster. But such full statistics are not generally kept, and the compilation of a sufficient record would require years of constant observation in a large number of mines. Hence, for the present, we must be content with such values as may lie in the natural conditions antecedent to explosions which make the events matters of record.

Under the exigencies of the case, it would be folly to trace the line from cause to effect, starting with natural phenomena which would produce the specified antecedent conditions, and then expect each series to find its logical conclusion in a mine explosion. Our method should rather be inductive—from effect to cause. Given, a mine explosion; the condition of gas accumulation must have been present; now can we trace this condition back to a natural phenomenon, such as an earthquake or volcanic eruption, occurring about the same time? Hence, we should not attempt to find a mine explosion for every seismic or volcanic disturbance, nor yet an earthquake or an eruption for every mine explosion, but such concurrences as we do find should be carefully studied. With the foregoing thought in mind, I have rearranged Prof. Beard's list to present it in a more graphic form and have augmented it somewhat by inserting data gathered from other sources:

TABLE SHOWING CONCURRENCE OF MINE EXPLOSIONS AND SEISMIC DISTURBANCES.

Mine Explosions.	No. Killed.	Seismic and Volcanic Disturbances.
	1896.	
Jan. 23, Newburg, W. Va.	39	Jan. 10, earthquake Persia—2 villages destroyed.
Mar. 23, Berwinsdale, Penn.	15	Mar. 29, violent earthquake Chile,
Oct. 29, S. Wilkes-Barre, Penn.	6	Oct. 18, tidal wave coast of Mexico. Result of submarine earthquake.

*Los Angeles, California.

1897.									
Jan. 4, Alderson, Ind. Ter.	5	Jan. 2, earthquake Ottawa, Ontario. Jan. 9, earthquake Christianstadt, Sweden. Jan. 11, earthquake Kishma Island.	Aug. 1, Wallangang, N. S. W.	127	July 31, earthquake Cal. Santa Barbara. Aug. 4, earthquake Los Alamos, N. M. Aug. 4, earthquake Montana. Aug. 5, earthquake Genoa and Pisa, Italy.	Oct. 13, Fredericks-town, Penn.	6	Oct. 3, earthquake Ecuador, heavy. Oct. 7, Vesuvius active. Oct. 9, earthquake Calabria, Italy. Oct. 12, Vesuvius active. Oct. 15, earthquake Cuba, Jamalca.
1898.									
Sept. 23, Browns-ville, Penn.	8	Sept. 16, earthquake S. Dak. and Neb. Sept. 17, earthquake Deering, Me. Sept. 19, new craters open Vesuvius. Sept. 24, Vesuvius active.	Sept. 16, Algona, W. Va. Sept. 22, Stafford, W. Va.	17 6	Sept. 5, Kilauea, Hawaii; active. Sept. 6, Vesuvius; active. Sept. 7, Izalco, Salvador; active. Sept. 9, Alaskan volcanoes. Sept. 9, Stromboli, active. Sept. 20, severe earthquake Adelaide, Australia. Sept. 20, Sunfriére; active. Sept. 22, earthquake Guam. Sept. 22-23, earthquake Russian Turkestan; severe. Sept. 28, earthquake Hilo, Hawaii.	Nov. 4, Vivian, W. Va. Nov. 15, Bentleys-ville, Penn. Dec. 1, Diamond-ville, Wyo.	7 8 18	
1899.						**1906.**			
July 24, Grindstone, Penn.	5	July 22, earthquake So. Cal.—slight. July 28, earthquake Hawaii—violent. July 28, Mauna Loa active.				Jan. 4, Coaldale, W. Va. Jan. 18, Detroit, W. Va. Jan. 24, Witteville, Ind. Ter.	22 18 14	Jan. 5-6, earthquake Nicaragua. Jan. 7, earthquake Nebraska and Kansas.	
Dec. 23, Sumner, Penn.	20	Dec. 13, earthquake Ceram Island, violent. Dec. 26, earthquake So. Cal.				Feb. 8, Parrol, W. Va. Feb. 19, Maitland, Colo. Feb. 27, Piper, Ala.	27 16 9	Feb. 1, Vesuvius active. Feb. 12, earthquake Calabria. Feb. 16, earthquake Ecuador. Feb. 19, earthquake, Formosa. 8000 killed. Feb. 21, earthquake Colombia, S. A. Feb. 21, Pelee active.	
1900.									
Mar. 6, Red Ash, W. Va.	46	Mar. 1, earthquake Nevada. Mar. 3, earthquake Petaluma, Cal.	Apr. 13, Carbon, Ind. Ter.	6	**1903.** Apr. 1, earthquake Montana. Apr. 21, earthquake Tuxpam, Mexico.	Mar. 10, Courrieres, France. Mar. 22, Century, W. Va. Mar. 28, Takashima, Japan.	1200 21 307	Mar. 17-19, earthquake, Formosa, Japan.	
May 1, Scofield, Utah.	200	May 9, Vesuvius active; violent eruptions. Nov. 1, earthquake Jacksonville, Fla. 8 distinct shocks.	Nov. 21, Ferguson, Penn.	17	Nov. 5, Malaspine, P. I.; active. Nov. 29, tidal wave, Hawaii. (Submarine earthquake ?).				
Nov. 2, Berryburg, W. Va.	15	Nov. 5, earthquake Cahto, Cal.			**1904.**				
1901.									
Apr. 29, Alderson, Ind. Ter.	6	Apr. 2, earthquake Hungary.	Jan. 25, Cheswick, Penn. Harwick mine.	178	Jan. 16, volcanic eruption, Central America. Jan. 18, earthquake Shemokka, Russia. Jan. 29, volcanic eruption, Colima.	Apr. 21, Trinidad, Colo.	22	Apr. 7, earthquake Formosa, Japan. Apr. 18, earthquake San Francisco. Apr. 20, earthquake Calumet, Mich. Apr. 20, earthquake Honolulu. Apr. 26, Mount Hecla, Iceland; active. Apr. 26, Mount Colima, Mexico; active. Volcano Las Palmas, Discovery Islands, 9000 ft. high.	
May 15, Chatham, W. Va.	10								
May 27, Richland, Tenn.	20				Feb. 24, earthquake Saltillo, Mex.				
June 10, Port Royal, Penn.	19		Mar. 6, Catsburg, Penn.	5					
Oct. 26, Diamond-ville, Wyo.	32	Oct. 7, earthquake and tidal wave, Ecuador. Oct. 30, earthquake Italy.	Oct. 28, Tercio, Colo. Nov. 29, Luke Fidler, Penn.	19 7	Nov. 6, earthquake Formosa.	June 6, Red Lodge, Mont.	8	June 1, earthquake Seattle. June 25, earthquake Kansas. June 27, earthquake S. Wales.	
Nov. 14, Pocahon-tas, W. Va.	9	Nov. 8, earthquake Erzeroum, Turkey. Nov. 13, earthquake Salt Lake, Utah. Nov. 15, earthquake Salt Lake and Russia.			Dec. 6, earthquake Formosa.				
					1905.				
			Feb. 20, Virginia City, Ala. Feb. 26, Bluefield, W. Va.	116 23	Feb 2, eruption Nicaragua; severe. Feb. 2, earthquake Andizan, Central Asia. Feb. 4, earthquake Lordsburg, Cal. Feb. 23, eruption Mauna Loa.	July 19, Huger, W. Va.	5	July 2, earthquake Socorro, N. M. July 8, tidal wave Sandy Hook. July 12, tidal wave Cal., N. M., Texas. July 16, tidal wave Texas and N. M. July 24, Stromboli, Sicily; active.	
Nov. 22, Pocahon-tas, W. Va.	8								
1902.									
Jan. 24, Lost Creek, Ia.	20	Jan. 16, earthquake state of Guerrero, Mex. Jan. 24, earthquake Mexico, Missouri, Illinois.	Mar. 18, Rush Run, W. Va. Mar. 22, Princeton, Ind.	24 9	Mar. 12, earthquake Menominee, Mich. Mar. 24, earthquake Saltillo, Mex.	Oct. 3, Pocahontas, W. Va. Oct. 5, Blosburg, N. M.	37 15	Oct. 1, earthquake Sydney, N.S.W. Oct. 1 earthquake bed of Indian Ocean.	
May 19, Frayter-ville, Tenn.	184	May 18, eruption St. Vincent.	Apr. 3, Zeigler, Ill.	53	Apr. 4, earthquake San Jose, Cal. Apr. 4, earthquake northern India, severe. Apr. 7, earthquake Redding, Cal. Apr. 19, earthquake Santa Cruz, Cal.	Oct. 14, Wingate, Eng. Oct. 24, Johnstown, Penn.	24 7	Oct. 6-11, Pelee active. Oct. 12, earthquake Socorro, N. M. Oct. 15, Vesuvius active. Oct 18, tidal wave Miami, Fla. Oct. 21, Chulo active.	
May 23, Fernie, B.C.	127	May 20, eruption Mt. Pelee. May 20, earthquake St. Augustine. May 21, earthquake Cal. May 25, volcanic eruption Portugal	Apr. 20, Cabin Creek, W. Va. Apr. 28, Du Bois, Penn. Apr. 30, Willerton, Ind.	6 13 13	Apr. 23, earthquake Los Angeles, Cal. Apr. 23, earthquake North of England. Apr. 25, earthquake Albis, Persia. Apr. 27, earthquake San Francisco and San Rafael, Cal. Apr. 29, earthquake Italy, Switzerland, France.				
July 10, Johnstown, Penn.	112	July 7, earthquake Salonica. July 8, earthquake St. Vincent. July 9, eruption Mt. Pelee. July 9, earthquake Persia. July 11, Mt Pelee violent. July 27, earthquake Cal., Sta. Barbara. July 28, earthquake and tidal wave, St. Vincent. July 30, volcanic eruption, Costa Rica.							
					May 3, earthquake Island of Hilo. May 9, earthquake City of Mexico.				
			July 5, Vivian, W. Va	10	July 15, earthquake Manie				
						1907.			
						Jan. 23, Primero, Colo. Jan. 28, Reden mine, near Essen, Germany. Jan. 28, Lievin colliery, Lille, France Jan. 29, Stuart mine near Fayetteville, W. Va	20 158 3 85	Jan. 14, earthquake Kingston. Jan. 28, earthquake Kingston.	
						Feb. 4, Elkins, W Va.	25	Feb. 4, earthquake recorded Leibach Observatory.	
						Feb. 18, Las Esparanzas, Coahuila, Mexico.	50	Feb. 17, earthquake State of Washington.	

Mar. 2, Holden colliery, Taylor, Penn.	7	Mar. 1, earthquake Costa Rica.
Mar. 2, Woodward mine, Kingston, Penn.	2	Mar. 13, Akutau, Alaska; active.
		Mar. 29, Bitlis, Turkish Armenia; worst earthquake in 40 years.
Apr. 24, Plymouth, Penn.	4	Apr. 3, Azore Islands.
		Apr. 14-17, Colima volcano in eruption.
		Apr. 14-17, earthquakes in Spain.
		Apr. 15, earthquakes City of Mexico and other Mexican cities.
		Apr. 17, earthquakes at Valparaiso, Chili.
		Apr. 17, earthquakes at Constantinople.
		Apr. 17, all seismographs active.
		Apr. (?), earthquake reported in China.
		Apr. 19, earthquake at Charleston, S. C.
		Apr. 29, Stromboli in eruption.
May 1, Whipple mine, W. Va.	21	May 26, fissure opened on Vesuvius.
May 14, Plymouth, Penn.	2	
June 19, Priceburg, Penn.	7	June 5, earthquake at San Francisco.
		June 20-July 5, columns of fire 250 ft. high at sea, off Tonga and Friendly Islands.
		Aug. 30, Vesuvius restless.
Sept. 7, Las Esparanzas, Mexico.	27	Sept. 2, earthquake recorded as 6000 miles from Washington, D. C., probably in north Pacific off Japan.
Oct. (?), Wilkes-Barre, Penn.	4	Oct. 24, earthquake shocks in Calabria, So. Italy.
		Nov. 20-30, ash-storm at Nome, Alaska, from supposed eruption in Aleutian Islands.
Dec. 1, Naomi, Penn.	34	
Dec. 6, Monongah, W. Va.	353	
Dec. 16, Golande, Ala.	56	
Dec. 19, Darr mine, Jacob's Creek, Penn.	233	
Dec. 22, Schoonberg mine, near Pittsburg, Penn.	0	
Dec. 31, Crow's Nest mine, near Massillon, Ohio.	5	
Dec. 31, Bernal mine, Cartbage, N. Mex.	12	
1908.		
		Jan. 7, cave of Vesuvius broke and sank.
		Jan. 15, earthquake at Gonaives, Hayti, W. I.
		Jan. 25-28, whole earth reported as trembling as indicated by seismographs everywhere.
Jan. 31, Port Blanchard, Penn.	0	Feb. 1, earthquake 3800 miles from Washington, D. C.
Feb. 7, Port Hood, N. S.	10	Feb. 5, quakes in Connecticut.
Feb. 10, South Carrollton, Ky.	10	Feb. 8-10, earthquakes 8000 miles from Washington, D. C.
Feb. 14, Glencoe, Natal, So. Africa.	42	Feb. 14, earthquake, two shocks recorded at Cheltenham observatory, Md.
Feb. 21, Globe mine, Washington, Eng.	14	Feb. 19, earthquakes in the Azores.
Feb. 27, Rosita, Coabuila, Mex.	200 (?)	
Mar. 24, Pittston, Penn.	1	Mar. 26, Mexican cities destroyed by earthquakes.
Mar. 28, Hanna, Wyo.	55	

While this article was in preparation there came two striking confirmations of Professor's Beard's theory: March 26, 1908, occurred a severe earthquake in Central Mexico, damaging buildings in that city, destroying the town of Chilapa and causing great destruction of life and property. March 28—two days later—we note a disastrous explosion in the No. 1 mine of the Union Pacific Coal Company at Hanna, Wyoming, in which 70 men lost their lives. As an interesting side light on the question under discussion, the following associated press despatches are worthy of notice:

"Beloit (Wis.), March 19, 1908. The roaring well on the Charles Lathers farm northeast of Beloit, sounds from which preceded the San Francisco disaster, is again emitting rumbling noises and a strong wind from its cavernous depths. It is asserted that this well began roaring a few weeks before the San Francisco earthquake, and ceased at exactly the hour of the quake."

"Beloit (Wis.), March 27, 1908. The famous "roaring well" has again made good. March 19 it was found that the phenomenon, on the farm of Charles Lathers, northeast of this city, was active. The well roared for several weeks before the great earthquake at San Francisco, and the curious sound of rumbling, together with wind from the mouth of the well, ceased at the precise hour when the shock struck the California city. When the well resumed its clamor last week residents of Rocky county predicted a calamity. Yesterday it came—in Chilapa, Mex.

Beloit, Wis., is far removed from San Francisco, yet it appears that there was some sympathetic connection between the roaring well and the earthquake in the latter place April 18, 1906. Again, a still greater distance intervenes between the roaring well and the City of Mexico, yet the phenomenon is repeated March 26, 1908. Such sympathetic action can only be accounted for on the theory of a general stress upon the earth's crust preceding and concurrent with seismic action. I may also add that through personal correspondence with the owner of the well above mentioned, and with reliable citizens of Beloit, Wis., I have confirmed the truth of the press despatches just cited.

An Analysis of the Foregoing Table

The concurrence or close approximation between earth disturbances and mine explosions noted in the foregoing table certainly gives color to the theory that the danger in deep mines is augmented during periods of seismic unrest. When such a theory is abundantly supported by reason, it challenges consideration. The following fundamental conclusions are obvious:

1. That a seismic convulsion is due to great stresses or strains acting upon the crust of the earth.

2. That the fracture and displacement of strata open up fissures through which gases may escape as the result of internal pressure.

3. That a subterranean explosion producing a volcanic eruption must be accompanied by a lateral and backward pressure equal to that which projects the material from the crater.

4. That with seams in the surrounding strata opened by earthquake shocks, and a great lateral pressure from a subterranean explosion or other cause, gases may be driven to great distances.

5. That such gases may be discharged through fissures into deep mines, and accumulate in the chambers to such an extent as to invite disaster.

As Professor Beard observes: "Because two occurrences or phenomena are of record almost invariably contemporaneous, proves no more than the fact of their association. It remains to be shown whether the association is one of cause and effect, or whether they are both alike the effort of a hidden cause as yet unknown, perhaps unsuspected."

However, in the case under consideration, the cause and effect seem to be closely united on theoretical grounds at least, and the close association empirically shown, while not conclusive, is nevertheless entitled to due weight.

Seismic Disturbances Are Not Local

It may be objected that volcanic eruptions and seismic shocks are, in a sense, local phenomena; that the principal effects are restricted to a definable area, including the volcano or the epicentrum of the earthquake. Yet it is true that by aid of the seismograph, a tremor from a heavy tectonic earthquake may be traced around the world, showing that at least a secondary effect—a vibration of the earth's crust—is general.

There has been a movement among the more advanced seismologists, of whom the late Professor Heilprin was a representative, to attribute a much closer connection between volcanic eruptions and earthquakes than was formerly conceded, even when the two classes of phenomena are widely separated. An inquiry as to whether there could be any association between a violent outbreak of Vesuvius and an earthquake in San Francisco, both occurring at nearly the same time, would not be flouted by an uptodate investigator. We are still too far from a satisfactory demonstration of the prime causes of seismic and volcanic disturbances to allow, in such case, much weight to a dogmatic disclaimer.

Miners Convention Adjourned

The convention of the United Mine Workers of America, after three weeks of turbulent deliberations in Indianapolis, Indiana, adjourned late Saturday night, Feb. 6. The sessions of the last week dragged along in a manner characteristic of the entire convention and were marked by the customary wrangling. There was scarcely a report made during the convention that did not create some factional disturbance. A resolution was passed providing for the amendment to the by-laws which it is hoped will enable the organization to elect officers without the taint of fraud, and also for the expulsion of any official, candidate or member guilty of making or circulating false statements against one another.

Before the convention adjourned a more friendly feeling was manifested between the factions and the vote of thanks to President Lewis was not opposed.

The scale committee which had under consideration the situation in the anthracite district of Pennsylvania made its report recommending the adoption of the wage scale agreed upon by the anthracite districts at a conference held at Scranton, Penn. last fall, as follows:

"1. That an agreement shall be negotiated between the representatives of the miners and operators of the anthracite region, and all disputes arising under the contract shall be adjusted as provided for in said agreement.

"2. We demand the complete recognition of the United Mine Workers of America as a party to negotiate a wage contract, and that the United Mine Workers of America shall be recognized in our right to provide any method we may adopt for the collection of revenue for the organization.

"3. That we demand an eight-hour day with no reduction in wages.

"4. That all coal shall be mined and paid for by the ton of 2,000 pounds.

"5. That we demand a definite and more uniform scale of wages and prices for all classes of labor at all collieries in the anthracite region; and that all employees paid $1.50 or less per day shall receive a 10 per cent. advance and all employees paid more than $1.50 and less than $2 per day shall receive a 5 per cent. advance.

"6. That the system whereby a contract miner has more than one job or employs more than two laborers be abolished.

"7. That the employers be required to issue uniform pay statements, designating the name of the company, the name of the employee, the colliery where employed, the amount of wages and the class of work performed.

"8. That the contract shall be made for a period of one year."

The committee recommended that the officers of the Mineworkers' organization use their best efforts to bring about a conference with the operators and left the details with the executive committee.

The convention concurred in the report.

On account of the cost it was decided not to send a representative to the International Mining Congress in Europe next year. A number of facetious speeches were made by President Lewis, J. P. White, W. D. Ryan, E. S. McCullough and others previous to adjournment.

The newly elected officers are: President T. L. Lewis, Vice-President, E. S. McCullough; Secretary-Treasurer Edwin Perry.

Indianapolis was again selected as the place of holding the convention next year.

Pocahontas Consolidated Collieries Company Merger Sustained

An important decision in favor of the Pocahontas Consolidated Collieries Company, Incorporated, was rendered by the U. S. Circuit Court of Appeals at Richmond, Va., on Jan. 16, in the case styled Campbell *vs.* Jones, affirming the decision of the lower Federal court.

It will be recalled, as reported in the JOURNAL last January, that this suit was brought by the dissenting minority holders of the $300,000 of the preferred stock of the Pocahontas Collieries Company, which was merged with and under the name of the Pocahontas Consolidated Collieries Company, Inc., on July 1, 1907, under the Virginia Corporation Act.

The new or merged company issued $6,000,000 of 50-year 5-per cent. bonds, $2,800,000 of preferred stock, and $4,520,000 of common stock, upon the combined properties of the company located in the Pocahontas coalfield in Virginia and West Virginia.

Under the plan of merger the preferred stockholders of the Pocahontas Collieries Company were to receive in exchange for this stock $1,500,000 of the new bonds. All the securities of the several companies merged were exchanged in accordance with the plan of merger except the $300,000 of this preferred stock of the Pocahontas Collieries Company, and the holders of these shares of stock attacked the merger on the ground that they did not wish to exchange their stock for a 5-per cent. bond, and asked the courts to set aside the merger.

The case was heard in Lynchburg, Va., in June, 1908, in the United States Circuit Court of the Western District of Virginia, and a decision rendered in favor of the company, dismissing the suit, from which an appeal was taken, the result of which was the decision as above mentioned, affirming the decision of the lower court. The effect is, to remove any question as to the validity of the securities issued under the plan of merger, and the decision is important, in that it is the first large merger that was made under the Virginia Corporation Act, which act is also sustained by this decision.

Rescue Apparatus in Austrian Mines

Among the amended regulations issued by the Austrian Mining Board is an interesting provision relative to the use of rescue apparatus. This regulation states that some approved form of rescue apparatus shall be kept in working order, and in a readily accessible place at all mines. In order to keep the valves and fittings from being attacked by rust, the oxygen bottles must be perfectly dry inside, and recharged with dry oxygen by a dry pump. A by-pass valve must be provided for use if the reducing valve gets out of order. In the most dangerous class of mines, the prescribed number of sets of rescue apparatus is as follows: Five when not more than 200 men are at work per shift, 10 for shifts working from 200 to 400 men, and 15 for shifts of over 400 men. Each apparatus must be able to supply oxygen for 1½ hours at the minimum. Where the mines are less dangerous and belong to the nonfiery class, the number of apparatus is fixed at five, irrespective of the number of men per shift, except that where these are below 200, a smaller apparatus—supplying enough oxygen to last for an hour—is permitted.

Where a number of dangerous mines, employing over 200 men per shift, are situated close together, all the apparatus in excess of the five sets necessary for the equipment of one corps of rescuers may be kept at a central depot of easy access from all mines. Rescue stations must be furnished with a duplicate source of oxygen bottles, and a number of safety lamps of some permitted type; one oil lamp for testing the presence of firedamp is necessary when the other lamps are electric. A trained deputy must be placed in charge of the station and made responsible for the good order and maintenance of the equipment. The men trained for rescue parties must be medically examined, and each corps must use the apparatus at least every six months, the results of practices being entered on official forms, together with those of the examinations of the apparatus, etc., at regular intervals.

The cost of mining at Mount Lyell mine, Australia, for the six months ending Sept. 30, 1908, including cost of removing overburden, was 6s. 9d., or $1.62 per ton.

Colliery Notes

A shot-firer should not charge any shot-hole until he has thoroughly examined all accessible places within a radius of 60 ft. from the shot.

There is so little known as to how the elements are combined in coal that many fuels of the same apparent composition produce entirely different results when subjected to combustion.

Should a shot misfire and after a sufficient lapse of time, the shot-firer decides to authorize the workmen to drill another hole, it is most important to see that the second hole is located at a distance not less than 12 in. from the misfire.

There are but few cases where a superintendent is justified in erecting dams to keep back gas in old workings; if an explosive mixture is shut off in this way, it must be so effectively dammed back that the gas will not assist in furthering any future explosion. The safest method of dealing with all accumulations of gas whether in old or new workings is by efficient ventilation.

As a general rule, a coal-cutting machine requires a space of 4 ft. clear from the face, so that it may work continuously and without danger of being buried; for this reason, many superintendents advise against the adoption of coal cutters in a mine where the roof has a tendency to fall. It may be stated in this connection, however, that mining machines are now being successfully used under a bad roof, the timbering being done from behind.

Firing shots with a covering of paper, waterproofed with wax or other inflammable material, is a doubtful practice. It is, of course, necessary to preserve the explosive from dampness while it is being stored; however, this could easily be accomplished by having two coverings, the inner one of non-inflammable material, and the outer one of damp-proof paper; the outer cover should, therefore, be removed immediately before the shot is inserted into the shot-hole.

A sinking shaft may be satisfactorily ventilated by employing a small blowing fan 4 or 5 ft. in diameter; the mouth of the fan is connected to a column of 15-in. diameter circular galvanized air pipes, these pipes being conducted from the fan to within a few yards of the bottom of the sinking shaft. The ventilator is driven by belting from an engine. One end of every pipe should be tapered so as to fit into the end of the next pipe, and the two sections can then be attached to each other by bolts passing through lugs riveted on each end of every pipe. The pipe column can be suspended in the shaft by stays located 18 or 20 ft. apart.

When the water in a steam boiler is dangerously low, the first precaution is to close the draft and bank the fire with ashes or damp earth. After awhile, if the boiler has cooled and the fire been made "dead," the fuel may then be withdrawn if the operation can be performed without increasing the heat. The safety valve must not be opened with the mistaken object of decreasing the steam pressure, for just as much steam as escapes will again be generated and add additional dangers by further decreasing the supply of water that remains in the boiler. If, when the evil is discovered, the engine is stopped, the recoil of the steam is likely to form a serious danger; it is advisable, therefore, to keep the engine running until the danger has been somewhat lessened. A further precaution is to avoid starting the feed pump, for should this be done, the overheated plates are liable to snap when suddenly cooled.

When a miner or other workman receives a severe electric shock rendering him insensible, remedial measures should be persevered with until a medical man has pronounced life extinct. A victim subjected to a severe shock often exhibits symptoms that cause observers to conclude life extinct; however, death should not be assumed. One recent case occurred where a workman received a 2000-volt shock from hand to hand, but was not badly burned; the man was insensible, and those present could not feel his heart beating; his eyes were turned up so that only the whites could be seen, his jaw dropped, and his breath did not cloud a mirror. The victim, to all appearances, was dead, but after 45 min. artificial respiration the man recovered. It is almost certain that in the earlier days of electricity, many people were given up for dead after receiving an electric shock when they might have been restored by the immediate application of artificial respiration.

Every mine should have a fixed rule making it necessary for a workman to first secure permission from the manager or superintendent, before being permitted to fire shots upon any main haulage or air roads, up to a stipulated distance, say 50 yd. from the face. The reason for this precaution is that haulage-roads and airways generally hold an accumulation of very fine dust due to the passage of loaded cars and the tramping of miners going to and from work. The high velocity of the air current in these main entries causes the smallest particles of dust to be located in the roof, sides and floor, and creates a more dangerous condition than exists at the face of entries or chambers. The mine manager is not taking too great a precaution, should he go still farther and require that all shots of this kind should be fired between shifts, or at night when all men except the shot-firers are out of the mine. If such shots are fired by electricity, the cable should be from 45 to 50 yd. in length, so as to enable the person who fires the shot to be out of reach of the flying stone.

An English company has installed a 2000-kw. steam turbine mounted on a special rubber foundation, which latter has been introduced to obviate any possibility of vibration. The turbine set is bolted to a special slab of concrete about 2 ft. thick, reinforced with a steel grid and supported by a series of circular rubber stools, which rest on the ordinary concrete built into the ground. The top of the floating concrete slab is level with the engine-room floor, but the edges do not come in contact with the floor, so that there is no connection between the concrete slab to which the turbine set is bolted, and the foundation, except through the rubber. This eliminates the possibility of vibration due to the reciprocating engines which are located nearby. As a further precaution in this unique installation, a trench is provided around the floating slab so that the rubber stools can be inspected. Each rubber stool is a cylinder of about 4 in. in diameter and 3 in. in hight when compressed by the weight of the turbine set. The rubber stools are all separately renewable, and can be withdrawn and reinserted by further compressing them, by tightening of the "jacks" in which they are held by means of screws. This is the largest turbine ever mounted in this way.

Since the Royal Commission appointed to investigate the life of the coal supplies of England, reported that the fuel beds of that country would not last more than from 500 to 800 years, the chief scientists of Great Britain have been theorizing as to what source of energy they can turn when the coal supply has been exhausted. The oilfields are already showing a decreased production, and the water power in Europe is estimated not to exceed 2,000,000 h.p., while the industries of England are expending approximately 100,000,000 h.p. at the present day. The extraction of power from the tides as well as the use of engines worked by solar heat are ideas of doubted value. The only possible alternatives, according to Sir William Ramsey, are to either obtain a supply of heat in the form of steam by drilling a hole in the earth's crust at least 10 miles deep, or to extract energy from the ether. As to the extraction of steam from deep drill holes, Mr. Parsons, of turbine fame, states that execution of such a project would cost $25,000,000, and could not be accomplished in less than 80 years. The best scientific opinion also asserts that the possibility of a discovery to extract energy from ether is highly remote; it therefore appears that for all practical purposes the scientific world is unable to dethrone King Coal from his enviable position as the greatest necessity of man.

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Consumption of Copper in 1908

The statistics of the Copper Producers' Association enable us to approximate the deliveries of copper in the United States in 1908, for which in our issue of Jan. 9, 1909, we reported "no reliable data available." The table may now be completed as follows:

	1907.	1908.
Stock Jan. 1	9,000,000	120,000,000
Imports of refined	5,000,000	None
Production	1,152,747,890	(e) 1,105,000,000
Total supply . .	1,166,747,890	1,225,000,000
Exports	508,929,401	661,876,127
Remaining in U. S.	657,818,489	563,123,873
Stock Dec. 31 . . .	120,000,000	122,357,266
Delivered for consumption	537,818,489	440,766,607

(e) Computed as per footnote, JOURNAL, Jan. 9, 1909, p. 56.

The delivery for consumption in 1908 appears therefore to have been about 82 per cent. of that in 1907, and 66 per cent. of that in 1906. The basis for comparison is well established, our own statistics and those of the Geological Survey for 1907, each computed from data collected independently, having been in close agreement, our own figures with those of the Geological Survey in brackets having been as follows: 537,818,489 (545,000,000).

While the production of crude copper increased in 1908 about 70,000,000 lb., that of refined is computed to have decreased about 48,000,000. This was because the refineries were operating at reduced capacity in the early part of the year. The increase in the smelting production overlapped into 1909 as is clearly shown by the refinery production of 112,135,200 lb. in January. Even if the smelters should now restrict operations the refinery output would continue at substantially undiminished rate for nearly two months.

Some criticism has been directed against the association statistics of stock on hand on the ground that they do not disclose the whole quantity of merchantable copper. We understand, and believe, that they do—including the Lake, electrolytically refined, and the bessemer bars that are sold for casting—being in fact all of the merchantable copper in first hands, whether sold or unsold, excepting that which may be in the hands of smelters of scrap and junk probably a very small amount. An insignificant quantity may also be in second hands.

The swelling of the figures of the copper accumulation by adding the copper in transit and in treatment at the refineries is deceptive, because about two months' production must always be in that state. It would be quite as logical to go further back and reckon the copper in ore awaiting treatment at the smelteries of which there were some large reserves on Jan. 1.

Because the delivery for consumption in 1908 appears to have been about 440,000,000 lb., it does not follow that consumption was so large, inasmuch as the manufacturers probably had stocks in their yards. The large deliveries in January were to a great extent the filling of orders placed in November. Of course, no one believes that consumption was going on at the rate of nearly 600,000,000 lb. per annum in January. The inference is obviously that the requirements of manufacturers are still well provided for, which explains the small sales in February so far and prepares us for the report of a further accumulation of stock, the shipment of the November sales approaching completion.

If the price for copper should become attractive to the manufacturers so that they would transfer the whole, or a part, of the present stock to their yards, the producers would be relieved, but after all we must look to the final consumer who takes the metal out of the market and puts it to use.

Earthquakes and Colliery Explosions

It is proper for us to remark that the suggestive article by Mr. Spalding, which appears in this issue, was written many months ago, and if he had had an opportunity to revise it, he would have been able to make some important citations from recent experience. It is well known that the period of great seismic disturbances, culminating with the catastrophe in Italy last December, has been accompanied by an unusual number of colliery explosions. An argument on the basis of *post hoc ergo propter hoc* is inconclusive. Nevertheless, it must be admitted that the coincidence between earthquakes and colliery explosions is such as to warrant careful study of the conditions. In this connection, full credit must be given to James T. Beard, who has for many years been drawing attention to this matter, as the readers of the JOURNAL are well aware.

The subject has now become one that is attracting international attention. Our Paris correspondent, in his letter in this issue, remarks that M. Moreux, manager of the observatory at Bourges, is an exponent of the earthquake theory. Of equal importance is the suggestion made before the Meteorological Congress, recently sitting at St. Petersburg, where it was pointed out that oscillations of the earth frequently cause the escape of gas in mines. This led several delegates to suggest that a seismograph be installed at every mine to record the least earth movement and thereby warn the engineers of the possibility of danger.

This, together with the atmospheric theory, that we have previously discussed, continues to demand the careful attention of colliery engineers. Our propaganda as to the probable effect of atmospheric conditions has led many operators to install barometers at their mines and observe them carefully for warning of approaching low pressure. Such warnings are generally recognized in Europe as being of great practical benefit.

Two Efficient Colliery Safeguards

We have remarked some scores of times that there is no great mystery about colliery explosions, which are not "acts of God," but rather are due to the carelessness of men. The greatest safeguard against them is obedience to the laws and eternal vigilance. However, it is human to err and perfection is not to be expected as long as there is a personal equation. What the engineers and investigators are really aiming to develop is a system of safeguards which by application will make a "fool-proof" mine. In this connection engineers are directing their attention principally to the control of shot-firing and to methods of underground sprinkling. Mr. Harrington, formerly chief engineer for the Utah Fuel Company, has written an admirable discussion of these two safeguards. In the JOURNAL of Jan. 23 was published his article on "Spraying Coal Dust," while the JOURNAL of Jan. 30 contained an article on "Shot-firing." We consider these articles to be a highly important contribution to knowledge as to their subjects, both of them being distinguished by an eminently practical character.

It is doubtful if any other coal company in America has applied these systems so thoroughly as the Utah Fuel Company, and it is, therefore, important to learn that after years of experience the officials of that company heartily indorse the installation of similar systems in all coal mines.

A complete spraying system as outlined by Mr. Harrington costs approximately $7000, which expenditure if distributed over a year would amount to about 2⅓c. per ton at a mine where the annual production is 300,000 tons. If the same outlay were distributed over a period of five years, the cost would be less than 0.5c. per ton of product. The total operating cost of this spraying system amounts to less than 1c. per ton. The cost of installing a shot-firing system like the one described in Mr. Harrington's second article is about $1250, which, if paid by one year's output at a mine producing 300,000 tons annually, would add but 0.4c. per ton of product. The annual operating cost of this latter system does not exceed $1900, according to Mr. Harrington's figures, which would increase the cost of coal about ⅔c. per ton. At other collieries the cost has been found to be a little more than that, but even so, it is insignificant in comparison with the advantage gained.

The greatest objection from mine operators to such systems as those suggested has been the increased cost of coal. Now that actual figures are placed before us, there remains no reason for doubt on this score. Many coal-mine managers, whose properties are in bad condition, are at present making much noise in promoting the notion that our so-called ideal mines have been the ones lately visited by serious disasters. It will not be surprising if the same individuals soon claim that a well planned, carefully operated mine is the very one to be shunned as dangerous to the welfare of the mining industry. Of course, those who have planned and developed ideal mines should be commended for their enterprise and condemned only for having overlooked the personal factor of neglect and carelessness on the part of individual miners.

If a blown-out shot should cause an explosion in a mine after all of the employees have reached the surface, it is certain no human lives would be dedestroyed. It is also indisputable that dust explosions, from whatever cause, cannot well occur in workings where the fine coal is reduced to a point of saturation. Consequently, it appears that the precautions suggested by Mr. Harrington are the proper measures to perfect and make our so-called ideal mines really safe.

The time is fast approaching when miners will be punished for violations of rules, and mine officials will be compelled to prove that they are really guiltless in event of a serious disaster. On Jan. 25, a mine superintendent and foreman at Wilkes-Barre, Penn., were found guilty of negligence which resulted in two disasters, one causing the death of 12 and the injury of 13 men, and the other the death of six and the injury of five miners. Although the judge who rendered the decision suspended sentence, declaring that the conviction will serve the ends of justice and carry with it its own punishment, the incident is interesting because it lends hope to the desire that justice be meted out equally to all.

American Smelting and Refining Company

The statements made in the application of this company to the New York Stock Exchange for transfer from the unlisted department to the regular list includes some interesting technical data, although these appear to have been somewhat carelessly prepared. Of course the attention of the committee of the Stock Exchange is directed chiefly toward the financial details, as to the accuracy of which no question is here raised.

According to the statement of the company, its present smelting capacity is 4,465,000 tons of ore per annum. Of this, 1,600,000 tons is in the live Colorado plants, five in number. (However, we believe, that all of the Colorado plants, including the Grant and the Philadelphia, that are now shut down, have never smelted more than 1,000,000 tons of ore per annum). The smelting capacity in Utah is 523,000 tons, which of course does not include that of the Garfield works, belonging to the Securities Company. The capacity in Montana is 235,000 tons. The three Mexican plants are able to treat 1,333,000 tons, while the El Paso works, which is to be considered both as an American and Mexican plant, has a capacity for 492,000 tons. In connection with the refineries at Omaha, Chicago and

Perth Amboy, there is a smelting capacity for 282,000 tons.

The company says that "The actual amount smelted has averaged about 3,500,000 tons annually." That is decidedly a vague statement and leaves much to guess. However, it is the first time that the company has ever given any indication of the amount of ore smelted. We guess that 3,500,000 tons may be close to the amount smelted in the year of banner profits, viz., 1906-07.

In an article in the JOURNAL last summer, it was estimated that the amount of ore smelted in 1902-03 was probably about 2,500,000 tons, on which basis, the net profit to the company was a little less than $2.20 per ton. Assuming 3,500,000 tons for the amount smelted in 1906-07, the profit in that year was $2.83 per ton, which of course includes not only the profits in smelting directly, but also that from the various commercial and mining enterprises of the company and the gain upon metals in hand arising from a strongly advancing market. However, as we have previously pointed out, the income account of the Smelting Company does not allow, in our opinion, as much as necessary for amortization of plant, and probably actual profits are less than will appear from any way of figuring.

Pig Iron in 1908

The complete statistics of pig-iron production in the United States in 1908, as collected by the American Iron and Steel Association, show a reduction of 38 per cent., as compared with 1907, the heaviest proportional loss for many years. The production last year was less than two-thirds of that of the preceding year, and was only a little above that of 1901; being less than that of any intervening year. The make was only about one-half of the total capacity of the furnaces.

The division according to the purposes for which the iron was intended is as follows:

	1907		1908	
	Tons.	Per Ct.	Tons.	Per Ct.
Foundry & forge	5,397,777	24.8	4,307,734	27.0
Bessemer pig	13,231,620	51.3	7,216,976	45.3
Basic pig	5,375,219	20.9	4,010,144	25.2
Charcoal iron	437,397	1.7	249,146	1.5
Spiegel and ferro	339,348	1.3	152,018	1.0
Total	25,781,361	100.0	15,936,018	100.0

Steel-making irons were 73.5 per cent. of the total in 1907, and 71.5 in 1908; indicating that the demand for foundry products decreased in a slightly less proportion than that for finished steel. The most interesting point of comparison is the increased proportion of basic pig made last year.

The production of pig iron apportioned by districts was as follows:

	1907.	1908.
N. England, N. Y. and N. J.	2,052,060	1,258,661
Pennsylvania	11,348,549	6,987,191
Ohio, Ind., Ill., Mich., Wis. & Minn.	8,467,045	5,050,303
Maryland	411,833	183,502
Southern states	3,033,388	2,143,290
West of the Mississippi	468,486	313,071
Total	25,781,361	15,936,018

This classification is based chiefly on ores used. It is not possible to make an exact division in the report by States, but the errors will nearly balance. Thus the New York furnaces which use Lake ores offset those in eastern Pennsylvania which use local ores. Maryland production is largely from imported ores. The table shows that approximately 75 per cent. of the pig iron made in 1908 was from furnaces using Lake Superior ores, and 13.5 per cent. in Southern furnaces. Over 88.5 per cent. of the raw material came from those two districts.

Perhaps the only encouraging feature of the statement for 1908 is that the second half of the year showed a gain of 2,100,010 tons, or over 30 per cent., over the first half. This is a sign of improvement in business; but 1908 will stand out —for a long time, let us hope—as a preeminently lean year.

The Anti-Japanese Turmoil

The hostile legislation by some of the States on the Pacific coast against the Japanese appears now to have been sidetracked through the efforts of the Federal Government, but inasmuch as the projects discussed at their present sessions were but the recurrence of previous agitations, it is to be feared that the snake has not yet been fully scotched. It is time for the engineers and business men of the Pacific coast, as well as elsewhere in the United States, to think over what this thing means. At the last meeting of the New York Section of the American Chemical Society, when Dr. Baekeland announced his marvelous discovery of bakelite, Dr. Takamine, the eminent Japanese chemist who resides in New York, spoke feelingly as to the present attitude of America toward his country. He was, of course, promptly assured that it was not the attitude of America, but of only a small portion thereof.

Nevertheless, the agitation of these trouble-makers is undoubtedly having an adverse effect upon our commercial relations with Japan. Prominent Japanese residents in this country, as well as Japanese engineers visiting here, have called attention to the likelihood that, unless the repetition of such agitation be stopped, our important trade relations with Japan will be injured. While the intelligent class of the Japanese may understand that the agitation is local, yet it is feared that persistence in it will eventually engender ill feeling between the people of both countries and undermine the amicable relations that have heretofore existed. It is, of course, difficult for the foreigner to draw a sharp line between the Americans in California and the Americans in other States.

Indeed, we understand that orders for material contemplated for this country have already been placed in Europe. Our business with Japan in railway material, mining machinery, manufactures of iron and steel and other articles amounts to many millions of dollars per annum. This immense business has been gained by years of persistent effort on the part of American manufacturers. Unless this agitation against Japanese residents in this country be checked promptly, we shall inevitably lose much of the ground that we have gained. The more enlightened among the citizens of the Pacific coast must exert earnest efforts not only in behalf of fair play, but also for the sake of American interests in a highly important place, namely the pocketbook.

ACCORDING TO THE New York *Sun*, the officers of the Amalgamated Copper Company asked the Government experts who went to Montana to investigate the smelter smoke nuisance if they could suggest a remedy. "The only thing they could offer was convert the poisonous products into sulphuric acid and build a pipe line to the Pacific Ocean, dumping the product into the sea." The Butte correspondent of the *Sun* says that this suggestion was made in sincerity; yet we feel that the Government experts must have been joking.

Mine Explosion in England

One hundred and thirty-seven miners were imprisoned Feb. 16 by an explosion in the West Stanley mine, at Durham, England. At present writing, all attempts to reach the men have been unsuccessful. The West Stanley shaft is 700 ft. deep, and is badly damaged. It is feared that the entombed men, if still alive, will perish before rescuers reach them. At practically the same time that the explosion occurred, a severe earthquake did much damage to property and lives on the northern frontier of Asiatic Turkey.

American Smelting and Refining Company

In its application for transferal to the regular list of the New York Stock Exchange this company made the following statements:

The American Smelting and Refining Company operates directly by itself and owns in fee the following smelting and refining works, all of which are equipped with the most modern machinery and appliances:

Smelters

At Denver, Colo.: The Grant Plant occupies about 120 acres of land within the city limits, but is not now being operated and has been virtually dismantled. The Globe Plant occupies 150 acres just outside the city limits. It has seven furnaces, with an annual smelting capacity of 322,000. tons.

At Pueblo, Colo.: The Pueblo Plant—100 acres, seven furnaces, 328,000 tons annual smelting capacity. The Eilers Plant—80 acres, six furnaces, 295,000 tons annual smelting capacity.

At Durango, Colo.: The Durango Plant—200 acres, four furnaces, 146,000 tons annual smelting capacity.

At Leadville, Colo.: The Arkansas Valley Plant—200 acres, 10 furnaces, 509,000 tons annual smelting capacity.

Near Salt Lake City, Utah: The Murray Plant—60 acres, eight furnaces, 523,000 tons annual smelting capacity.

Near Helena, Mont.: The East Helena Plant—250 acres, four furnaces, 235,000 tons annual smelting capacity.

At Monterey, Mexico: The Monterey Plant—300 acres, 10 furnaces, 460,000 tons annual smelting capacity.

At Aguascalientes, Mexico: The Aguascalientes Plant—300 acres, 10 furnaces, 720,000 tons annual smelting capacity.

At Chihuahua, Mexico: The Chihuahua Plant—200 acres, three furnaces, 153,000 tons annual smelting capacity.

At Chicago, Ill.: The National Plant—six acres, two furnaces, 60,000 tons annual smelting capacity.

At Maurer, N. J.: The Perth Amboy Plant—40 acres, three furnaces, 140,000 tons annual smelting capacity.

Making a total smelting capacity of 4,365,300 tons. The actual amount smelted has averaged about 3,500,000 tons annually. (This appears to include the capacity of El Paso and Omaha, stated below.)

Refineries

At Chicago, Ill.: The National Plant, with a capacity of 84,000 tons of refined lead and 16,400,000 oz. of refined silver and gold.

At Maurer, N. J.: The Perth Amboy Plant, with a capacity of 66,000 tons of refined lead, 66,000 tons of refined copper, and 36,000,000 oz. of refined silver and gold.

Other Interests

The Consolidated Kansas City Smelting and Refining Company owns and directly operates a smelting plant near El Paso, Tex., known as the El Paso Plant—1500 acres, 10 furnaces, 492,000 tons annual smelting capacity. Every share of the capital stock of the Consolidated Kansas City Smelting and Refining Company is owned by the American Smelting and Refining Company.

The American Smelting and Refining Company operates a smelter and refinery at Omaha, Neb., known as the Omaha Plant, upon a leasehold running for 18 years from the present time. The smelting plant consists of two furnaces, with 82,000 tons annual smelting capacity. The refining plant has a capacity of 156,000 tons of refined lead and 36,000 oz. of refined silver and gold. The copper-converting plant has a capacity of 12,000 tons of blister copper annually.

The Omaha and Grant plants are subject to a mortgage issued by the Omaha & Grant Smelting Company, one of the original constituent companies making up the American Smelting and Refining Company. The bonds still unredeemed amount to $349,000. By the condition of the mortgage they are still being redeemed yearly, and will be all redeemed in 1911. There are no mortgages other than the above on any of the plants or mines of the company, or of its constituent companies.

The annual value of the products of the smelters is approximately $70,000,000.

The annual product of the refineries is as follows: Gold, 1,250,000 oz.; silver, 66,000,000 oz.; copper, 66,000 tons; lead, 225,000 tons; giving a total value of refined metals sold annually approximately $97,000,000.

The company also owns and directly operates the following mines for the purpose of supplying ores which are most largely competitive:

At Sierra Mojada, in the State of Chihuahua, Mexico, the company operates five mines, with an annual output of 33,000 tons.

At Santa Eulalia, State of Chihuahua, Mexico, four operating mines, with an annual output of 60,000 tons.

At Asientos, State of Aguascalientes, Mexico, one mine with an annual output of 72,000 tons.

The American Smelting and Refining Company guarantees the payment of quarterly dividends at the rate of 5 per cent. per annum on $30,000,000 par value of the American Smelters' Securities Company preferred stock, series "B."

The investment account, in the statement of assets and liabilities, is made up very largely of 13,889 shares of preferred stock of the American Smelters' Securities Company, series "B," as well as 1600 shares of the preferred and 4500 shares of the common stock of the United States Zinc Company.

The company owns 177,510 shares of the common stock of the American Smelters' Securities Company, par value $100 each, but as yet the value of this stock has not been included in the investments of the company.

Chihuahua Copper Company

Special Correspondence

The property of the Chihuahua Copper Company, of which James Parker, of El Paso, Texas, is general manager, is situated 22 miles west of Moctezuma, Mexico, a station on the Mexican Central Railway, and 110 miles from El Paso. The hills in the vicinity reach an elevation of about 500 ft. A good wagon road leads to the property. The prevailing country rocks are limestones, andesites and quartz porphyries. The eruptives are massive, and well defined dikes are to be found from a few feet to several hundred feet in thickness. Large croppings of hematite and brown oxide of iron appear in the vicinity of the company's mines. Copper in various forms is found in these croppings and also disseminated throughout the bedding planes of the limestones. The mine shows native copper, malachite, azurite, chalcocite and chalcopyrite. Fluorspar is encountered in places. The chief development to date has been in the carbonate ores. Over 250 tons of ore has been shipped to the El Paso smelter, the copper content of which ranged from 6 to 9 per cent., with from two to three ounces silver per ton. The shaft is 230 ft. deep. Northwest of the shaft 200 ft. is a tunnel 100 ft. in length. This follows the bedding planes in the limestone and shows from one to three feet of good grade copper ore. Most of the ore shipped has been mined about 150 ft. from the tunnel, from irregular workings following the bedding planes in the limestone. About 2000 ft. northwest of these workings there is a large body of low-grade chalcopyrite. Here the ore seems to thoroughly impregnate the fractured seams of the limestone.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machine

T. R. Woodbridge's classic diagram in the JOURNAL of Jan. 30 explains why the scoop of a sampling machine does not eliminate from 10 to 50 per cent. of the coarse particles from the sample at once, thus condemning the entire system without more ado. I can not speak for John A. Church, but my objections to the falling-stream principle are not quite so crude as that explanation seems to imply.

The theoretical division of the area is quite as it should be, that is, if the action of the machine were also according to theory. The explanation assumes that the lumps of ore which strike the edge of the scoop are regular in shape, that they slide gently upon it without impact and that they then invariably choose the side of the division toward which the center of mass inclines. It does not take into account the fact that the impact upon the hard-steel edge always causes more or less rebound, and that the chance of the flying particle's coming to rest in its proper receptacle is small, depending as it does largely upon the relative extent of the areas upon which it may fall. What is the area of the scoop as compared with that of the entire sampling room?

The rebound of the particles from the edges of the scoops is the great objection to sampling by slicing a stream of falling ore, and that is also the objection to the use of the assayer's scoop in the final division of the sample. In every one of the four positions of the scoop shown in Mr. Woodbridge's diagram, the edge interferes with the free fall of material, and the chances of the larger particles striking and rebounding are greater than those of the finer particles by the ratio between their respective diameters.

A simple experiment carried out as outlined below will prove whether my statement that it is possible to remove all coarse particles from a sample by repeatedly passing it over a sampler's scoop is correct or not. To make the process as little tedious as possible, prepare a sample by mixing clean dry screened quartz sand with a third to a quarter of its weight of ¼-in. quartz lumps; 25 lb. will be enough. Take a single sampler's scoop, 2 in. wide between the edges and 2 in. deep. Remove the bottom and fix it upon a corresponding slit in the cover of a box. Now pour the sample upon the scoop with a shovel at any angle whatever. After all the material has been applied, there will be two lots, the sample in the box which we may call "tails," and that upon the outside, which we may designate as "heads."

Repeat the operation upon the two lots separately, the tails yielding two products, tails and middlings, and the heads only heads and middlings. The middlings will be again separated into heads and tails. It would, of course, be still more effective if more classes of material were made, but three classes will usually tell the story before long. Continue the operation for, say, an hour, and then see whether a difference is not apparent.

I agree with Mr. Woodbridge's statement that, "sampling is a commercial enterprise calling for continual compromises between the theory of the subject and local requirements and conditions, and the allowable cost of plant and operation." Nor do I wish to condemn utterly the present sampling machine. It is simple and inexpensive and may be modified indefinitely with a minimum of ingenuity; moreover it answers the purpose very well except in unusual cases. It satisfies everybody but the captious ore shipper who is not a good gambler and refuses to take an even chance. It seems to me that that is saying a great deal for any mechanical device. Then why claim for it all the remaining virtues and deny that it has certain defects?

A. VAN ZWALUWENBURG.

New York, Feb. 4, 1909.

Successful Prospecting with Churn Drill Under Unfavorable Conditions

In the JOURNAL of August 1, 1908 in the article, "Steam Churn Drill in Hot and Cold Climates," J. P. Hutchins takes a pessimistic view of churn-drill prospecting when done under trying conditions. He used a steam-operated drill while under either class of conditions that he describes a gasolene-operated drill would have been better. In fact from Mr. Hutchins' article one would infer that if the weather is very hot, or very cold, or if the ground is very marshy, or water is very scarce, or if several other conditions occur in unison or singly, the power churn drill as a prospecting apparatus is very unsatisfactory.

This impression which he conveys, either intentionally or not, I desire to refute and to do so I am going to give a brief description of a type of churn drill, which we are successfully using, in prospecting for coal in a country where there is little vegetation other than sagebrush, where the "wagon" roads are nothing more than sheep trails, where water is ten miles away and where moves from hole to hole often have to be made over every steep grades.

THE CHOICE OF THE TYPE OF DRILL

In churn drilling the important thing is to use a machine suited to the conditions under which the drilling is to be done, for it cannot be expected that one type of drill will be successful under all the conditions met with in drilling. When a man knows beforehand the conditions under which the work is to be done he should try to provide himself with a machine so constructed as to successfully meet those conditions. This at least was the idea followed out by the purchasers of our drill, and the success we have had with our drilling work seems to warrant me in recommending it to others.

If the holes to be drilled do not exceed 500 ft. in depth, it is folly to invest in a machine capable of drilling to a depth of 1000 ft. simply because some time in the distant future you might want to drill that deep a hole. Not only does a large machine cost a great deal more in the first place, but its weight is much greater, it takes more time and power to move it from hole to hole, and it takes more fuel to run it after it is set up. This item is not of such great importance when all conditions are favorable, but it increases in importance in direct ratio as conditions become adverse. If water and fuel are scarce and can be obtained only by long hauls, then steam as a motive power is not to be considered. If the country is rough and mountainous, with no roads and is sparsely settled, then a drilling method must be used which, without sacrificing speed in work or accuracy in results, will involve the least weight in outfit. If the work is to be done in a country where low temperatures prevail, then the outfit must be so arranged that nothing about it will freeze and interfere with the work. Contingencies such as I have mentioned and all such as have a bearing upon the work must be considered and planned for, in the purchasing of a drilling outfit, if the drill work is to be succeesful. As I have said before, and it is a point which cannot be emphasized too strongly, first find out the work which the drill will have to do and the conditions under which it will have to work, and then buy a drill to suit the conditions

The Gasolene-operated Churn Drill used by Roundup Coal Company

The drill work that I will describe is being done near Roundup, Mont., for the Roundup Coal Company. The machine is a little hollow-rod outfit, with a rated capacity of 500 ft., especially designed and constructed for meeting the adverse conditions such as prevail in this country. The power is furnished by a gasolene engine, the only kind which, owing to scarcity of water and the long hauls it would be necessary to make in order to get fuel, it is possible economically to use here. The engine is of special construction, being well adapted to the hard service of drill work and to undergoing the low temperatures which prevail at times. The drilling machine proper is mounted upon one set of trucks and the engine upon another set. This arrangement, while it necessitates a little more time in setting up, is especially adapted to haulage on steep grades, or over soft ground.

As gasolene power is continuous in its operation and admits of only a limited throttling, the drilling machine must be made so as to meet this condition. In the machine that we are using this difficulty has been overcome by placing a double clutch in the bull-wheel shaft, which, with the operating lever in one position throws the spudder in motion, and in the reverse position throws in the hoisting gear, but which, when it is on center, prevents the engine from gearing with either. The objection to the use of a clutch on the spudder has been overcome by making the clutch with an automatic positive attachment, which, however, does not engage until after the friction has taken hold, and then only when a heavy overload occurs; at such times the positive clutch engages and continues to hold until the clutch lever is thrown to the neutral position. This positive feature of the clutch is an arrangement which is highly recommendable in a clutch machine, when drilling in "heavy" ground. I mention these mechanical details simply to show that when special conditions are to be met special machines must be designed to meet them.

The Work Accomplished

The holes being put down are 2½ in. in diameter, and at present range in depth from 100 to 300 ft. The Republic Coal Company, which is working coal lands near the Roundup company, has an exactly similar machine and has put down holes more than 650 ft. deep. I might add as a further evidence of the great usefulness here of the churn drill that the Republic Coal Company also owns a diamond-drill outfit which, owing to its high cost of operation in comparison with the churn drill, has been stored away, so that now all the prospect drilling is done with the churn drill.

The drilling done by the Roundup Coal Company is mostly in sandstone and shale, with some limestone and slate. In an eight-hour day with the temperature 10 to 20 deg. F. below zero from 40 to 70 ft. is drilled. From 3 to 4 gal. of gasolene, and, in starting the hole, from 1 to 1½ bbl. of water are used per day. After a depth of about 100 ft. is reached the holes "bleed" a small amount of water and, as the rods pump it out as the water runs in, the hole supplies all the water that is necessary. Consequently, in drilling a hole it is often not necessary to haul more than 3 bbl. of water. This is an important item when the water often has to be hauled many miles over rough country.

Those who have spent a winter in Montana, or who have investigated its winter temperatures need not be told how cold it gets here, and yet this gasolene drill is able to operate satisfactorily in any weather in which it is possible for a man to work. From the satisfactory manner in which our little Cyclone machine has worked at the low temperatures here, I feel confident that it would prove equally satisfactory in any climate where man or beast can live.

If the churn drill is properly constructed mechanically and is adapted to the work it is expected to do, my experience has taught me that for certain kinds of prospect work, regardless of weather or other unfavorable conditions, churn drilling is one of the surest and cheapest methods of prospecting.

R. R. Sanderson.

Roundup, Mont., Dec. 22, 1908.

"Concrete Lumber" and Forest Preservation

In a recent number of an engineering paper appears an editorial entitled, "How 'Concrete Lumber' Has Made Forest Preservation a Farce." The article opens with the following words:

"The fast-perishing forests of America have been the theme of many a statistical lament. 'Behold the loss of this wealth, this criminal waste of natural resources!' cries the statistician, until we find ourselves almost sniffling in sympathy. Amid all this *illogical agitation* (sic) for forest preservation it is well to turn an eye toward the timber of the future, 'concrete lumber,' as it has been aptly called. . . ."

Are we to understand that engineers and contractors are willing to look forward to a concrete age, which will be independent of the waste of natural resources? The statistician tells us that the production of cement in 1890 was 335,000 bbl.; in 1907 it was 52,000,000 bbl., worth $56,000,000. Will someone tell us how many tons of coal will be required to manufacture the cement which the world will require during the present century? And then will someone go further and estimate how many board feet of lumber are likely to be used to make the forms required for concrete construction? The organized effort which is now being made to educate the people, so that wasteful extravagance shall cease, should receive the hearty support of the engineering profession and press. The following statement of Dr. I. C. White, State Geologist of West Virginia, is likely to become classic and cannot be too often reprinted:

"Just as sure as the sun shines and the sum of two and two is four, unless this insane riot of destruction and waste of our fuel resources which has characterized the past century shall be speedily ended, our industrial power and supremacy will, after a meteor-like existence, revert before the close of the present century to those nations that conserve and prize at their proper value their priceless treasures of carbon."

Allerton S. Cushman,
Assistant Director, Office of Public Roads, U. S. Department of Agriculture.

Washington, D. C., Feb. 8, 1908.

Automatic Scale for Weighing Coal

The use of an automatic scale in weighing coal has heretofore been limited by the fact that no machine was designed to weigh coal unless the pieces were previously crushed to a diameter of less than 6 in. The Richardson Scale Company, of New York, has recently designed a machine which is capable of handling pieces of 15 in. and more in diameter. When this scale is used, the general practice is to first deliver the coal to a large bunker; this bin is then tapped on its sloping side to feed the automatic scale. When the exact quantity of coal has passed into the weighing hopper, the feed gate of the scale automatically closes and the hopper is discharged into a tapering spout, which carries the coal into the power house or other point of consumption.

This new scale is of 1500 lb. capacity, and is capable of handling about 100 tons per hour. The most unique feature of the machine is the method of feeding from a side gate rather than from an under-cut gate, as was employed in the former types. This new type of side-feed chute and gate entirely overcomes the difficulty of passing large lumps, and also the inability to raise the feed gate when it is closed, which were the chief troubles attending the use of the under-cut gate. It has also been found that only one-third as much power is required to raise the gate, as was necessary with the old type. The angle of the chute leading from the scale is about 40 deg. and the construction is such that it is impossible for the coal to bridge.

The deepest mine at Kalgoorlie, Western Australia (Percy Ifould, *Aust. Min. Stand.*, Nov. 18, 1908), is the Great Boulder whose shaft is 2400 ft. deep.

Electrically Driven Mine Pumps

By Sydney F. Walker*

At mines, pumping was the first important work to which electricity was applied, and apparently the first electrically driven mine pump was installed at the Trafalgar colliery in the Forest of Dean, Gloucestershire, England. This pump was a small one using only about 1 h.p. In the United Kingdom, a great many collieries are worked through shafts, and a number of them are troubled with water. In slopes a self-contained, three-throw plunger pump, with an electric motor, mounted on a truck that travels along the ordinary slope track is a good arrangement for following the water down. A drum can be arranged that holds enough wire to allow the pump to be lowered a considerable distance; this way there is no change in the resistance of the conductors for a considerable time.

The Series-wound Motor for Mine Pumps

In the early days of the electrically driven mine pump, the series-wound motor was universally employed, partly because the shunt-wound motor was not then properly understood, and partly because alternating currents were not then used at mines. The method employed at that time in England, and I believe, very largely at the present day, was, and is, to run the pump for a certain number of hours during the day, lowering the water that had run into the workings sufficiently to allow work to be continued until the next pumping period. One of the difficulties was starting the pump. It usually had to be started against the resistance of the inert column of water in the pipes leading to the bottom of the shaft, and sometimes in the entire column up to the surface. Considerable torque was required at the moment of starting, and the series-wound motor furnished that quite easily. Unfortunately however, starting was only a part of the work that the motor was required to do, and starting against the inert column of water was only one of the conditions under which the pump was required to work. It was not unusual for the pump to be started and left to run by itself for a certain time, an attendant going to it occasionally, or it even being switched off at surface. This would have been all right if the quantity of water to be pumped had been the same day by day, but in a great many cases at least in Great Britain, especially at shallow mines, the quantity of water varies with the rainfall on the surface, the water making its way into the workings, not immediately after the rainfall, but at some later time depending upon the overlying strata. This is the case of the series-wound motor led to trouble for, when the pump began to lose water, the series-wound motor would run away, and unless the current was promptly switched off, often injured itself, or the pump, but more particularly itself. This is one of the great defects of the series-wound motor. It changes its speed so much with a varying load. In coal cutting for instance, when a nodule of pyrites is met with, the series-wound motor will slow up and, providing there is power behind it, will cut its way through, but immediately the nodule is passed, it will commence to race unless the attendant is on the lookout, and is able to switch off the current, or stop it in other ways.

At the present time, there is apparatus on the market, that would enable the series-wound motor to be employed for pumping with perfect safety and without the necessity of constant attendance. Automatic appliances are arranged to start a motor when the level of the water rises to a certain point, and to stop it when the level has fallen to a certain point. The automatic appliance consists of a solenoid electro-magnet with a tripping contact, actuated either directly or indirectly by a float. The solenoid electro-magnet then actuates the ordinary starting resistance.

Shunt-wound and Three-phase Motors for Mine Pumps

The shunt-wound motor is undoubtedly the best all-round motor for general work about a mine, including pumping, and the three-phase motor is quite as good, except for the one objection that while the speed of the shunt-wound motor can be increased from one to six times, regulation of the speed of the three-phase motor is difficult. Both the shunt-wound continuous motor and the three-phase motor are self-governing, and both run at nearly constant speed—within about 4 per cent.

Where it can be arranged so that the pumping is done for a certain number of hours during the day, either the shunt-wound, continuous motor with continuous current, or the three-phase motor with alternating current will answer perfectly. They will deal easily with any variations of load incidental to the ordinary working of the pump. So long as the water that is made during a certain portion of the 24 hours can be pumped out so as to leave the workings free during working hours, the shunt motor, or the three-phase motor, running during those hours at constant speed, will do the work. Also with varying quantities of water, if varying times can be applied to getting the water out, again the shunt-wound and three-phase motor working at constant speed will do the work. But where large increases in the amount of water must be pumped at certain seasons of the year, after heavy rains, or due to other causes, and increased time cannot be given to getting the water out, the pumps must be run at a higher speed.

The shunt-wound motor lends itself readily to increased speed. By adding a resistance to the field coils of the motor, which is thrown into the field circuit at the time that a higher speed is required, the speed may be increased as much as 20 per cent., and even in certain cases 25 per cent. But with the ordinary construction of the continuous-current motor, as the speed increases, and particularly as it approaches 20 to 25 per cent. above the rated speed, sparking commences and becomes somewhat violent at the brushes. This difficulty is easily overcome, if it is known, when the motor is ordered, that a varying speed will be required, for motors are now made with what are called commutating or auxiliary magnet poles, placed between the ordinary field magnet poles. These auxiliary poles suppress the sparking which takes place when the speed is greatly increased. There is not space here to explain the full action of the apparatus, but it may be mentioned that the increased sparking is due to the weakening of the magnetic field, produced by the insertion of the resistance in the circuit of the field coils. As the resistance added to the field coils is increased, the magnetic field produced by the field magnets is decreased, and the speed of the motor may be proportionately increased. By the aid of the commutating poles, the speed may be increased up to as much as six times the normal. Probably the ordinary motor, with resistance added, would answer the purpose, because the pump could hardly be allowed to run at more than 20 or 25 per cent. above its normal speed.

In the case of the three-phase motor, a similar method of regulation is not available because the speed of alternating-current motors depends, not upon the current strength, but upon the number of alternations of the current. A certain variation in speed can be obtained, say half speed, three-quarter speed, if it is known beforehand that it will be required, by altering the connections of the coils of the stationary part of the motor, but no intermediate speeds can be obtained, except by the use of wasteful resistances.

Centrifugal Mine Pumps

It may perhaps be noted, that while the three-throw plunger pump has been such a great favorite, and such a good servant, the centrifugal pump now has many advocates. Not very long ago the centrifugal pump could only be employed for low heads, but now single centrifugal pumps are made for heads of 100 ft., and by placing two or more pumps in series, any head that may be desired can be worked against. I understand that the Worthington company has supplied centrifugal pumps raising water as high as

*Consulting engineer, Bloomfield Crescent, Bath, England

2000 ft. in a single lift. The centrifugal pump is much more convenient than the three-throw plunger pump. It occupies less space for it can be connected directly to the axle of the driving motor, and the later designs of centrifugal pumps are certainly more efficient than the older forms of the three-throw pump. It also, however, has certain features that have to be reckoned with, when applying pumps. The centrifugal pump can be designed for constant quantity, constant speed, or constant head, but when the conditions for which it was designed are changed much, the efficiency of the pump decreases rapidly. Thus, in the case of the pump designed for constant quantity, its highest efficiency is when it is delivering that quantity. If the quantity is increased, the efficiency commences to fall, and with a comparatively small increase, falls very rapidly. On the other hand, if it is not delivering that quantity, its efficiency is also very much less. I have the results of a test of a pump designed to deliver 1250 gal. per min. against a head of from 100 to 117 ft., the pump to run at 700 r.p.m At 700 r.p.m., the efficiency of this pump was about 72 per cent.; at 750 r.p.m., it was still 72 per cent.; at 800 r.p.m. it had fallen to 70 per cent.; at 900 r.p.m. it was only 58 per cent. and at 950 r.p.m. it was only 40 per cent. Similar conditions are met with in pumps designed for constant speed, or constant head. So long as centrifugal pumps are working within a short margin of the condition for which they are designed, they work at high efficiency, but when those conditions are departed from the efficiency falls very rapidly. These facts, it appears to me will bear upon the question of centrifugal pumps for mines.

The best form of pump would probably be that designed for constant speed, provided that the quantity of water to be dealt with did not vary much. In those cases where the water might vary, probably the pump designed for constant head would be the best. With constant speed, the pump may be driven by either the shunt-wound motor, or the three-phase motor, and should give at least as good results as the three-throw pump, but if the speed has to be altered, the shunt-wound motor is practically the only one available. With reference to the matter of the starting torque, in which the shunt-wound motor is comparatively weak, this difficulty may be overcome by having a few turns of wire on the motor, making it temporarily a compound-wound motor, the few turns being in series with the armature. These few turns will give the starting torque required and can be cut out after the pump is running at full speed. It should be mentioned, that the improved efficiency of the centrifugal pump has produced the natural result, improved efficiency in the three-throw pump.

The Utah Copper Company

The company's statement for the quarter ended Dec. 31 shows net earnings of $530,658; rents, etc., $9623; total net, $540,281. The production of copper was 11,776,664 lb., or 224,261 lb. less than in the third quarter of 1908. The report says that 11 sections of the Garfield plant were in partial operation until Nov. 20, when the 12th and last section of the plant was placed in commission. Owing to the deficiencies in tonnage, largely due to transportation difficulties, but partially to unusually rigorous winter weather, the entire plant has not yet been operated to its full capacity, excepting for periods of a few days at a time. This deficiency is reflected almost in direct ratio in a decrease of copper output. The decrease in tonnage, and consequently in copper output, resulted in a proportionate increase in the cost per pound of copper; the average cost for the fourth quarter having been 9.35c., which includes all mining, milling, managerial, general expenses of all kinds, transportation, smelting and all selling costs. This result is readily understood when consideration is given to the fact that the tonnage we were unable to mill because it could not be supplied to the plants, could have been handled with practically no additional cost.

The recovery per ton of ore milled continues to be unfavorably, and very decidedly, influenced by the necessity of milling large quantities of oxidized and low-grade material resulting from the continued unavoidable admixture with the ores mined by steam shovels of a considerable percentage of such surface material, from which little recovery is made.

The earnings are based on an average price of copper for the quarter of slightly less than 14.10c. per lb., which is approximately the average price at which copper was sold during the quarter. The net price received for the last two months of the quarter was 14.30c. At the expiration of the quarter there was no finished copper on hand unsold—sales having been made during the quarter to cover all copper available for delivery up to about the middle of January.

Notwithstanding bad weather conditions, stripping of capping from the orebodies was continued, resulting in the removal of an average of slightly over 88,000 cu.yd. per month. Of the total ore mined and milled during the quarter 25 per cent. came from underground mining and 75 per cent. from steam-shovel operations; the increased percentage from shovels, as compared to last quarter, resulting in a further slight decrease in the cost of mining.

Since placing the last unit of the Garfield plant in commission we have been able to demonstrate, for short continuous periods, when we could secure the tonnage, that the plant has an economical operating capacity in excess of 6000 tons per day, that being the nominal capacity for which it was designed. It has thus been determined that the two plants can handle more than 200,000 tons per month as soon as that quantity can be delivered to them.

Progress has been made toward the application to our operations of better and more secure transportation facilities, and we expect to be able to report definite measures for relief from existing difficulties in our next quarterly issue.

Events Following the United Mine Workers' Convention

The last of the coal miners' delegates and the district officers, who came from all parts of the country to attend the recent international convention at Indianapolis, have left that city. President T. L. Lewis has gone to Pennsylvania to open negotiations with the anthracite operators. The international board remained for several days to complete consideration of the things referred to it by the convention. The board discussed earnestly the situation in the anthracite district where the present scale expires April 1. It was decided to send committees into West Virginia and Pennsylvania to investigate troubles in those districts.

Just what will take place in the anthracite districts is a serious problem. Much is depending on President Lewis, and he is hopeful of getting the operators into a conference with a view of making and adopting a scale. The anthracite owners do not recognize the miners' organization except to permit them to hold their union meetings and to post notices in the mines regarding these meetings. The operators have for years refused to make contracts with the miners as a unionized organization. The mine workers do not believe a strike would be wise at this time, and will avoid such a thing if possible. The executive board will meet again in Indianapolis March 15.

Gold in Western Australia

Gold returns from Western Australia show a production of 139,160 oz. fine in December, which is 2160 oz. more than in November, but 15,295 oz. less than in December, 1907. For the full year ended Dec. 31 the report of the Council of Mineowners gives the total at 1,697,552 oz. in 1907, and 1,647,912 oz. in 1908; a decrease of 49,640 oz. The output of 1908 was $34,062,341 in value.

The tin mines of Tasmania, according to a late report of the Secretary for Mines, employed during the last quarter of 1908 a total of 1747 men, 1641 of whom were Europeans and the balance Chinese.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

John E. Rothwell, of Denver, Colo., has been seriously ill.

A. von der Ropp has been a visitor in New York, on his way to Europe.

Ernst F. Eurich, of New York, has gone on a trip to Panama and the West Indies.

Prof. Henry M. Howe, of Columbia University, New York, has returned from Europe.

Albert Maltman is superintendent of the Three Stars mine at Ophir, in Placer county, California.

James M. Barr has been appointed manager of the Woodstock Iron Company, at Anniston, Alabama.

Prof. J. W. Richards, of Lehigh University, South Bethlehem, Penn., has returned from his European trip.

Glenville A. Collins has opened an office for the practice of civil and mining engineering at Seattle, Washington.

C. W. Whitley, manager of the Utah smelters of the American Smelting and Refining Company has gone to San Francisco.

Doctor Heroult, of Paris, France, recently visited the Electro-Metals Smelter Works at Welland, Ont., in which he has an interest.

Sherwood Aldrich, president of the Ray Consolidated Copper Company, and D. C. Jackling, general manager, are at Kelvin, Arizona.

Neil McL. Curran, manager of the North Star mine at Kimberley, East Kootenay, B. C., has lately been in Montreal, on business.

Francis Henry Shepherd, of Nanaimo, Vancouver Island, B. C., has been appointed chief inspector of mines in the province of British Columbia.

Thomas Hoatson, managing director of the Keweenaw Copper Company in the Lake Superior district, is in New York, attending a meeting of the directors.

Archibald A. C. Dickson now has his office located at Rejoulie in the Gaya district, India. His telegraphic address is at Nawadah, on the East Indian railway.

J. M. Gray, who recently resigned the position of State mine inspector of Alabama, is now superintendent of the Empire Coal Company in Walker county in that State.

John B. Hobson, who for years has been engaged in hydraulic mining for gold in the Cariboo district of British Columbia, has been spending the winter in California.

Alexander Faulds, superinendent of the coal mines of the Nicola Valley Coal and Coke Company, at Middlesboro, B. C., has resigned, and James Gray has been appointed in his stead.

James W. Malcolmson, mining expert for the Kansas City, Mexico & Orient Railroad Company, is in the City of Mexico. He is accompanied by L. M. Lamar, of Sabinas, Coahuila.

J. W. Carse, of the advisory committee of the Steel Corporation, has been in the Birmingham district in Alabama, inspecting the works of the Tennessee Coal, Iron and Railroad Company.

J. E. McAllister, general manager of the British Columbia Copper Company, attended the annual meeting of the company at New York, and returned to Greenwood, B. C., Feb. 10.

S. V. Tench, formerly superintendent of the Red Ash Coal Company at Wilkes-Barre, Penn., has been appointed superintendent of the Eastern division of the Lehigh Coal and Navigation Company.

Hon. Wm. Templeman, Canadian Minister of Mines, has been returned to Parliament as representative for the Comox-Atlin district in British Columbia, which enables him to retain his position in the Cabinet of the Dominion.

James Chynoweth, president of the recently organized Arizona & Michigan Mining Company, has returned to Calumet, Mich., after a visit to Globe, Arizona, where he has been inspecting the property of the new company.

Dr. F. H. Hatch, of London, well known for his work in the Transvaal, has been appointed mining expert for the colony of Natal. His first work will be the preparation of a report on the mineral resources of the colony.

George Gordon Crawford, president of the Tennessee Coal, Iron and Railroad Company, and Charles S. Stillman, Southern manager for Rogers, Brown & Co., have left Birmingham, Ala., for a trip to Europe and Egypt, which will last two months.

A. F. Holden, managing director, and the executive committee of the United States Smelting, Refining and Mining Company, have been at Salt Lake City. They are on a general trip of inspection to all the company's properties in the United States and Mexico.

H. L. Charles, formerly superintendent of F. Aug. Heinze's smelting plants in Utah and Montana, has taken a similar position with the Colusa Parrot Mining and Smelting Company, at Butte, Mont. This is a Clark property, generally known as the Butte Reduction Works.

Frank A. Keith, formerly general manager of the Tonopah Mining Company, Tonopah, Nev., has been engaged as directing engineer for the Pioneer Mining and Leasing Company. The position of superintendent of the Tonopah will be filled by W. H. Madder, formerly with the Devereaux Engineering Company of New York.

Obituary

Arthur G. Yates, who died in New York Feb. 9, aged 65 years, had been president of the Buffalo, Rochester & Pittsburg Railroad Company for several years. For many years he was a member of the firm of Bell, Lewis & Yates, of Buffalo, extensive coal operators in the western part of Pennsylvania. He was instrumental in organizing the Buffalo, Rochester & Pittsburg Coal and Iron Company, and was its president for several years before going to the railroad company.

Societies and Technical Schools

Royal School of Mines—The 36th annual dinner will be held at the Hotel Cecil, London, March 30. The secretary of the committee is George T. Holloway, 57 Chancery lane, London, W. C. In accordance with the usual custom of selecting a distinguished graduate to preside, the chairman this year will be F. W. Rudler, past president of the Geologists' Association. The secretary particularly requests old graduates to notify him of any change in their addresses.

Appalachian Engineering Association—At the fifth annual meeting at West Virginia University, Morgantown, W. Va., Feb. 6, the following officers were elected for the ensuing year: President, E. A. Schubert, Roanoke, Va.; vice-president, Baird Halberstadt, Pottsville, Penn.; secretary, Dr. Henry M. Payne, Morgantown, W. Va.; treasurer, C. E. Krebs, Kanawha Falls, W. Va. At the afternoon session the visiting members were welcomed by Dr. D. B. Purington, president of the university, to which President-elect Schubert responded in behalf of the association. After the auditing of the reports and the transaction of routine business the following papers were read and discussed: "Methods Used and Results Obtained in Triangulation of the Fairmont Region," by John G. Smyth, chief engineer of the Fairmont Coal Company; "Municipal Shortsightedness," by Prof. D. C. Weller, Waynesboro, Penn.; "The Surveyor vs. The Engineer," by Guy B. Hartley, Morgantown, W. Va. The evening session was opened with a stereopticon address on "Machine Mining with the Electric Puncher," by John L. Wagner, Syracuse, N. Y., who was followed by E. A. Schubert, of Roanoke, Va., upon the subject, "Side Lights Upon the Iron Ore Deposits of the World, with Special Reference to the Virginias." Prof. R. L. Morris, of West Virginia University, then spoke on "Good Roads," and the session closed with an address by Dr. I. C. White, State geologist of West Virginia, on "The Barren Zone of the Northern Appalachian Coal Field."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Goldfield, Salt Lake City, Denver, London and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 10—The Northern California Dredging Company is about to move its office from San Francisco to Eureka, Humboldt county. Thos. Blair is president and Frank H. Tooby is secretary, both of Arcata, and most of the stockholders are residents of Humboldt county. If the dredge now at Hamburg Bar comes up to expectations others will be put on the rivers in Humboldt county. The one at Hamburg is on the Klamath in Siskiyou county. The company has about 4000 acres of possible dredging ground in Humboldt county and it is probable that other dredges will be put in between Weitchpec and the mouth of the Klamath.

The Byron Jackson Machine Works are building at Berkeley the new machinery for a dredge to be put in use in the southern part of this State. It will be of large capacity and is being built for Los Angeles capitalists.

Since the renewed activity of the smelting companies in Shasta county more and more mining claims are being opened in that county. In the first two weeks of January of this year 150 claims were located, most of them for gold and silver, but some for chrome. These claims are in the districts of Shasta, Old Diggings, Centerville, Spring Creek, Lower Springs, Quartz Hill, Churntown, South Fork, Harrison Gulch, French Gulch, Pittsburg, Backbone, Texas Springs, Ono, Whiskeytown, Flat Creek, Muletown, Stella, Buckeye, and Slate Creek. Some of these claims were relocations, but many are new prospects.

The Weather Bureau is arranging to establish stations for reporting on the amount of snowfall in the mountains of California so as to determine how much water may be available from this source when the spring rains melt the snow. Some stations will be in the higher ranges for the purpose of getting snow measurements. This will be of great advantage to the miners of the State as well as to those raising crops. Two divisions are arranged for California. One division will be in the Sacramento valley and the other at Los Angeles, and a number of permanent observers will be employed at different points.

In northern Plumas county in the channel between the Sunnyside and Glazier mines, a distance of about four miles, a number of drift mines are being reopened and developed. These include the Sunnyside, Alum Cove, Last Chance, San Jose, Scott, Cameron and Glazier properties. Work is also being done on the Pliocene and Salmon Falls claims which are continuations of the same channel on the north bank of the North Fork. There is apparent more activity also in the drift mining sections of Sierra county where some large enterprises are contemplated. Both Sierra and Plumas counties have vast tracts of ancient channel gravel not yet touched.

Goldfield, Nevada

Feb. 9—The milling output in Goldfield for the week ending Feb. 6 was from Goldfield Consolidated mill, 4200 tons valued at $168,000; Florence mill, 630 tons valued at $12,600; Nevada Goldfield Reduction Company's mill, 475 tons valued at $23,750; Combination mill, 750 tons valued at $30,000. This does not include ore shipped to the Western Ore Purchasing Company.

The output for Tonopah for the week ending Feb. 6 was Tonopah Mining Company, 3050 tons; Montana Tonopah, 745; MacNamara, 295; Tonopah Belmont, 650; Tonopah Midway, 50; Jim Butler, 300; West End, 250; total of 5340 tons having an estimated value of $132,000.

The hole being drilled by the Bay State Oil Company at Salt Marsh, near Blair, is now 575 ft. deep; at that depth the drill is in blue clay heavily impregnated with oil. Several days ago it was reported that the drill had reached cap rock, but later developments proved the statement in error.

Coal has been reported to have been opened in paying quantities six miles north of Blair by H. C. Petty. The existence of this deposit has been known to Mr. Petty for the past five years, but little work was done. Three miners are now hoisting the coal from the 200-ft. level where a vein 24 ft. wide is disclosed; 42 in. of this is of a good coking grade.

After a litigation extending over a period of 15 years, Judge Pike recently rendered a decision in the district court at Reno, giving to the plaintiffs, B. A. Gamble, F. S. Chadbourne, et al. the power to enforce an option, to buy, dispose of or work the Pittsburg-Silver Peak mine from the time the judgment becomes final. The property in question is one of the large mines of the State and has been operated by the heirs of John I. Blair with a large output.

Charles S. Sprague, president of the Goldfield Chamber of Commerce, was notified Feb. 1 that the American Mining Congress will hold its 1909 meeting at Goldfield. An attempt will also be made to have the meeting of the American Institute of Mining Engineers held here at the same time.

John Q. Critchlaw, president of the Chafey Investment Company, last week made the statement that his company had decided to install a 30-ton custom mill in the Chafey mining district; the intention is to enlarge the mill as conditions warrant.

Salt Lake City

Feb. 12—A blizzard of several days' duration has tied up the Utah Fuel Company's mines at Winter Quarters and Clear Creek, as well as those of the Union Pacific at Scofield. At Alta the snowfall has been greater than in many years. At Park City there has also been much snow. The Silver King Coalition is running out its regular tonnage; the Daly-Judge has kept its roads broken, and the Daly-West has been working through the Ontario tunnel. Most of the smaller properties, however, have been shut off by the snow and forced to discontinue work.

The storms throughout the State caused the smelters considerable annoyance. Some trouble is always experienced during the winter season, but this year it is far worse than usual. The American Smelting and Refining Company is operating five furnaces; three are idle. The United States Smelting, Refining and Mining Company has four in commission and three idle. The net earnings of the United States Smelting, Refining and Mining Company for November were $398,000, for December about $350,000, and for January probably in the neighborhood of $300,000. The mines and plants of this company are said to be in excellent shape. President Sharp, Managing Director Holden and Messrs. Storrow, Winslow, Rice and Clark of the United States Smelting, Refining and Mining Company are here on a trip of inspection to the company's Western plants and properties.

E. P. Mathewson, who is in charge of the railroad and smelter construction for the International Smelting and Refining Company at Toocle, arrived here from Butte a few days ago. It is said that the company will soon let contracts for rails, structural steel and other equipment. The roadbed from the main line of the Salt

Lake railroad to the smelter site is now being built, and plans for the smelter are nearing completion.

A party of 25 Chicago capitalists under the guidance of W. C. Orem, made a trip of examination to the Boston Consolidated company's plants at Garfield. The Utah Apex mine, at Bingham, is shipping 90 tons of lead-silver ore and concentrates per day.

The shaft at the Black Jack mine, now 1400 ft. deep, will be sunk to a depth of 2000 ft. The Uncle Sam is drifting on the 210-ft. level and it is expected that the new orebody will be found within 200 ft. On the 100-ft. level they are also driving for this orebody.

The Sioux Consolidated has declared a dividend of 8c. per share, or $59,631.12. This company has paid 33c. per share during the last five months. The Colorado company also posted a dividend of 8c. per share, or $80,000.

The Utah Copper Company produced 4,174,859 lb. of copper in December, so that the production for 1908 amounted to 43,689,875 lb. The mill at Garfield consists of 12 sections of 500 tons capacity each. Two of these were placed in commission in July, 1907, and the remainder were started up as they were completed, the last unit being added in December, 1908. Since July, 1907, the production has been as follows: July-September, 1907, 5,305,368 lb.; October-December, 1907, 7,716,712; January-March, 1908, 8,527,939; April-June, 1908, 11,568,390; July-September, 1908, 12,000,925; October-December, 1908, 11,592,621 lb. During this time the shares have been selling at $13 to $52. As soon as the price of copper improves the mill will probably be enlarged. At present the company is said to be clearing a little over 5c. on each pound of copper produced.

The drain tunnel on the 1200-ft. level of the Daly-Judge mine is being driven toward Bonanza Flat, paralleling the Daly fissure. The Daly company extracted $9,000,000 worth of ore along a distance of 1500 ft. on this fissure. The Daly-Judge company is now able to handle the water on its 1400- and 1500-ft. levels. This will give to the company an immense area of stoping ground, that up to date could not be worked owing to the large quantities of water coming from the Daly fissure.

Denver

Feb. 13—The United States Reduction and Refining Company, in its annual report, shows that the company's operations from Aug. 1, 1907, to Jan. 1, 1909, gave a net profit of $372,876, of which $225,250 was paid in interest on bonds, and $59,187 paid in preferred dividends, leaving a balance of $88,439 to be put in the treasury.

The two chief owners and organizers of the Western Metals Company, owning the electrochemical ore-reduction process, are about to show that they have the courage of their convictions, by erecting a plant at two mines, one in Georgetown, and one in Idaho Springs, of which mines they are respectively one the owner and the other the general manager.

It is also announced that a custom cyanide mill of 150 tons capacity, for the treatment of low-grade telluride ores, is to be built at Sugar Loaf in Boulder county.

Toronto

Feb. 12—On Feb. 11 the Judicial Committee of the British Privy Council rendered its decision in the case of the Dominion Iron and Steel Company vs. the Dominion Coal Company for breach of contract, sustaining the judgment of the Supreme Court of Nova Scotia in favor of the steel company and remitting the case to that court to have the damages assessed. This is probably the most important Canadian civil action on record. For a time the coal company was leased and operated by the steel company. This arrangement ceased in 1903, and on Oct. 20 of that year an agreement was entered into under which the coal company agreed to furnish the steel company with all the coal required for 90 years at $1.24 per ton, with 4c. per ton for use of cars. The steel company, in accordance with the terms of the agreement indicating that the coal was to be taken from the Phelan seam of the Dominion coal areas, as most suitable for its purposes. In the year 1905, the coal company made default as regards furnishing a sufficient supply. The steel company in April, 1906, notified it that during August, September and October it would require 80,000 tons per month. The coal company only supplied 58,270, 50,525 and 62,618 tons for these months, respectively. The steel company offered to take slack and banked coal without prejudice to contract rights to make up the quantity, but on the coal company's failing to deliver, it was notified that the steel company would not take coal except from the Phelan seam. After Nov. 1, 1906, the coal company's cars were sent to the steel works labeled, "Run-of-Mine Phelan Seam," without indicating the pit from which the coal was taken, thereby compelling the steel company's analyst to analyze the coal to ascertain its quality with the result that much of it was rejected as unfit for steel manufacturing.

The coal company thereupon gave notice that the contract was terminated on the ground that it had been broken by the rejection of the coal. The steel company closed its works Nov. 6, 1906, until it could arrange for securing coal elsewhere, and a temporary agreement was made for a supply from the coal company at a price much higher than that specified in the original contract. The steel company sued for damages and, after a trial lasting 16 days, Judge Longley, of Nova Scotia, found in its favor. The coal company took an appeal to the Privy Council.

Lord Atkinson, in an elaborate judgment declared that it was not a case into which it was necessary to import by implication words into the contract to effectuate the intention of the parties. The contention of the coal company that the phrase, "reasonably free from stone and shale," appearing in the contract implied that the coal supplied should be only as free as reasonable and proper picking could make it, apart from impurities in the laminæ permeating the coal, could not be sustained. The provisions of the contract were only explicable on the assumption that of the coal to be supplied, 90 per cent. was to be reasonably suitable for use in the operations it was known the company intended to carry on in the works described. The plaintiffs were entitled, owing to the wrongful repudiation of the contract by the defendants, to treat the contract itself as at an end, and recover damages in respect to breaches of it committed before its repudiation, viz., to Oct. 31, 1906. The coal company was ordered to pay the costs of the appeal.

About $57,000,000 of capital are affected by the decision, the stock and bond issues of the Dominion Iron and Steel Company amounting to about $34,000,000 and those of the Dominion Coal Company to $23,000,000.

Victoria, B. C.

Feb. 8—The Dominion Government is making provision for a representative display of the minerals of British Columbia, as well as of the products of other parts of Canada, at the Alaska-Yukon-Pacific Exposition to be opened at Seattle, Wash., next summer. R. W. Brock, director of the Geological Survey of Canada, has requested that the district boards of trade collect the minerals for the exhibit, he has intimated that a Dominion official with wide experience in connection with mineral exhibitions will be detailed to look after the final selection and display. It is suggested that mineral specimens shall be 1 cu.ft. in size, with a few very large specimens of high-grade silver-lead and copper-gold ore; also specimens illustrative of the metallurgical processes and products, building stones, clays and clay products, and in fact all natural economic substances.

The matter has been taken up energetically by the Associated Boards of Trade, which at their recent annual convention appointed a committee to make arrangements for a representative exhibit from the Kootenay and Boundary districts. As yet, though, there has not been similar

practical interest shown in the Coast district of the Province, and the Provincial Government has not announced any intention to promote the object in view in making a large exhibit, leaving arrangements to the Dominion Government as being more within the jurisdiction of the latter.

William Hutchinson, Canadian exhibition commissioner, accompanied by an architect from Ottawa, was in Seattle early in February, making preliminary arrangements for the Canadian building at the exposition, for which structure an appropriation of $75,000 has been made.

At the seventh annual convention of District No. 18 of the United Mine Workers of America, held recently at Lethbridge, Alberta, an important departure was made in connection with Asiatic labor. Heretofore, in the constitution under which the affairs of the district were carried on, an invitation was extended to all men employed in and around mines, without regard to race or color, excepting Chinese and Japanese, to unite with the organization. The constitution committee advised the striking out of the words "except Chinese and Japanese," and after a spirited debate this was agreed to by a majority of those in attendance at the convention.

At Edmonton, Alberta, in the district court, a judgment was lately given, by Judge H. C. Taylor, which is of importance to laboring men employed in that province. This was in the matter of an action brought by 18 employees of the United Collieries Company against two directors of that company for the recovery of wages due, amounting to about $760. The action was regarded as a test case and the judgment shows that wage-earners may recover the wages due to them by the company from any or all of the directors of a joint stock company, in the event of the company failing to pay.

London

Feb. 2—The West African goldfield continues to interest speculators and there is a considerable traffic in shares. The popularity that the goldfield is now enjoying is founded more on anticipation of future prosperity than on successful results already achieved. For on the whole, mining on the Gold Coast has, in the past, been a disappointing business. It is claimed, however, that improved results have lately been obtained by the crushing mines and further improvements are promised if capital is provided to enable operations to be carried on on a larger scale.

Whether these optimistic views, upon which the present boom appears largely to be founded, will be realized, remains to be seen. The recent records of the prominent mines indicate that dividends are still a considerable way off. In the report of the Fanti Consolidated Mines, Ltd., for the year ended Sept. 30, 1908, it is stated that at the Presta Block A mine, one of the best quartz mines of the colony, the costs for August, September and October last were $5.52 per ton milled exclusive of development. Allowing 96c. for development, which was the amount allowed in 1907, and 40c. for London expenditure, the total working costs comes to $6.88. During these three months the value of the gold recovered was about $7.44, so that the margin of profit is very small. At the Abbontiakoon Block 1 mine, one of the banket group, the costs for August, September and October were $7.80, exclusive of depreciation, and the revenue $8.74 per ton.

At the Wassau mine, another banket mine, the yield for the year, 1908 works out at $6.72 per ton milled. The costs during 1907 were $8.64, and during January, February and March $4.80 exclusive of development and London expenditure, which may be put at $2.40, making a total cost of $7.20. There is no profit here. The Abosso and Taquah mines, both on the banket field, show more favorable results.

The Taquah commenced crushing in September, 1907, with a new 50-stamp mill. For the period to June, 1908, the yield was $16.32, and the costs $10.56. For the year 1908 the yield has been $16.56 per ton. At the Abosso mine the yield and costs for the year ending June, 1907, were $14.44, and $9.12, respectively, and for the year ending June, 1908, the yield and costs were $12 and $8.40. During the last six months of 1908 the yield has fallen to $10.80 per ton milled. The reduction in grade that the mines develop with increased production is very noticeable.

In the face of the above figures it is difficult to get up much enthusiasm about West African gold mines; and it is somewhat surprising that fresh money is being found by one or two of the South African mining houses to develop some of the dormant properties floated during the last boom.

Until the old established mines have been placed on a sound dividend-paying basis, it seems premature and incautious to attack areas of the banket field, where the indications of value are less favorable, as far as is known at present, than in the present working mines.

Paris

Feb. 3—T. Moreux, manager of the Observatory of Bourges has recently advanced an explanation of firedamp explosions. He finds that these explosions are in close relation with the tempests of the sun and consequently with the spots that are observed frequently on the surface, and that earthquakes also take place during the same periods. In fact, in November last two enormous spots were observed on the sun causing magnetic deviations on Nov. 12, the date of the disastrous explosion at Hamm, Westphalia. On April 29, 1896, violent earthquakes accompanied by storms were observed at the time of the disaster in the Giphy mine and the explosion at Micklefield. On July 3, 1898, earthquakes and storms in Italy and Austria accompanied explosions of firedamp in Belgium in a mine where that gas had never been detected before. Among many other dates given by T. Moreux is that of the Courrières disaster in March, 1906, which occurred during a period of solar crisis.

The French mining law of 1810 has been frequently discussed in the Chambers with a view of altering it, but so far no fundamental modification has been adopted. A new mining law will be submitted soon to a vote of the deputies. The commission which is preparing it has decided to adopt the principle of the nationalization of the mines, i. e., to cause the mines to be worked by the State, or at least to make an investigation with that end in view. A sub-commission will examine conditions in Switzerland and Holland where mines are operated in this manner. The proposal of the commission will be submitted to the Chamber of Deputies before spring.

Portable electric lamps are now used underground at the Bruay and Carvin collieries. They weigh a little less than 5 lb., last 12 hours, have a capacity of 1.2 candlepower under two volts, consuming two watts per candlepower. The accumulator alone weighs 2½ pounds.

The largest producers of gold in Madagascar, Mortages & Grignon, are erecting a complete 950-lb. 25-stamp mill at their mine of Andavakoera in the northern part of the island 100 kilometers from Diego-Suarez. Owing to the difficulties of transportation the machinery supplied by Fraser & Chalmers, Ltd., was sectionalized to 500 kg. It is reported that it safely reached the mine and the erection is well advanced. The mill will probably be started in March. The Governor of Madagascar intends to attend personally the starting of this mill, which will be the first stamp mill running in the colony. Up to the present time the Andavakoera ore has been picked by about 3000 natives, crushed by hand in small mortars and then washed in *bateas*. A native crushes about 12 lb. of ore per day. As the natives chose only the pieces showing visible gold, considerable ore is on hand for the mill besides the ore not yet extracted by the natives. Assays made on ore carrying invisible gold show 100 gram per metric ton. The ore of Andavakoera has been worked by the owners for 17 months, and the average monthly production has been 100 kg. gold containing about 25 per cent. silver. The richness of the ore is increasing for the production of a single fortnight recently was 180 kg. of gold.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Bisbee—The Phelps-Dodge copper smelting companies have filed with the Interstate Commerce Commission, at Washington, complaints against the Baltimore & Ohio and other railroads, alleging discrimination in the rates for transportation of coke from Eastern cokefields to smelters in Texas and Arizona. The complaints say that the railroads charge 30c. a ton more from the coking region to Chicago on coke used for smelting copper, than on coke used for smelting iron. Practically all the coke used by the Southwestern smelters is shipped by way of Chicago and complaint is lodged only against the charge made for the haul to that point, the rate beyond being satisfactory.

GILA COUNTY

Arizona Commercial—At a depth of 710 ft. in the Eureka shaft, a station 36 ft. square is being cut.

California

AMADOR COUNTY

Boardman Hill—Joseph Garibaldi has commenced hydraulicking the gulch on the Boardman Hill, the last spot which has never been mined in the Volcanic Basin. The top dirt only is washed. The claim is in dispute before the Land Office, but Garibaldi is so sure of winning the contest that he has begun work.

BUTTE COUNTY

Big Blue Lead—Test washes of gravel show $3 per car in coarse gold, the fine gold not being saved.

CALAVERAS COUNTY

Benson—A 15-ft. vein of satisfactory quartz has been found in this mine at Altaville; George F. Walker, superintendent.

Bovee-Fritz—This is a reorganization of the company owning the Sultana mine near Angels. Capital has been secured, and active operations will shortly commence.

EL DORADO COUNTY

Golden Hatchet—Garretson, McLellan & Co. are about to secure the gravel mine on Webber creek, 10 miles from Placerville. The mine is on one of the well defined gravel channels of the county.

INYO COUNTY

Dodd's Springs—Jas. L. Butler is opening a new mine under the superintendency of John McCormack in the Saline Valley section at Dodd's Springs. The ledge carries gold, silver, copper and lead.

KERN COUNTY

Tungsten—The tungsten mines at Atolia have started up again with about 60 men at work.

Yellow Aster—The company at Randsburg is now employing 300 men and taking out large quantities of ore. Mining is quite active at Randsburg and Johannesburg.

MODOC COUNTY

Fort Bidwell Consolidated—From the Mountain View claim, R. L. Mason, superintendent, some high-grade ore is now being taken at a depth of 70 ft.; ore is being taken out from this and other mines in Hoag district to be ready for the 20-stamp mill to be erected this spring.

NEVADA COUNTY

Lecompton—This Nevada City mine, Samuel Colt, superintendent, has been compelled to close down owing to water due to the heavy storms. Work will not be resumed until winter is past.

Niagara—At a meeting of the company at Grass Valley it was decided to move the offices to Santa Barbara. It is possible that the mine may be reopened after the rainy season is over.

Yellow Metal—A 12-in. ledge at this property near Bowman's dam is yielding high-grade ore. The mine is being developed by A. D. Keller for Nevada City and Grass Valley men. The mine is in the granite gold belt, in a new district.

PLACER COUNTY

Northern California Gold Mining Company—W. R. Leonard and A. F. Sawhill, of Pittsburg, Penn., are examining the Herman mine and the financial standing of the company in Placer county.

Three Stars—The work of pumping out has commenced under superintendence of Albert Maltman.

SAN BERNARDINO COUNTY

In the district 10 miles north of Bagdad and Amboy, several companies are developing orebodies. One company has a mill and others in the district are working on the same ledge.

SIERRA COUNTY

No Better—At this group, owned by the Forest Green Gold Mining Company at Forest, J. C. Chandler, superintendent, the shaft is now down 165 ft., and will be continued to 500 ft., when drifts will be run.

SISKIYOU COUNTY

Bennett & Co.—This firm now has five big hydraulic plants at work near Forks of Salmon with plenty of water for effective work.

Dakin—This copper mine at Happy Camp continues working, and, having moved the power house, now has plenty of power.

Gardner & Weed—On this claim in Quartz Valley 15 men are at work with several giants, and have plenty of water for hydraulicking.

Grouse Creek Gravel—This company near Callahan, has a full head of water for all its giants. This is an ideal season for hydraulic mining.

TRINITY COUNTY

East Fork District—On the Yellow Jacket a small force of men has been set at work in the tunnel to develop the orebody found last fall. Development work is also being done on the Meier, Weedman & Condon, Johnson, Oversight group and Golden Chest. The Hoodoo is being developed by Grant Day near the Enterprise, with George S. Fenwick as superintendent.

TUOLUMNE COUNTY

Nonpareil—Arbuckle & Morrison have commenced work on this claim under a bond given them by the assignees of the creditors. The property is expected soon to become a producer.

Soulsby—This mine at Soulsbyville has resumed operations with a full force of men after running some time with only one shift.

Colorado

LAKE COUNTY—LEADVILLE

Bertha—In this mine, Breece hill, the body of ore opened in the lower level has widened out to a fair oreshoot; the ore running well in gold. It is more than likely if a satisfactory extension of the lease is granted to the present lessees, that they will sink the shaft to a depth of 500 ft. to open the orebody at greater depth.

Dinero Tunnel—In this adit, Sugar Loaf, the upraise, that is being carried from the tunnel level to make connections with the old workings, recently ran into a body of high-grade silver ore. In about three weeks the upraise will have made the connection and developing the body of ore at the breast of the tunnel will be started. Shipments will be started as soon as the wagon road is opened to the smelter.

Iron Silver—This company is increasing its force of men on the Moyers, Iron hill, and also the Tucson, and the daily output is materially increased. As long as spelter remains at its present figure the company will gradually increase the working force and its output. The same can be said of the A. Y. & Minnie.

Jennie June—In this mine, Tennessee Pass district, drifting from the bottom of the shaft to the north on the vein has been going on during the winter, following a small streak of ore that carried gold. The vein is now widening.

Sunday Tunnel—The footwall of the recent strike has been caught and the vein from wall to wall is 12 ft. wide, with 6 ft. of solid mineral; the balance is milling ore. The ore is a lead sulphide carrying 60 per cent. lead, with gold and silver. At present the tunnel is being driven ahead and when sufficient ground is cut for a large station and compressors, etc., installed, the work of connecting with the shaft will be started and also drifting on the vein, both sides.

TELLER COUNTY—CRIPPLE CREEK

El Paso Consolidated—The annual report of this company shows that the property produced during the past year ore to the amount of $432,000, or 19,600 tons of the value of about $23 per ton. In January, 1908, the property was leased to a number of operators who have taken out the ore. No ground below the water level, or 600-ft., was leased. No work was done on company account. Good headway is being made on the drainage tunnel. El Paso will be one of the first mines to be unwatered. A. L. Burris, of Colorado Springs, is the president of the company.

Gold Issue—The surveys from the railroad to the mill of this company have been completed and it is understood that the construction work will soon commence. The mill, which is known as the Wish Bone mill, is situated on the north side of Mineral hill, away from the railroad, and the surveys that have just been made are for the purpose of running a line from Hoosier pass, so that ore can be taken from all parts of the district to the mill. The mill owners have leases on several mines and dumps in the district. P. M. Collins, of Cripple Creek, is in charge of the mill. Some new machinery is being installed.

Golden Cycle—Ground is being broken for a new mill on this property, designed to treat the very low-grade ore at the mine and in the dumps that will not stand the freight to the valley mill of the company. It is understood that the mill is to be a concentrator and is to have a capacity of 500 tons per day. A large amount of ore is produced by this property. H. McGarry, of Colorado Springs, is general manager.

Trail Mountain—Some prospecting is being done on this hill, which is some distance south of the town of Victor. Several years ago a mill was erected in this vicinity and some ore treated. The mill is not running at present, but some values are reported as having been found in prospecting. As this is outside the known mineral belt, developments are being watched with interest.

Illinois

MERCER COUNTY

Coal Valley Mining Company—This company's mine at Cable has been finally worked out and abandoned after 35 years' continuous operation. The mine was worked on the room-and-pillar system, and all the pillars were successfully taken out, except those immediately around the bottom of the shaft. The company will soon begin work on another shaft, three miles from the old one. It will be equipped with the latest machinery.

Indiana

WARRICK COUNTY

White & Wilson Coal Mining Company—This company's shaft on the Lutz farm west of Boonville, has reached coal. The vein is 6 ft. thick and of excellent quality. It is 60 ft. below the surface and has a good roof of limestone rock. A switch is being put in from the Southern railway. The company will begin operations in the fall, with a daily capacity of 1800 tons.

Michigan

COPPER

Seneca—The shaft being sunk at this property has reached the first level, a distance of 200 ft. from the surface. A crosscut is being driven to the lode from this point. The shaft is in the footwall approximately 60 ft. from the lode.

Ojibway—The lode has been encountered in cutting the station at the 650-ft. level of No. 1 shaft. The face of the formation is well charged with copper. The lode opened in the level above consisted of two beds separated by about 14 ft. of trap.

New Baltic—This exploration company operating on lands adjoining the Arcadian property has opened up the lode and disclosed an amygdaloid formation. The ledge is covered with but a few inches of overburden and is badly disintegrated, but it is believed to be an extension of the Baltic lode.

Wyandot—This company continues driving the crosscut from the bottom of its exploratory shaft, a distance of 700 ft. from the surface, and is now cutting the third amygdaloid formation. Drifting northward on the first formation continues and the same minerals, epidote with some copper. No. 2 lode is being opened to the south and is about the same as the first formation.

Osceola—This company has stopped stamping Ahmeek rock in its mills, which in all probability means an increased production from its own shafts. No. 4 shaft of the North Kearsarge branch will soon be in condition to begin producing.

Allouez—The Kearsarge lode recently encountered in No. 2 shaft of this company is proving up exceptionally good.

Columet & Hecla—This company has put in commission a series of electrically driven centrifugal pumps in No. 5 shaft, which will take care of all the water from the northern portions of the mine, and has discontinued water hoisting at the Red Jacket shaft.

Montana

BUTTE DISTRICT

Butte & Balakalava—The shaft is down 1248 ft. and ore has been encountered at that depth. Sinking has been temporarily stopped and a station is being cut on the 1200-ft. level from which a crosscut will be run. Sinking will then be continued to the 1500-ft. mark. The management states that a modern surface plant will be installed and orders have already been placed for the machinery. The last 110 ft. of the three-compartment shaft were sunk and timbered, and all rock hoisted to the surface during a period of 30 days, which is a record for the camp at that depth.

Butte-Montana—A plan for reorganization is under consideration by which the capital will be increased to $2,000,000, with shares of the par value of $10. Ten of the old shares are to be exchanged for one of the new and a portion of the new stock will be sold for the purpose of carrying on further development work. Development work is now being carried on in the lower levels and shipments are averaging two railway cars per week.

Raven—Operations were suspended Feb. 8 by order of the board of directors. It is understood that the stockholders have failed to support the directors' efforts to refinance the company by subscribing for the treasury stock recently offered to them, and the directors, being unwilling to advance more money for continued operations, have shut down the mine. The time in which the stockholders may sub-

scribe for the new stock has been extended to Feb. 24, and if no response is forthcoming by that time the property may be closed permanently. The mine was formerly worked through the Buffalo shaft of the Amalgamated company, which was leased for that purpose to the Raven company, but since a dispute arose as to the ownership of several bodies of ore opened up through the Buffalo, the further use of the shaft was refused and the company then began to sink on its old shaft and reached a depth of 1300 ft. before the suspension of operations.

DEER LODGE COUNTY

Washoe Smelter—The new 87-ft. blast furnace was blown in last week and is the largest in operation in the world. The two other blast furnaces are 51 ft. in length. There are eight reverberatory furnaces at the plant. The smelter is producing from 300 to 400 tons of copper daily, depending upon the grade of ores smelted.

JEFFERSON COUNTY

Elkhorn Electrometals Company—The new electrolytic plant was put in operation on Feb. 5. The plant is the first commercial one of its kind in the country.

BROADWATER COUNTY

Keating Gold Mining Company—Final payment was made last week upon the company's group of claims in the Radersburg district. The management has under consideration a plan to use traction engines in place of teams for hauling ore

Nevada

ESMERALDA COUNTY—GOLDFIELD

Blue Bull—In the Knickerbocker lease on this property, ore of good grade has been cut in a drift from the bottom of a winze sunk from the tunnel level.

C. O. D. Consolidated—The oreshoot that was cut in the drift from the winze sunk from the 200-ft. level has also been cut by the crosscut run for that purpose on the 300-ft. level. The orebody has been penetrated for about 4 ft., and shows high-grade shipping ore the entire distance, with considerable free gold showing.

Combination Fraction—The first shipment to the Nevada Goldfield Reduction Company's mill under the new terms was made Feb. 1. The shipment consists of 105 tons with an average value of $40 per ton. A daily production of 85 tons will be maintained in the future. Forty additional men were put to work at the mill which is now in position to run, at full capacity, 20 stamps.

Crackerjack—The shaft on the Mitchell & Fairfield lease on the Henry Clay lode of the Crackerjack company is now 135 ft. deep. The low-grade vein that was cut at a depth of 95 ft. still shows in the bottom of the shaft.

Goldfield Whiterock—This company is doing a large amount of exploratory work. From shaft No. 7 a crosscut is being run to the east on the 540-ft. level to connect with shafts Nos. 4 and 5, about 2000 and 2200 ft. distant, respectively, through ground never before opened up.

Great Bend Diadem Lease—A rich strike was reported in the west drift on the 400-ft. level of this property last week; 20 in. of this ore is very rich.

Hazel Lease—At a meeting of the stockholders of the Hazel Goldfield Mining Company recently held in Chicago, W. H. Jordan was elected president, F. Fitch vice-president and treasurer, and A. R. Cuthbert secretary. John A. Farwell and Geo. H. Phillips are the additional directors. The mine is making about 20,000 gal. of water per day, and a pump is to be installed. The shaft will then be sunk an additional 150 ft., and development work carried on to the east of the shaft.

Little Florence Lease—A double-drum, electric hoist, and a compressor capable of supplying nine drills, are being installed. Development work has been curtailed owing to the inefficiency of the gasolene hoist now in operation; with the new hoist in operation both hoisting compartments of the shaft will be used. The crosscut on the 357-ft. level recently cut the hanging wall of a promising looking vein, but where cut it is low in gold. The crosscut has passed through 14 ft. of vein matter without reaching the footwall.

Red Top Consolidated—A dividend of 2c. per share, amounting to $20,000 was declared Feb. 1, affecting stockholders of record Feb. 20. Ore is being mined at four different points in the mine; all the ore is of high grade.

ESMERALDA COUNTY—HORNSILVER

Great Western—The west drift on the 300-ft. level recently opened a large body of good gold-silver ore. This ore is considerably richer than that in the same shoot on the 200-ft. level. The property is shipping an average of one carload a week to the Western Ore Purchasing Company.

ESMERALDA COUNTY—LUNING

Blue Light Copper Company—The shaft, now more than 700 ft. deep, is being sunk deeper; the intention is to continue it to water level. The property has produced some ore, and considerable ore is now blocked out.

Parrot—Work on this property has been resumed by the Nevada Champion company. Much money has been spent in opening this mine, but all work was stopped with the decline of copper.

NYE COUNTY—BULLFROG

Bullfrog Pioneer—This property shipped two cars aggregating 80 tons last week, having an estimated value of $100 per ton. The crosscut is not yet in the lode proper, though it is thought that the footwall has been cut. A number of new leases have been granted on Pioneer ground adjoining the Bi-Metallic claim, the leaseholds being blocks 200x300 feet.

Gold Hill Mining and Milling Company—This company, operating on the Conservative claim which adjoins the Pioneer Bonanza lease, is planning to sink a two-compartment shaft to a depth of 50 ft. A hoist has been ordered.

Homestake-King—It is estimated that the clean-up for January will show a production of about $13,000. The mill is now treating about 75 tons per day averaging $7 per ton.

Montgomery-Shoshone—The mill treated 4600 tons of ore during the month of January. The last shipment of bullion weighed 800 lb., and included the product of the concentrates which are now being treated successfully at the mill.

National Bank—The Logland lease on this property is preparing a shipment for the smelter at Needles; the shipment will be about 30 tons and all comes from the 50-ft. level.

NYE COUNTY—HELENA

Broken Hills—This company is at present sinking two shafts; the main working shaft is about 220 ft. deep. In the drift on the 100-ft. level from this shaft a body of milling ore 25 ft. wide has been opened up. This shaft will be sunk to a depth of 300 ft. before another crosscut is run. Much the richest ore on the property was opened up in an incline shaft about 200 ft. from the main shaft; this high-grade vein was followed from surface to a depth of 90 ft. The vertical shaft, which was sunk from the surface to connect with the bottom of the incline, is now 60 ft. below the bottom of the incline shaft, and has been in ore below the incline. A drift being run on this body from the 45-ft. level found an orebody of shipping grade 12 ft. wide. Twenty blocks of ground have been let to leasers; all of these leases are being worked, and many of them are equipped with uptodate machinery. A good grade of ore has already been opened up on two of the leases. The town of Helena, which has sprung up since the mine was opened, now has a population of about 300 people The Broken Hills company is constructing a telephone line to connect the camp with Tonopah, 12 miles of the line being already in operation. This work will be completed in about three weeks. J C. McCormack, principal owner and manager of the property, states that the Broken Hills ore is a petzite carrying about two-thirds of the value in gold. The survey

has been made for the mill site, but more exhaustive tests of the ore will be made before the plans for the mill are drawn. The company owns water rights ample for all milling and domestic purposes.

NYE COUNTY—TONOPAH

Montana-Tanopah—The mill ran continuously with all the stamps dropping and crushed 1040 tons of ore, .745 of which came from this property and 295 tons from the MacNamara. The contract in force under which the company agreed to treat an average of 50 tons per day from the MacNamara expires March 15 and will not be renewed.

NYE COUNTY—IONE

Ione—Thomas D. Murphy, E. R. Collins and Downie D. Muir, all of Goldfield, are preparing for extensive work on their placer ground, which comprises about 500 acres. A Fairbanks-Morse pump and 10,000 ft. of pipe have been ordered. Ione is south of the Reese River range, from which a large water supply can be easily obtained.

WHITE PINE COUNTY—ELY

Steptoe Smelter—During the month of January, 2,700,000 lb. of blister copper were shipped. The smelter is now treating nearly 5000 tons of ore per day of which two-thirds comes from the Nevada Consolidated and the balance from the Cumberland-Ely companies.

New Mexico

GRANT COUNTY—SYLVANITE

Sylvanite Townsite and Development Company—William Clark has purchased a controlling interest in the Sylvanite Townsite and Development Company. John T. Goshen, who has been the agent of the townsite company since its organization, has resigned as secretary, and C. H. Morse, president of the Eureka Sylvanite Mining Company, has accepted the position as secretary and agent under the new management.

Gold Hill Mine—I. J. Russell, the superintendent, reports 6 ft. of shipping ore in the upper tunnel; the two lower tunnels are both in good ore. A compressor plant is on the way to the mine. Ore bins have been built. Regular shipments were commenced this week.

Sylvanite Queen Mining Company—This company, which owns the Ajax, Alexander, Cowboy and other promising claims in the Eureka district, has elected new officers. Asa T. Hoy is president; E. A. Tovera, vice-president; G. K. Reynolds, secretary, and J. P. Connelly, treasurer, all of Bisbee, Arizona.

Fairview Group—This group of four claims at Granite Gap, four miles southeast of Sylvanite, has been optioned to G. F. Humbert. At this property there is a dike, 40 ft. wide, that carries copper, gold and silver.

Pennsylvania

BITUMINOUS COAL

D. G. La France & Co., of Johnstown, has bought from various owners a tract of 2820 acres of coal land in Quemahoning township, Somerset county, the price paid being $225 per acre. The coal on the land is the lower and middle Kitanning and the Freeport seams.

FAYETTE COUNTY

Republic Connellsville Coke Company—Plans are in progress for the organization of this $2,500,000 corporation which has been formed by merging the Republic Coke Company and the River Coal Company.

South Dakota

LAWRENCE COUNTY

Hidden Treasure—Work is to be resumed in the early spring when Supt. Nate Hart, of Lead, will commence drifting on the 200-ft. level to tap the ledge struck in the shaft.

Pennsylvania—Drifting on the 150-ft. level is being prosecuted, and it is expected to strike the vein within a few feet.

Pluma—President T. A. Harding, who spent some days here, announced that the plans for building a 500-ton mill would be completed soon. Work will commence in the spring when the drifting will be continued.

PENNINGTON COUNTY

Deep Down—A new strike has been made in a drift on the 50-ft. level where a body of free-milling gold ore was opened up. It also carries bismuth, and is being developed.

Dakota Power—Work is about to be resumed by L. A. Richards, of Rapid City, who has just returned from an Eastern trip, having completed financial arrangements to finish the flume work and establish and equip a generating plant.

Utah

BEAVER COUNTY

Beaver Carbonate—The new compressor at this mine has been started. Development work in the large orebody on the 700-ft. will now be hastened.

Commonwealth—Two drifts are being driven on the 400-ft. level; both show considerable ore.

Harrington - Hickory — This property owned by the Majestic Mining Company has opened a shoot of fine lead-silver ore on the 500-ft. level, just above water level. The entire face of the drift is in ore.

Peacock Consolidated—Three fissures are being prospected by drifts. In one of these, ore carrying gold, copper and silver has been found, and in another 2½ ft. of good lead-silver ore shows.

DAVIS COUNTY

Buckland Mining Company—This company has been incorporated for $100,000, the shares having a par value of 10c. The company will develop 14 claims in the Farmington mining district.

TOOELE COUNTY

Shipments—During the week ending Feb. 5, the Tintic mines have shipped as follows: Dragon Iron, 29 small cars; Colorado, 62; Ajax, 4; Brooklyn, 7; Beck Tunnel, 4; Swansea, 6; Black Jack, 2; Horn Silver, 4 small cars. The Centennial Eureka mine shipped 44 large cars; Eureka Hill, 8; Gemini, 2; Yankee, 2; May Day, 2; Eagle & Blue Bell, 1; Bullion Beck, 2; Sioux Consolidated, 14; Iron Blossom, 3; Ajax, 1 large car.

JUAB COUNTY

Bullock—At this property good copper-silver ore has been cut in the shaft at a depth of 190 feet.

Eureka Lilly—The shaft is being retimbered to the 300-ft. level. As soon as this work is completed drifting will commence.

Tintic Standard—A crosscut is being driven on the 400-ft. level, but it will be some time before the vein is reached.

SALT LAKE COUNTY

Big Mitt—A shaft is being sunk on the vein. Some of the ore assays several thousand dollars in gold and as high as 26 per cent. copper.

SUMMIT COUNTY

Shipments—The Park City mines shipped as follows for the week ending Feb. 5: Silver King, 1,951,480 lb.; Daly-West, 1,150,000; Daly-Judge, 683,000; Daly-Judge, zinc, 800,000 lb., or a total of 4,584,480 lb. The smelter settlements for the week ending Feb. 6 were $675,000.

Woodman—This group consisting of six claims has been added to the property of the Ohana Mining Company. On the Woodman there is a good showing of gold-silver-copper ore; the company also owns water rights. The Ohana company will run a tunnel 700 ft. long, to cut three veins which have promising surface showings.

Wyoming

CARBON COUNTY

Penn-Wyoming Copper Company—The properties of this company, which has been operating mines, mills and a railroad at Encampment, are reported sold to a new $10,000,000 corporation, the United Smelters, Railway and Copper Company.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 6 were as follows: Buffalo, 44,260 lb.; Coniagas,

126,590; Crown Reserve, 272,540; Kerr Lake, 81,637; La Rose, 310,620; McKinley-Darragh, 41,000; Nipissing, 255,310; O'Brien, 64,040; Temiskaming, 120,000; Trethewey, 125,400; total, 1,441,397 pounds.

City of Cobalt—In the course of sinking a winze from the 200-ft. to the 300-ft. level a rich strike was made at a depth of 225 ft. from the surface, the vein having a width of 9 in. of high-grade ore. Native silver slabs and argentite were found.

Crown Reserve—A strike has been made in the north crosscut at the 100-ft. level, consisting of two veins, each about 3 in. wide, and 15 in. apart. One of the veins gives an assay of 12,000 oz. of silver to the ton and the other more than 2000 ounces.

La Rose—On the McDonald vein at the tunnel level the width has increased from 2 to 6 in., the ore still showing high silver contents and yielding in places over 10,000 oz. to the ton. In No. 10 tunnel stoping is in progress. The shaft on No. 3 vein is being continued from 125 to 150 ft. or deeper. On Feb. 10 the Imperial Privy Council gave judgment in the appeal case in the suit of the La Rose Mining Company against the Temiskaming & Northern Ontario Railway Commission. The La Rose, owning property on each side of the track, claimed the right to mine under the railway. The Canadian court decided against them and this decision was confirmed by the Privy Council and the appeal dismissed.

McKinley-Darragh—The big concentrator with a capacity of upward of 60 tons per day is now in operation. The winze by which the 200-ft. level is reached will be sunk an additional 100 ft. At the bottom of the winze is from 3 to 4 in. of high-grade ore. On the Savage property No. 2 shaft is down 112 ft. The financial statement presented at the annual meeting showed receipts from sales of ore during the year, $345,792. The expenditures included additions to plant, $46,231; operation and development, $139,921, and dividend, $202,309. The amount of cash on hand at the end of 1908 was $46,612.

Peterson Lake—On the leasehold of the Kerry Mining Company, ore showing good silver contents has been found at 95 ft. in the main shaft. A vein 2 to 4 in. wide, which had previously shown niccolite, has run to cobalt with native silver.

Station Grounds Mining Company—This company is negotiating contracts with the Cobalt Lake Company to prospect its holding from the working of the Cobalt Lake. The west drift of the latter company is under the lake for several hundred feet at a depth of 154 ft. and is now within 50 ft. of the Station Grounds boundary.

ONTARIO-GOWGANDA DISTRICT

Bonsall Claims—These claims, comprising 320 acres, the first to be staked and developed in the region, have been purchased by Hon. Clifford Sifton and M. J. O'Brien for $500,000. Several veins of native silver have been found.

ONTARIO—LARDER LAKE

Dr. Reddick—At the annual meeting held at Ottawa Feb. 1 the shareholders rejected a proposition to amalgamate with the Cleopatra mine and the Richardson claim of the Larder Lake district. It was decided instead to issue $500,000 more of 8-per cent. cumulative preference stock, bringing the capital up to $2,500,000—only $300,000 of the amount to be issued at present. The report of the superintendent showed that the first 30 tons milled yielded $8 and the next 100 tons between $10 and $12 per ton.

Mexico

CHIHUAHUA

Barranca de Cobre—Mendoza and Nesbitt, leasing operators of this mine and mill in the Urique section, are making regular shipments of high-grade copper-gold ores and concentrates to the Aguascalientes plant of the American Smelting and Refining Company.

Cerro de Tarahumares—Promising lead-silver properties are being exploited in this section 30 miles west of Conchos on the Mexical Central. Among the operators are Leon Escobar and Luis Terrezas, Jr., of Chihuahua.

Guazapares—Since the opening up of the Rio Plata silver mine there has been prosecuted successful prospecting at a number of localities tributary to this old camp. One of the best prospects is that opened up by L. S. Ferry and W. E. Orr.

Zinc Ores—Following the recent affirmative decision of the United States Court of Appeals in placing carbonates in the calamine class as duty-free in importation to the United States, there is evidenced a greatly increased demand for Chihuahua zinc ores. Large United States concerns have lately had representatives in the field and the closing of several large contracts with producers in the St. Eulalia, Los Lamentos and other districts is reported. A number of zinc mines and prospects have also been optioned to responsible men and the indications point to an early and marked improvement in the State's zinc industry.

Hidalgo—This Boston company is now preparing for the equipment and operation of its property situated 80 miles north of Parral. J. V. Dignowity is managing director, and E. L. Dignowity is the superintendent.

GUANAJUATO

Production—Shipments of concentrates for the week ending Feb. 8 to the smelter at Aguascalientes amounted in value to $90,500. During the same period $175,000 in bullion was shipped to the refinery at Mexico City.

JALISCO

Chatterton Mining Company—The mines of this company in the Tapalpa district have been sold to W. H. Baldwin, of Delavan, Ill. The Virginia and the San Antonio are the principal mines of the group. There is a 10-stamp mill and concentrating plant.

SONORA

Black Mountain—The new oil-burning machinery for the power house at Magdalena has arrived and will probably be installed ready for operation about the middle of February.

Douglas Copper Company—The company smelter at Fundicion and the mines at El Cobre, which have been idle for several months, are expected to be in operation about the middle of February, according to the resident manager.

Quintera Mining Company—The mill has shut down and some of the old material is being disposed of. The management is reticent as to the cause of the shutdown, but refuses to dispose of any of its new material or stock supplies. The company is controlled and managed by a French syndicate.

San Antonio de La Huerta—The San Antonio Copper Company was organized under Arizona laws last October as a holding company for the San Antonio Copper Company, S. A., of Mexico, which owned this property in Sonora. The holding company has 250,000 shares of stock, par value $10, of which 100,000 have been issued as full paid, 100,000 shares issued upon which $1 per share has been paid in and 50,000 shares remain in the treasury. The board of directors of the company comprises John Uno Sebenius, director of the North Butte Mining Company; L. W. Powell, vice-president of the Calumet & Arizona Copper Company; E. G. Kingsford, of Michigan; C. D. Fraser, of New York, and D. G. Kerr, of Pittsburg. Otto C. Davidson is president, J. A. Crowell vice-president and George J. Eisele secretary and treasurer, all of Iron Mountain, Mich. The property is 80 miles from a railroad, but the Cananea, Yaqui River & Pacific railroad should be built to the property by January 1, next. The property is in the early stages of development, but the work to date has disclosed high-grade ore.

Zambona Development Company—The Zambona, at Minas Nuevas, is preparing to resume active operations and will install a new 200-ton plant for fine grinding and cyaniding. This equipment will consist of tube mills, Pachuca agitators, vacuum filters, classifying machinery, pumps, etc. A. J. Yeager is the general manager.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 17—The bituminous coal trade in the East continues quiet, no activity having developed since our last report. Manufacturers seem to be using only a moderate amount of coal, and are very reluctant to replenish their stocks.

The anthracite trade continues dull. The decrease in January shipments as compared with last year is apparently a forerunner of other losses to come. The anthracite companies, as a rule, are not running their mines full time. Most of them are operating only three or four days in a week. Even at that, coal is still being stocked in anticipation of the strike or suspension of mining which everyone now believes is sure to come in the spring, when the present agreement will expire. It is understood that President Lewis of the United Mine Workers has notified the anthracite companies of his readiness to discuss with them the question in dispute. No answer has been made, however, and it is quite probable that the companies will refuse to take up the question with anyone outside of their own employees.

In the West there is a little improvement in trade here and there, but no general advance. Steam coal continues dull and the mild weather still restricts the domestic demand. The recent storms brought some cold weather with them, but it did not last long enough to have any permanent effect on the trade.

The committee appointed by the Pittsburg coal operators has had one hearing before the Interstate Commerce Commission but the matter was adjourned in order to give the railroads time to present facts. The claim made by the Pittsburg people is that the present rates on coal to Lake Erie ports constitute an unlawful discrimination against the Pittsburg district and in favor of West Virginia and Ohio coals. The Ohio people—particularly those in District No. 8 and the Hocking Valley—while willing to admit discrimination in favor of West Virginia, maintain that their rates are unequal also. They think that the Pittsburg people desire an unfair advantage

Coal Traffic Notes

The coal production of Colorado in 1908 is reported as follows: Anthracite, 69,440 tons; bituminous, 6,824,117; semi-bituminous, 818,216; lignite, 1,991,234; unclassified and small mines, 70,000; total, 9,773,007 short tons.

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 8, 1908, and Feb. 6, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite	546,046	492,720	D. 53,326
Bituminous	3,275,980	3,496,394	I. 220,414
Coke	725,922	1,016,582	I. 290,660
Total	4,547,948	5,005,696	I. 457,748

Average daily tonnage, 116,614 in 1908, and 135,289 in 1909; increase, 18,675 tons.

Shipments of coal passing Lock No. 4 on the Monongahela river for the year were 8,336,620 short tons in 1907, and 6,095,880 in 1908; a decrease of 2,240,740 tons, or 26.9 per cent.

Coal receipts at Boston in January reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	141,579	99,855	D. 41,724
Bituminous	244,016	226,444	D. 17,572
Total domestic	385,596	326,299	D. 59,296
Foreign	45,702	28,200	D. 17,502
Total	431,297	354,499	D. 76,798

The foreign coal comes chiefly from Nova Scotia mines.

Coal and coke tonnage, Chesapeake & Ohio railway, six months ended Dec. 31, short tons:

	Coal.	Coke.	Total.
New River	3,288,078	108,855	3,396,933
Kanawha	2,638,150	15,205	2,653,355
Kentucky	180,860	.....	180,860
Connecting lines	129,315	35,329	164,644
Total	6,236,403	159,389	6,395,792
Total, 1907	6,050,533	221,134	6,271,667

Deliveries in 1908 to points west of mines, 3,290,177 tons coal and 96,184 coke; points east, 774,049 tons coal and 63,205 coke; tidewater, 2,164,639 tons coal; anthracite to line points, 4538 tons.

New York

Anthracite

Feb. 17—The anthracite trade locally is in the same quiet condition that it has been in for some time past. It is still a weather market, and the weather has not been such as to stimulate the demand for coal. Many collieries are running short time and this has resulted in a rather smaller supply of the steam sizes. There is enough, however, of these sizes to meet current demand. Domestic sizes are still being stocked on a large scale.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The discussion of yearly contracts is still in order. It is held back for the time by the fact that the railroads have not yet announced the rates for the coming season. It is generally believed, however, that there will be no change from last year and a few contracts have been made. Producers are not willing to make any concessions from the low prices of last year, and it is quite possible that contract prices may be a shade higher.

As far as current business is concerned the Far East is taking no coal. Business is dead and dealers are wondering how consumers have made their stocks hold out. The Sound ports are buying some coal, but not in a large way. New York harbor is a bargain counter and business depends on the small necessities of the buyer. Good grades of steam coal are selling at $2.40@2.50 f.o.b. harbor shipping port, while lower grades can be had at $2.20@2.30. All-rail trade seems to be better than tidewater and more coal is being taken. Car supply is abundant and transportation is fair, coal coming through on about schedule time.

The Coastwise market is slow and vessels are hunting for charters. The rates still continue pegged at 75c. from Philadelphia to around Cape Cod. The quoted rates for large vessels from Philadelphia are: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Newburyport, 95c.; Portsmouth, 80c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Feb. 15—The coal trade in Alabama is quiet, and there is a curtailment of production. Never before has there been such a slack demand during the winter as at present. Chief State Mine Inspector Edward Flynn states that the production is off at the present as compared to the latter part of 1908, and that conditions are approaching those that prevailed a year ago.

There is no need for such a large production of coke, and as a consequence some of the ovens are to be cut off while others have been cooled off already. There is a large quantity of coke already stacked up.

Chicago

Feb. 15—Cold weather in the last week has increased the demand for both bi-

tuminous and anthracite, and has bolstered up prices that were inclining downward because of the previous unseasonable weather. This situation is encouraging for the immediate future, but affects domestic coals more than steam and is looked upon by the trade as likely to be of brief duration. The real improvement that is looked for is a general increase in the demand for steam coal and there are no signs as yet that such a change is at hand. Eastern as well as Western coals have been benefitted by weather conditions, though there is still a condition of general overloading of the market by eastern coals.

Illinois and Indiana lump brings $1.80@2.40, run-of-mine $1.60@1.75 and screenings $1.40@1.60. Smokeless, the leading coal from east of Indiana, continues in such large supply that sacrifice prices are made to escape demurrage, the list being cut 15@25c., making Pocahontas and New River lump $3.05@3.45, and run-of-mine, $2.85@3.15. Hocking Valley likewise has been in too large supply, but is now holding up nearer to the list price of $3.15 than for many weeks, though some has sold at $2.75 in the last week. Youghiogheny moves almost wholly on contracts at $3.15 for ¾-in. gas and Pittsburg No. 8 is slow at $2.65@2.75.

The anthracite market has notably improved in the last three or four days, but individual sales are small, though widely distributed.

Cleveland

Feb. 16—The cold snap has cheered up the retailers, and consumption of domestic coals has improved, but hardly enough to call for any change in prices. In steam coals there is no alteration in conditions. Slack continues to sell better than lump or run-of-mine. There is much interest here in the movement to adjust rates on coal for Lake shipment.

Indianapolis

Feb. 15—E. L. Wolford, president of the United Fourth Vein Mining Company, has closed a contract with the United States Steel Corporation for from 7500 to 15,000 tons of Fourth Vein coal a day. The Fourth Vein company owns seven mines in the Linton district. Part of these have been idle for several months and others have only been kept in operation as the business permitted. The new contract, with the other business that will be handled, is expected to improve working conditions in this field very materially.

The United Mine Workers have finally adjourned, the most interesting point left unsettled being the anthracite situation, which is now in the hands of President Lewis and the special committee. The executive board will hold a meeting March 15, in Indianapolis.

Pittsburg

Feb. 16—During the week the Crucible Steel Company of America sent out inquiries for its supply of coal for the year beginning April 1. It usually takes 200,000 tons and the Pittsburg Coal Company has held the contract for several years. They will be strong competition for the business, as annual contracts this year are rare. Consumers who heretofore made contracts in January for the year are buying only as they need the coal. When asked to renew old contracts they say they do not know whether they will need any coal this summer. The mines are running about the same as last week, the river mines being in full operation and the railroad mines running about 35 per cent. The Pittsburg-Buffalo company is doing better than other concerns as its production is around 70 per cent. The Marianna mine, where the great disaster occurred in December, is in full operation. The rivers reached a coal-boat stage this morning and so far about 2,000,000 bu. of coal have gone down to lower ports. More coal likely will be sent out tomorrow. Prices remain unchanged and are on the basis of $1.15 a ton for mine-run coal at the mine. Slack is selling at 65c. at mine.

Connellsville Coke—Outside of the placing of a few contracts for furnace coke the week was a dull one. Several small orders were received for foundry coke at reduced prices. Most of the producers are holding furnace coke for prompt shipment firmly at $1.75 and on contract at $1.90@2. Some sales were made at about 15c. a ton less. Foundry coke has declined and $2@2.15 is quoted for both spot and for deliveries running to July 1. The *Courier* gives the production in both fields at 262,156 tons. The shipments amounted to 9674 cars as follows: To Pittsburg district, 3488; to points west of Pittsburg, 5306; to points east of Connellsville, 880 cars.

Foreign Coal Trade

German Coal Trade—Imports and exports of fuel in Germany, year ended Dec. 31, metric tons:

	1907.	1908.	Changes.
Imports:			
Coal	13,721,509	11,661,503	D. 2,060,006
Brown coal	8,963,103	8,581,966	D. 381,137
Total coal	22,684,612	20,243,469	D. 2,441,143
Coke	584,221	575,924	D. 8,297
Briquets	195,404	192,391	D. 3,013
Exports:			
Coal	20,061,400	21,062,362	I. 1,000,962
Brown coal	22,065	27,877	I. 5,812
Total coal	20,083,465	21,090,239	I. 1,006,774
Coke	3,793,073	3,579,278	D. 213,795
Briquets	1,301,661	1,493,104	I. 191,443

Coal exports exceeded imports in 1908 by 846,770 tons; coke exports were in excess by 3,003,354, and briquets by 1,300,713 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 6: Best Welsh steam, $3.42; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.16; seconds, $1.92. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 17—The iron and steel trades continue to be in a waiting condition. The combined effect of the expected changes in the tariff and the general belief in a coming reduction of prices have kept the markets extremely quiet, in almost all lines. While the tariff discussion has its effect, the price question is really the leading influence at the present time. Cutting is reported in almost every kind of finished material. No open action has been taken by the leading interest, but there is no doubt that some step in this direction is under serious consideration. A significant point is that a contract with the Steel Corporation for plates which has existed for some years on the part of a large steel-car manufacturer has expired, and has not been renewed, the company preferring to buy in the open market.

In pig iron, business is very dull, few new orders coming in. Northern furnaces are nominally maintaining prices, but there is no difficulty in securing concessions on a good order. The foundries are buying only for immediate needs and no placing of contracts is reported. The only melters who seem to be at all well supplied with orders are the cast-iron pipe makers, most of whom have a good deal of work on hand. In the South, furnaces are claiming that the price of $13 base for No. 2 foundry at Birmingham is maintained, but it is currently reported that business has been taken at 25 and 50c. less.

In finished material there is nothing doing except in structural material and plates. The structural people are taking some contracts and there are a number of building projects ready to be put in hand, but the question of prices is holding purchasers back. The railroads have placed some orders for steel cars which will require a considerable tonnage of plates and shapes. Otherwise there is little railroad business coming forward and rail orders are at a minimum point.

An informal meeting and dinner of steel-trade representatives was held in New York, Feb. 17. No official statement was given out, and it is said that no positive action was taken, though there was a general discussion of the price question. The general belief is that a decision involving a general "readjustment" of prices may be expected at an early date. This will undoubtedly have a favorable effect on the trade

Baltimore

Feb. 16—Exports for the week included 209,687 lb. tin scrap to Rotterdam; 2,025,542 lb. steel bars, 775,711 lb. galvanized sheets and 158,328 lb. tinplates to Panama. Imports included 1118 tons ferromanganese from Liverpool and 10,800 tons iron ore from Cuba.

Birmingham

Feb. 15—Southern pig-iron manufacturers are confident that there will be an improvement in general conditions before long. There has been no curtailment in the production yet. If inquiries which are coming in develop any business, there will be a demand for all the iron that can be manufactured. The orders which are being received now are in small lots. There has been no change made in quotations and the general price is $13 per ton, No. 2 foundry. The make in this district is better than it has been for a year and a half. It is believed that production during this month will show an increase over January, though during that month there was more than 148,000 tons of iron reported. The home consumption is holding up well, the cast-iron pipe plants working practically full, the machine shops and foundries doing well and the steel plant of the Tennessee company doing fairly well.

The announcements of the reorganization of the Southern Steel Company and the statement that there will be a resumption of operations in the near future at several of the plants of this company, has had an encouraging effect.

Chicago

Feb. 15—The iron market continues very quiet. Sales of pig iron are in small lots. Everywhere melters seem inclined to go slowly and await developments—tariff legislation and the inauguration of a new President. Prices are weakening generally, though a collapse is apparently not looked for by buyers; even at lower prices, openly quoted, it is probable, to judge from the tone of opinion in the local trade, that buying would not be much larger. Carload lots up to 300 or 400 tons, with an occasional lot for more as the exceptional purchase, will apparently continue in vogue for the next week.

Quotations are not stable, remaining nominally at $13 Birmingham ($17.35 Chicago) for Southern No. 2 and $17.50 for Northern No. 2. Cuts of 25 to 50c. under these figures evidently prevail and a large sale might bring still lower prices. That there is a sagging tendency in Southern cannot be denied, but it is asserted in some quarters that Northern will remain fairly stable because of diminished output of the local furnaces.

Iron and steel materials are in general dull, though structural steel is in better demand. Coke is weak at $4.85 for the best Connellsville.

Cleveland

Feb. 16—No buying of iron ore is reported. The furnaces seem to be in no hurry to take ore, and sellers are not pressing. No action has been taken on prices for the coming season, but the general belief is that no change will be made.

Some inquiries for pig iron have been received, but no considerable sales are noted. The tendency is to shade prices where a fair order can be secured. No. 2 Northern foundry is quoted nominally at $16.25@16.50, Cleveland, but sales are reported at 50c. less.

Finished material is dull, with the exception of some inquiries for structural steel.

Philadelphia

Feb. 17—No progress can be seen in pig iron. Foundry business is in small lots, and little is doing in basic. Some inquiries for this sort are in, but they have not produced results so far. While some furnaces are holding back and standing on their prices, others are hungry for business and are quite willing to make concessions to get it. Buyers are not in any hurry, apparently, and do not seem to think they will lose anything by waiting.

Steel Billets—Business has been disappointing, only a few small sales having been made, at unchanged prices.

Bars—The store demand is reported about the same as last month. The market is not in good shape, and iron bars have been offered at low prices; steel bars are also cut.

Plates—Some demand from car-builders has kept up this market, but prices are uncertain.

Sheets—No change is reported, and business is on a small scale.

Pipes and Tubes—Local business is only moderate, though a little more demand from boiler shops is noted.

Structural Material—New building contracts are talked about, but most of them seem to be held back on the price question. If that is settled right, there will be good business placed.

Scrap—Some dealers are quietly laying in stock, believing there will be a demand for it before long. Others, however, are letting things drift, and are afraid they will have to carry stock too long to make it profitable.

Pittsburg

Feb. 16—Efforts to maintain prices in all lines of finished iron and steel products and crude steel have failed and plans are now being perfected, it is understood, for a general readjustment. It is known that the serious cutting of the regular rates on several important products by independent producers has been responsible for the hesitancy on the part of buyers to come into the market for their usual requirements. The jobbers, who in former years replenished their stocks in January, are buying only for immediate needs. In order to bring out this business it has been decided to make a general cut. While these reports have not been officially confirmed by the large interests, indications are that they are not without foundation. Instead of small reductions as were made at the meeting of steel concerns in New York last June it is said the cuts will range from $4 to $7 a ton and will include billets, sheet-bars and all lines of finished products. While there has been no cutting of merchant pipe and tinplate, these products will be reduced owing to the cut in raw material. Steel bars will not come down very much, as prices are already low. Steel rails alone will not be affected. The uncertainty regarding the tariff has affected the iron and steel trade and it is expected that this will be removed soon after Congress meets. It is not believed here that any radical changes will be made. With the tariff and the price question adjusted satisfactorily there will be no apparent reason for further delay in buying.

Pig Iron—There is no pig-iron market, the only business being the shipping of iron on old contracts. Production is not being curtailed and stocks are piling up. The Carnegie Steel Company on Monday started its new No. 6 blast furnace at the Ohio works, Youngstown. It will make basic iron for the new open-hearth furnaces. The Midland Steel Company which operates one blast furnace at Midland, 25 miles below Pittsburg on the Ohio river, plans to build another furnace and contracts will be let in a short time. The new furnace will have a capacity of about 90,000 tons of foundry iron annually. Pig-iron quotations, in the absence of actual transactions, are nominal as follows: Standard bessemer, $16; malleable bessemer, $15.50; basic, $15.25; No. 2 foundry, $15; gray forge, $14.25, all f.o.b. Valley furnaces.

Steel—There is no change in the market for crude steel. Billets are held at $25 and sheet-bars, $27.50, Pittsburg. Plates are still quoted at 1.60c. but sales are made at $2 a ton less. Merchant steel bars are firm at 1.40 cents.

Sheets—Cutting of sheet prices continues and sales of all sheets are at $2 a ton under what is regarded as the official prices which is as follows: Black sheets, 2.50c. and galvanized sheets, 3.55c. for No. 28 gage.

Ferro-Manganese—There is little doing, and while there are reports of low prices, dealers continue to quote $45.50@46, Pittsburg.

Metal Market

New York, Feb. 17—The metal markets generally continue in a rather depressed condition. Demand has not improved, and there has been no recovery in prices.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1908..	$ 7,358,707	$ 5,122,538	Exp. $2,235,169
" 1907..	1,004,441	44,448,515	Imp. 43,444,074
Year 1908..	71,215,456	50,246,099	Exp. 30,969,357
" 1907..	55,215,681	143,398,072	Imp. 88,182,391
Silver:			
Dec. 1908..	4,726,289	4,382,290	Exp. 343,999
" 1907..	4,413,598	4,222,036	" 191,662
Year 1908..	51,837,671	42,195,966	" 9,640,705
" 1907..	81,625,855	45,912,360	" 15,713,506

Exports from the port of New York, week ending Feb. 13. Gold, $3,382,000, chiefly to Buenos Aires; silver, $756,194, chiefly to Paris and London. Imports: Gold, $136,583, from Central and South America; silver, $104,203, from the West Indies and Mexico.

The mint price of gold in France is 3444.44 fr. per kilogram. A coinage charge of 7.44 fr. per kg. is deducted, making the net price paid for gold 3437 fr., or $663.34 per kg. This is equal to $20.63 per troy ounce.

Gold—The price of gold in the open market in London continues unchanged, 77s. 9d. per ounce being paid for bars and 76s. 4d. per ounce for American eagles. The Bank of England this week took nearly all the gold offered, including arrivals from the Transvaal and Australia. The Bank of France is still out of the market. In New York an additional shipment of $500,000 is reported to Argentina, and it is generally expected that more gold will go out soon.

Platinum—The market is very dull and sales are lighter than for some time past, although they are better than at this time a year ago. Prices continue unchanged, dealers quoting $23.50@24.50 for refined platinum; $26 per ounce for hard metal and $19@21 per ounce for scrap.

Our St. Petersburg correspondent writes, under date of Feb. 4, that prices are unchanged both in Ekaterinburg and in St. Petersburg. The demand is good, especially from Paris. The small miners expect loans from the State bank and an increase of prices as a result. A conference on the question of the loans is to be held soon. The quotation in St. Petersburg is 19.800@20.000 rubles per pood; at Ekaterinburg, 5 rubles per zolotnik, for crude metal, 83 per cent. These prices are equivalent to $19.00 and $18.80 per oz., respectively.

Silver—The market has been fairly steady the past week, declining to 23⅝d. in London on selling by Chinese banks. The market closes steady at 23 11 16d. on buying by India bazars.

SILVER AND STERLING EXCHANGE

Feb.	11	12	13	15	16	17
New York....	51¾	.....	51⅝	51½	51¼	51⅛
London.....	23⅞	23¾	23⅞	23¾	23¾	23⅛
Sterling Ex..	4.8725	.....	4.8720	4.8710	4.8710	4.8695

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shipments of silver from London to the East, year to Feb. 4, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India... ...	£ 799,900	£ 467,560	D. £ 332,340
China.....	451,400	80,000	D. 371,400
Straits.....	.....	61,000	I. 61,000
Total.....	£ 1,251,300	£ 608,560	D. £ 642,740

Imports for the week, £180,000 from New York. Exports, £11,500 to India.

Copper, Tin, Lead and Zinc

Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
11	13⅜ @13½	13 @13¼	59	28¼	4.00 @4.02½	3.85 @3.87½	4.72½ @4.75
12	.....	.....	....	....	.....	.....	.....
13	13⅜ @13½	13 @13¼	....	28¼	4.00 @4.02½	3.85 @3.87½	4.72½ @4.75
15	13⅜ @13½	13 @13⅛	58⅜	28⅜	4.00 @4.02½	3.85 @3.87½	4.72½ @4.75
16	13⅜ @13½	13 @13⅛	58⅜	28⅞	4.00 @4.02½	3 85 @3.87½	4.72½ @4.75
17	13⅜ @13½	13 @13⅛	58⅜	28⅞	4.00 @4.02½	3.85 @3.87½	4.72½ @4.75

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium. Spelter prices given are at St. Louis; prices at New York, Feb. 11-17 were 0.15c. higher than St. Louis each day.

Copper—The lower prices have so far not attracted buyers. On the contrary, consumers, both in this country and in Europe, have withdrawn altogether except for their immediate needs, as they hope to force a further reduction. Business on this account has been more or less of a retail character. Some Lake has been reported sold to domestic consumers under special conditions at a price a little above the real market, but this grade has been freely offered by leading interests at 13½c. without drawing much business. Electrolytic has been dull. The market closes lower at 13⅜@13½c. for Lake copper; 13@13¼c. for electrolytic copper in ingots, cakes and wirebars. The average of the week at which business in casting copper has been done is 12¾@13 cents

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb., base. Copper wire, 15½c. base, carload lots at mill.

The speculative market in London has been a very uninteresting affair throughout the week and prices close lower and barely steady at £58 7s. 6d. for spot, £59 2s. 6d. for three months.

Statistics for the first half of the current month show a decrease in the visible supplies of 700 tons.

Refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £61 10s.@£62 10s.; strong sheets, £73 10s.@£74 10s.

Exports from New York and Philadelphia for the week are reported at 2571 long tons copper. Our special correspondent states the exports from Baltimore at 426 tons.

Supplies, deliveries and visible stocks of coper on Jan. 31, as reported by Henry R. Merton & Co., Ltd., London, in long tons:

	1908.	1909.	Changes.
Imp. in Jan. N. America...	36,143	19,295	D. 16,848
Chile.....	3,000	3,000	.....
Australia.....	1,668	2,600	I. 932
Other countries.....	5,769	6,278	I. 509
Total.....	46,580	31,173	D. 15,407
Stocks, Jan. 1.....	19,710	55,677	I. 35,967
Total supplies.....	66,290	86,850	I. 20,560
Deliveries in January.....	45 630	33,915	D. 11,715
Stocks, Jan. 31..... ..	20,660	52,935	I. 31,275

Deliveries in January, 1909, included 400 tons reshipped to America.

Tin—The London market has become very strong. It develops that supplies are again concentrated, and as shipments from the Far East are of moderate volume only, holders of the present supplies are in a position to advance the market easily, if they decide to do so. The close is cabled at £130 5s. for spot, £131 15s. for three months.

A fair business has been done in this market, especially among dealers, and prices have advanced at the close to 28⅞ cents.

Lead—Orders are few and far between and the market is depressed at 3.85@3.87½c. St. Louis, 4@4.02½c. New York.

The London market has had a rally, due to covering of the bear contingent, but closes somewhat below the best price at £13 6s. 3d. for Spanish lead, £13 8s. 9d. for English lead.

Spelter—The lower prices have not as yet helped business, the uncertainty of the future of the iron and steel markets being the main restraining influence. The close is unchanged and easy at 4.72½@4.75 St. Louis, 4.87½@4.90c. New York. More or less speculative business in spelter is going on

The close in London is cabled at £21 7s. 6d. for good ordinaries, £21 12s 6d. for specials.

Base price of sheet zinc is 7c., f.o.b La Salle-Peru, Ill., less 8 per cent.

The European Zinc Syndicate is to continue for two years from Jan. 1, 1909. One important maker—Giesche's Erben—did not go into the agreement, but doubtless will act in harmony with the syndicate.

Other Metals

Antimony—The market is almost dead for the present. In the absence of business prices are difficult to quote, but any sales must be made at a shade below last prices. Cookson's may be quoted 8⅞c.; Hallett's, 8c.; with 7⅜@7⅝c. for ordinary brands.

Aluminum—There are no new developments in this metal. The Aluminum Company of America continues to quote 24c. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is still offered at 22c., New York delivery. No considerable sales are reported.

Quicksilver—The market is quiet and business mostly of a retail order. Prices are unchanged, New York quotations being $45@46 per flask of 75 lb. San Francisco quotations are also unchanged, being nominal at $45@46 for domestic business and $43@44 for export. The London price is still £8 7s. 6d. per flask, but down to £8 5s. is quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This material is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Petroleum Exports

Exports of mineral oils from the United States in January, in gallons:

	1908.	1909.
Crude	5,746,334	13,043,008
Naphthas	2,162,176	6,001,809
Illuminating oils	80,865,494	82,937,688
Lubricating oils	12,948,426	10,096,652
Residuum	3,399,627	8,457,198
Total	105,122,057	120,536,355

Paraffin is included in lubricating oils. Increase this year, 15,414,298 gal., or 14.7 per cent.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 13—The highest price paid for zinc ore this week was $38; the base price for 60 per cent. zinc was $36@37 per ton.

Lead ore, 80 per cent., sold Tuesday at $50 per ton, but offerings were later lowered to $46 per ton.

SHIPMENTS, WEEK ENDED FEB. 13

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	576,240	.....	154,200
Hazel Green	350,700	67,700	.....
Benton	249,470	.....	.....
Linden	221,570	..	.....
Strawbridge	185,000	.....	.....
Cuba City	118,340	75,340	.....
Galena	73,000	.....	.....
Livingston	50,000	.....	.....
Shullsburg	.....	50,000	.....
Total	1,824,320	193,040	154,200
Year to Feb. 13	14,038,826	446,000	1,315,600

There was shipped in the three weeks previous, not heretofore reported, from Highland, 400,740 lb.; from Linden, 367,650 lb.; from Harker, 280,910 lb. zinc ore; from Linden, 50,160 lb. lead ore.

There was shipped this week to the American Zinc Ore Separating Company 146,100 lb.; to the Joplin Separator Works, 271,010 lb. zinc ore.

Joplin, Mo., Feb. 13—The highest price reported paid for zinc sulphide ore was $40, the base ranging from $35 to $38 per ton of 60-per cent. zinc. About 150 tons sold on the highest base, purchased on Tuesday when a blizzard was predicted by the weather bureau. There was no change in zinc silicate, which sold on a base of $19@22 per ton of 40-per cent. zinc and as high as $26. It is conceded the bottom has been touched, the market indicating a slightly increased strength at the week-end. Nearly half the lead shipment was from purchases of the two previous weeks, which sold at $52@53 per ton, but the highest offering of this week was $51, closing the week at $50 per ton.

Mine wages have generally been reduced to the level of last year and with almost every day ideal for outputting the production continues strong, but the heavy shipment this week exceeded the output about 500 tons, reducing the bin stock to approximately 6500 tons.

SHIPMENTS, WEEK ENDED FEB. 13

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,492,540	1,478,340	$114,908
Joplin	1,734,830	318,210	38,434
Galena	1,076,400	45,860	20,034
Duenweg	910,910	117,980	17,018
Miami	796,880	116,150	14,856
Prosperity	583,730	43,170	11,045
Alba-Neck	477,060	.....	8,109
Spurgeon	340,460	112,930	6,986
Aurora	413,080	20,140	6,556
Granby	331,850	6,800	4,256
Quapaw	223,620	.....	3,678
Badger	174,550	.....	3,045
Sarcoxie	176,290	.....	2,778
Carthage	129,230	.....	2,196
Carl Junction	86,880	8,670	1,911
Zincite	79,420	4,500	1,542
Stott City	40,900	.....	450
Totals	12,068,630	2,272,750	$267,700
Seven weeks	72,979,580	11,411,700	$1,645,619

Zinc value, the week, $199,142; 7 weeks, $1,349,617
Lead value, the week, 68,558; 7 weeks, 295,902

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.66	$38.46	$46.88	$52.17
February	36.63	.....	34.92	.....	49.72	.....
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.69	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Feb. 17—The general situation continues unchanged from our last report. Business is quiet and without any animation.

Copper Sulphate—While demand is still fair, prices are a little lower than last week. The present quotations are $4.60 per 100 lb. for carload lots, while $4.85@5 per 100 lb. is asked for smaller parcels.

Arsenic—The market is quiet with small sales, but prices are unchanged. Current quotations are 3@3⅛c. per lb. for white arsenic.

Nitrate of Soda—Trade is rather dull. Prices are unchanged, spot nitrate selling for 2.15c. For futures 2.12½c. is asked for all positions.

Mining Stocks

New York, Feb. 17—The general stock market has varied from day to day without much significance. Business has been quite moderate in volume, and prices have advanced and receded alternately. Early in the week there was a slightly stronger tendency, but this was followed by a weakening in quotations, and the close is near the point of depression. It is claimed that the tone is good, but the activity is lacking.

On the Curb there was a good deal of trading in the copper stocks, but the close showed some weakness in nearly all the prominent companies. Only one or two held up to the earlier level. The Nevada gold stocks were a little more active than recently, but without any gain in prices. Cobalt stocks were in fair demand. There was free buying, but no advance.

Boston, Feb. 16—There has been prime speculation in the Lake mining issues, particularly those that have got a Calumet & Hecla tag attached to them. Notwithstanding denials, it is believed that negotiations for the taking over of the Bigelow properties by Calumet & Hecla interests have been practically concluded and it is only a matter of detail which prevents an official announcement. There has been some response in other stocks, but it has been feeble. The continued weakness of the metal and the lack of demand mitigates against any sustained upward movement. The closing of the exchange over from Thursday until Monday tended to restrict business and make a short week of it. The declaration of regular quarterly dividends of $1 each by the North Butte and the Quincy companies had no effect, marketwise.

Isle Royale and Superior Copper divided attention for a spell. The former sold up $4.50 to $33, maintaining its strength, and

Superior rose $6.25 to $45.25. In the case of the former it is believed that it occupies a strategic position in Calumet & Hecla's plans. In Superior favorable mill runs have been the cause of the speculation largely.

Atlantic rose $2.50 to $17.75. Favorable underground developments are reported from that quarter and it is said to be earning mining expenses. La Salle also came in for a rise, moving up $2.75 to $16.75. Osceola rose $4 to $136, Tamarack $8.50 to $88.50, Allouez $5.50 to $45, and Centennial $2.75 to $34.75.

East Butte has had a good market and rose $1.87½ to $13.50 on heavy trading. Boston Consolidated has been weak, falling $1.75 to $12.50 on free offerings.

Dominion Iron and Steel is up 15, to $35, on the judgment awarded in its suit against the Dominion Coal Company.

Superior & Boston mining has been taken from the Curb and put on the unlisted department of the Stock Exchange. The 100,000 shares of Rhode Island Copper have been stricken from the list as practically all of its shares have been exchanged for Franklin. Contest for control of the Victoria Copper Mining Company will appear at the annual meeting Feb. 23.

Seneca and Ahmeek made new high records on the Curb, the former touching $105 and the latter $165. They are both Bigelow properties. The curb has temporarily suspended trading in Southwestern Development shares.

STOCK QUOTATIONS

NEW YORK	Feb. 16	BOSTON	Feb. 16
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	2¼	Adventure	9
Amalgamated	76⅞	Allouez	44
Anaconda	45⅞	Am. Zinc	26⅝
Balaklala	12⅞	Arcadian	4¾
British Col. Cop.	7¾	Arizona Com	36
Buffalo Mines	3⅜	Atlantic	17⅞
Butte Coalition	24⅞	Boston Con	13⅛
Colonial Silver	⅞	Calumet & Ariz.	106
Cum. Ely Mining	8¼	Calumet & Hecla	650
Davis Daly	3¾	Centennial	34
Dominion Cop.	⅞	Con. Mercur	1.34
Douglas Copper	2⅛	Copper Range	76
El Rayo	3⅜	Daly-West	$10
Florence	3⅞	East Butte	13½
Foster Cobalt	.56	Franklin	15⅝
Furnace Creek	.11	Greene-Can	10½
Giroux	8	Isle Royal	32¾
Gold Hill	⅜	La Salle	16⅞
Goldfield Con	7⅞	Mass	15⅛
Granby	101½	Michigan	11¼
Greene Gold	¼	Mohawk	65½
Greene G. & S.	7	Nevada	18⅝
Guanajuato	1¾	North Butte	75⅛
Guggen. Exp	181	Old Colony	2.00
Hanapah	.15	Old Dominion	52¼
Kerr Lake	8⅛	Osceola	136
McKinley Dar.	.93	Parrot	28⅝
Miami Copper	14⅛	Quincy	92
Micmac	2	Rhode Island	4¾
Mines Co. of Am.	⅞	Santa Fe	12¼
Mitchell Mining	¼	Shannon	15⅝
Mont. Sho. C	1⅞	Superior	44⅞
Nev. Utah M. & S.	3¼	Superior & Pitts.	15⅛
Newhouse M. & S.	4⅞	Tamarack	87
Nipissing Mines	9⅞	Trinity	15⅛
Old Hundred	1/16	United Cop., com.	113¾
Silver Queen	.70	U. S. Oil	31⅛
Stewart	⅜	U. S. Smg. & Ref.	41⅛
Tennessee Cop'r.	40⅛	U.S. Sm. & Ref., pf.	44⅛
Tri-Bullion	1	Utah Con.	41¾
Union Copper	1 1/16	Victoria	5¼
Utah Apex	6⅛	Winona	5⅛
Utah Copper	44	Wolverine	150
Yukon Gold	4¾	Wyandotte	3

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	39¼
Am. Smelt. & Ref.	86¾
Am. Sm. & Ref. pf.	104¾
Colo. Fuel & Iron.	40⅜
Federal M. & S., pf.	‡84
National Lead	80
National Lead, pf.	108¾
Pittsburg Coal	‡11⅞
Republic I. & S.	24
Republic I.& S., pf.	85⅛
Sloss-Sheffield	78⅜
Standard Oil	662½
U. S. Steel	52⅜
U. S. Steel, pf.	114
Va. Car. Chem	46⅜

BOSTON CURB	
Ahmeek	160
Black Mt.	2¾
Chemung	22¼
Globe Con	6¾
Hancock	13
Helvetia	13⅞
Keweenaw	14¾
North Lake	17⅛
Ojibway	14
Superior & Bost.	16¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	Feb. 13	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.06	.03
Center Cr'k	1.80	1.40
Cent. C. & C.	79.00	78.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	120.00	110.00
Gra. Bimet.	.25	.17
St. Joe	13.00	12.00

LONDON	Feb. 17		
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton'sInd.	0	3	3
Camp Bird	0	16	6
Esperanza	3	1	6
Tomboy	0	18	9
El Oro	1	4	3
Oroville	0	11	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 17.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.	.08
Belcher	.36	St. Ives	.17
Best & Belcher	.37	Triangle	.02
Caledonia	.08	BULLFROG STOCKS	
Chollar	.11	Gibraltar	.03
Comstock	.30	Homestake King.	.07
Con. Cal. & Va.	.47	Mont. Shoshone C.	1.87½
Crown Point	.40	Tramp Cone	.09½
Exchequer	.28	MISCELLANEOUS	
Gould & Curry	.05	Bonnie Clare	.04
Hale & Norcross	.21	Lee Gold Grotto	...
Mexican	.70	Nevada Hills	1.37½
Ophir	1.22	Nevada Smelting.	1.00
Overman	.07	Nevada Wonder	.35
Potosi	.11	Nevada-Utah	3.25
Savage	.20	Penn-Wyoming	.08
Sierra Nevada	.25	Pittsburgh S. Pk.	.78
Union	.27	Rawhide Coal	.44
Utah	.02	Round Mt. Sphinx	.07
Yellow Jacket	.39	Quotations not received on account of storm.	
TONOPAH STOCKS			
Belmont	.80		
Extension	.48		
Golden Anchor	.01		
Jim Butler	.16		
MacNamara	.32		
Midway	.22		
Montana	.70		
North Star	.03		
Tono'h Mine of N.	6.00		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.13		
Booth	.22		
Columbia Mt	.12		
Comb. Frac	1.14		
Con. Red Top	.12		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.05		
Goldfield Daisy	.74		
Great Bend	.19		
Jumbo Extension	.14		
Kendall	.07		
Lone Star	.06		
May Queen	.04		
N. Y. C. O. D.	.04		
Oro	.10		
Red Hill	.11		
Roanoke	...		
Sandstorm	.15		

COLO. SPRINGS	Feb. 12
Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con	3⅛
Dante	6¼
Doctor Jack Pot	9
Elkton	71¾
El Paso	46
Findlay	16
Gold Dollar	11¾
Gold Sovereign	3⅛
Isabella	24¾
Index	....
Jennie Sample	7⅛
Jerry Johnson	16
Mary McKinney	$34⅛
Pharmacist	3½
Portland	1.01
Un. Gold Mines	14⅛
Vindicator	78
Work	7

Assessments

Company.	Delinq.	Sale.	Amt.
Addie, Utah	Feb. 15	Mar. 6	$0.00½
Atlantic, Ida	Feb. 20	Mar. 22	0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Gould & Curry, Nev	Feb. 15	Mar. 9	0.10
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
National, Mich	Mar. 15		0.40
Owyano, Idaho	Jan. 25	Feb. 27	0.001
Overman, Nev	Feb. 18	Mar. 11	0.00
Reindeer, Ida	Feb. 15	Mar. 18	0.10½
Seven Bros.-Plocho, Nev	Feb. 1	Feb. 27	0.00½
Sierra Nevada, Nev	Feb. 12	Mar. 5	0.10
Silver Eagle, Utah	Feb. 1	Mar. 1	0.001
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Surprise, Ida	Jan. 26	Feb. 26	0.001
Temple, Ida	Feb. 22	Mar. 15	0.005
Utah-United, Utah	Feb. 15	Mar 1	0.01
Zelbright, Cal	Feb. 15	Mar. 6	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	.....	25.855	.....
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.477	.....
June	53.693	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	.....	13.098	.....	58.786	.....
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	.....	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Montb.	New York.		London.	
	1908.	1909.	1908.	1909.
January	3.691	4.175	14.469	13.118
February	3.725	.....	14.250	.....
March	3.868	.....	13.975	.....
April	3.993	.....	13.469	.....
May	4.253	.....	12.938	.....
June	4.466	.....	12.600	.....
July	4.447	.....	13.000	.....
August	4.580	.....	13.375	.....
September	4.515	.....	13.125	.....
October	4.351	.....	13.375	.....
November	4.330	.....	13.538	.....
December	4.213	.....	13.156	.....
Year	4.200	.....	13.439	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.426
February	4.788	.....	4.638	.....	20.875	.....
March	4.665	.....	4.527	.....	21.078	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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Milling at Grass Valley and Nevada City

Amalgamation, Concentration and Cyanide Treatment Are Employed, Concentrates Being Shipped to Smelters or Treated by Special Process

BY G. E. WOLCOTT*

With the exception of the North Star and the Central mills of the North Star Company and the Pioneer mill near Nevada City for treating concentrates, all of the mills of the Grass Valley, Cal., district employ practically the same process, differing only in regard to details. In this article only one mill, the Empire, will be described; it uses the more common method, and may be taken as a typical installation.

The ore from the mine dumps directly at the Empire plant into bins from which it is fed to a large gyratory crusher situated immediately below. From the gyratory crusher which crushes to a maximum of about 2 in. the ore passes by gravity to bins below from which it is drawn into cars and trammed to the mill building. Here it is fed by automatic feeders to 1000-lb. stamps, making 102 drops per minute and crushing through a No. 7 slotted screen. The stamps give a crushing capacity of about 2¾ tons per 24 hours. The discharge from the batteries passes over amalgamation plates 4 ft. 4 in. wide by 17 ft. long, set at an inclination of 1½ in 12. There is one plate for each battery of five stamps. Both inside and outside amalgamation is used, the inside plates being cleaned twice each month and the outside plates twice every 24 hours. Mercury is added at intervals in the battery. The plates are plain copper without any silver plating.

The pulp from each plate goes to amalgam boxes and then passes to two Frue vanners. The concentrates are not treated at the mill, but are either shipped to smelters or sold to the Pioneer plant at Nevada City.

Concentration

The tailings from the vanners pass through a wooden settling box, where the coarse material is taken out, and passes to the last set of blanket concentrators. The overflow from the settling box passes to 26 canvas-covered tables arranged, as shown in the accompanying illustration. These tables are 12 ft. wide and 8 ft. long on the incline, and are made of a wooden support covered with a coarse canvas cloth. These tables are washed every half hour by means of a length of hose placed at convenient intervals. A board about 6 in. wide is hinged to the lower end of the table and serves to deflect the stream of concentrates into a separate launder. The board is simply lowered by means of a rod extending to the upper part of the table where it can be reached by the operator. The tables have an inclination of about 1 in 8.

From the tables the concentrates pass to a stirring box which serves to keep the pulp in suspension and also to equalize the flow to the Gates vanner, the next machine in the order of treatment.

The tailings from the first vanner pass to a second of the same size (6x10 ft.) for concentration. Tailings from this vanner pass to two canvas-covered tables, 15 ft. square, which are washed every hour. Tailings from these unite with the tailings from the first 26 tables and with the spigot discharge from the settling box, and flow over the final concentrator, a 22x60-ft. canvas-covered table.

The concentration by blankets and vanners is carried out more fully at the Empire mill than is customary elsewhere. Exact figures as to the recovery are not obtainable. The ore varies greatly in value as well as in the percentage of free gold contained. As a rule most of the concentrating mills are able to get their tailings from a $10 mill run down to 50c. or less per ton. With high-grade rock the tailings run higher and may even reach several dollars in value.

Central and North Star Mills

The North Star Company has two mills in operation, one at the North Star shaft and the other at the Central shaft. Each has 40 stamps and both employ practically the same process.

The ore from the mine, after crushing, passes to the stamp battery where it is crushed through a needle-punched steel screen having 19 holes to the inch. The holes in the screen are not continuous, but are interrupted every inch for about ⅛ in., so that the screen is divided into squares by strips of unpunched metal about ⅛ in. across. By this means the screening surface is slightly reduced, but the life of the screen is increased from two to three times. This is due to the fact that the unpunched metal prevents the tearing of the screen.

From the batteries the pulp passes over silver-plated amalgamation plates, 4x18 ft., having an inclination of about 2½ in

IDAHO-MARYLAND MINE, GRASS VALLEY, CAL.

NORTH STAR MILL, GRASS VALLEY, CAL.

*Mining engineer, Reno, Nev.

12. After passing over amalgam traps the pulp flows to eight Dodd buddles, making concentrates, middlings and tailings. The middlings are returned to a separate buddle on the same floor. The tailings from all of the concentrators pass to a roughing cone, 7 ft. in diameter with 60-deg. sides, from which the spigot discharge goes to the sand-collecting tanks. The overflow passes to two 5-ft. Merrill classifiers, the spigot discharge from which unites with that from the first cone and passes to the sand-collecting tanks.

Cyaniding

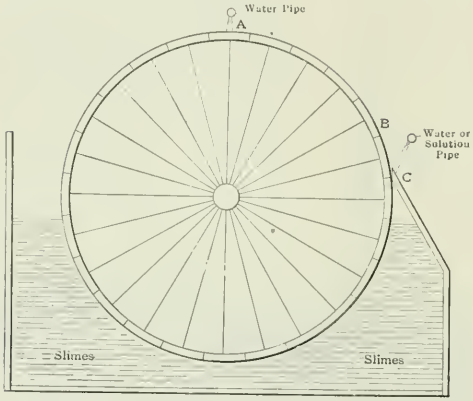
The sands are leached with a 0.10-per cent. cyanide solution, the total treatment taking seven to eight days. The tanks are discharged through four bottom-discharge gates by means of a revolving distributor which is here used to carry water for washing out the tank instead of for pulp. The water is carried to the distributor under pressure, and no labor is used in discharging the tanks.

The slime overflow from the last cones passes to six settling tanks 14 ft. diameter by 12 ft. deep, from which the overflow is pumped to a storage tank above the mill and returned to the mill circulation. Slimes are drawn off from the settling tanks every hour to a slime-collecting tank from which they pass to an Oliver filter.

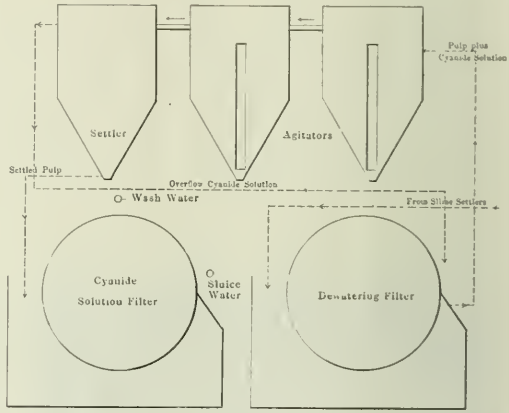
The slime-settling tanks have conical bottoms, and in discharging, the upper portion which contains a lower percentage of pulp, is left in the tank. In this way the water content of the slimes is kept lower than would be possible by discharging the whole tank. The pulp in leaving the settlers has a consistency of about two water to one slime.

The first of two Oliver filters acts as a dewaterer and the slime is washed from the filter scraper with cyanide solution. Cyanide is not used in the battery solution. From the filter the slimes now pass to the first agitation tank. This is connected toward the top with a second agitation tank and this with a third, which acts as a settler. The tanks are 8 ft. in diameter by 7 ft. deep to the conical bottoms which have a pitch of 60 deg. The tanks are of the Pachuca type, the slimes being agitated by compressed air passing upward through a central cylinder. The air is under 7 to 8 lb. pressure. The pulp passes continuously through the two agitation tanks and into the settling tank. In the settler the solution from the top goes to the first Oliver filter to wash down the slimes as already described. The settled pulp passes to the second Oliver filter which extracts the cyanide solution, washes the slimes and discharges it into the tailings flume.

The total time of treatment of the slimes is about 6 hours. The slime heads assay from $1.50 to $2, and the tailings from 20 to 25c. per ton.



SKETCH OF OLIVER FILTER



ARRANGEMENT OF FILTERS

The Oliver Filter

The Oliver filter is an invention of the superintendent of the North Star mills, and is manufactured by the Taylor Foundry and Engineering Company, at Grass Valley. It consists of a revolving cylinder, the periphery of which is the filtering surface. This is divided into 24 compartments, each of which is connected by suction and pressure pipes passing through the center of the machine. The cylinder revolves in a tank which contains the slimes and makes one revolution in from five to six minutes. The portion of the filter in the slimes is subjected to a suction corresponding to about 20 lb. air pressure, which draws and holds the slimes upon the filtering surface. In revolving to the upper part of the cylinder, the pulp is reduced to about 25 per cent. moisture. At this point, *A* in the accompanying illustration, wash water is added from an overhead pipe, and at the same time the suction changes so as to draw the solution through a different pipe. Just before reaching the scraper at *C* the valve arrangement is such that pressure is applied in the filter compartments immediately above the scraper and this, together with the action of the scraper, discharges the pulp into the proper receptacle. The change from suction to pressure takes place automatically in one compartment just before reaching the scraper and suction is again automatically restored upon leaving it. The filters in use are 7 ft. long and 10 ft. in diameter, and have a capacity of nearly three tons per hour. The weight of pulp on one side of the filter very nearly balances that on the other side, so that very little power is required for the revolution of the cylinder. These filters have been in use several months at the North Star and Central mills with satisfactory results.

Treatment of Concentrates

The concentrates from both mills are treated at the Central plant. Pulp is dumped into a circular wooden tank, about 8 ft. in diameter by 8 ft. deep, from which it is discharged by means of scrapers attached to two arms extending from the center to the circumference and revolved by means of a central shaft to which they are attached. The pulp discharges through the center into a pipe line leading to an Abbe tube mill 4½ ft. in diameter by 20 ft. long. Cyanide solution is added just after leaving the tank; this washes the concentrates into the mill. The ratio of solution to solid matter is a little less than 1 to 1. The cyanide solution has a strength of 0.15 per cent. cyanide. The tube mill is run at 20 r.p.m., consuming 16 h.p. An increase of 8 r.p.m. is said to have increased the power consumption to 48 h.p. Pebbles gathered in

the creek bed near the mine are used in the tube mill; this material costs $4 per ton at the mill. The consumption of pebbles is 40 lb. per ton of ore crushed.

The pulp from the tube mill passes over amalgamation plates and then to cone classifiers from which the spigot discharge is returned to the mill. The overflow goes to agitation tanks where it is agitated in solution for six hours. It is then decanted twice and the remaining pulp sent to a small Oliver filter. The concentrates treated run from $30 to $40 per ton, and an extraction during two years' run of 93 per cent. by bullion returns has been made. The consumption of cyanide to 2½ lb. per ton treated and the total cost of treatment is $3 approximately.

Pioneer Mill

The Pioneer mill is a small plant near Nevada City which treats concentrates from the neighboring mills. The process consists simply in roasting "sweet" and leaching with cyanide solution. A minimum charge of $10.50 per ton at the mine is made, and returns are given of 93 to 94 per cent. of the assay value.

The gold from the cyanide solution is precipitated on zinc shavings dipped in lead acetate. The precipitated material is first treated with sulphuric acid to remove the zinc, and then with a mixture of sulphuric acid and sodium nitrate for removing any copper present. The gold is then dissolved in a mixture of 10 lb. salt, 100 lb. commercial sulphuric acid and 10 lb. potassium permangamate. This amount is sufficient to dissolve from $5000 to $6000 in gold. The gold is precipitated from solution with ferrous sulphate and melted with a flux of borax and niter. The resulting bullion is usually 995+ fine.

CANVAS CONCENTRATORS, EMPIRE MILL

Reminiscences of Goldfield, Nevada

By Mark R. Lamb*

The scenes which occurred in Nevada camps in the early days of the great excitement were probably not equaled anywhere in the world. One thinks of the United States as a highly civilized and law-abiding nation, but what a surprise to see in the Goldfield district acts, which in Russia, are justification for wholesale deportations, and in Mexico, for the introduction of troops with ball cartridges.

Think of a camp with 37 buyers of small lots of ore—37 competing buyers of stolen ore—37 honored citizens who would buy one pound or a ton of ore from miner or mine foreman, or would purchase bullion or zinc precipitate in any shape and quantity, knowing beyond a shadow of doubt that it was stolen from one of the three plants then in operation in the camp. The climax came when the owners of one mill advertised openly to buy bullion—and are known to have bought bullion from their own employees which was stolen from their own mill!

I remember walking in front of Cook's bank in Goldfield with a friend, who was hailed by a miner seated on the curb.

"George, come help me up!"

"What's the matter—drunk?" my companion asked as he went toward the man to help him.

"Oh, no, but I've got too big a load—not whisky, but ore."

He was helped up, staggering, and then he showed us his load of ore bulging from pockets, "leg pockets" (long, narrow bags to hang down the trouser legs), and "ore harness" (double canvas shirts entirely made up of stitched pockets for ore), with finally a big double-crowned Stetson hat, capable of holding at least five pounds of ore.

"Willis, the assayer, tells me that I bring the record loads out of the Mohawk," he boasted. "The foreman had to help me out of the bucket as I came off night shift," he continued, grinning, "and he is one of those cranks who would like to kick about our taking our share."

A story, a true story, is told of two miners who, after getting a little of other people's money together in this way, took a lease and were lucky and struck "jewely" ore. As they were "wise" they attempted to prevent high-grading. One day they caught the entire shift cleaning out a rich streak of ore.

"Here, you fellows, you can't take any of that out of this mine," one said as both covered the miners with six-shooters.

"You have no kick," retorted one of the shift. "You did the same thing on the Riley lease."

"Maybe I did," was the reply, "but I did not take all the best ore, and anyway this is my lease and high-grading don't go—see?" And it stopped.

At one mill the precipitated gold, worth about $30,000, was in the clean-up acid tank. The cutting of the short zinc was not quite finished at the end of the day, so the clean-up room was locked and a watchman placed, with the intention of completing the job the next day. In the morning the windows were found covered on the inside, a tray of "shorts" gone, and as the acid tank had been disturbed it was supposed that the settled gold in it was also gone. Great consternation reigned, but a hurried investigation showed that though an attempt had been made to scoop out the gold, the acid solution was so dense and saturated that the gold had not settled. As the clean-up turned out more gold than was expected, the loss could not have been great. Of course, the stolen gold was melted up in one of the "assay offices."

How great was the temptation at Goldfield is shown by the difficulty that the express company experienced in getting honest drivers to gather up the shipments of stolen ore from the assay offices each night. There was no real need of doing this work at night, but it "looked better."

The sudden "ups" and "downs" of life in Goldfield were simply incredible. The best places to get stories were around the gaming tables and at the club. This latter was merely a social club with no civic duties or responsibilities—a fact empha-

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sized whenever a "vigilance committee" spirit was expected of it, though it had a large and "better element" membership. Over glasses or a little supper one would hear tales of sudden wealth which made the wonders of Aladdin's lamp fade. One fortunate fellow, known to his associates as "Dick" and now rated with seven figures after his name, told of leaving Tonopah as a laborer with a party of surveyors headed for the new camp, then called Grandpa. His pay was $50 per month and board. It was a chance to get to a new strike at no cost. None of his party thought the camp had any merit after they had been over it thoroughly, but Dick, as he naively tells it, wanted a job after returning to Tonopah, so he boosted for Grandpa in order that the survey party be sent out again and he be enabled to get his $50 and board. He located a number of claims in order to have something to sell, then bought a small share in one of the mines which afterward became a big producer. One little deal after another finally made a broker of him and the rest was easy. Ability to succeed was his and the opportunity presented itself.

Another man, now a millionaire, arrived at Goldfield literally broke. He slept out of doors for lack of the price of a bed, and sought the warm wall of a mud bake-oven in order not to freeze. His name is now spoken most respectfully by everyone from Pullman porter to smelter manager. In order to get to Goldfield another pawned a diamond ring—his last available asset. He is now an honored member of the Rocky Mountain Club of New York, and pawns no more.

Two men, both big fellows, came to me one morning when there was no chance for them except to shovel tailings from the tanks. It was new work for them, so they worked hard—and beat the record. This led to a contract and that month the tailings gave no trouble. But a month was all they wanted. A lease on the Mohawk soon fixed them beyond all care—unless they put the profits back into some other hole.

Labor was hard to get and harder to keep. I have decided that of all labor, batterymen are the most dependable. Whether it is because he works so hard for his pay or because it takes a steady, phlegmatic man to run a battery, I know not, but he seldom quits to gamble, or in fact, for anything but a good excuse. And although he has the best chance in the world, a millman rarely high-grades.

My first task in Goldfield was to thaw out a frozen pipe line ten miles long. The temperature was about zero. The line had been loosely and hastily laid and in some places was above ground. Money could hardly hire men for outside work. Grave diggers were paid $20 per day, for no one was prepared with clothes for such weather, as the year before had been mild and the second year before—no one knew, as the place was uninhabited. But finally by building fires with sage brush, digging frozen ground, drilling into the pipe, and moving along bit by bit as the water showed at the drill holes we got the water flowing through the pipes again.

The railroad to Goldfield made money It paid for itself in six months. Strange things happened during the first few months after the completion of the branch. For instance, the company that I was working for was anxious to get in a small boiler for a mill then being built. The freight agent would not receive it, saying that the road was already blockaded with freight, but in his capacity as express agent he gladly loaded the boiler into a freight car, charged us express rates and sent it through. One leaser, immediately after securing a good block of ground, hurried to Denver, bought his hoisting machinery, chartered a special train and returned to Goldfield with the machinery in less than passenger time. It was expensive, but his lease allowed him only six months and every moment counted. He sunk 300 ft., found rich ore and cleared just $50,000 over all expenses in that time.

Speaking of leasing brings a flood of interesting reminiscence. While I was at the Combination mill our assayer and samplers regularly tested the ground as fast as it was opened up by the various leasers, so that we actually knew before the leasers themselves, when good ore was struck. One leaser on the extreme end of the Combination ground had sunk his shaft within a few feet of the endline of the claim. One day the assayer reported that the ore assayed $600. We were all excited, went down to see the ore, studied the formation and decided that the ore must certainly run into the adjoining claim. The stock of the latter was then selling at 20c. a share. In spite of all favorable indications, only two of the staff had the nerve to buy—and the stock went to 85c. in two days. It can easily be imagined how we felt because we had not bought. An "investment" of $500 on margins would have made a royal profit of $25,000. I hate to spoil this, but must add that the men who did buy, kept on buying until the stock dropped again, since the ore did not go where we expected it. One of these men is still in Goldfield, has made and lost many fortunes (on paper), but still has his salary to live upon.

One newsboy in Goldfield got the speculative fever, but he was cold blooded and took no chances. Jimmie was a favorite with the brokers, and kept his mouth shut, so when one of them knew of a planned manipulation (it required an expenditure of only $1000 or so of real money to cause a flurry), Jimmie was tipped off and so cleared a little profit. His bank account soon reached $10,000.

The margin between success and failure is sometimes very narrow. One leaser—an Italian—missed the ore on his block of ground, spent his grub-stake of $5000, and in disgust sold his lease for $3000. His successor, a clever young fellow with several years of experience in prospecting and mining, found ore It was of such grade that he took his bed and tent to the ground, using them to cover and catch the rock blown out by the first few shots. He took out over a hundred thousand in the first two weeks.

On another lease a party of Easteners had begun sinking in a spot which brought them ridicule from all sides. After spending all their capital they had agreed that they were wrong: one of the party gave up in disgust and started for Chicago to begin life over. Just out of Denver he received a telegram from his partners, "Better come back. Ground looking better." His remarks will not bear repeating. This same hope had been held out ever since the shaft had been started. Within a few hours another telegram was handed him that read, "Hurry back. Have cut a small stringer of rich ore."

"Porter," he said, "if you bother me with another telegram before morning there will be a nigger missing on this car.' But at 12 p.m., the conductor brought him a telegram to the smoker. It said: "Have cut seven feet of $900 rock." That was more than he could stand so he started back. This was the first of the rich leases on the Mohawk mine, which has produced literally tons and tons of gold, for one carload, alone, of special picked ore contained more than a ton of pure gold.

A friend took me to see a mine of his which was very promising. He had recently bought it and was building a mill on the ground. I presume thousands of men had been over the claim after its discovery, examining the vein, commenting on the coarseness of the gold and envying the lucky owner. I followed suit. He gave me specimens which were more than half gold. After I had returned to Goldfield and had almost forgotten that mine, a wise prospector came along and took a lease on the surface dirt. Just the loose stuff, mind you, with no rights to do anything but dry-wash the loose gold. For weeks he took out $1500 a day clear profit. Now, why did not *I* think of that?

All short trips to examine mines were made in autos. As there were few roads the autos had to run over sage brush, boulders and cactus, but serious accidents were rare. The expense of such trips was not taken into consideration. If a new discovery was made it was simply a question of getting there first at any cost. One claim near the original discovery would sell for the price of several autos, whether it had good indications or not. Such claims are always "extensions" of the original discovery. Autos have made the trip from Tonopah to Rhyolite and back in a day, a recorded distance of more than 250 miles.

Electric Hoists as Adapted for Coal Mines

The Numerous Advantages of Electrical Winding Are Discussed, and the Most Improved Equalizing Systems Are Compared in Detail

BY R. H. ROWLAND*

In most of our modern collieries and mines, electric haulage is adopted, if not in its entirety, at least to some extent, and its advantages over mule and steam haulage, from results of experience have been tested and proved at various mines throughout the United States and foreign countries. Briefly, the advantages consist of an increased production at a decreased cost, a very material factor to the operator.

The majority of colliery and mine operators, at whose mines are installed steam hoisting plants, are not desirous of replacing their installations by electrical machinery, although these steam plants might be inefficient and uneconomical. Perhaps the chief reason for their objection to the installation of electricity is owing to the initial cost of installing, and the consequent disposal of the original equipment. However, at many mines operated in countries where fuel is expensive, large companies have already begun to tear out steam hoisting plants and substitute electrical installations.

Winding engines may be driven by three-phase induction motors, or by direct-current motors, either direct-coupled or through gearing. For large winders, the adoption of direct-coupled motors is preferable, and they become a necessity for 400 h.p. and above. The inertia of direct-coupled motors is considerably less than that of geared motors, and small inertia is of importance when high acceleration and high rope speeds are required. Three-phase induction motors may be used in connection with three-phase power transmission. Slow-speed induction motors of about 60 r.p.m. should be built with 25 cycles, but not for 60 cycles, owing to the poor performance, and the high price.

Selecting the Style of Motor

Three-phase motors may be used whenever the losses in the starting resistance are a small percentage of the total power consumption, and when the weight of the drum or friction wheel is low. In this case the unbalanced load produces a sufficient retardation, without regenerative braking. If the power can be advantageously generated in a direct-current unit in the vicinity of the winding engine, direct-current motors can be successfully adapted. Also, whenever the conditions given above for induction motors are not fulfilled.

Advantages of Electrical Winding

Electrical winding has different advantages compared with steam winding engines. Some of these advantages are in the greater flexibility and uniform torque of the electrical motors, which reduces the flywheel effect of the winding engine to the minimum amount, while the steam engine must in many cases have a greater flywheel effect due to its reciprocating action. These features of electrical winding result in many detailed advantages, such as smaller boiler engine capacity, the practical elimination of losses by heat radiation of a plant with considerably smaller capacity, no overload or variable strain of the material and apparatus of the power house, and lastly, the possibility of centralization of the production of energy necessary for all the machinery in the mine. Other advantageous features of electric hoisting are the extremely simple and smooth action of the controlling apparatus of the winding engine, and almost constant accelerations, (not obtainable with steam hoists).

Electric hoists, therefore, insure less maximum speed with the same time per wind, or with the same maximum speed less time per wind, this latter fact resulting in an increased carrying capacity of the shaft, or in other words an increased output of the mine.

The Saving in Fuel

Perhaps the most important advantage is the considerable saving in steam or coal per unit of material extracted. This, however, applies only in the event of it being possible to erect the electrical equipment so that the power station is able to produce the energy with practically 100 per cent. load factor, and it is only in this fact that a saving can be obtained. In this way the electrical energy is generated with the maximum possible efficiency.

The power demand of winding engines varies within wide limits; during the decking period no power is consumed by the winding motor, while during the accelerating period the load on the winding motor is increased to two or three times the average load calculated for the total time. The load curve, therefore, will be periodic, and its shape entirely dependent on the mechanical outlay of the winding engine. Such a load curve is shown in Fig. 1 by the letters *X A B C D E X*, which embody an area. The average ordinate of this polygonal line gives the mean power for the winding motor, and in order to obtain a constant load following the line *A D a d*, a means must be found for storing during the pause, the energy represented by the area *E D a F* and delivering same to the winding motor during the period of overload *A B C D*. This result can be obtained by using a heavy flywheel, arranged so as to absorb energy during the interval *D a* and to give back same during the time *a d*, so that it will thus be possible to install a power station working continuously with 100 per cent. load factor and designed for the average power demand. Such a power station would result in a "considerable saving in steam or coal per unit of material extracted," as previously stated.

Equalizing Systems

There are different load equalizing systems, chief among these are the Ilgner motor-generator system, the Ward-Leonard system, and the Westinghouse converter-equalizer system. The Ilgner system is practically an adaptation of the Ward-Leonard motor-generator system. The motor of the motor-generator is either an induction motor with slip rings (Fig. 2) or a direct-current shunt motor (Fig. 3). These diagrams show the Ilgner system mostly used at the present time in order to arrive at the equalizing effect above referred to.

The generator is shunt wound and connected to a direct-current shunt-wound winding motor. The generator and the winding motor are separately excited, and by varying the excitation of the generator, any voltage between minus maximum and plus maximum may be applied to the winding motor terminals. The operation is as follows:

The motor (*A*), Fig. 2, is first started and brought up to speed with the flywheel (*B*), dynamos (*C*), and the exciter (*G*) on the same shaft. The field circuit (*D*) of the exciter is then closed and current is supplied to the field winding (*E*) of the winding motor. By moving the controller (*F*), which consists of a reversible field rheostat, the field current of the generator, and consequently the voltage at its terminals, can be varied to any desired degree.

The motor coupled with the flywheel

*Mining engineer, 255 West Forty-fourth street, New York City.

must be allowed to slip in order to let the flywheel discharge a part of its kinetic energy. This is obtained by inserting a resistance in the secondary of the induction motor (Fig. 2), or by regulating the field excitation of the direct-current shunt-wound motor (Fig. 3). The regulation is arranged so as to work automatically and keep the input of the motor constant. The speed variation with an induction motor cannot, for economical reasons, be higher than 10 per cent. of the maximum speed, while with the direct-current shunt motor the speed variation may be as high as 30 per cent.

Westinghouse Converter-Equalizer

The Westinghouse converter-equalizer may be used in conjunction with either alternating or direct-current motors. The equalizer for alternating-current motors, shown in Fig. 4, consists of a rotary converter (*A*) connected through transformers (*B*) to the high-tension transmission lines. The rotary converter on its direct-current side is connected to a direct-current machine (*C*) with flywheel (*D*), and is compounded in a special way, so as to compensate automatically for the magnetizing currents of the induction motors in the system. The voltage of the direct-current flywheel machine is controlled automatically by a quick-acting regulating apparatus (*E*) from the high tension transmission line through series transformers. This enables the converter-equalizer to discharge energy into the high-tension system whenever the load of the latter is greater than the constant station output, and to store up energy in the flywheel whenever the power demand in the high-tension supply system is less than the constant output of the station.

When no load is on the high-tension system, the rotary converter is acting with 100 per cent. power factor, giving up to the flywheel the total constant station output until maximum speed is reached. The capacity of the flywheel is made sufficiently large to take care of the overload periods of the high tension system. The flywheel machine is preferably built for high speeds in order to obtain high electrical efficiency combined with light weight. The flywheel may have a maximum slip of 40 per cent. of its maximum speed, but in ordinary service 30 per cent. will be sufficient.

The over-all efficiency of this converter-equalizer (the energy input divided by the energy output) is about 70 per cent., which can at least be compared to a chemical accumulator, besides having the advantage of a cheaper price for the output, and a smaller cost for maintenance and repair.

In view of the fact that this converter-equalizer is only handling the overload and underload energy, which represents but a small amount of the constant station energy delivered, the efficiency of the whole system will be considerably higher, and for the small loss in the load equalizer, a gain of at least 8 to 10 times the amount results in the power station. This is due to the fact that without the load equalizer a larger station capacity to withstand the maximum load had to be provided, and is operated with a very small load factor. The average load factor of the winding engines in most cases is not higher than 15 to 20 per cent., and the same load factor is on the station without the load equalizer.

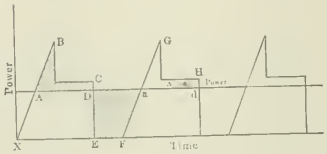


FIG. 1. THE LOAD CURVE IS DEPENDENT ON OUTLAY OF WINDING ENGINE

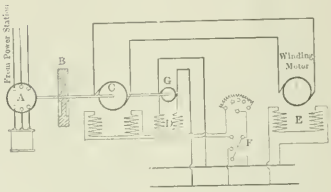


FIG. 2. ALTERNATING CURRENT POWER TRANSMISSION

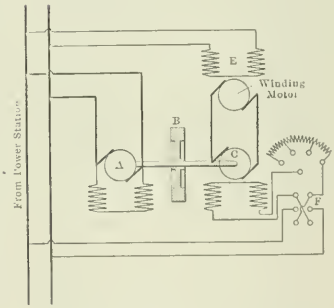


FIG. 3. DIRECT CURRENT POWER TRANSMISSION

This converter-equalizer in connection with alternating-current motors may be installed at any suitable place on the alternating-current system, and need not be situated near the winding motor.

The equalizer for direct-current motors shown in Fig. 5, consists of a rotary converter (*A*) connected to the alternating-current mains in the same way as is shown in Fig. 4. The direct-current side is connected to a direct-current machine (*B*) fixed on the same shaft with a flywheel and a direct-current machine (*C*). This latter machine being connected in series with the machine (*B*) acts as a voltage regulator in order to obtain a variation of voltage on the winding motor terminals (*D*) between minus maximum and plus maximum.

The direct-current voltage of the machines (*A*), (*B*), (*C*) is one-half of the maximum voltage of the winding motor (*D*), so that if the latter is built for 500 volts, the machines (*A*), (*B*), (*C*), will have 250 volts each.

When the winding motor (*D*) has to be started, the voltage of the regulating machine (*C*), will be opposite to that of the machine (*B*). By decreasing gradually the voltage of (*C*) to zero, and increasing it in reverse direction any desired tension between zero and maximum may be applied to the winding motor. In order to regenerate it is only necessary to decrease the voltage impressed on the winding motor.

The energy will always be taken from the alternating-current supply circuit with a 100 per cent. power factor; or a leading current may be sent into the same by properly regulating the shunt field of the rotary converter. The voltage regulating machine (*C*) can sometimes be omitted, and the winding motor (*D*) started by resistance. This is applicable in all cases where the losses in starting resistance are very small.

The Load Variations Are Equalized

This equalizer will also act so as to equalize at the same time the load variations on the alternating-current circuit produced by any other motors. It may be compounded in a suitable way in order to regulate the power factor of the whole alternating-current system. If it is not desired to equalize the entire alternating current load, the automatic regulator will be connected into the direct-current side of the converter and the motor magnet operated by direct current. It is essential that this converter-equalizer for direct-current motors be installed in the neighborhood of the winding engine.

The direct-current winding motor will usually be shunt wound, particularly if electric regeneration is required, but it may be series wound if used in connection with large haulage gears.

Comparison of Systems

It may be interesting to engineers and others concerned to here make a comparison of the advantages and disadvantages of the Ilgner motor-generator system and the Westinghouse converter-equalizer system for the operation of winding engines.

The Ilgner system uses a motor generator which transforms the total current consumed by the winding motor from three-phase energy into direct current,

while the Westinghouse converter-equalizer transforms only that amount of energy into direct current, and back into polyphase currents, which is in excess or below the constant output of the station. The former is an indirect system and the latter a direct system.

Owing to the fact that the Ilgner system has a direct-current motor on the winding engine, which, if geared to the winding drum, might cause trouble, due to sparking on account of the vibrations on the pinion, this trouble is eliminated by the polyphase induction motor with slip rings which is adopted for driving the winding engine in accordance with the Westinghouse system.

In underground work, and especially in coal mines, induction motors are generally adopted; the use of direct current for the winding engine would therefore make it necessary to use two different electrical systems. With the Westinghouse equalizer, it would only be necessary to use polyphase current in the mine.

As stated previously, the Westinghouse converter-equalizer may be installed at any convenient place in connection with the high-tension transmission system, in the power station in the center of the power consumption area, or near the winding engine. So that if the winding engine is located at a place which is not easily accessible, repairs can be made at a place which is convenient, and where the converter equalizer is installed. If, therefore, as often occurs, the mine is situated at a remote place in the mountains, it will be extremely inconvenient to transport spare parts and make repairs in case of any damage to the heavy motor generator used in connection with the Ilgner system, which it is essential must be installed near the winding engine at the shaft.

Should any irregularity happen with the motor generator of the Ilgner system, it is necessary to shut down the winding engine, but with the Westinghouse system, if the station is unable to stand the overloads, the winding engine can still continue its operation, although at a reduced load.

Another advantage of this equalizer is that if the same is handling light loads, as is often the case at night time, so that no equalizing of the station is necessary, it may be shut down; but the motor generator of the Ilgner system cannot be shut down, although its load equalizing effect is not needed under this condition, and therefore a great loss with a low load factor results.

The Motor-generator Must be Shut Down

During long pauses in the operation of the winding engine, it is advisable to shut down the motor-generator of the Ilgner system, owing to the fact that when the flywheel is started again by the induction motor, there is produced such an overload shock on the power station that in order to avoid it, it is preferable to run the motor-generator for a longer time without load; with the Westinghouse equalizer, however, during long pauses, the machine can be shut down, owing to the converter acting with 100 per cent. power factor, the light flywheel when started again does not re-

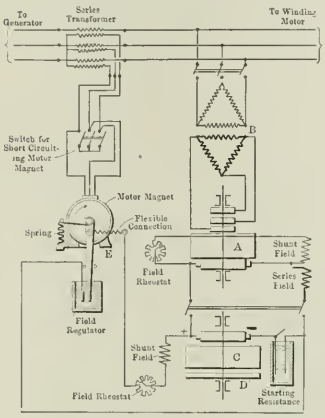


FIG. 4. EQUALIZING SET WITH A. C. MOTORS

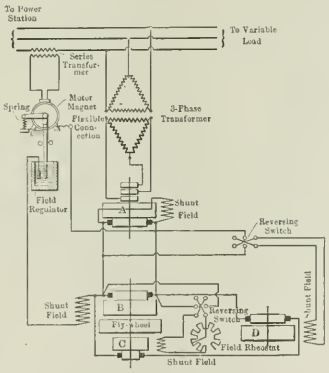


FIG. 5. EQUALIZING SET WITH D. C. MOTORS

quire more than approximately one-quarter of the apparent power of the Ilgner motor-generator.

The flywheel of the Ilgner motor-generator can only charge and discharge a small amount of its total kinetic energy, which fact makes it very heavy. The heavy flywheel has to be built up in one or more solid steel disks in order to get sufficient strength with the high speeds, and it is a very difficult matter to transport these flywheels on railroads, owing to the limits of the loading gage, and for large high-power winding engines, transportation would in many cases be impossible.

The flywheel of the Westinghouse converter-equalizer can charge and discharge three times as much of its total kinetic energy as the Ilgner flywheel, and this enables it to have one-third the weight. A light flywheel, too, can be made in one piece, and transport by railroad does not entail any difficulties. The flywheel, also, can be made for any size of winding engine.

It is necessary that the capacity of the Ilgner generator be sufficient to handle the peak load, but the capacity of the flywheel machine of the Westinghouse equalizer need only be sufficient to handle the difference between the peak load and the average load; also the speed can be higher and the cost lower, in the former case the speed is less than the latter. The transport of heavy fly-wheels in mountainous districts is difficult, while light flywheels can be moved without trouble.

The Ilgner flywheel must be built of a large diameter in order to obtain a sufficient speed at the radius of gyration, but the Westinghouse flywheels with high speeds are built with small diameters.

Finally, the installation of the Ilgner motor-generator means in many cases the erection of a sub-station and therefore de-centralization, while the great advantage of polyphase high-tension transmission is the absence of sub-stations with rotating machinery which needs inspection. The installation of the Westinghouse equalizer with an induction motor for winding does not necessitate the erection of a sub-station. It should, in fact, be preferably placed in the power station if general conditions permit.

There are various schemes of electrical winding plants to suit the several conditions; however, it would go beyond the scope of this article to embody the whole, and while much has been said in the engineering papers regarding the adoption of flywheels as being unsatisfactory, the Ilgner system of electrical hoisting has found much favor on the continent.

In figuring the mechanical data, the details for the engineer to carefully consider are the shaft, loads, speeds, decking operations, rope, pit-head sheaves, winding gear, and position of winding engine; the electrical data embodies the power house, etc.

The friction wheel so largely adopted on the continent is a factor to be recommended whenever winding engines driven by electrical motors are to be considered, owing to the fact that the small weight of the friction wheel, and the consequent large reduction of the total mass allow the winding motor, as well as the equalizing plant, to be much smaller, and therefore cheaper. The wear and tear on the

rope is less than with the drum winder, and the possibility of overwinding, causing the cage to run up against the pithead sheaves, is avoided, owing to the fact that the rope will slide on the wheels as soon as the cage reaches the bottom of the pit; lastly it is impossible to exceed a given strain on the rope, as same will slide should the pull exceed a certain maximum. Regarding the costs of installation of the respective equipments, this is entirely dependent on the conditions to be fulfilled, but it may be generally taken that they compare favorably.

The Crab Locomotive in Coal Mines

The Jeffrey Company, of Columbus, Ohio, has recently added to its line of electric mine locomotives a new type of gatherer known as the "crab locomotive." With the common type of gathering locomotives provided with a reel, it has been difficult to pull loaded cars out of rooms driven to the dip. Again, where the tracks are level, it is often found economical to push the empty into the room by hand, so that mechanical means are required only for hauling out the loaded cars. The crab locomotive was designed to overcome these faults, and is supplied with a small winding drum, or crab, which is mounted on the power end of the locomotive. On this drum is wound 350 ft. of 3/8-in. flexible wire cable, which latter is used for pulling the loaded cars from the room and out onto the entry track.

In mines where the double-entry system is used, the locomotive usually hauls a trip of empty cars into one entry and drops them off at the rooms where they are required. Returning on the other entry, it stops in front of each room where a loaded car is ready. The trip rider then drags the cable into the room, attaches it to the car and signals the motorman who starts the crab motor and pulls the car out of the entry track. The locomotive then either pulls the car to the next room, or leaves it standing until as many cars have been drawn from the room as are required to make up a trip. These loads are then coupled up and hauled to the parting. On the return trip the empty cars are distributed in the entry from which the loads have just been removed, and the locomotive gathers a load of cars from the entry which was supplied with the empties on the preceding trip.

Where the single-entry system is employed, the locomotive usually runs in with a train of empties. Stopping successively in front of the rooms in which loaded cars are ready, it hauls each car to the entry track and pushes it ahead to the next room, dropping off an empty to replace each loaded car taken out. When all empties have been distributed, the motor then proceeds to the parting with the loads gathered. By each of these methods a locomotive can gather from 75 to 200 cars per day, depending upon local conditions.

The crab device is made as compact as possible; the drum is driven by the gearing, through a friction clutch, which acts not only as a smooth starting device for the cars, but also as a safety device in case a car becomes derailed, or the motorman fails to throw off power until the car bumpers strike those of the locomotive. Without this friction arrangement the cable would in such cases break, or serious injury would result to the gearing or motor itself.

The motor which actuates the crab being entirely separate from the locomotive motor, is controlled by a separate starting box, and when the car approaches the entry track the motorman starts the locomotive ahead. As it advances past the switch point the car follows and runs out upon the entry track without either the locomotive or the winding of the crab being stopped. The crab may be stopped when the car strikes the locomotive, but the locomotive need not stop until the room is reached from which the next load is to be hauled. The cable may be paid out from either end of the locomotive. Ordinarily, however, it is more convenient to take the cable out past the motorman, as that end of the locomotive is then opposite the room mouth, and the motorman can watch the light carried by the trip rider, and can see him signal to start winding. He can also watch the car to better advantage as it takes the switch, and can stop instantly if it should become derailed.

One advantage claimed for the crab locomotive is that, except where there are rooms driven to the rise at so great a pitch that the cars cannot be pushed into them by hand, it may replace animal haulage at once without making any changes in the track or conditions in the rooms. When rooms are driven to the rise, it is impracticable to use the crab device for hauling cars into these chambers.

Testing Explosives

Director George Otis Smith of the United States Geological Survey has sent a letter to manufacturers of explosives announcing a series of preliminary tests of such explosives in the presence of inflammable gas, coal dust and the like. The tests are to be made in the experiment station at Pittsburg, Penn., and the object will be to make official studies of articles which manufacturers may desire to have certified with regard to their permissibility for use in mines containing gas or dust in dangerous quantities. The conditions of the test are as follows:

(1) The manufacturer is to furnish 100 lb. of each explosive which he desires to have tested; he is to be responsible for the care, handling and delivery of this material at the testing station on the United States Arsenal Grounds, Fortieth and Butler streets, Pittsburg, Penn., at the time the explosive is to be tested; and he is to have a representative present during the tests who will be responsible for the handling of the packages containing the explosives until they are opened for testing.

(2) No one is to be present at or to participate in these tests except the necessary Government officers at the testing station, their assistants, and the representative of the manufacturer of the explosive to be tested.

(3) The tests will be made in the order of the receipt of the applications for them, provided the necessary quantity of the explosive is delivered at the plant by the time assigned, of which due notice will be given by the Geological Survey.

(4) Preference will be given to the testing of explosives that are now being manufactured and that are in that sense already on the market. No test will be made of any new explosive which is not now being manufactured and marketed, until all explosives now on the market that may be offered for test have been tested.

(5) A list of the explosives which pass certain requirements satisfactorily will be furnished to the State mine inspectors, and will be made public in such further manner as may be considered desirable.

A South African Colliery Accident

Special Correspondence

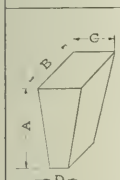
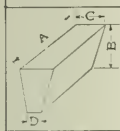
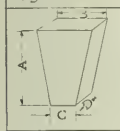
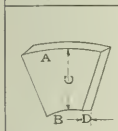
The commission appointed by the Natal government to inquire into the cause of the explosion occurring in the Glencoe colliery early last year through which the lives of 70 persons were lost, has issued its report. The accident was due to an excessive charge of explosive, where the coal had been previously imperfectly blasted, creating a cavity in which gas accumulated. Serious blame is thrown upon the management for laxity of control and for failing to inspect the workings with proper frequency. Generally speaking, the coal mines of South Africa are remarkably free from danger of explosion, but the Glencoe mine is one calling for a special vigilance. One of the recommendations made is that in collieries where safety lamps are required, a new regulation should provide for the removal from a working place of all loose coal before drilling or coal-cutting is resumed.

Shape Brick and Methods of Calculating Requirements for Furnace Work *

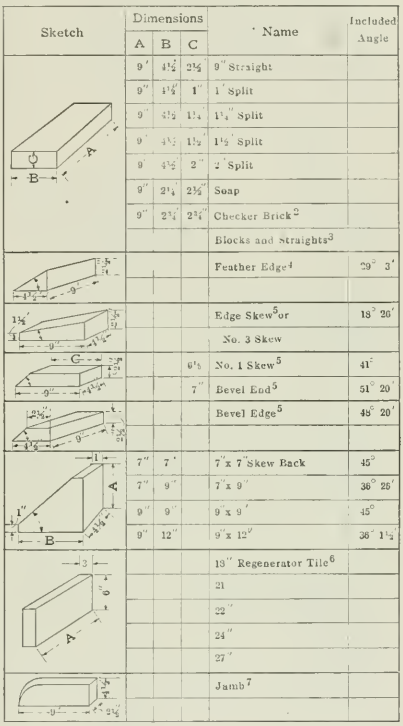
By Ulrich Peters

A subject to which perhaps the least attention is paid in practical or theoretical discussions by engineers is that of the detailed construction and arrangement of bricks in furnaces, flues and foundations. Usually the mill bricklayer is supplied with no other information than an outline drawing of the furnace and flues he is about to build or rebuild. Detail questions generally come up when the roof arch or some other part of the furnace falls in—sometimes almost before the light of its fire is seen. The old-time method of chipping bricks to suitable shapes has been abandoned almost entirely by adopting shape bricks, and in order to obtain practical gas-tight walls of greater strength all necessary cutting to exact dimensions should be done by grinding. This gives beter results in quality of workmanship and economy of labor.

The building of the different parts of the furnace has an important bearing on its life. So-called shape bricks of the best obtainable grade of refractory material of moderate sizes are used and kept in stock. Suitable ready-made shapes have been in practical use for years for building up and repairing walls, ports and arches in the least time and with the least cutting and trimming of the bricks. Most of the geometrical brick shapes have in the interval progressed to certain standard dimensions, commonly called "stock shapes." Sizes vary more or less with the maker and the composition of the refractory material, which may have a different coefficient of expansion and contraction in the process of manufacture. So far only the natural tendency has been followed in the adoption of these standard forms, and no attempt seems to have been made to investigate for the best geometrical forms, or those giving the greatest number of combinations with the smallest number of different stock shapes. Complicated and irregular shapes are avoided as much as possible in furnace construction, as they are liable to cracks and distortions, and not being specially repressed, are not as strong as the sizes now in common use.

Sketch	Dimensions A	B	C	D	Name	Included Angle	No. of Brick to the Circle	Inside Circle
	9"	4½"	2½"	1¾"	No. 1 Wedge	3° 32′	102	
	9"	4½"	2¼"	1¾"	No. 2 Wedge	0° 21′	56	
	9"	4½"	2¼"	2"	No. 3 Wedge or Bullhead	3° 10′	113	
	0"	0¾"	2½"	1½"	No. 2A Wedge	6° 21′	56	
	9"	6¾"	2¼"	2"	No. 3A Wedge	3° 10′	113	
	9"	13½"	2¼"	1½"	No. 2 Wedge Tile	6° 21′	56	
	9"	13½"	2½"	2"	No. 3 Wedge Tile	3° 10′	113	
	9"	13½"	3½"	2¼"	13½" Arch[1]			
	9"	4½"	2½"	2⅛"	No. 1 Side Arch	5° 0′	72	
	9"	4½"	2½"	2"	No. 1A Side Arch	6° 21′	56	
	9"	4½"	2½"	1¾"	No. 2 Side Arch	8° 23′	42	
	9"	4½"	2¼"	1½"	No. 2A Side Arch	12° 40′	28	
	9"	4½"	2½"	1"	No. 3 Side Arch	18°	20	
	9"	4¾"	4"	2¾"	No. 1 Key	3° 10′	113	
	9"	4¾"	3½"	2¼"	No. 2 Key	5° 43′	63	
	9"	4¾"	3"	2¼"	No. 3 Key	9° 43′	38	
	9"	4¾"	2¾"	2¼"	No. 4 Key	14° 24′	25	
	9"	6"	5⅛"	2½"	9" x 6" Key			
	9"	6¼"	4¼"	2¼"	No. 1 Circle	30	12	33"
	9"	7 9/16"	4½"	2¼"	No. 2 Circle	25° 24′	14	45"
	9"	7⅝"	4½"	2½"	No. 3 Circle	20°	18	51"
	9"	6 7/16"	6"	3"	No. 1 Cupola Brick	21°	15	30"
	9"	6¾"	6"	3"	No. 2 Cupola Brick	21° 10′	17	36"
	9"	7 3/16"	6"	3"	No. 3 Cupola Brick	17° 10′	21	43"
	9"	7½"	6"	3"	No. 4 Cupola Brick	14° 24′	25	69"

1. In all Tapers.
2. For Regenerative Furnaces.
3. All Sizes.
4. For Inclined Wells and Skewbacks, etc.
5. Same as Feather Edge.
6. Used for Supporting Checker Work of Regenerative Furnaces.
7. Used around Door Openings.

Sketch	Dimensions A	B	C	Name	Included Angle
	9"	4½"	2¼	9" Straight	
	9"	4½"	1"	1" Split	
	9"	4½	1¼	1¼" Split	
	9"	4½	1½"	1½" Split	
	9"	4½	2"	2" Split	
	9"	2¼	2½"	Soap	
	9"	2¾	2¾"	Checker Brick[2]	
				Blocks and Straights[3]	
				Feather Edge[4]	29° 3′
				Edge Skew[5] or	18° 26′
				No. 3 Skew	
		6½		No. 1 Skew[5]	41°
		7"		Bevel End[5]	51° 20′
				Bevel Edge[5]	48° 20′
	7"	7"		7" x 7" Skew Back	45°
	7"	9"		7" x 9"	36° 26′
	9"	9"		9" x 9"	45°
	9"	12"		9" x 12"	36° 1½′
				13" Regenerator Tile[6]	
				21	
				22"	
				24"	
				27"	
				Jamb[7]	

DETAILS OF VARIOUS SHAPE BRICK USED IN FURNACE CONSTRUCTION

Standard Shapes

The adopted standard mill size of a straight furnace brick in the United States measures 9 in. long, 4½ in. wide and 2½ in. thick. As a stock shape it is commonly known as "9-in. straight," and is shown in Fig. 1. Evidently a greater number of combinations would result from adopting 2¼ in. in thickness instead of 2½ in. The stretcher as well as the header courses, being then multiples of the individual dimensions, would match in all the various combinations for plain wall constructions. Firebrick, as well as the common red brick, are usually undersize and laid with very little clay mortar; if possible, rubbed close at the joints. Therefore little or no allowance is given for the vertical joints in the following standard thickness table:

	Inches.		Ft. In.
½ brick thick	4½	2¼ bricks thick	2 0¾
1 brick thick	9	3 bricks thick	2 3
1½ bricks thick	13½	3½ bricks thick	2 7½
2 bricks thick	18	4 bricks thick	3 0
2½ bricks thick	22½	etc.	

For the horizontal joints of the courses of furnace masonry about ¼ in. for mortar is allowed, so that the hights of brick walls are as follows:

	Inches.		Inches.
1 course high	2½	5 courses high	13¾
2 courses high	5¼	6 courses high	16
3 courses high	8	9 courses high	24
4 courses high	10½	etc	

The rules governing the construction of building masonry also apply in furnace work, i.e., the bricks should be in bond,

*From *The Iron Age*, Oct. 15, 1908.

and, if possible, none of the vertical joints of the alternate courses should meet. The latter rule is, however, not strictly observed in the bond usually employed in the furnace walls, in which for five to nine rows of alternate stretchers one row of header is used as face bond, Fig. 2. It takes much less time to build and practically answers the purpose as well as a better bond, being more or less temporary as compared with the life of furnaces in general. As a rule, all brickwork should be topped off with headers or a row lock, Fig. 3, to prevent the breaking out or falling out of bricks in the top layer.

The principal tapering shapes are further known as wedges, side arch and key bricks. In the wedge shape the sides taper toward the ends, while in side arches the sides taper toward the edges. Both shapes are extensively used in forming arches and circles. The key brick, whose edges taper toward the ends, are the shapes mainly employed for circular walls of coke ovens, lining of blast furnaces, etc. The accompanying table of taper bricks will be found convenient for practical reference. Other very important shapes are enumerated in a separate table.

Rules for the Construction of Arches and Circles

The construction of furnace arches according to best practice involves several problems. Arches and circles of various radii or diameters are built by proper combinations of the different taper bricks and the use of straights for enlarging. Evidently the sum of the included angle of all the single bricks equals the total angle of the arch between the skewbacks, as in Fig. 4. For a complete circle the total angle is naturally 360 deg., and the sum of all the taper-brick angles used to form the circle will have to check up with the total angle of the circle. This gives us an easy method for figuring the proper angle of skewbacks, also a quick method by which to choose the taper and number of bricks to suit a certain skewback.

The accompanying table gives the number of bricks required to form circles of various diameters, and is intended for ready reference. For circles in general the number of taper bricks is derived from the equations below, wherein

r = the inner radius of circle in inches.
t = the thickness of circle in inches.
x = the number of adopted X shapes tapering b to a inches.
y = the number of adopted Y shapes tapering d to e inches.

The outer circumference is then

$$C = 2\pi\,(t + r) = b\,x + d\,y,$$

and the inner circumference

$$c = 2\pi\,r = a\,x + e\,y.$$

Solving both equations for x, we have:

$$x = \frac{2\pi\,(e\,t - d\,r + e\,r)}{e\,b - a\,d}.$$

Or

$$x = \frac{2\pi}{b}\,\frac{e\,t - b\,t + e\,r}{e - a}$$

if d equals b, as is ordinarily the case.

For the number of Y shapes we have similarily:

$$y = \frac{2\pi\,(a\,t - b\,r + a\,r}{a\,d - e\,b}$$

and

$$y = \frac{2\pi}{b}\,\frac{a\,t - b\,r + a\,r}{a - e}$$

if again d equals b.

The figuring of arches having the span s, the rise r and the angle a of skewbacks can be conducted on one of two plans. The first is to make a test by the conditions involved in the equation

$$c = a\,x + e\,y,$$

which is to say, the length of the inside arc should equal the sum of the a and e lengths of the X and Y bricks used. Further, the sum of the angles of these shapes should equal twice the complementary angle of the skewbacks, i.e.:

$$\Sigma < (x + y) = 180 - 2\,a.$$

By a few trials it will be possible to arrive at figures checking with both equations.

The other plan is more direct and much similar to the former calculation of circles. Here the length of the outer arc C and that of the inner arc c, previously calculated from tables, are substituted in the general equation

$$x = \frac{e\,C - d\,c}{e\,b - d\,a},$$

or for

$$y = \frac{a\,C - b\,c}{a\,d - b\,e}.$$

It is much quicker and more accurate for the determination of the number and sizes of shapes required in an arc to use a little of the simple mathematics given than to rely only on a big scale layout, which according to my experience is seldom practically close enough.

After knowing the exact number of brick shapes required for an arch, it is necessary to distribute them in such a manner as to form a symmetrical arch,

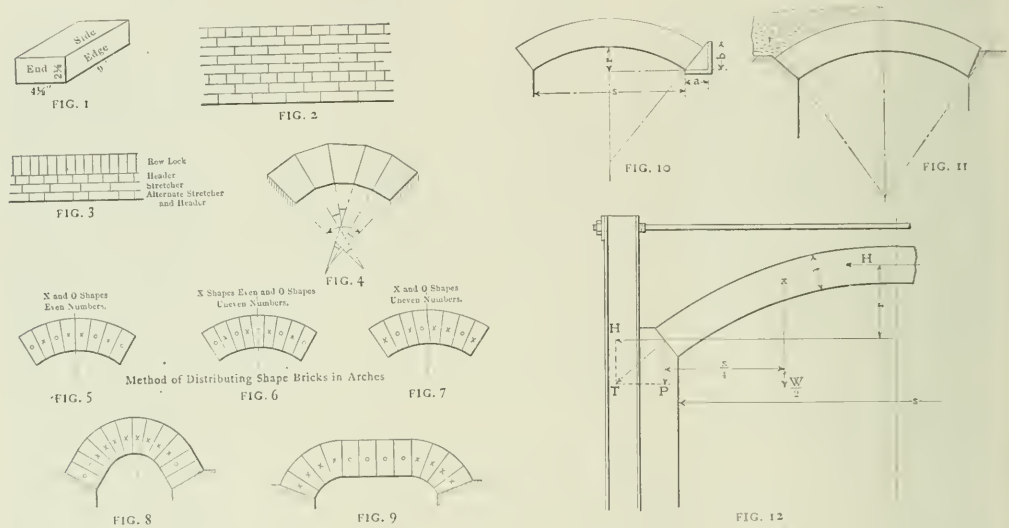


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6 FIG. 7 FIG. 8 FIG. 9

USE OF STRAIGHT AND SHAPE BRICK IN WALL AND LOCK CONSTRUCTION

FIG. 10 FIG. 11 FIG. 12

DETAILS OF SKEWBACKS

Figs. 5, 6 and 7, also a strong arch. From the sketches of arches in Figs. 8 and 9 it is evident that even though both the same kind and number of shapes are used, the arch in Fig. 8 will be much stronger than the other. In distributing the shapes the tendency should be to throw those of greater taper toward the crown of the arch. Under any conditions a practical bricklayer will never use a greater number of straights than about 50 per cent. of the total required for an arch. Straights and taper brick should interchange as much as possible, and two straights should be avoided, because they often cause the easy slipping out of single bricks and the consequent failures of arches.

The most natural form of a roof and such arches as are not subjected to other loads is the curve in which a perfectly flexible rope will hang, i.e., the catenary curve. Building a flat-roof arch to the customary circular form of the false work is really not a mistake, for under the high temperature any arch will change its curvature and rise from the influence of the expansion of the bricks and tend to open up at the joints of the back, in many instances also causing the collapsing of a roof arch. Sand distributed on top serves here as the only effective means of keeping the arch bricks relatively in place, besides helping greatly to hold the heat in the furnace.

TABLE OF BRICK REQUIRED FOR VARIOUS CIRCLES.

Inside Diameter of Circle.	Wedge Brick.				Side Arch Brick.				Key Brick.				
	No. 2 Taper 2½" to 1¼"	No. 3 Taper 2½" to 2"	9 inch Straight.	Total.	No. 2A Taper 2½" to 1¼"	No. 1A Taper 2½" to 2"	9 Inch Straight.	Total.	No. 4 Taper 4½" to 2½"	No. 3 Taper 4½" to 3"	No. 2 Taper 4½" to 3½"	No. 1 Taper 4½" to 4"	Total.
1'-1½"					28			28					
1'-3"					25½	5½		31					
1'-6"					23	11		34	25				25
1'-9"					18½	19		37½					27½
2'-0"					14	27		41	17	13			30
2'-3"	56			56	11	34		45					32
2'-6"	51	9		60	8	41		49	9	25			34
2'-9"	48½	15½		64	4	48½		52½					36
3'-0"	46	22		68		56		56		38			38
3'-3"	42½	29		71½		56	4	60					40
3'-6"	39	36		75		56	8	64		32	10		42
3'-9"	35	44		79		56	11½	67½					44
4'-0"	31	52		83		56	15	71		25	21		46
4'-3"	26	60½		86½		56	19	75					48½
4'-6"	21	69		90		56	23	79		19	32		51
4'-9"	18½	75½		94		56	26½	82½					53
5'-0"	16	82		98		56	30	86		13	42		55
5'-3"	10½	91		101½		56	34	90					57
5'-6"	5	100		105		56	38	94		6	53		59
5'-9"	2½	106½		109		56	42	98					61
6'-0"		113		113		56	46	102			63		63
6'-3"		113	3½	116½									65
6'-6"		113	7	120							58	9	67
6'-9"		113	11	124									69
7'-0"		113	15	128							52	19	71
7'-6"											47	29	76
8'-0"											42	38	80
8'-6"											37	47	84
9'-0"											31	57	88
9'-6"											26	66	92
10'-0"											21	76	97
10'-6"											16	85	101
11'-0"											11	94	105
11'-6"											5	104	109
12'-0"												113	113
12'-6"												113	117

Skewbacks

With respect to the proper choice of skewbacks, there are several points to consider. In the first place, having regard to scientific correctness, the skewback line should be radial. But this condition is not practicable where it is desirable to have only a limited number of stock shapes at hand For radial skewbacks the ratio of the rise r to the span s will be, as in Fig. 10:

$$\frac{r}{s} = \frac{\sqrt{a^2 + b^2} - b}{2a}.$$

For 45-deg. skewbacks $a = b$ and

$$\frac{r}{s} = 0.207.$$

The furnace builder will keep in mind, when not meeting the above conditions exactly, that a low skewback, shown to the left of Fig. 11, is better adapted for underground or loaded arches, such as flues, etc., while for arches not loaded, as in the case of roof arches, a slightly higher skewback, as shown on the right of Fig. 11, is to be recommended on account of its greater wedging action.

Roof arches exert a considerable thrust on the skewbacks, Fig. 12. This thrust per running foot of arch has two components, the horizontal thrust H and the vertical thrust P, which latter is simply equal to half the total weight of the roof arch. As seen in the figure, the horizontal thrust component is figured from the approximate relation

$$H = \frac{Ws}{8r}$$

to

$$Hr = \frac{W}{2} \times \frac{s}{4}.$$

And substituting for the weight

$$W = 128 \times s \times t,$$

if 128 is the weight of brick of 1 cu.ft.,

$$H = \frac{16\,ts^2}{r},$$

in which t = thickness and r = rise of arch in inches and s = span in feet. It is easy to proportion from the above formulas the spacing of buckstaves and the size of tie rods.

"The Mineral Industry"

Readers of the Journal are loyal constituents of "The Mineral Industry" and consequently are interested in the affairs of that annual publication, which has indeed come to be an institution rather than merely a publication. In the first place, we have pleasure in announcing that the response to the increase in the price of the volume, made last year, was such that the publication is to be continued. Its future is entirely in the hands of its friends.

This article is written to answer some inquiries as to how the work in connection with "The Mineral Industry" is done in so short a time. In outlining the magnitude of the work it is useful to quote from an editorial in the Journal of Aug. 22, 1908, as follows:

"The average scientific or technical treatise is a work of about 400 pages, with about 400 words to the page. From the time when the manuscript is received from the author to the time of the publication of the finished volume, there is usually a peroid of six months. "The Mineral Industry" is a volume of upward of 1000 pages, and 500 words go to the page. Its publication is executed in the period of six to seven months, which includes not merely the putting of the book through the press, but also the preparation of the entire manuscript and the collection of its multifold statistics, the latter work alone involving the writing of thousands of letters and telegrams and the coördination and tabulation of the statistical reports."

Considering merely the bulk of the products, "The Mineral Industry" is, therefore about three times the size of the average technical treatise.

The work of bringing out a volume of "The Mineral Industry" up to the time of furnishing the complete manuscript comprises the following:

1. Collection of statistics by direct reports from the producers and consumers. This involves sending out thousands of letters and handling the replies thereto. Comparatively few of the letters of re-

quests are printed circulars, the bulk of the letters being actually written. Many of the blanks are improperly filled out by the respondents and special correspondence must be undertaken to settle uncertainties. This work cannot well be inaugurated before Feb. 1, because at the offices of many companies reports from the mines and works are not received until about that time. We have found by experience that if requests for statistical reports be sent out earlier than they can command immediate reply, they are apt to be put aside and forgotten, which multiplies the correspondence. Even as it is, a great deal of special writing must be done to tardy producers, but we are pleased to say that the majority extend their interested coöperation and are prompt.

2. Collection of the statistics of foreign countries. In some cases these are also obtained by direct reports from the producers, but in general the official reports of the foreign government are used. It is desired always to give the statistics for the last calendar year. In some cases the foreign statisticians are two years behindhand, and then, of course, we must be content with the latest figures that they can give. Among the prompter, some of the official reports reach us by May, which is in ample time. We aim to publish "The Mineral Industry" as early in the year as possible. However, if we should publish it too early it would be inevitably deficient in information. We have decided that for going to press May 31 is the date that combines the maximum of usefulness with the maximum of promptness. In some cases, where the official reports are not going to be out until June, July or August, the foreign governments are so good as to give us advance copies of their reports in manuscript, thereby saving for us the time in passing through their printing offices, without anticipating their own publication. Of course, all of this also involves a great deal of correspondence.

3. The bulk of the commercial and industrial reviews are prepared in this office. Hundreds of letters have to be written to obtain the necessary information. Incidentally, we may remark that throughout the year the newspapers and technical exchanges are carefully scanned and clipped, and the clippings are filed under an adequate system for use at this time. In many cases the clippings are reliable; in other cases, they are merely suggestive and lead to correspondence for verification, etc.

4. The nature of the special technical articles, other than the regular reviews of progress in the arts, is determined and arrangements are made with the desired contributors. Of course, this is generally done previous to Feb. 1. But after that date there is inevitably an extensive correspondence with the contributors, of whom the number to Vol. XVI was 105. Besides the work of the outside contributors, a large part of the reviews are written by our regular staff. The matters of editing the MSS., reading the proofs, coördinating the whole, etc., including keeping track of the work (not the least of the details) we shall not go into here.

We come now to the matter of putting the book through the press. We plan a volume of about 1000 pages, of which about 100 are devoted to the foreign statistics and general matter that may here be dismissed from consideration. This leaves about 900 pages of straight text.

This determination of size is not based upon any mechanical reasons (although it is desirable to have a book that will be mailable without having to use unpleasantly thin paper); it is the maximum that the present editor can supervise. We send the first "copy" to the printer on Feb. 15, and expect to have the last piece of "copy" in type on May 31. This means doing the the whole composition in 15 weeks, or at an average rate of 60 pages per week, which is conformed to as nearly as possible. The printer can do the type-setting much faster than 60 pages per week; indeed it is difficult to prevent him from accumulating "copy" until he can run off 200 pages in a few days. The controlling factor here is that we cannot revise proofs, etc., faster than 60 pages per week.

We cannot always supply required statistics when the "copy" goes to the printer. Perhaps the figures will be filled in on the galley proof; perhaps not until we receive the proof in pages; invariably a large number of pages are being held on May 31, awaiting figures. If the manuscripts were held back until complete in all respects, the book would be a year "in the pickle."

Another factor that contributes to promptness is the preparation of the manuscript, and composition of the same, so far as possible in the alphabetical order of the chapters. The result of this is that the chapters on aluminum and antimony may be printed and in the bindery, awaiting the arrival of the last sheets, before zinc has been completed.

Thus it will be seen that every week after Feb. 22 the available space is diminished by 60 pages, and that if we do not receive the several manuscripts at the required times we shall be to some extent delayed; also if manuscripts come in late and greatly exceed the estimate of their probable length, we shall also be in trouble Of course, we can never operate strictly according to schedule. We have always to leave gaps for some belated articles. (In that case the article must of necessity be cut down to fit the gap; we never leave too big a gap.) But the fewer gaps we have to leave, the smoother is the progress of the book.

We aim to have everything in type on May 31, in which event the book will be out before the end of July, something like two months being required to revise the last proofs, print, and bind. If everything were in the best possible shape on May 31, it might be possible to bring out the book in the first week of July, which some year we hope to accomplish.

Rope Driving

By Sydney F. Walker*

Rope driving is arranged in two ways. In America the method preferred is to carry a single rope from pulley to pulley as many times as there are grooves in the pulleys, the ends being then spliced together so as to form one endless rope. In the United Kingdom, the method preferred is to have as many endless ropes as there are grooves in the pulleys. In my opinion, the American method has the great advantage that all parts of the rope take their share of the strain, and therefore, as compared with the English method, a smaller number of turns should be able to do the work. In the English method it is supposed that each rope takes its share of the work, but in practice it is always found that a portion of the ropes are tight, doing the work, and the remainder slack. What happens is that the ropes which are doing the work at any instant become stretched, and gradually fall out of service; the other ropes then gradually take the work up, then they become stretched, and fall out of service, and so on. But the practical point appears to be, that twice or three times the number of ropes that could perform the drive must be present. It is claimed for the English method that it is more easily cleared, if a rope breaks, for with the American method, if the rope breaks, there is a very much longer length of rope to give trouble.

Transvaal Gold

The gold production of the Transvaal in January is reported by cable at 615,113 oz. fine, or $12,714,386. The output was 45,487 oz. less than in December, but the production of that month was swelled by the inclusion of reserve gold and other additions. A fairer comparison is with November, and the January production exceeded that of November by 740 oz. It was greater than that of January, 1908, by 54,784 oz. During the month there was some interruption of production by the floods on the Rand, which interfered with operation of mines and mills.

The Robinson mine in the Transvaal reports for 1908 a total profit of $5,500,000 from its mill of 220 stamps

*Consulting engineer, Bloomfield Crescent, Bath, England.

Glory-Hole Mining at DeLamar, Nevada

The Material Is Drawn from an Old Widened Ore Chute, the Total Cost of Extraction Being Less Than Thirty-four Cents per Ton

BY W. R. WARDNER*

The De Lamar mines are situated 30 miles west of Caliente, Nev., a division point on the Salt Lake route, and have been worked for the last 14 years. The Bamberger De Lamar Gold Mines Company, controlled by Salt Lake and New York men, has operated the property for the last six years. The company owns its own electric power plant, situated on the railroad at Stine. Utah coal is used as fuel and the power is transmitted to the mine 13 miles away. There are 14 miles of pipe lines and four pumping stations to supply water to the town and works. All supplies for the mine are hauled from Caliente over a very fair wagon road at a cost of 55c. per hundredweight.

GLORY-HOLE FROM SURFACE

DE LAMAR, NEV., SHOWING TOP OF GLORY HOLE

The country is quartzite dipping to the east at an angle of 15 deg. from the horizontal. The ore occurs in relation to a system of north and south gouges and east and west cross dikes. The ore deposits and peculiarities of mineralization are very large subjects in themselves and will not be considered in this article.

Condition of the Workings

The accompanying sketch of the glory-hole ore zone shows a part of the vein system on the plane of Level No. 6. The sections *A-A* and *B-B* give a good idea of the way the ore lies about the glory hole. In these drawings no effort is made to show the areas already stoped by square sets, for the workings are so extensive that it is impossible to make an intelligible representation.

Originally the present glory hole was a prospect raise from No. 10 level to the surface, which was later used as a mill hole and called rock chute No. 5. By years of use the chute was cut out until it was in places more than 50 ft. across. As will be seen on the sketch plan the chute lies between the southeast and southwest veins. Owing to its unusual size it was a constant menace in the extraction of the surrounding orebodies by the square-sets system. In fact stoping had been carried beyond a point of safety and it would not have been possible to take out much more ground by that method.

Assuming a workable area by glory hole down to the level No. 8, there remained in these two orebodies alone something like 250,000 tons of ore, of proved value, in pillars and backs, to say nothing of stope fillings of ore from previous years operations which could not be worked profitably when a high mill heading was maintained. To obtain this tonnage cheaply and safely was the engineering problem that confronted the management.

Method of Operation

The commencement of glory-hole operations was the caving of the stopes around chute No. 5 into the mill hole. At this time there was about 50,000 tons of rock broken down; it is evident that gravity alone will break most of the ground for some time to come. As shown in the drawings the ore will slip away from the gouges; since the formation back of them is very hard it does not slab off to any great extent. In fact there are perpendicular walls of quartzite 200 ft. high in the open-cut workings that have been standing unsupported for several years.

The broken ore varies in size from dust to boulders of very hard quartz, many of them weighing several hundred tons. Up to date practically the only expense for breaking ground has been in handling these boulders. There is considerable waste in the ore, most of it being gouge and dike matter with some country rock. It has been found more economical to neglect the small waste entirely, and the only sorting that is done is to pick out the larger pieces. By so doing the dirt is handled quickly and at a low cost.

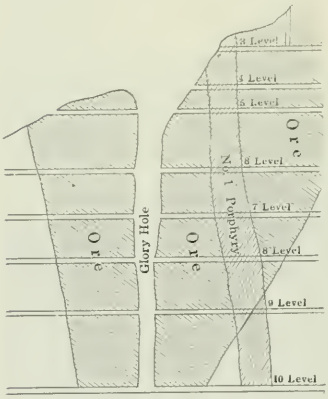
On account of the very large tonnage of broken ore contained in the glory hole—20,000 tons most of the time—it is advisable to draw the ore in such a manner that the grade will average fairly high, and with this end in view it is customary to attack the pile at any convenient entry in the upper levels, being governed by the position of the better ore. For instance, if the rock in the lower part of the hole is of low grade, and there is a cave of better ore on top, instead of waiting for this to be drawn down to the level No. 10,

*Mining engineer, Hollywood, Cal.

as large a part of the tonnage as necessary is tapped from entries on the upper levels. In this way a steady output is maintained without any material sacrifice of grade.

Handling Material

The sketches showing the sorting chambers and entries on level No. 10 give a fairly clear idea of the arrangements for handling and sorting this material in the most economical manner. The broken rock is drawn down upon 10x12-ft. shoveling plats, the larger waste is thrown into the waste pocket and the ore into the ore pocket. There are four of these chambers. It often happens that a large boulder comes down and completely blocks a chamber; this must be broken up, the other chambers being used in the meantime in making the required output. The train draws the pockets as needed, usually twice a day. The method of handling the rock on the upper level entries is about the same with the exception that the waste



SECTION A—A

must be laid aside, the ore loaded into smaller cars and run to the nearest mill hole, and the waste to the waste hole.

The danger is small, for about all the men have to do is to protect themselves from a run of rock in the breast of the room. Most of the time they are working under cover. There is some risk in blasting the boulders when a chamber is blocked; but for an intelligent miner accustomed to this work the danger is not great.

Costs

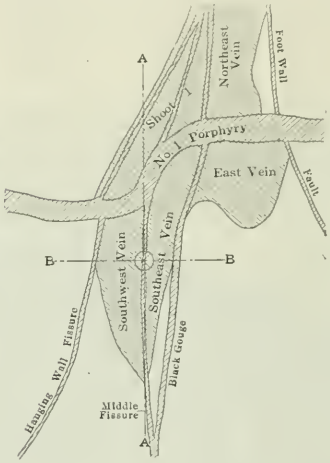
The accompanying tables of costs are for five months' operations. During this time the glory-hole ore amounted to 58 per cent. of the mill tonnage; the other 42 per cent. was obtained from the stopes, 86 per cent. from square-set stopes, 6 per cent. from stull stopes, 4 per cent. from fillings, and 4 per cent. from development. For this period the mill monthly average was 9800 tons.

COST OF PRODUCING GLORY-HOLE ORE
(28,400 Tons).

	Amount.	Per Ton.
Labor (handling and sorting)	$7,958	$0.280
Labor (haulage to mill)	1,137	0 040
Powder, fuse and caps	258	0.009
Candles	191	0 007
Hardware and tools	13	0 000
Total	$9,556	$0.336

CONTINGENT EXPENSES OF MINE
(48,900 Tons).

	Amount.	Per Ton.
Foreman and shiftbosses	$4,499	$0 092
Tool dressing and nipping	5,281	0 108
Track and pipe work	1,027	0.021
Hoisting (men, timbers and tools)	1,858	0 038
Compressed air	4,401	0 090
Assays	2,103	0 043
Surveying	334	0.015
Total	$19,903	$0.407



SKETCH OF ORE ZONE

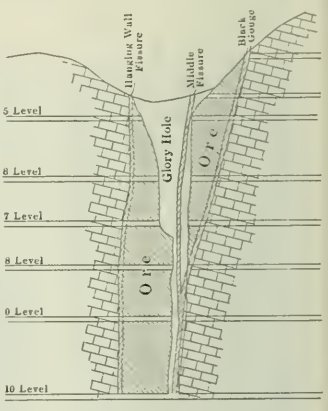
COST OF PRODUCING STOPE ORE
(20,500 Tons).

		Amount.	Per Ton.
Ore Breaking:			
Labor		$12,435	$0 606
Powder, fuse and caps		3,144	0.153
Candles		332	0.016
Hardware and tools		130	0 007
Total		$16,041	$0.782
Timbering:			
Labor		$3,840	$0 188
Lumber (plank)	$4,649 94		
Round timber.....30c	532.20		
Pole lagging.20c	52.40		
		$5,235	$0 255
Operating sawmill		305	0 015
Hardware and tools		230	0 011
Total		$9,610	$0.469
Hauling and Mucking:			
Labor (including haulage to mill)		$12,217	$0 596
Operating electric haulage system		876	0 043
Candles		335	0 016
Hardware and tools		58	0 003
Total		$13,485	$0 658
Grand total		39,136	$1 909

COMPARISON OF COSTS PER TON.

	Stopes.	Glory Hole.	Run of Mine.
Cost of producing	$1 909	$0 336	$0 996
Contingent expenses	0 407	0.407	0 407
Total mine cost	$2 316	$0 743	$1 403

From these tables it appears that there is a margin of $1.57 per ton in favor of the glory-hole product, a large difference in itself. The system allows a profit on exceedingly low-grade material. It is evident that even should the value of the glory-hole ore fall so low that there would actually be no profit, so long as there is no loss, it would pay to continue operations by this method, since the cost of producing the run-of-mine ore is so greatly reduced that it is possible to make the maximum profit from the better-grade ores such as the mine affords.



SECTION B—B

C. D. Leslie, general manager for the Simmer & Jack Proprietary Mines, in the company report for the year ending June 30, 1908, states that, while the cost of recruiting and repatriating the Chinese laborers has been great, the remarkably high standard of efficiency attained by them proved a valuable object lesson to the native "boys," and he attributes the increased efficiency of the Kafir "boys" in a great measure to the example of the Chinese. While the Simmer & Jack company employs more Chinese than any other mining company on the Rand, still by reorganizing the work to the best advantage the number of Chinese employed was gradually reduced during the year without any diminution in profits.

It is not always an advantage to connect several mines, for often the ventilation becomes poorer than before, since the farther the air travels through mine workings the more it becomes vitiated.

Mining in Spain

A recent consular report gives figures for the mineral production of Spain during recent years. With the exception of coal the statistics are those of export.

In metric tons the exports of iron ore and pyrites in 1907 were: 9,966,135; in 1906, 10,349,619; in 1905, 9,349,869. Nearly half this tonnage was exported from Bilbao, Santander and Cartagena handling nearly a million tons each. Spanish iron ores are of unusually high grade, those from the Calasparra mines, in Murcia province, averaging a little above 60 per cent. metal with low sulphur and phosphorus. The Bilbao district is declining, and in 30 years will probably be worked out. From the mines of Asturias, which last year produced about 60,000 tons, an increased output is expected; and when the port of Musel is completed, five years hence, it should be possible to ship upward of 200,000 tons. There are other large deposits in Burgos province and in the Sierra Menera, but their situation for foreign transport is bad.

Of coal Spain in 1906 produced 3,095,043 tons; almost the same amount in 1905. In this field the English industry predominates, the imports last year being 2,544,466 tons.

Spain does a considerable business in tin plate in connection with the Gallician sardine-canning industry. About 20,000 tons is the annual consumption. The imports from England last year were 4475 tons, the rest came from the Hornos, Basconia and Lugones copper works. The product is said to be inferior to the Welsh plate. A duty of 140 *pesetas* per ton protects the industry. In 1907, 254 tons were exported, as against 94 in 1906, and 79 in 1905.

The north of Spain being productive of rich iron ores and fuel, the iron and steel business has grown important. In 1906 379,241 tons of pig were produced from 790,177 tons of ore, and about 200,000 tons of steel was made. The Sociedad de Altos Hornos de Vizcaya and the Sociedad Metallurgica Duro-Felguera are the chief works.

With 185,000 tons, Spain reached the second place among the world's producers of lead last year. Lead is mined in the southern provinces of Jaen, Murcia and Almeria, the chief center being Linares. But much business is done around Cartagena, where the Linares, Mazarron and Gurrucha ores are smelted. Lead exports for 1907 were 170,131 tons.

The Almaden mines increased their output of quicksilver in 1907 to about normal, i.e., 1500 tons, the average grade of cinnabar treated being 9.6 per cent. A recent commission reported that there were 400,000 tons of mineral above the twelfth level, and twice that amount below, and considered that the Almaden was well able to control the market.

The export statistics for 1907 of other mineral products were, in tons, as follows: Calamine, 33,882; antimony, 362; copper, 1,239,874; manganese, 67,997; zinc 1391; blende, 120,184.

The 1907 figures for copper show an advance over those of 1905 of about 25 per cent.

Petroleum was worked in Cadiz province during the year, and some prospecting was done elsewhere.

The production of sulphur for 18 months ending December, 1907, was 6000 tons, a reduced output due to the flooding of the mines.

In Alicante the Torrevieja salt mines produced nearly 140,000 tons; the salt pans of Cadiz about 250,000.

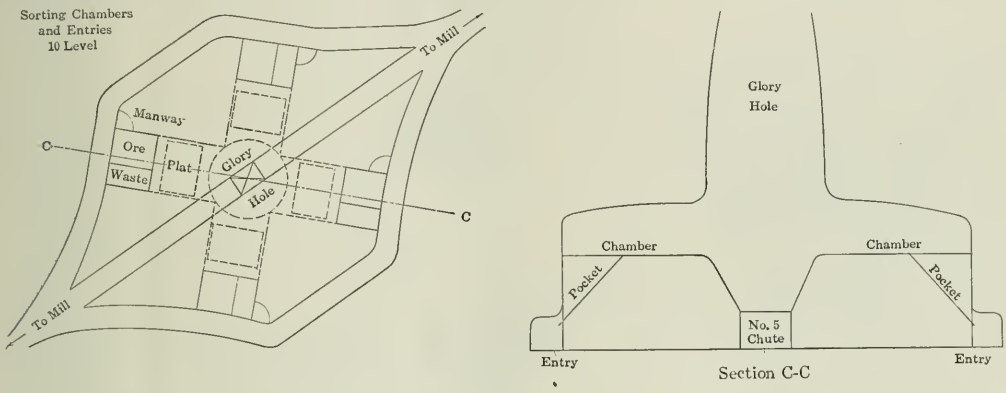
An increasing emigration due to low rates of wages has led the government to pass a restrictive emigration law, which, it is hoped, will stop the drain.

There is a 3 per cent. tax on the gross output of all mines, and the authorities have experienced considerable difficulty in collecting it. They are making experiments for the payment by mine-owners of lump sums. Foreign mining companies in Spain are likely to be seriously affected by the proposed measures restricting mining work to native engineers.

Moderate-Pressure Air Compressors

Special Correspondence

Owing to the great demand for moderate-pressure air compressors for industrial air blast and exhauster service the General Electric Company has designed a centrifugal type of fan and is now prepared to furnish a line of standard centrifugal air compressors with pressures rated from 0.98 to 4 lb. per sq.in. and in capacities from 750 to 10,000 cu.ft. of free air per minute.



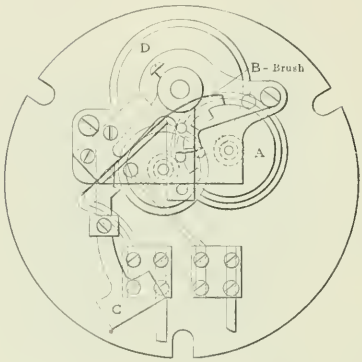
ARRANGEMENT FOR HANDLING AND SORTING MATERIAL ON NO. 10 LEVEL

In appearance and in operation this type is similar to the well known centrifugal pump for it consists of a rotating impeller surrounded by a suitable casing with an intake opening at the center and a discharge opening at the circumference. For driving these blowers hydraulic turbines or directly connected motors using either alternating or continuous current are used. The pressure in the mains leading from the compressor is entirely free from pulsation and practically constant for all volumes within the rated capacity of the compressor. Contrary to the results obtainable with positive pressure blowers, the power required to drive these so-called centrifugal compressors is said to vary approximately with the volume of air delivered when operating at a constant speed. This fact gives a greater flexibility and improved economy to the centrifugal type where variable loads are required, satisfactory efficiency being obtained between the limits of 25 and 125 per cent. of the rated load.

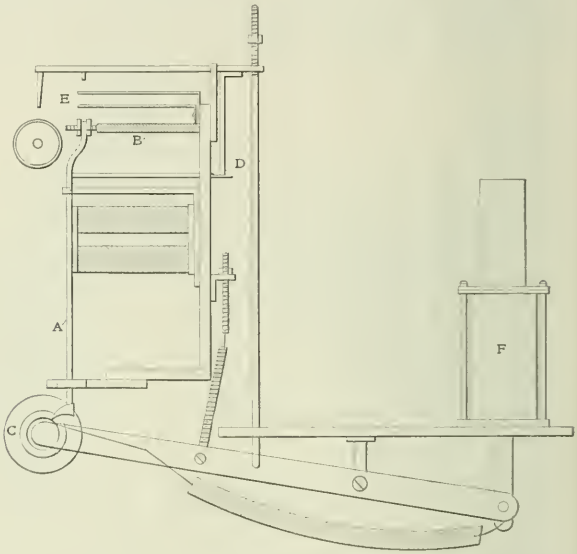
Electric Recording Apparatus for Mine Watchmen

By Carl L. C. Fichtel*

An electric system for recording the movements of watchmen is installed and in operation at one of the deep shafts of the Calumet & Hecla mine. The apparatus is operated by means of electromagnet, current being obtained from storage batteries at 30 volts and a flow of 75 m.-amp. In the shaft there are at present 49 stations, representing the beat of seven watchmen and necessitating the running of seven complete circuits. All wires leading down the shaft are encased in a 1½-in. pipe. At each level, or station a junction box is placed, with a ½-in. pipe tap leading off to the station box and in which the electrical connections are made in series. The station boxes are of cast iron, and contain a clock-like mechanism mounted on a porcelain base and actuated by means of a spiral spring. These boxes are constructed so as to be as nearly moisture proof as possible, but the extreme variations of temperature caused considerable moisture to collect within the boxes and caused the steel parts to rust. This one disadvantage was overcome by filling the chamber with oil.



STATION BOX MECHANISM



CLOCK CIRCUIT

Surface Equipment.

Besides the recording apparatus with its switchboard, the surface equipment includes two sets of portable storage batteries and a motor-generator set for charging, together with the necessary switchboard. The storage batteries are composed of 15 cells each, each cell containing nine 6x8-in. plates inclosed in a glass jar. The motor-generator set consists of a three-phase, 440-volt induction motor, direct connected to a 3-kw., 30-volt direct current generator.

The switchboard panel for controlling the charging current has a voltmeter and an ammeter so connected that a reading on either set of storage batteries or the generator may be taken, and the voltmeter can also be used to get a ground reading on any of the underground circuits. This switchboard also contains controlling switches, a rheostat and two I. T. E. circuit breakers.

The time element of the recording apparatus consists of a clock operated by means of heavy weights. Geared to this clock and in such a ratio as to make one complete revolution in eight hours, is a brass roller, 30 in. long and 20 in. in circumference; on this roller is fastened the log, or sheet, upon which the numbers corresponding to the underground stations are stamped. This log is a record for 24 hours, from 6 p.m. to 6 p.m. and is divided into spaces, each representing 10 minutes. It takes records of the movements of 30 watchmen.

The electrical arrangement consists of two independent circuits; the one leading from the apparatus to the underground boxes is a closed circuit and the one contained within the apparatus an open circuit.

Method of Operation.

By referring to the accompanying sketch of the station box mechanism it will be seen that the circuit is opened and closed through the wheel *A*, this wheel or any part of the mechanism being one side and the brush *B* which is insulated from it, the other. By turning the key one turn the spring is tightened, which then gradually works back, causing the wheel *A* to make one complete revolution and breaking the circuit the same number of times as there are notches in this wheel. The time of making this revolution is controlled by the pendulum *C*.

After the watchman has turned his key one complete revolution, the movements of the mechanism within the box are beyond his control; the winding device consists of a rachet and arm placed on the under side of the box cover. The spring does not begin to actuate the movements until the shaft upon which it is fastened is turned to a point where it catches, by means of a dog, the drive gear *D*, but simultaneously the arm is released from the ratchet, and any further turning of the key cannot hinder the action of the spring until the normal position has been resumed and the number of the station recorded.

The opening and closing of the circuit causes the arm *A*, which is held against the tension of the spring *B* by the pull of the magnets to operate back and forth and consequently to move the type wheel forward a number of spaces corresponding to the number of breaks. The instant this circuit is opened and the magnets release the catch *D* it drops, allowing the projecting point of the arm to fall on the ribbed roller. This roller is connected by means of a sprocket and chain to the clock and allows the arm to work slowly down, and its weight to bring the two points of the local, or clock circuit to-

*Calumet, Mich.

gether; it takes about 30 sec. to accomplish this, which gives the underground box ample time to have returned to normal position and to close the circuit.

The closing of the local circuit energizes the solenoid *F*, which causes the type wheel to be brought down with great force upon the log, thereby stamping, with the aid of an inked ribbon, the number of the station. This same movement in conjunction with the adjustable rod closes the local circuit and again brings it under the control of the underground circuit. The lever is returned to its normal position by the action of the spring and the dashpot placed above the solenoid, the plunger of which is an extension of the solenoid plunger. This is done slowly allowing time for the type wheel to be returned to its starting position by the pull of the spring placed beneath the lever.

The switchboard is composed of three panels of white marble. Mounted upon it are lightning arresters, current indicators, ammeter plugs and push-button connections for ground readings on either side of the line. There are also the double set of knife switches for controlling the two circuits.

The records made by this recording apparatus show at a glance the time at a station and also the time intervening between stations.

The Opasatika Lake District, Province of Quebec

By Fritz Cirkel*

A number of discoveries have been made on the stretch of lakes extending from the lower arm of Wendigo lake, 35 miles north of Cobalt northeast toward Opasatika lake, on the Quebec side of the line; and although their proper exploitation seems to be handicapped at present by the difficult access, they are important for the fact that they demonstrate the extension of the mineralized belt into the province of Quebec.

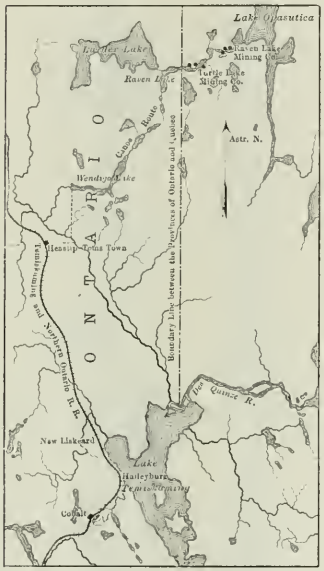
The route of travel begins at Heaslip Station, about 30 miles north of Cobalt; a stage drive over a good government road leads through Toms-Town to Wilsons Landing on the western shore of Wendigo lake, a distance of 9½ miles. Here the canoe route commences, and the trip leading through a whole stretch of lakes, ponds and rapids in high water, is somewhat hazardous. The distance from Wilsons Landing to Opasatika lake by this canoe route is about 30 miles; in low water 15 portages have to be made of which the longest is about half a mile. Under ordinary lake-level conditions these 15 portages may perhaps be reduced to about eight or nine.

Physically the country traversed is one of the roughest; low hills change with mountainous ranges, rising abruptly in cliffs over the water's edge. No agricultural land could be seen along the whole canoe route; the country is of uneven, rocky nature, and is covered almost wholly with original forests, or with a second growth of timber. Toward lake Opasatika, on Birch lake and Green lake, high, straight cliffs partly form the lake shores, and the various colors of moss covering these rocks, impart to the whole a beauty of its own.

A year and a half ago Wendigo and Raven lakes were the scene of extensive travel to Larder lake, which was reached by trail from the upper arm of Raven lake.

The Rocks

The rocks along the route belong to different geologic horizons; no special study has as yet been made of them. Along Wendigo lake the rocks seem to consist mostly of a gray-greenish conglomerate, approximately the same conglomerate as that found around Cobalt. The conglomerate is cut by dioritic and basaltic rocks, and some discoveries of cobalt have already been made in this series.



OPASATIKA LAKE DISTRICT, QUEBEC

Several years ago almost the whole shore of Wendigo lake was staked, but subsequent prospecting work showed, save for a few discoveries, that that part of the country is not bountiful in minerals. Arsenical pyrites is frequently found in the conglomerate and in one place, where more work has been done, the ore occurs in small veinlets or pockets irregularly distributed through the rock and not confined to what may be called a vein or ore lode. Whether this arsenical pyrite carries any gold I am not able to say, but the work which consisted of a shallow cut into the hillside was subsequently abandoned. Several discoveries of cobalt bloom were made, some of them carrying silver, but exact and reliable data could not be obtained.

The most important discoveries have undoubtedly been made on the shores of Turtle lake, Moose lake and Mud lake, west of lake Opasatika. Access to these locations is difficult.

Around Turtle lake the rocks consist of a greenish slate, for the most part, with distinct bedding planes; the strike varies from northeast to strictly east-west, while the dip varies from the horizontal to almost vertical. These rocks are fine-grained, and represent probably the alteration product of gabbro and dolerite. They vary in color from pale gray-green through yellowish green to dark green; they are generally rather soft rocks, yielding to the scratch of the knife.

Mineralized Vein

Fissures are numerous and are for the greatest part filled with a milkwhite quartz, carrying minute particles of iron pyrites or chalcopyrite. These quartz veins either occur as a series of parallel stringers from ½ in. up to 12 in. in thickness, or they occur as regular lodes of solid quartz, measuring all the way from 1 ft. to 70 ft. in thickness. Their general or approximate strike is east-west; their dip almost vertical. Almost all of the quartz lodes observed are metalliferous. The most frequent constituent is copper pyrites and in a less degree iron pyrite, the latter imparting to the quartz a rusty color wherever it occurs.

Altogether seven vein locations have been made, but several of the latter, according to survey, have been made in the same ore lode, and the number of metalliferous quartz veins may be reduced to four. The most important of these veins is one located on the north shore of Turtle lake. This vein strikes northeast 80 deg.; it dips almost vertically and consists of a rusty quartz carrying rich disseminations of copper pyrites, with green and blue carbonates intersprinkled; the lode is at some places 2 ft., in others 3, 5, or 10 ft., and in others it is split up into several separate quartz lodes, without, however, losing its ore.

The assay value ranges between 4.5 and 6.5 per cent. copper; in some places assays as high as 10 per cent. were obtained. Most of the accompanying country rock is impregnated with the mineral, and there is reason to believe that in actual mining operations, instead of a strictly silicious ore a semi-silicious copper ore may be produced. This ore lode has not been followed far inland, but judging from the strong character of the vein there is some ground for the assumption that its horizontal expansion is large.

*Mining engineer, Montreal, Canada.

All these locations were made close to the shore; no attempt has yet been made to follow farther inland; in fact not one discovery has been made farther than about 1000 ft. from shore.

Toward Lake Opasatika

Proceeding from the Turtle lake region along the chain of lakes toward Lake Opasatika the formation changes entirely. Instead of the greenish varieties of rock we meet fine-grained grayish quartzites, graywacke, granitoid and purely feldspathic rocks. Reddish granites are frequent and form for the most part the steep shores of several of the smaller lakes. In the vicinity of Moose lake and Mud lake quartz lodes of considerable extent have been explored; they range in width from 10 to 70 ft., the strike being mostly east-west, or nearly so. They are not auriferous, but they carry fine disseminations of copper pyrites; the quartz lodes are divided by planes parallel to the walls into several parts, each of which carries a certain percentage of the ore. One part, say, of 3 ft. may contain an average of 3 per cent. of copper, while the next division may not carry more than 1½ per cent. Exploration on these large quartz veins has not been carried far enough to allow of an average assay being taken, but from present indications it appears that a good part of some of these large veins may carry copper ore above the working limit.

The country, however, is not conveniently accessible for actual operations, and here, too, the lack of transportation facilities will prevent mining for some time to come.

All the discoveries along the stretch of lakes toward Lake Opasatika go to show that this country is not so devoid of mineral deposits as originally supposed, and it is likely that in the course of time additional discoveries may be made, which may induce the Quebec government to do something in the way of furnishing proper transportation facilities.

A Novel Stadia Rod

By J. H. Granbery*

In preliminary surveys and often in more accurate work, the use of stadia measurements is rapidly increasing. This is primarily due to the convenience of such methods, as well as to the saving of time resulting; such measurements compare favorably for accuracy with ordinary chaining, and bring the responsibility for the work directly to the instrumentman who is generally more accurate and careful than the subordinate chainmen. Stadia work has, however, been limited to sights of 1000 ft. or less. Beyond this distance most of the characters upon the ordinary stadia rod are so indistinct that the rod cannot be read; at even less distances the red characters appear black, and the figures used to denote the unit divisions are confusing and often illegible.

In surveying marshy islands on the Georgia coast, the interior of which was often inaccessible, a system of primary triangulation was used for the establishment of points from which measurements might be taken and referred to the base lines used in the triangulation system.

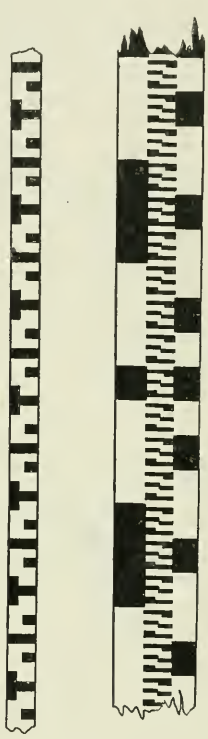


FIG. 1 FIG. 2

The base lines were chained with great accuracy in every instance, but the character of the shore was prohibitive of meandering, or of instrumental determination using only one instrument, unless stadia measurements were resorted to. The ordinary stadia rod was tried, but, except in a limited number of instances, the length of sight required was too great for its use. Accordingly, I designed for the work a stadia rod which has several novel features.

A Rod Without Figures

The method of division is the striking feature of the rod. It was developed after trial of various forms and has proved of accurate service in the measurement, by a single sight, of distances as great as 3800 to 4400 ft. The rod has *no figures*; the divisions being indicated by characters of varying form, but each foot of division bears the same characters, in the same relative position, as every other foot. In practice it is found easier to count the divisions than to decipher a printed figure; indeed, counting divisions is itself dispensed with after a short use of the rod, as the *location* of signs, rather than the counted divisions guides the instrumentman, in much the same manner that time is usually read by the position of the hands on the clock face rather than by reference to the numerals. Consequently, readings may be made with great rapidity.

Divisions

The rod is divided as shown in Fig. 1, the T-shaped characters being used for the major divisions; the stem of the T is 0.1 ft. in vertical width, and the arms extend 0.1 ft. beyond the stem. Each of the minor divisions is also 0.1 ft. in vertical width, and reference to the figure will show that by the grouping adopted every tenth of a foot is marked by the edge of a solid black figure so that the rod is easily read at a considerable distance.

Subdivisions into 0.01 ft. are made by the small forms or characters shown in Fig. 2; each of these is so formed that the division is at the edge of a solid black figure, in the same manner as provided for the tenths divisions. By making the divisions as shown it is seen that reading to half tenths, or to fiftieths, is facilitated; hundredths are also equally prominent and read with the same degree of ease. The fact that every hundredth is represented by a different combination of length, or position, of the edge of the character makes the reading as plain, after practice, as if the numeral itself were seen. By placing the characters representing feet and tenths at opposite edges of the face of the rod for alternate feet the reading may also be facilitated, as all the even feet divisions are then at one side and all the odd feet divisions are at the other side. This has been found unnecessary in practice, however, as the characters are so clear and distinct that mistakes of observation are rarely due to reading.

In making the sights referred to, a rod 23 ft. long was used; it was made of two long strips of light, dry wood, secured to each other in the form of a T so as to prevent warping and twisting. The rod was handled by one man, and the readings were made first between the lower stadia wire and the horizontal cross-hair, and then (without removing the eye from the telescope of the transit) between the cross-hair and the upper stadia wire. The mean of the two readings was used—with an instrument in perfect adjustment a single reading, however, would suffice.

*Consulting civil engineer, 20 Broad street, New York City.

Sand Boils

By J. J. Fred Brand*

There seems to be but little published information on the subject of sand boils. An explanation of their causes, and a method of preventing them, which works well in practice, came only after much thought and many experiments.

The furnace at which the experiments were conducted is of the air, or reverberatory type, having a capacity of 10 tons. The blast is supplied by a fan blower through a 9-in. pipe which leads to the ash pit. A 70-ft. stack, 48 in. in diameter carries off the products of combustion.

The hearth, which measures 12x6.5 ft., is separated from the firebox by a 16-in. bridgewall, built 22 in. higher than the grate bars; the opposite end of the hearth gradually slopes into the neck leading to the stack. The silica bottom is put in when the furnace is cold and is heated before charging the metal. The life of the bottom is 6 to 15 heats, before it is necessary to renew it. The first charge on new bottoms usually gave trouble. Charges of a certain analysis, melted on an old bottom, would be ready to tap at the scheduled time, while another charge of the same mixture melted on a new bottom, would remain in the furnace anywhere from one to four or more hours longer.

The following record of two such heats taken from my memoranda will serve as an illustration: The first is the record of heat No. 203, weight 5850 lb., and was the last charge melted on an old bottom. The second is the record of heat No. 204, weight 5875 lb., the first charge melted on a new bottom.

No. 1: 585 lb. of pig containing 1.58 per cent. Si; 585 lb., 1.31 per cent. Si; 585 lb., 2.21 per cent. Si; 1170 lb., 1.51 per cent. Si; and 2925 lb. scrap containing, approximately, 0.60 per cent. Si. The scrap and pig charged at 9:32 o'clock, melted in 1 hr. and 43. min., and was tapped 59 min. later. The first test was only slightly turned; this heat was tapped when the test gave a clear fracture. Metal ran well.

No. 2: 585 lb. of pig containing 1.58 per cent. Si; 585 lb., 1.31 per cent. Si; 585 lb., 2.21 per cent. Si; 1170 lb., 1.51 per cent. Si, and 2950 lb. scrap containing, approximately, 0.60 per cent. Si. The scrap and pig charged at 11:30 o'clock melted in 1 hour and 23 minutes, and was tapped 3 hours and 52 minutes later. The first test was dark speckled; 23 more tests were taken, none showing any improvement over the second test, which was somewhat lighter than the first. This heat was tapped when the test gave a clear fracture. Metal ran well.

*Findlay, Ohio.

Control of Furnace

All the constituents of the pig iron (carbon excepted) were specified, but in the absence of a laboratory it was necessary to judge the progress of the metal during the oxidation period, and the condition of the scrap, by test plugs which measured 1x1x6 in., which were cast in sand. Those taken by the melter on the platform were allowed to remain in the sand for two minutes before drawing, when they were slowly cooled by quenching in water. The first test was taken immediately after the metal was melted; the remaining tests were taken at intervals of 10 to 20 minutes. Those taken at the spout at certain intervals during the pour were allowed to cool in the sand. Thus we were able to judge within close limits the percentage of silicon in the scrap.

According to the memoranda there was but little difference in the appearance of the scrap which was charged into the above heats, but the melter's first tests show that melt No. 204 contained a little less silicon than melt No. 203 at the time charges were melted.

Those first heats were dreaded, except when some new remedy was to be tried; we were many times led to believe that a remedy had been found, only to find out sooner or later that another cause contributed to the success of that particular heat.

The general opinion was that the bottom, not being thoroughly fused, would peel off and rise to the surface of the metal, thus causing the slag to become acid from which silicon would be reduced and absorbed by the metal. In accordance with the above opinion special efforts were made to fuse the bottom thoroughly before charging.

The best grade of quartz sand was considered too refractory to be used alone; therefore, various proportions ranging from a few shovelfuls to half of the batch of a poorer grade of silica were added; at other times various proportions of fireclay or firebrick dust were added or sprinkled over the top. Crushed slag was always thrown in just before the metal was charged, that is, after the bottom had been burned well, which was (unless the fireman happened to be irregular) heated intensely.

Many trials, covering a period of two years or more, were made to solve the problem along this line, and all failed. In view of the past failures and the following evidence, the writer had reasons to believe that the above conclusion regarding the reduction of the silica in the slag was wrong.

The slag from a first melt differed from the slags of the succeeding melts in that it was yellow and more basic than the black slags of the succeeding melts, as the following analysis will show:

No. 1 is a yellow slag from a first melt on a new bottom, while No. 2 is a black slag of the succeeding melts.

	No. 1, Per Cent.	No. 2, Per Cent.
SiO_2	37.05	51.52
Al_2O_3	16.30	18.10
FeO	3.60	22.90
MnO	1.65	1.85
CaO	32.11	3.81
Fl.	8.33	trace

It is highly improbable that silicon would be reduced from No. 1 slag, when no irregularities were experienced from No. 2 slag. It is also reasonable to suppose that if the silicon came from the slag, a test taken from the metal nearest the slag should give a fracture as dark as one taken after rabbling. No doubt existed in my mind at any time that the reduced silicon did not come from an acid slag, but that it came from the sides and bottom of the hearth.

There was every reason to believe that such was the case. Take, for example, the analogous killing or dead-melting stage in crucible steel manufacture, during which silicon is reduced from the walls of the crucible; provided, that the proper percentage of silica is present in the walls of the crucible, and sufficient carbon in the iron, with the required high temperature. It is self-evident that this latter condition is present in both iron and crucible, as externally applied heat must pass through the crucible walls before the whole is raised to a casting temperature.

In malleable practice both the carbon and silica are necessarily present in such amounts as would favor the reduction, but unless the silica hearth is of a proper temperature it cannot take place. In the attempt to keep the hearth from peeling off by the excessive heating, the conditions were made ideal for the reduction of silica from it.

Finally an opportunity was taken to put the theory to test and a succeeding bottom of the best grade of silica was put in, and heated only to redness; a barrow of crushed slag was then scattered over it and allowed to melt. A mixture of the same iron which gave good results on the previous old bottom was charged, but was melted, hot, and ready to tap in 18 minutes less time than had been required for the preceding charge.

The result of this single experiment, however, was not accepted as conclusive evidence that the theory was correct; we made further trials which were satisfactory, and we have every reason to believe that the cause of the phenomena has been discovered, as no more trouble is being experienced from "sand boils."

Shipments of tin from the Straits Settlements to the United States and Europe in January were 5733 long tons; an increase of 500 tons over January, 1908.

The Heroult Electric Furnace in the United States *

The United States Steel Corporation has decided to introduce the Heroult electric furnace and steel process, its engineers having made a close study of the general subject, extending over two years, and having made a number of visits to the localities abroad where electric furnaces and methods are in operation. At the same time its patent attorneys and experts made a thorough examination of the patents and of the state of the art.

The outcome of these investigations is that it has been decided to put up one 15-ton Heroult furnace at the South Chicago works of the Illinois Steel Company and one 15-ton furnace at the Washburn & Moen plant of the American Steel and Wire Company at Worcester, Mass. Probably a furnace at Homestead will follow. At the South Chicago plant, where three-phase current is available, both locally and from Gary, the purpose is to take the blown metal from the bessemer converter and refine it in the Heroult furnace for the manufacture of a specially high grade of steel rail, the capacity of the electric furnace being about 500 tons per day of 24 hours. As to the ability of the Heroult process to eliminate phosphorus and sulphur and to deoxidize the bath, overwhelming evidence has been accumulated abroad.

At Worcester the Heroult furnace will be served by two 50-ton open-hearth furnaces, and will be devoted particularly to the refining of the metal for use for the high-grade steels which the plant requires for the many lines of special wire products.

The United States Steel Corporation will, therefore, be the pioneer in introducing electric refining both in the manufacture of tonnage products like rails and special steels for the wire industry. The quality of rails has been a burning subject in recent years, and the plan of producing what will be equivalent to tool steel quality is one which raises high hopes for the future. In fact, the question suggests itself whether the verdict in favor of open-hearth steel which has been so freely given of late may not be reversed and whether the bessemer converter backed by the Heroult electric refining furnace may not yet come to its own within the enlarged field which the ability to utilize impurer ores will offer. It is even within the range of probability that for this service the 15-ton electric furnace does not represent the maximum unit, and that furnaces of larger capacity may be found practicable.

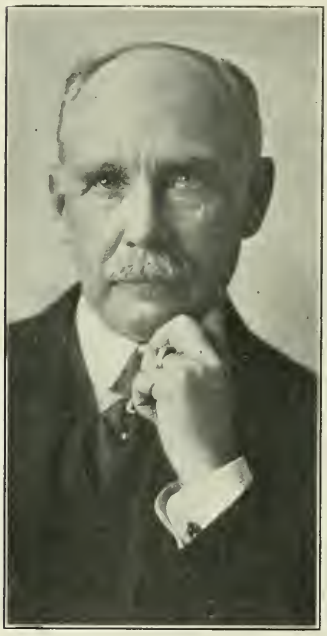
Hardly less interest attaches to the refining of open-hearth steel as at Worcester. Starting with a purer product from the steel furnace—whether it be acid with selected raw materials or basic open hearth steel from materials of moderate purity—the electric refining process will yield a final metal very low in impurities, and thoroughly deoxidized, which will greatly raise the standard of quality.

Plans for the two plants are now being drawn, and construction will be pushed vigorously so that both installations will be in operation before the early summer.

*From the *Iron Age*, New York, Feb. 18.

D. W. Brunton

Mr. Brunton, who has just been elected president of the American Institute of Mining Engineers, was born at Ayr, Canada, in 1849. He studied engineering at



D. W. Brunton

Toronto, practiced three years in the East, then took a post-graduate course at the University of Michigan, and went to Colorado as mining engineer for the Dakota & San Juan Mining Company in the spring of 1875. He next took a position as engineer for the Hunt, Douglas & Stewart mill at Georgetown, Colo., where he remained until the summer of 1876, when he became engineer for the Clear Creek Reduction Works. In 1876 he went to Silver Peak, first as mining engineer and later as manager, for the Silver Peak Mining Company, and in 1880 went to Leadville, and in partnership with F. M. Taylor, built the Taylor & Brunton mill in California Gulch. The business management of the plant was placed in the hands of Mr. Taylor, leaving Mr. Brunton free to devote himself entirely to professional work, in the course of which he became consulting engineer for the Dunkin, Robert E. Lee, Wolftone and Dinero mining companies, and for a time was manager of the Colonel Sellers mine. In 1889 he became consulting engineer for the sideline mining interests in Aspen, and had engineering charge of the long and bitter litigation in that district. On the termination of the lawsuits Mr. Brunton became manager of the mines at Aspen where he remained until the spring of 1893, when he removed to Denver and opened an office as consulting engineer.

One of the most important undertakings carried on by Mr. Brunton during his management at Aspen was the Cowenhoven tunnel, a 2¼-mile double-track bore, driven under Smuggler mountain for the purpose of affording drainage, transportation and ventilation to the principal mines of the district. This work, which was attended by many difficulties, attracted the attention of tunnel engineers in all parts of the United States. A paper on the methods employed in driving this tunnel, read before the Institution of Civil Engineers, brought him a Telford medal, and the miners, to show their appreciation of the care and forethought which made it possible to carry on the work from start to finish without a single accident, presented him with an elaborately engraved gold medal.

Mr. Brunton was one of the first to perceive the defects of the old-fashioned system of determining the value of ore by hand sampling, and after an investigation of the subject, invented what is known as the Brunton mechanical sampler, which was first installed in the Mathews & Webb plant at Denver. To realize greater returns from the invention than was possible by selling it under royalty, Taylor & Brunton built a public sampling works, utilizing this system throughout, in Aspen in the summer of 1889, and later extended this business until they now have a chain of samplers in Colorado, Utah and Nevada, which is perhaps the largest business of this kind in the world.

In the course of his professional career Mr. Brunton's mining trips have taken him into most of the principal mining districts of the world. He has made examinations from Alaska to Argentina, in addition to which he has traveled through Europe, Asia, Africa, Australia and New Zealand. Among his clients have been the Mines Limited of London, the Anaconda Copper Mining Company, Amalgamated Copper Company, New Jersey Zinc Company, Rio Tinto Mining Company, of Spain, and the Drainage Association of Cripple Creek.

The Robinson mine in the Transvaal reports for 1908 a total profit of 5,500,000 from its mill of 220 stamps.

Power from Copper Blast-Furnace Gases

Furnaces at Mansfeld, Germany, Carry Nearly 20 Per Cent. Coke and Yield Gas for Power Equivalent to 7.4 H.P. per Ton of Ore Treated

BY ROBERT SCHORR*

The famous Mansfeld district near Eisleben, Germany, and the metallurgical processes employed there are too well known to require description here. Some time ago the 700th year jubilee of the copper smelting works was celebrated, the occasion being honored by the presence of the German Emperor. The present company, which amalgamated the many independent interests, was organized in 1852. Since that time great progress has been made. The yearly report for 1907 states that 524,524 tons of *Kupferschiefer* (bituminous copper schist) and 151,890 tons of *Dachberge* (nonbituminous limestone, containing small amounts of copper) were mined, or a total of 676,414 metric tons. The copper schist contains from 1.8 to 3.7 per cent. copper in the form of bornite, chalcopyrite and chalcocite, and there are also small quantities of silver. The balance consists of about 40 per cent. silica, 10.7 per cent. alumina, 5 per cent. ferric oxide, 19.5 per cent. calcium carbonate, 2 per cent. sodium carbonate and 10.3 per cent. water and bitumen. In the stated tonnage of *Dachberge* some nickel ores and sand are included. The average yield per ton of ore charge amounted, in 1907, to 2.847 per cent. copper and 0.0155 per cent. silver. More than 135,000 tons of coke, or almost 20 per cent. of the ore burden, were consumed in the matte-smelting operations.

In view of the low grade of the ore and the high cost per ton for mining and treatment (about $9), great efforts have been made to utilize all waste products. The income from such sources amounted to almost 3,000,000 marks, two-thirds of this amount having been obtained from the sale of more than 18,000,000 slag bricks. The fumes from the matte-roasting kilns yielded about 24,000 tons of sulphuric acid, ranging from 55 to 66 deg. B., and 27 tons of ferrous sulphate. Only 2867 tons of flue dust were made, or recovered, equal to 0.5 per cent. of the total ore charge treated. From this source more than 200 tons copper, 383 tons lead, carrying 0.2 to 0.3 per cent. silver and 11.7 tons of nickelspeiss were obtained. It will be noted than the flue dust yielded more than 13 per cent. lead. The dust is mixed with ground shale and pressed into bricks which are calcined with schist before being smelted. There is a small blast furnace with four tuyeres at the Eckardt plant which is run periodically for this work.

The gas-engine plant of the Krughütte furnished in 1906 almost 7,000,000 kw. hours, and somewhat less in 1907. There are also a number of boilers fired with furnace gases, most important being the new installation of three 300-h.p. water-tube boilers at the Kupferkammerhütte.

Operations of the Mansfeld Works

Tables I and II summarize the smelting operations for matte (coarse metal) at the various Mansfeld works, and they give some segregated data pertaining to average daily charges and coke consumption. Round blast furnaces with deep crucibles are used throughout. They vary in size from 5 ft. 3 in. to 6 ft. 2 in. at the tuyeres, and* are equipped with bell-and-hopper feed arrangements. The feed floor is from 24 to 30 ft. above the floor level, and the connections with the gas mains are placed directly below the feed floor. Spacious dust bins are provided. Each furnace has six tuyeres, and the blast pressure ranges from 2.9 to 4.4 in. of mercury, equivalent to a pressure of 22.765 to 34.540 oz. per square inch.

The ore charge consists of 1700 lb. of roasted schist, 600 lb. *Dachberge*, 100 lb. slag and 100 lb. skimmings. Table II shows the amounts of matte produced and the grade. The work of the reverberatory furnaces is outlined in Table III. The production amounted to 19,240 tons of copper, and more than 96 tons of silver. The receipts from sales, inclusive of by-products, reached a total of $12,000,000, and the net profits were about $1,400,000. About 23,000 men are steadily employed.

TABLE I. MATTE SMELTING, MANSFELD WORKS, 1907.

Plant.	Ore Charge. Metric Tons.	Total Coke Used. Tons.	Coke Per Ton Ore. Kg.	Average Number of Furnaces in Use.	Copper Yield Per Ton of Ore-charge. Kg.	Silver Yield Per Ton of Ore-charge. Kg.	Average Ore-charge Per 24 Hours. Tons.	Average Ore-charge Per Hour. Tons.	Average Daily Ore-charge Per Furnace. Tons.
Krug-Hütte	232,510	53,245	229	4	26.92	0.153	636	26½	159
Koch-Hütte	193,700	39,708	205	4	29.51	0.150	531	22.1	135
Eckardt-Hütte	128,700	22,812	189	2 to 3	29.95	0.163	331	13.8	151.1
Cu-Kammer Hütte	130,400	19,299	148	2	28.35	0.161	356	14.8	168.5
Totals	677,310	135,064	199.8		28.47	0.155	1854		

TABLE II. MATTE PRODUCTION, MANSFELD WORKS, 1907.

	Tons.	Copper per Ton Kilograms.
Krug-Hütte	16,785	72
Koch-Hütte	11,059	59
Eckardt-Hütte	8,769	73
Kupfer-Kammer-Hütte	9,400	72
Total	46,012	

Gas-engine Power

In former years the waste furnace gases were used for raising steam and for heating the blast. The furnace gases at the first three works named in Table I have a heating value of from 590 to 630 cal. per cu.m., but in the fourth plant they are considerably poorer. The economy of central generating stations at this place is indicated by the fact that there are more than 350 steam engines representing 34,000 h.p. scattered over an area of about 60 square kilometers.

So far only the Krughütte has been equipped with gas engines. These are directly connected with electric generators, which furnish a three-phase current of 50 cycles and 3000 volts. Underground cables are employed for distribution. Table I shows that the Krug furnaces smelted at an average 636 tons of ore daily, or 26½ tons per hour. For every ton of ore approximately 800 cu.m., or 28,250 cu.ft. of gas is evolved, or 21,200 cu.m., 748,680 cu.ft. per hour for the whole charge. These quantities vary to some extent, depending entirely upon how the furnaces are operated.

The gas supply is fairly steady, as it is aimed never to have more than one furnace cut off from the mains; it is necessary to cut off the furnace while feeding. The average heat value of these gases is 600 cal. per cu.m., or about 68 B.t.u. per cu.ft. This is about two-thirds of the calorific value of an average gas from iron-blast furnaces, which always contains 1¾ to 2 per cent. of hydrogen; copper-furnace gas carries no hydrogen and consists of 9.2 to 10.8 per cent. carbon dioxide, 19 to 24 per cent. carbon monoxide, the remainder being nitrogen. The fluctuation in heat value amounts to about 10 per cent.

Efficiency

In view of the large power expenditure

*Consulting engineer, San Francisco, Cal.

required for cleaning the gas and for the compressing of such lean charges in the engine itself, it will not be safe to figure on less than 2700 cal. or 10,711 B.t.u. per effective horsepower-hour, corresponding to a gas supply of 4½ cu.m. or 159 cu.ft. The heat equivalent of one horsepower being 736 cal. or 2545 B.t.u., we have 2545 $= E.$ 10,711 or the thermal efficiency of the gas engine $E. = 23.76$ per cent. Better performances are on record, established by careful tests made under ordinary conditions and without previous cleaning of valve chests and cylinders. Since 21,200 cu.m. of gas is available per hour, this represents a total of $21{,}200 \div 4.5 = 4700$ h.p. equivalent or continuously 7.4 h.p. equivalent for every ton of ore treated in 24 hours. The power equivalent for every ton of copper made in 24 hours is then $7.4 \times 37 = 273.8$ h.p., since 37 tons of ore are smelted for every ton of copper produced. In all more than 41,000,000 horsepower-hours, or more than 30,000,000 kilowatt-hours could be generated at the Krughütte alone.

The gas as it leaves the four furnaces is entirely unsuitable for direct use in gas engines, because it contains 17 grams of dust per cu.m. and also sulphur, arsenic, potassium, cyanide, etc. It is therefore, first cleaned, the two gas mains feeding from the furnaces to Theisen gas washers. There are three washers housed in one building; two have a capacity of 6500 cu.m. of gas per hour each, and one is built for 15,000 cu.m. This makes a total capacity for the whole installation, of 28,000 cu.m. of gas per hour. The temperature of the entering gases is about 300 deg. C. or 752 deg. F. About 25 gal. of water are required for every 1000 cu.ft. of gas, or about three liters per cu.m. The power consumption for every 1000 cu.m. is at an average 6 h.p. or above 2¾ per cent. of the power represented by the purified gases.

The gas contains, after cleaning, only 0.003 to 0.005 gram solid matter per cu.m. The water from the washers is run into large settling tanks, the deposits in which carry up to 25 per cent. lead. The deposits are filter-pressed and treated for lead and silver with the balance of the flue dust, as obtained from the dust chambers in the furnace building.

In the original installation, the gases, after leaving the washing plant, were passed into a gasholder of 500 cu.m. capacity. More recently a second holder of 4000 cu.m. has been added, and also gas filters placed at the engine house. These filters are similar in construction to an ordinary scrubber, but they are arranged horizontally, and instead of wooden trays, beds of iron turnings are placed vertically at intervals. The gas leaves the filters with a temperature of 21 deg. C., and it is under a pressure varying from 1 to 5 cm. of water column.

The Gas Engines

The first installation of two 125-h.p. four-cycle Kœrting gas engines has been working almost steadily since 1901. The two 1300-h.p. Oechelhauser-Borsig engines operate on a two-cycle, and are single acting. They have been continuously in commission, day and night, for more than 3½ years. The latest addition is an 1800-h.p. two-cycle Kœrting engine built by the Klein Engineering Works of Dombruch. This unit was completed last April, was placed in service June 9, 1909, and has since run satisfactorily. This completes the original plan for the Krughütte gas-engine central station, bringing it up to a rated capacity of 4650 h.p. The new large engine has a stroke of 1300 mm. and is designed for 86 r.p.m.; the 1300-h.p. engines have a stroke of 950 mm. and make 125 r.p.m. All engines are directly connected to three-phase generators of 50 cycles and 3000 volts. The two smaller engines are in a separate building.

Much trouble has been caused by fluctuations in the percentage of carbon monoxide and carbon dioxide. As long as the ratio $CO_2 : CO$ is in the neighborhood of 1:2 the engines work perfectly, the compression averaging 16 atmospheres, or 227.6 lb. per sq.in. This is very high, and only possible with poor gas, without causing premature explosions. The work of compression is correspondingly high, amounting to about 9 per cent. of the cylinder duty. The pressure of explosion is 25 atmospheres, or 355 lb. per square inch.

To assure a uniform quality of gas, or to permit enrichment in the case of a sudden rise in carbon dioxide, the company has installed quite recently two Pintch gas generators with a combined capacity of 3000 cu.m. per hour. Locomotive cinders, which average about 3500 cal. per kg., or 6300 B.t.u. per lb., are employed with coke breeze in the proportion of three to one, the cost of enrichment being only 2 pfennigs per kilowatt-hour. These generators are arranged for hand feeding. The generator gases pass through coolers and scrubbers, as in the usual standard gas plant, to remove tar, ammonia, etc. In view of the small quantity of gas which will be required for the enrichment of the blast-furnace gases, there may have been no necessity to go to this complication and expense. It is also contemplated to use at times coke breeze and brown-coal coke screenings (*Grude*) instead of locomotive cinders.

The gas-engine plant of the Krughütte has been utilized to less than its full capacity, in order to avoid temporary overloads caused by the many and widely distributed secondary movers. In spite of this the financial result has been rather satisfactory. The total expenditure for operating and fixed charges in 1907 amounted to 122,512 marks, equal to about 0.67c. per kilowatt-hour. The results in 1906 were a little better, figuring 0.51.c. per kilowatt-hour, or about $33 per horsepower-year. With the full plant in operation the average yearly load factor will be considerably higher, and a further marked reduction in the power cost will be effected.

I am indebted to Otto Scharenberg, the engineer-in-charge, for much of the information used in the preparation of this article.

TABLE III. REVERBERATORY SMELTING, MANSFELD WORKS, 1907.

Plant.	Matte, Tons. Roasted.	Matte, Tons. Raw.	Flux (Sand-ores), Tons.	Coal, Tons. Total.	Coal, Tons. Per Ton of Ore.	Matte Per Day Per Furnace, Tons.	Copper in Product, Per Cent.	Silver in Product, Per Cent.	Number of Furnaces.	Black Copper Product, Tons.
Eckardt-Hütte	25,437	1,569	647	9,535	0.353	12.89	74.3	4.08	9	25,766
Cu-Kammer-Hütte	20,648	713	411	9,971	0.467	11.04	74.2	4.36	11	
	46,085	2,282	1,058	19,506	0.403	11.97				

Australian Gold Production

The Queensland Mines Department reports the gold production of the State in January at 24,500 oz., or $506,415. Of this, 400 oz. was placer gold, the rest from quartz mines. Mount Morgan reported 5409 oz. of the total.

Victoria gold production in January was 40,848 oz., or $844,328 in value.

The production of Western Australia in January was 132,267 oz. fine gold, or $2,713,959. This output was 17,552 oz. less than in December, and 6893 oz. less than in January of last year.

The gold production of New South Wales in January was 19,885 oz. or $411,023. The mineral production of the State for the year 1908 is valued at £8,609,607. This includes £954,854 for gold; £2,947,824 for lead and silver; £502,812 for copper; £205,447 for tin; £3,353,093 for coal. The coal production was 9,147,025 tons.

Correction

In the article on the "Progress of Gold Mining in North Carolina," by E. W. Lyon, in the Journal of Feb. 6, 1909, the beginning of the third paragraph of the third column on page 206 should read: "The discharge ends of machines are set 8 in. and 4 in. higher, respectively, than the feed end."

Economics of Steel Prices

The announcement on Feb. 19 that "official price schedules" for steel products, rails excepted, had been abandoned—in other words, that competition now is to be free and that all producers will sell at such prices as they may see fit—was in some ways the most important and most truly historic event since the panic of 1907, remarked *The Evening Post*. That it marked the withdrawal from the publicly promulgated theory of 1908, that economic depression and paralysis of consuming power were no conclusive reasons for reducing prices, was itself a matter of great significance; because, if that theory had been vindicated, a good part of the time-honored principles of political economy would have had to be discarded. But the scope of the steel trade's action is wider than the steel trade; it has to do with the whole problem of consumption and prices in hard times.

Even the three-dollar concession of last June was granted unwillingly and under protest; it was alleged, by way of argument against it, that it would not elicit an additional dollar's worth of orders. But this, quite obviously, was an argument wholly from the producer's point of view. If every industry dominated by a great corporation had adopted the same principle and had been able to hold prices permanently, any consumer of merchandise can see what his position would have been.

There are two distinct views expressed, in both financial and industrial circles, over the recourse to an "open market" in the steel trade. One, and the most obvious, was that a dangerously unsettling condition of things had come about, that profits in a basic industry were presently to be slaughtered, and that no one could read the future. The other held that a wholly artificial and untenable situation had been abandoned with a view to readjusting conditions to a basis where makers and consumers might meet on equal terms, break the long deadlock by gradual resumption of activity, and build from the bottom up for the new and certain era of prosperity. Even if the breaking-down of the "stand-pat policy" on prices means a leap into the unknown, the continued maintenance of that policy would equally have meant a pause on the brink of the gulf, into which the trade was well aware it must sooner or later plunge.

The "open market" of 1900 was in reality a result of the Boer war panic; for our steel trade, during 1899, had been relying largely on the huge mass of export orders placed by the booming industry of Europe. The financial collapse in England and Germany, and the fall in foreign steel prices, forced a reduction in our own steel market; it was not until October, 1900, when steel prices had been cut from the exorbitant $41 per ton of October, 1901, to $17, that the market righted itself. The price was back at $22, on a greatly improved trade, before the ensuing spring; after that, the United States Steel Corporation took the field.

In other words, little more than half a year elapsed, after the panic of 1893, before the open market had brought producers and consumers together on a stable basis; in 1900, a full year had elapsed. In neither year was there present the conserving and restraining power of a dominant corporation in the trade; in both, the lower level fixed turned out to be a spur to American ingenuity and enterprise, which presently sent our steel manufacturers into a broader field, where we met and conquered the rest of the producing world.

Duty on Zinc Ores

Special Correspondence

The Treasury Department has acquiesced in the decision of the court in the zinc ore case. It is now expected that the next move in the controversy will be the raising of a case in court to determine the meaning of the words "lead-bearing ores" in paragraph 181 of the Dingley act reading "lead-bearing ores of all kinds 1½c. per pound on the lead contained therein." This grows naturally out of the points settled in the case now accepted by the Government as closed. The Treasury Department makes its official announcement in a letter to the Collector of Customs at Corpus Christi, Texas, in which it says in part: "The Department is in receipt of a letter from the Attorney-General in which he states that no steps will be taken looking to a review of the decision of the United States Circuit Court of Appeals for the Fifth Circuit in suit No. 1961, United States *vs.* C. G. Brewster, involving the classification of zinc ore known as carbonate, silicate, and sulphide of zinc. The carbonates and sulphides were assessed with duty under paragraph 183 of the tariff act as crude, metallic, mineral substances, and the court affirmed the decision of the Board and Circuit Court that the carbonates are free of duty under paragraph 514 as calamine, and the sulphides are free of duty as minerals crude under paragraph 614. You are, therefore, hereby authorized to forward a certified statement for the refund of the duties collected in excess in this case. While the Circuit Court of Appeals affirms the decision of the Board and Circuit Court that the ores are free of duty, it sustained your assessment of duty under paragraph 181 upon the lead contents without regard to the percentage of lead contained therein and you are hereby instructed to assess duty upon the actual lead contents in future importations of such ores."

Economic Law Prevails

The meaning of the situation which was publicly recognized in the steel trade, today, is not at all mysterious, said *The Evening Post*, Feb. 19. Economic law has asserted itself, and the attempt, honestly but mistakenly entered upon last year, to prevent its operation through the power of aggregated capital, has broken down. That it was bound to do so eventually, on any other supposition except that the financial panic of 1907 was a mere teapot tempest, has been the belief of perhaps the majority of experienced business men. The mistake in last year's "stand-pat policy" on prices lay in its fundamental assumption that, since buying orders would not be instantaneously stimulated by a cut in prices during severe industrial depression, therefore no decline whatever in prices ought to be permitted. From such a position it was but one short step to the corollary which the Steel Corporation's chairman openly accepted, last April, that increased demand was not a deciding factor in higher, or increased supply in lower prices. The quite conclusive answer to that theory was, that it discarded entirely the function of great corporations as the regulators of prices—a perfectly normal office—and made them the absolute dictators. To hold the price of an industrial staple at the high level of prosperity, in the face of industrial depression and impaired consuming power, was every whit as unreasonable, from an economic point of view, as to have made a radical cut in prices at the hight of legitimate trade demand in 1906. The Steel Corporation wisely regulated trade that year by preventing a "runaway" advance in prices; it might have used, and still may use, its powers wisely in the existing situation to prevent an absolute slaughtering of values such as should throw industrial projects into chaos.

Recent investigation by the Government, through the Forest Service, as to the effect of bleeding pine trees of their resin has shown the following results: (1) that bled timber is as strong as unbled if of the same weight; (2) that the weight and shrinkage of the heartwood is not affected by bleeding; (3) that the durability of the heartwood is not affected by bleeding, since the resin comes from sapwood only. The investigation involved mechanical tests and the physical and chemical analyses of the wood of bled and unbled trees from the same locality.

The world's output of graphite is estimated by the Geological Survey of India to be in the neighborhood of 70,000 to 80,000 tons per annum. Of this about one-third comes from Ceylon. The Travancon state, of India, in 1906 produced about 2600 tons.

Rescue Apparatus

Mining men have recently busied themselves in studying the different types of rescue apparatus now on the market. Each manufacturer claims that his machine has all the virtues, while among the miners themselves, each rescue brigade at its respective station appears to have some favored form. Among the many machines now being used are the Draeger, Fleuss, Shamrock, Weg, and a liquid-air apparatus. A number of engineers are coming to favor the use of liquid air as an agency in rescue work, basing their preference for this machine on the fact that it provides a low, refreshing temperature to the air supplied to the wearer. Another point in favor of this apparatus is that it has only one valve (the outlet valve) which is an item of much importance, as valves are generally looked upon with suspicion. The chief argument advanced against this type of apparatus is the rapid evaporation that takes place, amounting in some instances to as much as 5 per cent. per day. One large coal company, however, has ordered a complete equipment of this type, and is now putting in a liquid-air plant of its own.

Many engineers object to the Draeger apparatus, because it uses a helmet, and the fact that the pressure gage is not accessible for inspection by the wearer of the apparatus. This gage is fixed behind, and another person must consult it for the wearer. Those who advocate the Draeger apparatus claim that the giddiness and faintness sometimes experienced, are not due to the head being boxed up in a helmet. They declare these symptoms are caused by poisoning from CO_2, there being at the time a preponderance of this gas in the breathing bag.

With regard to the gage being situated at the back of the wearer, this, of course, could be remedied at the cost of introducing a rubber-tube connection, which, however, would provide another source of weakness. Some of those who oppose the oxygen breathing apparatus claim that the men work at a greater rate than when a normal atmosphere is breathed. One authority in investigating this condition states that men breathing pure oxygen do not consume any more than they would if they were breathing atmospheric air. This same authority says that in breathing air containing from 9 to 63 per cent. of oxygen, there is no noticeable change in the sensations of the rescuer. It is only when the percentage of oxygen falls to 7 or 8 that a condition of numbness sets in. The human body is able to satisfy its needs of oxygen, provided that the inspired air contains from 10 per cent. the inspired air contains from 10 per cent. upward. It is difficult, therefore, to understand how increased energy can arise from breathing air containing an excess of oxygen.

Colliery Notes

In order to protect men at the shaft bottom, cage bonnets should be made high enough so that falling coal striking the bonnets will not be thrown into the entry.

On the continent, three-phase alternating current is often prefered to the continuous current in coal mines, on account of the danger supposed to lie in the commutator. Continuous-current motors generally spark at the brushes.

In inclined workings, tapered or sharpened props last much longer than those of uniform thickness. The former are also more economical, more efficient, and safer. Tapered props can also be taken out of the mine, re-tapered, and used in a thinner seam. Lastly, the tapered prop is more easily withdrawn.

The most favorable months of the year for cutting timber are December, January and February. During these months there is comparatively little sap in the trees. Timber cut when the sap is circulating through the tree decays rapidly. Seasoned timber will last fully one-quarter longer than green timber.

The efficiency of safety catches should be carefully tested at regular intervals. In making this test, the cage is generally raised above the top platform, and heavy timbers are laid across the head of the shaft to catch the cage, should the catches fail to work. The rope is then cut and the cage stopped by the catches.

The cost of electric power depends largely on the size of the plant. Centralization is the idea now being supported by good authorities. Statistics from England show that at a plant having an output of 2500 kw., the cost per kilowatt was $268. The total cost of this plant was $700,000. At another station having an output of 40,000 kw. and costing $5,800,000, the total cost per kilowatt was only $139.

When mules are used to gather cars at the face, the maximum distance the animal should haul is generally determined by the ability of the mule to haul the required quantity of coal to the parting as fast as it is hauled to the shaft bottom. This distance may vary from 600 to 2000 ft. In mule haulage, two drivers are preferable, since they can assist each other when cars are derailed. Except where the grades are steep, the drivers should follow each other rather than make alternate trips.

Where there are several landings in a shaft, great care should be taken in the arrangement of signals. A good plan is to safeguard against danger by providing for each landing a distinct bell that cannot be mistaken as belonging to any other level than the one with which it is connected. Strict rules should be enforced, prohibiting the movement of a cage from any landing before the engineer has received and responded to the signal given at that landing. When work is temporarily abandoned at any level, the safety gates should be locked or otherwise made secure.

In firing shots of high explosives, safety is obtained in proportion as the stemming is complete. One authority says that in ordinary shot-holes, he considers a safe proportion is a minimum of 9 in. of stemming to a charge of 3 oz. of high explosive, with a proportionate increase of stemming for larger charges. The knowledge that shots charged with a high explosive will blast the work required with little or no stemming, has caused a mistaken idea that the stemming of shot-holes is of only minor importance. Every experienced miner knows that shots fired without proper stemming emit a dangerous amount of flame, sufficient in most cases to ignite either firedamp or coal dust.

Every coal mine should have as a part of its equipment, a reliable barometer, so that careful readings of atmospheric conditions may be registered daily. An electric barometer has recently been invented, which depends for its operation upon the short-circuiting of a U-shaped carbon filament by means of a barometric mercury column. The filament dips into the top of the column, and as the atmospheric pressure increases the mercury rises in the tube, cutting down the length of the exposed part of the filament, and thus reducing the resistance. As the mercury is also affected by temperature, a second filament and mercury column is provided. In this latter column, the tube is sealed, so that the mercury will not be affected by atmospheric conditions.

Sixteen highly insulated, lead-covered, and armored cables, each carrying 100 e.h.p., will be much more expensive than four cables each carrying 400 e.h.p. Where all the current is required for a long-distance transmission, it is probable that for a great part of the distance all the current can go in large cables and at a reduction of perhaps 20 per cent. in the average cost per horsepower transmitted. If, for instance, we transmit our current two miles, with 400 volts at the motor, and a drop of 10 per cent. per mile from generator to motor, the cost of the cable for 100 e.h.p. will be approximately $12,000, and erection $2000. If these figures were multiplied by 16, we would have nearly $230,000 as the cost of the cables and of erection; however, if all the power were taken this distance in four large cables, each of 400 h.p., the cost of the cables would be reduced 20 per cent. In deciding a problem of this character, we have to reconcile two conflicting needs: First, the convenience and safety of low-tension motors; second, the economy of high-tension mains.

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The Cut in Steel Prices

In the JOURNAL of Feb. 6, we said: "In this country the Steel Corporation has been the leading exponent of the theory that reductions of prices were unwise and unnecessary. We have repeatedly argued against that fallacy, as have other journals. We understand that the directors of the Steel Corporation at last recognize among themselves that they were mistaken."

With that change of mind, it was, of course, only a question of time when a reversal of policy would be made. This was announced on Feb. 19, when radical cuts in the prices for steel products were made. This led to more or less demoralization in the stock market, where it is reckoned that the profits of the Steel Corporation will be seriously diminished. That does not necessarily follow. In the first place, there is likely to be a readjustment of wages, which matter is indeed taken care of in the cases of those companies which pay their men upon a sliding scale; in the second place, the cut will sooner or later stimulate business and enable the works to operate more nearly at full capacity, which will be more economical than the half scale or five-eighths scale of the last year and more; in the third place, it is apt to be more profitable to sell a lot of goods at a small profit than a small amount at a large profit, the latter being what the Steel Corporation has lately been doing.

If there be anything in economic theory—all recent experience, as well as all prior, proves that there is—the fallacious ideas of the managers of great aggregations of capital have been one of the most influential factors in retarding the return of prosperity, and consequently their retreat is one of the best things that could happen.

Mr. Carnegie remarked recently that it is a great mistake to try to hold up prices in time of panic. If he had been at the head of the Steel Corporation, he said, his policy would have been to reduce prices enormously, so that a man contemplating the erection of a skyscraper would say: "Here's a bargain. I will buy my steel and start work at once." This would be followed in other parts of the country and business would begin to pick up. We do not doubt that this will now come about—not right away, but much more quickly than otherwise was to be expected.

Chinese and Negro Labor in the Transvaal

The question of mine labor in the Transvaal having been finally decided by the legislature of that colony, which enacted a law requiring the deportation of the Chinese laborers as fast as their contract terms expired, the work of returning them to their own country has gone on steadily for over two years, without seriously interfering with the operation of the mines, notwithstanding the predictions made when the law was under discussion.

The total number of laborers reported in Transvaal mines—excluding white men—has been as follows for two years past, at half-yearly intervals:

	Kafirs.	Chinamen.	Total.
Jan. 1, 1907	83,567	53,828	137,395
July 1, 1907	89,593	51,441	141,034
Jan. 1, 1908	118,204	31,840	150,044
July 1, 1908	132,339	18,413	150,752
Jan. 1, 1909	148,722	12,283	161,005

In the two years there was an increase of 65,155 Kafirs, and a decrease of 41,545 Chinamen; a net gain of 23,610 laborers. This does not imply that the efficiency of the Kafir is less than that of the Chinaman. More laborers have been needed, owing to the extended operation of many mines, the increase in tonnage taken out owing to the working of lower-grade ore, and to the inclusion of some new mines. The handling of the lower-grade ore alone required a considerable increase in the working force in the mines and at the mills.

The larger force of natives has been obtained with little difficulty, owing to the concurrence of several causes. These were the discontinuance of railroad and other public works; the impoverishment of the natives over a considerable part of South Africa by the loss of cattle from plague; and the extension of recruiting operations for the mines over Portuguese and other territory heretofore untouched. A considerable number of negro laborers are now being brought to the Transvaal from the Zambesi country. These men are hardly the equal of the Kafirs in physical strength and in intelligence, and they require acclimation after their transition from their own hot, moist climate to the cooler region of the high veldt; but they are generally tractable and make good laborers when they become accustomed to the climate and the work.

The enactment of the deportation law

was the result of political rather than economical considerations, since the Chinese, as a rule, were fairly good mine laborers. The question has been heretofore fully discussed, so that it is sufficient to say here that the government seems to have been wise in its determination to eliminate the Asiatic element from the already mixed population of the Transvaal. It may be added that the importation of some 60,000 foreign laborers into the country within a few months, and their return to their native country in three years—for the last of them will probably go during the present year—with so little disturbance, constitutes one of the remarkable industrial movements of modern times.

The Revelation of a Metallurgical Secret

For many years, until a portion of it was destroyed by fire, the Argo works (near Denver, Colo.) under Dr. Richard Pearce, was one of the most instructive metallurgical plants of the world. Its rather exceptional processes were always an object of interest to visitors in Denver, to whom the works were thrown open, and they were described in important papers in the *Transactions* of the Institute. However, there was one department of the works to which visitors were never admitted, and of which no description was ever published. This was the department in which the gold-copper bottoms were refined. Doctor Pearce remarked in his presidential address before the Institute in 1889, "The treatment of this alloy and the separation of the gold from the copper is a part of the process which, for certain business considerations, I am not at liberty to describe." Many efforts were made by rival and curious metallurgists to discover this secret, but always without success.

The gold and silver refinery of the plant was destroyed by fire in 1906. In view of the development of modern practice in the refining of copper matte, etc., the management decided that it would be inadvisable to rebuild that part of the works. In a paper by Harold V. Pearce, in the *Bulletin* of the Institute for February, 1909, he says: "This decision probably removes altogether from the sphere of practice the Pearce method for the separation of gold. At all events, it removes the business reasons which have prevented hitherto the publication of the principles involved. At the suggestion of Doctor Raymond, secretary of the Institute, my father, Richard Pearce, the former manager of these works, has requested me to prepare a brief description of this process for the benefit of our members."

In the first place, it is interesting to chronicle how the process was evolved. In the early days of smelting at Black Hawk, the gold-copper bottoms were shipped to Boston for refining. This led to many annoying features of business. Doctor Pearce inaugurated a series of experiments, unknown to Professor Hill, to prove whether an idea that had occurred to him had any merit. Having satisfied himself by producing a lump of gold weighing 2 or 3 lb., and having explained to Professor Hill how it was done, the latter immediately ordered the Boston works to be closed after finishing the stock of material on hand, inasmuch as future refining was to be done at Black Hawk. The new process solved the whole problem, each metal being put into marketable form; the gold in bars ranging upward from 900 fine; silver in bars 999 fine, and copper as bluestone. During the 30 years that this process was used, 1,532,905 oz. of gold were extracted by it from 54,549 tons of copper.

Now for the secret disclosed by Mr. Pearce. If the gold-copper alloy in the form of copper bottoms be granulated and melted with a suitable quantity of pyrite, there results a matte and a copper-bottom, the latter carrying the bulk of the gold present in the original alloy. The iron sulphide acts upon the copper, producing a compound of copper with iron and sulphur, corresponding closely to the mineral bornite both in appearance and composition. The second bottom, being melted, refined, and again granulated, is once more melted with pyrite, a further quantity of copper combining with it to form matte, and a smaller amount remaining as metallic copper, still carrying the major portion of the gold. The process is, therefore, a series of refining with granulations and subsequent treatments, or "strippings," with pyrite, with the result that the whole of the copper is finally extracted or "stripped" from the gold. A certain quantity of gold passes into the matte at each stripping, but any attempt to remove too large a proportion of the copper in one operation results in too much gold being taken up by the matte. The process is described in detail in the paper by Mr. Pearce, from which we have been quoting.

In conclusion, Mr. Pearce remarked that "the process was never materially changed from the time it was first placed in operation in Black Hawk until the works were destroyed by fire. It is quite possible that the simplicity of the method of separation accounts for the fact that it was not developed before." Perhaps also it is the reason why the nature of the process was not surmised by outsiders; it is always the simple and obvious to which eyes are shut. However, it is certainly remarkable that this secret was preserved so completely for the long period of its use.

Carroll D. Wright

The death of Carroll D. Wright removes a public servant who for many years was content to do his work faithfully and with understanding without seeking for special reward; and this course brought him into the prominence which he had not sought. Few men understood the true value and uses of statistics better than he; and few had studied labor questions in their various phases more thoroughly and carefully. Perhaps the service which brought him most into general public notice was on the Anthracite Strike Commission of 1902-3. The shaping of the work of that commission was largely due to Colonel Wright's advice; and to him and to Judge Gray was due the organization of the conciliation board, which proved such a valuable part of the commission's settlement.

Colonel Wright was an indefatigable worker, and not even the incurable disease which shadowed the closing year of his life could keep him from doing what he could to forward his chosen work.

The secretary of a Comstock Mining Company, who is now a fugitive, appears to have developed the art of milking suckers to the highest point yet reached in the history of 50 years of nefarious transactions in connection with the Comstock lode. This brilliant gentleman issued 22,500 shares of fictitious stock of the Belcher Silver Mining Company, sold it, put the money in his own pocket, levied assessments on the fictitious stock along with the real stock, and appropriated those proceeds.

Spelter Statistics for 1908

By W. R. Ingalls

For the sake of promptness I am publishing the statistics of production without waiting for those pertaining to consumption, the collection of which is more laborious.

The production of spelter in 1908 is given in Table I, which is based on reports from all of the smelters.

I. PRODUCTION OF SPELTER.

(In Tons of 2,000 Lb.)

State.	1907.	1908.
Colorado	5,200	3,079
Illinois	56,103	50,244
Kansas	133,561	99,136
Missouri	11,594	10,196
Oklahoma	5,094	14,867
South and East	38,060	32,989
Total	249,612	210,511

There was no addition to smelting capacity in 1908, excluding the new plant at Danville, Ill., and the two new works at Bartlesville, Okla., which went into operation just before the end of 1907 and were completed early in 1908. Otherwise no smelter added so much as a furnace. So far as I am aware no plans for new plants were prepared during the year.

All of the smelters but three reported the stock of spelter at their works on Dec. 31, including that held for speculators. The total of their reports is 19,848 tons. This is a little less than was previously reported to me as of Dec. 15. Allowing for the companies that did not report I estimate the stock in first hands on Dec. 31 to have been 25,000 tons. The delivery into consumption is computed in Table II.

II. DELIVERIES FOR CONSUMPTION.

(In Tons of 2,000 Lb.)

	1907.	1908.
Stock January 1	4,550	32,883
Production	249,612	210,511
Imports	1,778	881
Total supply	255,940	244,275
Exports	563	2,640
Stock, December 31	32,883	25,000
Deliveries	222,494	216,635

In considering the figures in Table II it is important to make a distinction between "deliveries" and "consumption." The zinc industry joins hands with iron and copper, which are represented by the galvanizers on one hand and the brass-makers on the other. The consumption of iron and copper in 1908 was not more than 70 per cent. of that in 1907. It is unreasonable to suppose that the consumption of spelter did not fall off more than 5 per cent. Discussion of this subject must be deferred until the reports from the smelters of dross and other secondary material are in hand, together with the reports from the consumers.

Production of Zinc Ore

Every smelter in the United States reported his receipts of ore, enumerated according to State and country of origin. The totals are given in Table III.

III. PRODUCTION OF ZINC ORE IN THE UNITED STATES.

(In Tons of 2,000 Lb.)

State.	1907. Tons.	1908. Tons.
Arizona	285	879
Arkansas	4,088	2,582
Colorado	(a)142,510	(b)82,852
Idaho	11,847	1,558
Kentucky	1,005	341
Missouri-Kansas	297,126	273,420
Montana	1,218	2,783
Nevada	4,593	1,445
New Mexico	4,281	2,290
New Jersey	368,710	(c)
Oklahoma	3,250	9,300
Tennessee	1,071	566
Utah	9,043	709
Wisconsin	53,011	58,135
Others	885	85
Totals	902,923	.....
British Columbia	1,157	6,157
Mexico	108,800	66,383
Grand totals	1,012,880	.....

(a) Includes receipts of ore for making zinc-lead pigment at Cañon City, Colo. (b) Does not include receipts of ore for making zinc-lead pigment at Cañon City, Colo. (c) Not given, because it would practically disclose the business of a single company.

Determination of Gold in Copper Bullion

By Fred F. Hunt*

The amount of work necessary in the "all-fire" method for the determination of gold in copper bullion has lead to investigation for shorter methods for this purpose. Experience has shown that with only concentrated sulphuric acid too much sulphide of copper was formed to allow of good cupellation with only one scorification. To overcome this, mercuric sulphate has been used, but owing to the formation of globules of mercury and their possible loss, with a resultant loss in gold, this method has not been generally employed.

In dissolving the borings with sulphuric acid there seems to be more sulphides formed at the beginning of the action than later. This suggested the use of cupric sulphate with sulphuric acid and I found that this combination left such a small amount of sulphides that the usual scorification with 35 grams of test lead gave a button that was readily cupeled.

The following details are observed: To 80 c.c. of concentrated sulphuric acid add 25 c.c. of a solution of cupric sulphate (160 grams per 1000 c.c.), using a low, wide No. 5 beaker. Heat this mixture to such a temperature that on the addition of the borings action commences immediately; add 1 a.t. borings, spreading them over the bottom of the beaker, heat until all dissolving action has ceased (from 1 to 1½ hours), cool, add about 400 c.c. water, stirring to prevent caking of the crystals, bring just to a boil, filter and wash the beaker thoroughly, using a rubber-tipped glass rod as "scrubber." Place filter paper with precipitate in a 2½-in. scorifier, dry and burn off the paper, add about 35 grams test lead and 1 gram ground silica, scorify to button of about 9 grams, cupel and part as usual.

Silver may also be determined by this method by adding to the filtrate from the gold enough solution of permanganate of potash to produce a permanent color, then 1 drop of saturated salt solution and 10 c.c. of a 10-per cent. solution of acetate of lead; stir well and let stand over night, filter with the usual precautions, add paper and precipitate to the same scorifier with the gold and proceed as in the case of gold only.

*Chemist, 77 Pine street, New York.

"Blue Gas," a New Illuminant Used in Germany

By Robert Grimshaw*

In Germany there is being introduced a new system of illumination based on the same principles as that for railway-car lighting. This illuminant is called "blue gas." The gas is delivered in liquid form, in such shape that it may be used in closed rooms in hanging burners giving from 50 to 1000 c.p. To use the gas all that is necessary is to pour the liquid from the steel cylinders, in which it is delivered, into the gasometer. This is almost as convenient as having one's own gas plant, for one can protect himself against accidents at the factory or delays in transit by always having on hand several filled cylinders. A cylinder contains 22 lb. of the gas, and costs 12 marks, or about $2.86. This quantity will supply a 50-c.p. burner for 480 hours, so that this illuminant appears to be cheaper than petroleum. This "blue gas" can, of course, be used for heating and cooking as well as for forging, hardening and tempering, and other industrial processes. It is a hydrocarbon compound, free from carbon monoxide, and is not poisonous; its heating effect is 15,000 units against 4500 of ordinary coal gas. The gas is burned at a pressure of about an inch of mercury, or 13.6 in. of water at the burner. Almost any apparatus that is arranged to burn ordinary coal gas or acetylene gas can be altered without much difficulty to burn this; and in such cases all that is necessary is to make the connection between the cylinder and the house pipes through a reducing valve.

As regards its explosibility, Professor Götz of Augsburg reports that, while the range of explosibility of acetylene gas when mixed with air is between 2 and 49 per cent. (a range of 47 per cent.), and that of ordinary coal gas is between 6⅓ and 19⅓ per cent. (a range of 13 per cent.), that of "blue gas" is only between 4 and 8 per cent. (a range of 4 per cent.). No special permission from the authorities or the insurance companies is necessary for its use.

*Mechanical engineer, Dresden, Germany.

The International Conservation Conference

SPECIAL CORRESPONDENCE

The meeting of the International Conference called by President Roosevelt, began in Washington on Feb. 18, with a reception by the President for the Canadian and Mexican commissioners at 10 o'clock in the East room of the White House. Later the conferees proceeded to the Diplomatic room of the State department for regular sessions. The remainder of the morning was taken up with formal addresses of welcome and responses of the visitors. In the afternoon the conference began its work in earnest.

The delegations from Canada and Mexico include men known as experts in the natural resources of their countries. Canada is represented by Hon. Sydney Fisher, minister of agriculture of the Dominion; Hon. Clifford Sifton, ex-minister of the Interior, under whose administration many of the regulations concerning the use of Canada's resources were adopted, and Dr. Henri S. Beland, a member of the Canadian parliament, a well known authority on these subjects. The Canadian delegation is accompanied by Robert E. Young, land expert in the Canadian Department of the Interior, who acts as its secretary.

To represent Mexico, President Diaz sent Romulo Escobar, Manuel A. De Quevedo and Carlos Sollerier. Señor Escobar, who heads the delegation, is one of the foremost authorities in Mexico on the agriculture of the country. He has been at different times minister of the Department of Agriculture and of the Department of Forestry. With his brother he edits the farm paper *El Agricultor Mexicano*, and he presented a paper on "Agriculture in Mexico" at the time of the St. Louis exposition. Señor De Quevedo is the present minister of forestry. The conference is open to members of the Cabinet, and is shared in by all members of the National Conservation Commission.

The foreign delegates have prepared outlines of the conservation movement in their own countries. Early last year the whole of the public timberlands in British Columbia, except what has been leased, was placed in forest reserves. This action was taken to check waste by bringing the care and cutting of timber resources more effectually under government control. The action affected 150,000,000 acres—as much land as was put into all national forests of this country up to 1907. In the Yukon all water-power rights are now granted for only 20 years, and at the expiration of that time their control reverts to the public. President Diaz, of Mexico, is already applying the principles of forestry, and understands fully the benefits to be gained. He is also interested in the improvement of agricultural methods. Mexico has few large waterways, but has provided for the expenditure of several million dollars for the improvement of internal navigation.

Reports received here concerning recent discussion in the Canadian parliament of President Roosevelt's proposal for coöperation for the conservation of the natural resources of the whole continent indicate that the support of the conservation movement in the Dominion will be nonpartisan. R. L. Borden, leader of the opposition, was as enthusiastic in his support as Sir Wilfrid Laurier, the premier, who expressed his deepest approval of the movement.

Canada has sent to the National Conservation Commission a number of carefully prepared maps which show the present status of the public lands of the Dominion, as well as the distribution of the principal natural resources and the development of its transportation systems. The Canadian authorities have also gathered together and sent to the chairman of the commission a comprehensive collection of government documents bearing on the natural resources of the country. These have been carefully indexed and bound according to subjects for use at the conference.

The first meeting of the committee on coöperation recently appointed by the chairman of the Conservation Commission to block out methods of joint work on the part of the States and of the United States will be held in Washington for the purpose of determining upon some concerted action. No program has as yet been decided upon.

Gifford Pinchot, Chairman of the National Conservation Commission, was chosen chairman of the International Conservation Conference at the first regular session of the conference which met in Washington Feb. 18. In attendance the conference was limited to the commissioners from the three countries participating. A few members of the National Conservation Commission were present in an advisory capacity.

Secretary of State Bacon called the afternoon session to order. Mr. Sydney Fisher, the Canadian Minister of Agriculture, and chairman of the Canadian delegation, placed Mr. Pinchot in nomination, and Mr. Romulo Escobar, chairman of the Mexican Commission, seconded the nomination. No other name was proposed.

At the suggestion of the chairman of the Canadian delegation, the conference agreed to begin its deliberations by hearing statements from the commissioners of the respective countries as to the extent, condition, and regulations governing the resources of those nations. The first subject taken up was Forests, the first statement on which was made by Miguel A. de Quevedo, President of the Mexican Forestry Commission, who is one of the Mexican commissioners. Mr. Quevedo spoke in French. This was followed by a statement of forest conditions in the United States by Mr. Pinchot. The statement as to Canadian forests was made on the following morning by Commissioner Fisher. Other speakers followed with special papers.

The striking feature of the conference has been the effort to give it a world-wide scope. Anticipating the interest which would naturally be aroused in other countries by the present North American Conference, President Roosevelt believed that it could be made the precursor of a world congress on the same subject. By an *aide-memoire* in January last, the principal governments were informally sounded to ascertain whether they would look with favor upon an invitation to send delegates to such a conference. The responses have so far been uniformly favorable, and the Conference at Washington has suggested to the President that a general conference be called by him. The President feels, therefore, that it is timely to initiate the suggested world conference for the conservation of natural resources, by a formal invitation.

It is intended to have the conference consider a general plan for an inventory of the natural resources of the world and devise a uniform scheme for the expression of the results of such inventory to the end that there may be a general understanding and appreciation of the world's supply of the material elements which underlie the development of civilization. The conference will also probably consider the general phases of the correlated problem of checking and when possible, repairing, the injuries caused by the waste and destruction of natural resources and utilities, and make recommendations in the interest of their conservation, development, and replenishment.

With such a world-inventory and such recommendation, the various producing countries of the whole world would it is believed be in a better position to cooperate, in the safeguarding and betterment of their common means of support. As was said by the President in the preliminary *aide memoire*, "the people of the whole world are interested in the natural resources of the whole world, benefited by their conservation, and injured by their destruction. The people of every country are interested in the supply of food and of material for the manufacture in every other country, not only because these are interchangeable through processes of trade but because a knowledge of the total supply is necessary to the intelligent treatment of each nation's share of the supply."

Capital expenditure, according to Hugh F. Marriott, should include only the cost of the property and the cost of equipment. If more ground is acquired or additional equipment installed so as to increase the output, then these should be added to the capital-expenditure account.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Superheated Steam for Winding Engines

The statement in "Colliery Notes" in the JOURNAL for Oct. 24, 1908, to the effect that at a large English colliery by using superheated steam the number of winds had been increased from 60 to 70 per hour, giving an increased output of 400 tons per day, is of great interest and importance. When it was first introduced superheating was not always successful, and even now is not always successful. As in so many other cases, some engineers who adopted superheating, in the early days of its introduction, omitted to consider one important factor, the temperature of the steam with which they had to deal.

REASON FOR USING SUPERHEATED STEAM

Superheating was introduced to overcome the losses arising from cylinder condensation, and the winding engine affords probably one of the extreme cases. Assume that the steam enters the cylinder at a pressure of 120 lb. per sq.in. and at 350 deg. F., and is cut off, say, at half-stroke. Assume also, for simplicity, that the steam issues from the exhaust at atmospheric pressure, or at a temperature of 212 deg. F. The cylinder walls closely follow the changes of temperature in the steam, and a good deal besides happens in consequence. The winding engine stands, for a certain time, after each wind, and during that period, the engine is cooling and fairly quickly, too, by conduction, radiation, and convection. So that before the commencement of the next wind, the temperature of the cylinder will probably be several degrees below that of the exhaust steam. It may quite easily, in certain cases, be as low as 150 deg. F. The entering steam, at the commencement of the next wind being at a temperature of 350 deg. F., finds itself in the presence of a large mass of metal at, say, a temperature 200 deg. F., or lower. The large mass of metal comprising the engine cylinder is in metallic, and, therefore, thermal-conductive, connection with the large mass of the winding drum and with the rope, which also carries off some heat. As a result, the steam which enters the cylinder at the commencement of the first stroke is cooled very considerably, and the steam which enters the cylinder at each of the working strokes after the first few is also cooled to a certain extent, although not so much as that which enters at the commencement of the wind.

And now comes in another important, though rather a complicated, series of phenomena. We are accustomed to the three states of matter, the solid, the liquid, and the gaseous, but there is also a fourth condition into which many substances may enter, viz., that of vapor. Steam is a gas, and behaves as a gas. Water vapor is not a gas, and does not behave as a gas. Gases have the property of carrying a certain quantity of the vapors of certain substances. Steam, therefore, has a capacity for absorbing the vapor of water, the capacity increasing with the temperature. In the operation of the steam boiler a certain amount of water vapor is formed, and this is carried along by the steam. There is also a certain mechanical action going on in the steam boiler that results in the formation of minute globules of water; these are also carried over with the steam and add to the trouble. Consequently, the steam which enters the cylinders carries with it a certain quantity of the vapor.

The saturation curve for steam with vapor is steep between 200 and 350 deg. F.; so a large portion of the vapor is deposited upon the comparatively cold surface of the cylinder walls. Later on, this vapor which has been deposited, and which has become liquid, is reconverted, not to vapor, but to steam. In order that it may become steam, however, it must absorb heat from somewhere, and the only source is the steam which remains in the cylinder. This means that the steam, which has probably, by this time, commenced the expansive portion of the stroke, is cooled to a greater extent than simple expansion would cause. And as temperature and pressure go together with all gases, cooling the steam means lowering its pressure, and this means the lowering of the mean pressure against the piston.

BENEFITS OF USING SUPERHEATED STEAM

I believe that it has not been possible in winding engines to use a very high expansion, but in all engines expansion is carried on to as great an extent as possible. The pressure of the steam is falling from the moment the entry valve is closed, and, therefore, the mean pressure is always less than the boiler pressure. Assuming a cut-off at half-stroke, the mean pressure behind the piston would be about 115 lb. per sq.in., and with a cut-off at one-third the stroke, about 94 lb. per sq.in. The temperature of steam at 115 lb. per sq.in. is 347 deg. F., and at 95 lb., 334 deg. F. Assume, for the sake of calculation, that the mean temperature of the steam throughout the stroke is reduced 20 deg. F. With a cut-off at one-third the stroke, the mean pressure would be reduced to about 65 lb. per sq.in., or approximately a loss of 30 per cent. in the power obtained from the engine. With greater expansion, the loss would be greater.

The benefit of superheating is that it converts the vapor which comes over with the steam, and also any water that may be held in mechanical suspension, into steam, and any superheater or system of superheating, is efficient, exactly in the proportion that it accomplishes this. While steam which carries water vapor with it deposits that vapor upon the comparatively cold surfaces of the cylinder walls, superheated or "dried" steam is merely cooled to a certain extent and loses a certain amount of its pressure, and if the superheating is great enough the steam does not condense. Therefore, with properly superheated steam entering the cylinder, considerably more work should be done because, as there is no condensed steam to reabsorb heat at a later period of the stroke, there is less loss of heat energy.

One caution, perhaps, is necessary. Engineers sometimes imagine that applying superheat, in any way and to any extent, will cure the evils of cylinder condensation. Superheating is only effective, and economy only results when the vapor carried by the steam is completely converted into steam.

SYDNEY F. WALKER.

Bath, England, Dec. 29, 1908.

Windy Shots in Coal Mines

The most common cause of coal-mine explosions is usually attributed to blown-out or windy shots which have been tamped with fine coal or dust by a careless miner; as a matter of fact, no miner with a minimum of intelligence, ever thinks of tamping his hole with fine coal or dust without first thoroughly wetting it, for he knows very well that dry coal or dust as tampng would not adhere or pack around his needle sufficiently tight to allow the squib unrestricted passage to the cartridge.

I am aware that in many places the indiscriminate use of a blasting barrel is permitted, which practice cannot be too severely condemned, because it engenders gross carelessness in tamping the hole, this fact often furnishing the means of

a blownout shot. When a needle is used, conditions are different, because the miner must be careful in tamping his hole lest the same become clogged in withdrawing the needle thus preventing his squib from igniting the powder; in this latter case, the miner knows that he may have to drill out his hole and try it again.

Fine coal or dust that has been thoroughly moistened and used for tamping, never was and never will be the means of conveying a flame beyond the mouth of the hole. We sprinkle the mine to keep down the dust, the object being to prevent it from circulating with the air, and to render it less liable to ignition from any cause; the purpose is accomplished when the dust has been sprinkled thoroughly. The miner wets his fine coal for tamping, not with a view of preventing it from flaming, but because he knows that it would be worthless to him as tamping in a dry condition.

An Unusual Experience

That shots are an important factor in coal-mine explosions is too evident to be slighted even for a moment, but that the miner is invariably at fault is placing the blame where it does not always belong. In corrobation of this fact I will relate the following experience I had while managing a coal mine for a well-known Western company: The third level of this mine had advanced about 3000 ft. from the slope, and two practical miners were working in the entry face. One day they fired a shot as usual and immediately afterward repaired to the face to load the coal it broke down; the shot was an ordinary one, having just enough powder to do the work required. A few moments after the shot had been fired and while the drivers and other laborers were gathered on the entry near the slope, a gust of wind having the force of a cyclone hurled them in all directions, extinguished their lights and filled the place with dust from the roof and sides until they were almost suffocated, producing consternation in their minds and causing them to believe their hour of doom had come.

Two gas-watchmen were in the level above and having distinctly heard and felt the shock, at once concluded that an explosion had occurred somewhere in the mine. They hastened to the third level and an investigation was immediately begun to ascertain what damage, if any, had been done, and to discover if possible the cause of this unusual disturbance.

Here were all the characteristics of an explosion, save that there was no flame; the miners in the rooms along the entry had the same experience as the drivers and laborers, all had felt and heard the shock, which extinguished their lights and threw them to the floor. We learned that none of the miners had fired recently and all declared that the wind had come from the direction of the entry face. Accordingly we went on to the entry face and found the two miners there busily engaged loading their coal into a car. We questioned them closely and examined the effects of the shot carefully and saw no reason why such a commotion should result from a commonplace shot such as this one proved to be. The only solution we could arrive at was that the shot in question had in some manner created an air wave which had traveled against a strong current until it reached the slope where its force was spent in the larger area of the mine.

Had there been standing gas anywhere along the entry or in the rooms, an explosion must have occurred the moment it was carried by this wave in contact with an open light. This phenomenon, if such it might be called, occurred many times afterward, always from the entry, and always having the same characteristics, the entry miners at no time noticing anything unusual at the time the shot was fired.

A Practical Suggestion

A burglar, it is said, sometimes spreads a blanket over a safe before he blows or cracks it, his idea being to deaden the noise made by the explosion as much as possible; if he has the correct idea, then why should we not carry this idea into our coal mines, and hang a heavy curtain or door near the entry face the same to be tightly closed just before a shot is fired. The recent disaster at Marianna is said to have originated from a windy shot in the face of one of the Blanche entries; had a curtain or a door been suspended between the last crosscut and the entry face I venture to assert that the shot in question would not have occasioned any serious trouble.

My experience has been that a windy shot is liable to occur at any time regardless of what kind of tamping is used, and since they are bound to happen, we should endeavor to devise some means to prevent them from spreading the least possible distance from their source.

D. G. Thomas, Supt.
Evanston Coal Company.
Evanston, Wyoming.

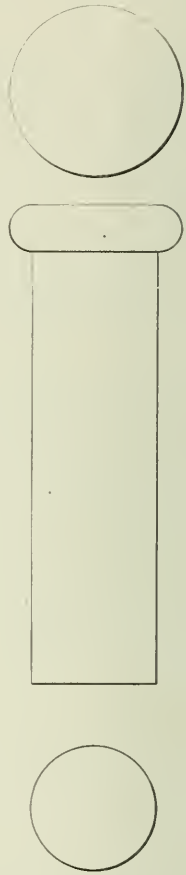
Jan. 25, 1909.

The Gordon Drill

Recently I have learned that the makers of both the Murphy and Waugh drills, who are using "vanadium steel" for the hammers in the drills, have found that it is not necessary to drill the centers out of the hammer, as vanadium steel can be made to take the desired temper *all the way through*. No other steel will do this.

The few of us who know of the breaking of the drills, which I mentioned in previous correspondence, are greatly puzzled over the peculiar action of the steel. I have thought that there might be such a thing as a "critical point" in the fatigue of steel; that is, if the weight and number of blows were increased or decreased slightly the steel, in this instance in the shape of drills, would "stand."

While the shapes of the hammers vary



AVERAGE TYPE OF HAMMER IN WHICH VANADIUM STEEL IS EMPLOYED

somewhat in the different makes of hammer drills, the accompanying sketch shows about the average type of hammer when vanadium steel is used.

W.

Denver, Colo., Jan. 31, 1909.

According to the report of the Secretary for Mines the tin ore raised in Tasmania for the quarter ending Sept. 30, 1908, was 1187 tons, valued at £111,004, against 1095 tons valued at £101,626, for the quarter ending June 30, 1908.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Placers

What valuable metals other than gold are found in placers?

R. S.

Chiefly tin and platinum. Metallic copper is found in certain placers in Alaska.

Monazite

What is the value of monazite sand?

R. S.

This varies according to the percentage of thorium, which ranges from five to seven in the ordinary commercial sand. The American production in 1907 was valued at 12c. per lb.

Shorthand by Machinery

What is the address of the maker of the machine for taking shorthand notes that was described in the Journal of July 11, 1908? F. H.

Address, The Stenotyper Shorthand Machine Company, 105 New Bond street, London, W.

Meerschaum in the United States

Is any meerschaum mined in the United States? Who are buyers of the mineral?

O. F. R.

So far as we are aware no meerschaum has been produced in the United States. The Meerschaum Company of America, 25 Broad street, New York, is reported to own a deposit in the Alunogen district, Grant county, N. M. Dana reports the occurrence of meerschaum in Utah and at Webster, N. C. The purchasers of meerschaum are the manufacturers of smoking pipes. William Demuth & Co., 507 Broadway, New York, is an important concern.

Value of Allanite

What is the market value of allanite? Who buys it?

C. McW.

The value of allanite depends upon the content of thorium oxide, which is very variable; so much so, that the mineral is not commonly regarded as a source of thoria. Sufficient cerium oxide is obtained as a by-product from monazite sand to prevent allanite from becoming a source of that oxide. The Welsbach Incandescent Lighting Company, Gloucester, N. J., would probably be interested in examining samples of allanite.

Hydrometallurgical Extraction of Copper

Are there any plants in successful operation recovering copper directly from its ore by roasting, lixiviation and precipitation? If so, please give a brief description of the plant, quality of ore treated, and results obtained.

A. B. W.

Such a process, with electrolytic precipitation, employed in Poland, was described in a recent number of the Journal. The Henderson process for burned pyrites is in constant use at Natrona, Penn. See *The Mineral Industry*, Vols. VIII and IX.

Weighing Gold and Silver

In the buying and selling of fine gold and silver on the large scale, what difference is permitted, commercially, between the weights of the buyer and the seller, arising from small discrepancies between the scales used by each one and the variation arising from differences in latitude and altitude? What differences is it customary to accept in the marketing of the precious metals at New York?

F. R.

The weights of the buyer are always taken, though the shipper has a right to be represented, and in case he is not satisfied with the weights rendered he may arrange for a referee who will weigh them on scales mutually accepted and this result be final. In selling silver in London less than ¼ oz. is disregarded; for instance, should the scale weight show 1000.37 the return would be 1000.25 oz. If the weight were 1000.15 the weight reported would be 1000 ounces.

Meerschaum

What is meerschaum, where is it found, and what are its uses?

A. G. M.

Meerschaum, or sepiolite, is the hydrated silicate of magnesium, containing varying amounts of water and frequently having some of the magnesium replaced by the oxides of iron, copper or nickel. H = 2 to 2.5; sp. gr. = 2 [Dana].

It is found in Greece and Asiatic Turkey; in the United States deposits have been discovered in Utah, North Carolina and New Mexico. The Utah and North Carolina deposits are said to be idle, but the Meerschaum Company of America, 25 Broad street, New York, is working the deposit in Grant county, New Mexico.

The meerschaum is found admixed with calcite and other impurities, and these are removed by dry concentration. The finely divided meerschaum is then pressed into blocks or other forms at a temperature of 1080 deg. C., and under certain secret conditions.

The largest use for meerschaum is in the manufacture of smoking pipes. The New Mexico variety is also used to make poker chips, toilet articles, and backs of mirrors.

Gayley Dry Blast

Will you name the blast-furnace plants at which the Gayley dry blast has been installed? W. F. C.

The following companies have installed the Gayley dry blast. The first figure given represents the number of furnaces equipped, and the second the year started: United States Steel Corporation, Isabella furnaces, Etna, Penn., 2, 1904; South Chicago Furnaces, South Chicago, Ill., 3, 1908; Warwick Iron and Steel Company, Pottstown, Penn., 2, 1906; E. G. Brooke Iron Company, Birdsboro, Penn., 1, 1906; Guest, Keen & Nettlefolds, Ltd., Cardiff, Wales, 2, 1907; total furnaces in operation, 10.

The following have plants under construction: Toledo Furnace Company, Toledo, O., 2 furnaces; N. W. Iron Company, Mayville, Wis., 2; Pioneer Iron Company, Marquette, Mich., 2; Thyssen, Deutscher Kaiser Works, Germany, 2 (also Bessemer plant); total under construction, 7.

Additional licenses have been sold to the following: Youngstown Sheet and Tube Company, Youngstown, O., 2 furnaces; Federal Furnace Company, Chicago, Ill., 2; Brier Hill Iron and Coal Company, Youngstown, O., 1; Hamilton Iron and Steel Company, Hamilton, Ont., 2; total additional licenses, 7. This gives a total of 24 furnaces equipped, in course of equipment, and licensed.

Floated Barytes

Please give me some information regarding the grinding and floating of barytes. What is the best machinery to use for reducing the mineral to an impalpable powder? A. L. F.

There are two methods in use for the preparation of barytes for the market. The first method involves crushing the mineral to from ¼ to ⅜ in. size, bleaching, drying, and then reducing to an impalpable powder in bur mills. The other method involves preliminary crushing in a rock breaker, reduction to an impalpable powder in bur mills or tube mills, bleaching and drying. In the second process the mineral is usually crushed wet, and when the final product is classified by floating, it is referred to as "floated" barytes.

The essential machinery for producing floated barytes includes crusher, tube mill, bleaching tank of wood or vitrified brick, classification tank, and dryer for the bleached and floated material. Bur mills may be substituted for tube mills, but in this case the crusher should be followed by rolls.

The operation of drying the floated material often presents many difficulties. As far as we know, rotary dryers give about as good results as any other kind. This part of the work must be carried on carefully, for the bleached mineral is liable to become discolored; the cause of the trouble is often hard to determine. Details of the methods used at different plants are not easy to secure, as most works operate behind closed gates.

Regarding the makers of the machinery required, reference should be made to the advertising pages of the Journal.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM SILICATE—Method of Treating Aluminum Silicate. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y., a Corporation of Pennsylvania. (U. S. No. 906,-173; Dec. 8, 1908.)

SOLDERING—Improvements in Soldering Aluminum. Thomas Harden, Fulham, and Amalgaline, Limited, London. (Brit. No. 26,932 of 1907.)

SOLDERING — Improvements in the Method of Soldering Aluminum. Albert Nielson, Nedre Strandgade, Bragernoes, Drammen, Norway. (Brit. No. 5055 of 1908.)

WELDING—Improvements in Welding or Melting Objects of Aluminum. Max U. Schoop, Garenne-Colombes, France. (Brit. No. 24,283 of 1907.)

BORAX

PROCESS OF MAKING BORAX. Gilbert E. Bailey, Los Angeles, Cal., assigner of one-half to Archie Stevenson, Los Angeles, Cal. (U. S. No. 911,695; Feb. 9, 1909.)

CHROMIUM

PRODUCTION FROM FERRO CHROMIUM—Process for the Production of Pure Chromium from Commercial Ferro-Chromium. Emilien A. O. Viel, Paris. (Brit. No. 24,875 of 1907.)

COAL AND COKE

BRIQUETTING—Method of Briquetting Carbonaceous Materials. Walter T. Griffin, Limoges, France; James Eddy Blake, Isabelle S. Graves, and Charles H. Clarke, executors of said Walter T. Griffin, deceased. (U. S No. 905,693; Dec. 1, 1908.)

COAL CUTTING—Improvement in, or Relating to Machinery for Cutting Coal. Hubert V. Neukirch and Ernst E. Freytag, Zwickau, Germany. (Brit. No. 10,946 of 1908.)

COAL-CUTTING MACHINES — Improvements in Mechanism for Driving Coal-Cutting Machines. Anderson, Boyes & Company, Ltd., Motherwell, Scotland. (Brit. No. 19,110 of 1908.)

COKE—An Improvement in Coke Quenching Apparatus. Aktiengesellschaft für Kohlendestillation, Gelsenkirchen-Bulmke, Germany. (Brit. No. 18,110 of 1908.)

COKE-DRAWING APPARATUS. Charles M. Clarke, Pittsburg, Penn. (U. S. No. 907,681; Dec. 22, 1908.)

COKE OVENS—Door for Coke Ovens or Furnaces. John Whitaker, Newhaven, Penn. (U. S. No. 912,218; Feb. 9, 1909.)

COKE OVENS—Horizontally-Moving Leveling-Rod for Horizontal Furnaces. Heinrich Koppers, Essen-on-the-Ruhr, Germany. (U. S. No. 907,818; Dec. 29, 1908.)

COKE OVENS—Improvements in, and Relating to Coke Ovens. Victor E. F. Fleschi, Douai, France. (Brit. No. 28,049 of 1907.)

COKE OVENS—Improvements in and Relating to Coke Ovens for the Recovery of By-products. Theodor von Bauer, Berlin. (Brit. No. 28,290 of 1907.)

CONVEYING—Improvements in, and Relating to Appliances for Carrying Coal or Other Minerals from the Headings, Rooms, Walls or Excavating Tunnels of Mines to the Hutches. Thomas P. Nelson, Coatbridge, Scotland. (Brit. No. 3193 of 1908.)

RESPIRATION APPARATUS for Use in Coal-Mines and Other Places. William E. Garforth, Normanton, England. (U. S. No. 911,389; Feb. 2, 1909.)

COPPER

ELECTROLYTIC REFINING—Process for the Electrolytical Refining of Copper. Joseph Awalow, St. Petersburg, Russia. (Brit. No. 26,829 of 1907.)

PYRITIC ORE TREATMENT—Improvements in Treating Pyritic Copper and Nickel Ores. James T. Carrick and Basil S. Pattison, Johannesburg, Transvaal. (Brit. No. 2971 of 1908.)

PYRITIC SMELTING. James T. Carrick, Johannesburg, Transvaal, assignor of one-half to Basil Stuart Pattison, Johannesburg, Transvaal. (U. S. No. 912,540; Feb. 16, 1909.)

GOLD AND SILVER

AMALGAMATOR. William F. Bedell, North Yakima, Wash. (U. S. No. 907,443; Dec. 22, 1908.)

AMMONIA-CYANIDE PROCESS of Treating Ores Containing Precious Metals. David Mosher, San Francisco, Cal., assignor to Ammonia Cyanide Engineering Company, San Francisco, Cal., a Corporation of California. (U. S. No. 911,254; Feb. 2, 1909.)

CYANIDE PROCESS—Improvements Connected with the Recovery of Gold by the Cyanide Process, and with other Chemical Processes Wherein Zinc is Employed. Edward H. Strange, Charles A. Pim and Francis E. Matthews, London. (Brit. No. 7211 of 1908.)

ELECTROMAGNETIC STAMP-BATTERY. James P. Lynn, Trafalgar, Kalgoorlie, Western Australia, Australia. (U. S. No. 910,-834; Jan. 26, 1909.)

IRON AND STEEL

ALLOYS—Improvements in the Manufacture of Steel Alloys. Jack R. Crawford, Pasadena, Cal. (Brit. No. 21,356 of 1907.)

BASIC BESSEMER PROCESS. An Improvement in the Basic Bessemer Process. Louis P. J. A. H. Messier, Lille, France (Brit. No. 8168 of 1908.)

BLAST-FURNACE. Joseph E. Johnson, Long Dale, Va. (U. S. No. 906,717; December 15, 1908.)

BLAST-FURNACE CASTING APPARATUS. Michael Killeen, Braddock, Penn. (U. S. No. 912,688; Feb. 16, 1909.)

BLAST-FURNACE GASES — Centrifugal Apparatus for the Purification of Blast Furnace, Generator and Other Gases. Communicated from the Société Anonyme John Cockerill, Seraing, Belgium. (Brit. No. 13,563 of 1908.)

BLAST-FURNACE PRACTICE—Method of Effecting the Precipitation of Fine-Dust in Blast-Furnaces and of Preventing the Formation of the Same. Ralph W. H. Atcherson and William Siddall, Bellaire, Ohio. (U. S. No. 912,641; Feb. 16, 1909.)

CASTING PIPE—Mode of Casting Soil, Water and Gas Pipe Direct from the Blast-Furnace in Permanent Molds. Edgar A. Custer, Philadelphia, Penn. (U. S. No. 904,-759; November 24, 1908.)

CASTING PLANT. William J. Patterson, Springdale, Penn., and Albrecht B. Neumann, Chicago, Ill. (U. S. No. 912,406; Feb. 16, 1909.)

CHARGING BLAST-FURNACES—Improvements in and Relating to Charging Apparatus for Blast Furnaces and the Like. Allgemeine Elektricitats Gesellschaft, Berlin. (Brit. No. 4969 of 1908.)

CUPOLA CAR-DUMPING MECHANISM. James Hyslop, Harvey, Ill., assignor to Whiting Foundry Equipment Company, Harvey, Ill., a Corporation of Illinois. (U. S. No. 911,725; Feb. 9, 1909.)

INGOT STRIPPER. Henry Aiken, Pittsburg, Penn. (U. S. No. 905,827; Dec. 8, 1908.)

MANUFACTURE—An Improved Process for Manufacturing Steel From Chromiferous Pig Iron. Frank D. Carney, Steelton, Penn. (Brit. No. 16,093 of 1908.)

MANUFACTURE—Process of Manufacturing Iron and Steel. Carleton Ellis, White Plains, N. Y. (U. S. No. 911,870; Feb. 9, 1909.)

ORE TREATMENT—Process of Treating Iron Ore. Charles B. Morgan, Cal. (U. S. No. 910,707; Jan. 26, 1909.)

RECEIVER FOR MOLTEN METAL. Harry H. Campbell, Steelton, Penn. (U. S. No. 907,680; Dec. 22, 1908.)

REDUCTION PROCESS—Process of Reducing Ores. George L. Fogler, Pittsburg, Penn., assignor to Fogler Heat and Reduction Company, Tacoma, Wash., a Corporation of Washington. (U. S. No. 908,234; Dec. 29, 1909.)

ROLLING-MILLS—Roll for Rolling-Mills. Evan Williams, New Castle, Penn. (U. S. No. 907,930; Dec. 29, 1908.)

TUYERE for Blast-Furnaces and Converters. Cyrus Robinson, Mount Vernon, N. Y. (U. S. No. 911,614; Feb. 6, 1909.)

MAGNESIUM

CASTING—Preparing Magnesium and Alloys Thereof for Casting. Paul Rakowicz, Griesheim-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany. (U. S. No. 906,-820; Dec. 15, 1908.)

RARE METALS

THORIUM—Art of Treating Orea. Robert McKnight, Pittsburg, Penn. (U. S. No. 912,-485; Feb. 16, 1909.)

TITANIUM ALLOYS—Process of Making Titanium Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, New York, N. Y., a Corporation of West Virginia. (U. S. No. 910,-894; Jan. 26, 1909.)

TIN

DETINNING—Apparatus for Detinning Tin-Scrap. Meredith Leitch, Elizabeth, N. J., assignor by mesne assignments, to Metal Process Company, a Corporation of New York. (U. S. No. 906,726; Dec. 15, 1908.)

DETINNING—Improvements in, or Relating to Apparatus for Removing Tin from Tin Plate Waste. Dr. Heinrich Brandenberg, Kempen-on-Rhine, Germany. (Brit. No. 2322 of 1908.)

ZINC

EXTRACTION PROCESS—Improvements Relating to the Extraction of Zinc from Ores of one-half to George W. Hunley, Garnett, Kan. (U. S. No. 909,928; Jan. 19, 1909.)

EXCAVATING SHAFTS, ETC.—Process for Excavating Shafts, Tunnels and the Like. Friedrich Koepe, Bochum, Germany. (Brit. No. 20,788 of 1908.)

MINING METHOD—Method of Mining. William G. Anderson, Smuggler, Colo. (U. S. No. 906,765; Dec. 15, 1908.)

PROPS—Improvements in Mining Props. John H. Eickershoff, Düsseldorf, Germany. (Brit. No. 22,223 of 1908.)

SIGNALING—Improvements in Signaling Systems for Mines and the Like. George T. Plumb, Johannesburg, Transvaal. (Brit. No. 10,104 of 1908.)

TIMBERING—Improved Method of Walling, Timbering and Propping Mines. Friedrich Nellen, Essen on the Ruhr, Germany. (Brit. No. 14,273 of 1908.)

VENTILATING SYSTEM for Mines. John Quin, Houtzdale, Penn. (U. S. No. 911,523; Feb. 2, 1909.)

ORE DRESSING

AGITATOR. David H. Sherman, Los Angeles, Cal. (U. S. No. 912,628; Feb. 16, 1909.)

CLASSIFIER. Charles W. Merrill, Lead, S. D. (U. S. No. 907,387; Dec. 22, 1908.)

CONCENTRATION—Apparatus for Concentrating Ores. Walter M. Sanders, Marion, Ky. (U. S. No. 911,077; Feb. 2, 1909.)

CONCENTRATION—Improvements in Ore Concentrating and Separating Apparatus, Francis and Henri Dallemagne, Pasages, Spain. (Brit. No. 11,684 of 1908.)

CONCENTRATING-TABLE. Willis G. Dodd, San Francisco, Cal. (U. S. No. 908,758; Jan. 5, 1909.)

CONCENTRATORS—Actuating Mechanism for Concentrators. William L. Card and Frank S. Card, Denver, Colo., assignors to the Card Manufacturing Company, Denver, Colo., a Corporation of Colorado. (U. S. No. 907,736; Dec. 29, 1908.)

DISINTEGRATING APPARATUS—Apparatus for Disintegrating Ores and Other Materials. Harry W. Harding, New York, N. Y. (U. S. No. 908,861; Jan. 5, 1909.)

ELECTROMAGNETIC ORE-SEPARATOR. Thomas Charlton, Chicago, Ill., assignor of one-fifth to Robert L. Dorbandt and one-fifth to James H. Parker, El Paso, Tex. (U. S. No. 912,363; Feb. 16, 1909.)

FLOTATION PROCESS—Apparatus for Separating Ores by Flotation. Auguste J. F. de Bavay, Kew, Victoria, Australia. (U. S. No. 912,783; Feb. 16, 1909.)

GRINDING—Improvements in Grinding Machines for Minerals and Other Substances. Lawrence S. Burt, London. (Brit. No. 8955 of 1908.)

GRINDING MILLS—Improvements in Grinding Mills. Joseph Barr, Allentown, and William J. Montz, Ormrod, Penn. (Brit. No. 14,398 of 1908.)

MAGNETIC SEPARATION—Improvements in, and Relating to Magnetic Separating Machines. The Rapid Magneting Machine Company, Ltd., Herbert H. Thompson and Alfred E. Davies, Birmingham, Eng. (Brit. No. 2203 of 1908.)

ORE-CONCENTRATOR. Ulysses S. James, Newark, N. J., assignor, by direct and mesne assignments, to James Ore Concentrator Company, a Corporation of New Jersey. (U. S. No. 906,433; Dec. 8, 1908.)

ORE-FEEDER. Thomas M. Topp, San Francisco, Cal. (U. S. No. 910,097; Jan. 19, 1909.)

ORE-GRINDING MACHINE. George A. Denny, London, England. (U. S. No. 909,286; Jan. 12, 1909.)

ORE SEPARATION—Improvements in Ore Separating Processes. Marcus Ruthenburg, Lockport, N. Y. (Brit. No. 28,191 of 1907.)

ORE SEPARATORS — Improvements in Centrifugal Ore Separators. Philip F. Peck, Chicago, Ill. (Brit. No. 3683 of 1908.)

ORE-TREATING MACHINE. John W. R. Laxton, Lynn, Mass. (U. S. No. 909,429; Jan. 12, 1909.)

SCREEN—Oscillating Screen for Ore and Other Materials. Albion B. Colcord, Kokomo, Colo., assignor to Robert B. McConney and Charles L. Buckingham, Denver, Colo. (U. S. No. 911,113; Feb. 2, 1909.)

SCREEN—Rotary Screen for Ores and Other Materials. Howard G. King, Denver, Colo. (U. S. No. 905,323; Dec. 1, 1908.)

SEPARATION—Improved Apparatus for Separating Metals and the Like from Extraneous Matter. Richard M. Simpson, Wellington, N. Z. (Brit. No. 16,663 of 1908.)

SEPARATION PROCESS—Improvements in Apparatus for More or Less Completely Separating Subdivided Solid Matter from a Liquid. Particularly Applicable for Thickening Ore Pulp and for Feeding or Measuring the Pulp or Solid. Francis E. Elmore and Alexander F. Elmore, London. (Brit. No. 26,821 of 1907.)

STAMP MILLING—Improvements in Ore Feeders for Stamp Mills and the Like. Arthur H. P. Fitzpatrick, Chester, Eng. (Brit. No. 14,585 of 1908.)

METALLURGY—GENERAL

ALLOY of Iron and Nickel with Vanadium Carbide. Walter Rühel, Hamburg, Germany. (U. S. No. 906,937; Dec. 15, 1908.)

ORE ROASTING—Method of Roasting Ores. Henry K. Hess, Philadelphia, Penn. (U. S. No. 912,568; Feb. 16, 1909.)

SMELTING—Improvements in the Metallurgic Treatment or Smelting of Ores and Other Materials. Kristian Birkeland, Christiania, Norway. (Brit. No. 913 of 1908.)

MINING MACHINERY AND APPARATUS

BORE HOLES—Device for Ascertaining the Deviation of Bore Holes. Louis Gerhardt Nordhausen, Germany. (Brit. No. 11,628 of 1908.)

BORE HOLES—Improvements in, or Relating to Device for Determining the Deviations of Bore Holes from the Vertical. Karl Haussmann, Aix-la-Chapelle, Prussia. (Brit. No. 3068 of 1908.)

CANDLESTICK—Miner's Safety-Candlestick. Frederick Muenger, Hill City, S. D., assignor of one-half to Camillo von Woehrmann, Hill City, S. D. (U. S. No. 906,449; Dec. 8, 1908.)

CENTRIFUGAL PUMPS — Improvements in, or Relating to Centrifugal Pumps. James T. Hossiter, London. (Brit. No. 21,584 of 1908.)

CONVEYER-BELT SUPPORT. Edwin E. Vrooman, Hyattsville, Md., assignor, by direct and mesne assignments, of one-half to John J. Ridgway, Chicago, Ill., and one-half to Edward G. Thomas, Brookline, Mass. (U. S. No. 909,833; Jan. 12, 1909.)

CRUSHING MACHINES—Improvements in Machines for Crushing Stone and Other Hard Substance. Saxon Engineering Company, Ltd., Saxon Iron and Steel Works and Edward G. P. Bousfield, Fenton, Eng. (Brit. No. 25,536 of 1907.)

DREDGE—Suction-Dredge or the Like. Franklin H. Jackson, Berkeley, Cal., assignor to Byron Jackson Iron Works, West Berkeley, Cal., a Corporation of California. (U. S. No. 906,234; Dec. 8, 1908.)

DREDGES — Suction-Mouthpiece for Dredges. Horace J. Clark, Chicago, Ill., assignor to Clark Dredge Manufacturing Company, Chicago, Ill., a Corporation of Maine. (U. S. No. 909,062; Jan. 5, 1909.)

DRILL-HOLE-CLEANING ATTACHMENT for Hammer-Drills. Daniel S. Waugh, Denver, Colo., assignor to the Denver Rock Drill and Machinery Company, Denver, Colo. (U. S. No. 907,430; Dec. 22, 1908.)

DRILLING—Core-Drilling Apparatus. Coleman A. Terry, New York, N. Y. (U. S. No. 904,161; November 17, 1908.)

DRILLS—Improvements Relating to Hammer Drills. George H. Rayner, Sheffield, and Cecil Walton, Moresby, Whitehaven, Eng. (Brit. No. 27,371 of 1907.)

DRILLS—Improvements Relating to Miners' Drills. The Hardy Patent Pick Company, Ltd., Heeley, and Mark Wainwright, Sheffield, Eng. (Brit. No. 10,503 of 1908.)

DYNAMITE-HEATER. Alexander H. Vannauker, Hazleton, Penn. (U. S. No. 911,463; Feb. 2, 1909.)

MINE-CAR PEDESTAL. John R. Roberts, Wilkes-Barre, Penn. (U. S. No. 905,000; November 24, 1908.)

MINERS' CANDLESTICK. Benjamin F. Kelly, Salt Lake City, Utah. (U. S. No. 910,390; Jan. 19, 1909.)

MINERS' CANDLESTICKS—Attachment for Miners' Candlesticks. Sanford M. Thurman, Los Angeles, Cal. (U. S. No. 908,821; Jan. 5, 1909.)

MINERS' DRINKING CANS — Improvements in, or Relating to Miners' Drinking Cans. Marks Gerecick, Cardiff, Wales. (Brit. No. 9252 of 1908.)

MINERS' SAFETY-LAMP. Ernest A. Hallwood, Morley, England. (U. S. No. 908,765; Jan. 5, 1909.)

PICKS—Improvements in Miners' and Like Picks. Arthur Roughley, Syennymoor, Eng. (Brit. No. 2772 of 1908.)

ROCK-DRILL. John H. Huhn, Fairmont, W. Va., assignor of one-half to John R. Steel, Barrackville, W. Va. (U. S. No. 904,436; November 17, 1908.)

ROCK-DRILLING MACHINES—Improvements in Rock-Drilling Machines. Henry Ball, John Ball and Robert Airth, Knights, Transvaal. (Brit. No. 9064 of 1908.)

ROCK-DRILLING TOOL. Hugh G. Williams, Granville, N. Y., assignor of one-half to Samuel F. Culbertson, Baltimore, Md. (U. S. No. 912,925; Feb. 16, 1909.)

ROCK DRILLS—An Improved Chuck for Rock Drills. Jabez H. H. Bunt, Penzance, Eng. (Brit. No. 25,002 of 1907.)

ROCK DRILLS—An Improved Valve for Rock Drills and Analogous Reciprocating Appliances. George H. Rayner, Nether Edge, Sheffield, Eng. (Brit. No. 20,989 of 1908.)

SAFETY APPARATUS for Mine-Railways. Norval W. Dickerson, Derwent, Ohio. (U. S. No. 911,298; Feb. 2, 1909.)

SAFETY-LAMP. Nickolas B. Ippolito, Pittsburg, Penn. (U. S. Nos. 909,415 and 909,416; Jan. 12, 1909.)

SAFETY LAMPS—Igniting Device for Miners' Safety-Lamps. Ferdinand A. Wicke, Barmen, and Rudolf Gartenmeister, Elberfeld, Germany. (U. S. No. 908,432; Dec. 29, 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps. Ernest A. Hallwood, Morley, Eng. (Brit. No. 25,596 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps, Especially Suitable for Use in the Underground Workings of Mines and in the Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 27,140 of 1907 and 24,414 of 1908.)

STEAM DRILLING—Steam-Motor for Operating Tools in Drilling-Rigs. Frank S. Barkelew, Los Angeles, Cal., assignor to the California Steam Drilling Rig Company. (U. S. No. 12,904; Reissue, Dec. 29, 1908.)

TUNNELING-MACHINE. Charles A. Case, New York, N. Y., assignor to Case Tunnel and Engineering Company, New York, N. Y., a Corporation of Arizona. (U. S. No. 910,500; Jan. 26, 1909.)

TUNNELING MACHINES — Improvements in Rotary Tunneling Machines. Russel B. Sigafoos, Denver, Colo. (Brit. No. 6916 of 1908.)

METALLURGICAL MACHINERY AND APPARATUS

ELECTRIC FURNACES—Improvements in, and Relating to Electric Furnaces. Communicated from the General Electric Company, Schenectady, N. Y. (Brit. No. 23,071 of 1908.)

ELECTRIC FURNACES—Improvements in, and Relating to Electric Furnaces. Antoine H. Imbert, Grand Montrouge, Seine, France. (Brit. No. 17,281 of 1908.)

ELECTRIC FURNACES—Improvements in, or Relating to Electric Furnaces. Charles A. Keller, Paris, France. (Brit. No. 21,741 of 1908.)

ELECTRIC FURNACES — Improvements in, or Relating to Electric Furnaces. Hans Nathsius and Westdeutsche Thomasphosphatwerke Gesellschaft, Berlin. (Brit. No. 7923 of 1908.)

FURNACE—Universal Ore-Treating Furnace. Chauncey C. Medbery, New York, N. Y. (U. S. No. 912,394; Feb. 16, 1909.)

FURNACE - CHARGING MECHANISM. David Baker, Philadelphia, Penn. (U. S. No. 909,049; Jan. 5, 1909.)

FURNACE GRATES—Improvements in, and Relating to Furnace Grates. Heinrich Uthlieb, Cassel, Germany. (Brit. No. 23,350 of 1907.)

FURNACE GRATES—Improvements in Furnace Fire Grates. Albert Jones and the Trimsaran Company, Ltd., Trimsaran, Kidwelly, South Wales. (Brit. No. 23,208 of 1907.)

HOIST FOR FURNACES—Bottom-Door Hoist for Furnaces of Cupolas. James Hyslop, Harvey, Ill., assignor to Whiting Foundry Equipment Company, Harvey, Ill., a Corporation of Illinois. (U. S. No. 911,726; Feb. 9, 1909.)

HYDROMETALLURGICAL APPARATUS—Mobile Hydrometallurgical Apparatus. Hiram W. Blaisdell and Joseph R. Brown, Los Angeles, Cal., assignors to Blaisdell Company, Los Angeles, Cal., a Corporation of California. (U. S. No. 907,309; Dec. 22, 1908.)

MOLD—Water-Cooled Mold for Receiving Supermolten Metal from an Electric Furnace. George O. Seward, Holcombs Rock, Va., assignor to Virginia Laboratory Company, New York, N. Y., a Corporation of New York. (U. S. No. 905,373; Dec. 1, 1908.)

ORE TREATMENT—Improvements in, or Relating to the Treatment of Ores for the Extraction of Metals Therefrom. Hugues Rosalt, Paris. (Brit. No. 25,357 of 1907.)

PRECIPITATING APPARATUS. John E. Greenawalt, Denver, Colo. (U. S. No. 906,011; Dec. 8, 1908.)

REDUCTION-FURNACE. Charles Van Brunt, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York. (U. S. No. 903,922; November 17, 1908.)

RETORT-FURNACES — Improvements in or Relating to Retort Furnaces and the Like. Hans Ries, Munich, Germany. (Brit. No. 8370 of 1908.)

ROTARY KILN. Manfred G. Semper, Weferlingen, Germany. (U. S. No. 909,464; Jan. 12, 1909.)

SMELTING-FURNACE Heated with Oil and Having Two or More Chambers Acting Alternately as Smelting or Preliminary Heating Chambers. (August Hock, Hanover-List, Germany. (Brit. No. 17,687 of 1907.)

SMELTING FURNACES—Improvements in, and Relating to Smelting Furnaces. Herbert F. Höveler, Merton Abbey, Eng. (Brit. No. 23,997 of 1907.)

TAP-SPOUT for Smelting-Furnaces. Frederick D. Gross, Denver, Colo., assignor of one-half to Colorado Iron Works Company, Denver, Colo. (U. S. N. 910,371; Jan. 19, 1909.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

There is a vacancy on the editorial staff of the JOURNAL open to a young mining engineer, who should have had some literary experience. Candidates are requested to call in person.

S. W. Mudd has returned to Los Angeles, California.

Wm. C. Ralston, of San Francisco, has been a visitor in New York.

S. F. Shaw, of Pasadena, Cal., is examining mines in Cochise county, Arizona.

J. W. Bryant, of Victoria, B. C., one of the Tyee Copper Company's mining engineers, is in Mexico.

Dr. William B. Phillips, of Birmingham, Ala., is examining iron-ore properties in Llano county, Texas.

E. B. Stahlknecht has established an office as consulting mining engineer at Torreon, Coahuila, Mexico.

John T. Fuller, Little Rock, Ark., has been appointed general manager of the Arkansas Diamond Company.

H. C. Hoover has returned from California and will shortly begin his course of lectures at Columbia University, New York.

Mortimer B. Fuller has been elected president of the International Salt Company, to succeed his father, the late E. L. Fuller.

George Stilwell, superintendent of the Hewitt mine, Silverton, Slocan district, B. C., has gone to England for two months.

Charles Briggs, president of the Calumet & Arizona Copper Company, of Bisbee, Arizona, is seriously ill at his home in Calumet, Michigan.

George M. Bloomer, manager of the Alamos Mines Corporation, Alamos, Sonora, Mexico, is in New York on business connected with the mines.

G. Harold Grant will shortly leave Victoria, B. C., on a professional visit to Japan. He may also go to Korea before returning to British Columbia.

Henry M. Adkinson has returned to Denver from a three weeks' trip of inspection to the properties under his management at Telluride, Colorado.

T. F. Cole, president of the Oliver Iron Mining Company, has been chosen to represent Minnesota on the reception committee to serve at the coming inauguration of President-elect Taft.

Frank Van Orden, superintendent of the Wyandot Copper Company in the Lake Superior district, has returned to the property after an extended visit to the Globe district in Arizona.

Allan Edyvean, formerly superintendent of the Arcadian stamp mill, has been appointed to take charge of the erection of the new Winona-King Phillip stamp mill in the Lake Superior copper district.

Edward G. Acheson, president of the International Acheson Graphite Company, of Niagara Falls, N. Y., has had the degree of doctor of science conferred upon him by the Western University of Pennsylvania, of Pittsburg.

H. H. Dyer, for five years past, superintendent of mines of the Shannon Copper Company, at Metcalf, Ariz., has resigned that position, to take effect March 1, and will open an office at Los Angeles, Cal., as consulting mining engineer.

Obituary

Edward Myers, formerly in charge of the Combination Fraction, at Goldfield, and recently operating a mine in the Gold Crater district, shot himself at Goldfield, Nev., Feb. 19, dying in a very short time.

J. H. Blanchard, a prominent mining engineer and operator, of Goldfield, Nev., died suddenly Feb. 11. At the time of his demise, Mr. Blanchard was operating the Combined Mining and Leasing Company, and the Grizzly Bear lease on the Consolidated ground.

John D. Bailey, who died in Pittsburg, Jan. 17, was born in that city in 1826. He was for a number of years connected with the Wayne Iron Works, and had charge at one time of the manufacture of the plates used on the ironclad vessels built for river service during the Civil war. Later he was prominent as an oil operator, and for some time was superintendent of the Chartiers Valley Gas Company. For many years past he had been a member of the Pittsburg Oil Exchange.

Carroll D. Wright died in Worcester, Mass., Feb. 20. Born in New Hampshire in 1840, he received a fair education in local schools. After serving with credit through the Civil war he began the practice of the law in Boston and also served two terms in the State Senate. In 1873 he was appointed chief of the Massachusetts Bureau of Statistics of Labor, and his intelligent and careful work in that position soon attracted attention. Before long his reports on labor questions were accepted as high authority. When the United States Bureau of Labor was established in 1885, Colonel Wright was appointed the first commissioner, and he held the position until 1905, a period of 20 years, during which his work was maintained at the same high standard which had marked it in Massachusetts. At different times he was called on to deliver special courses of lectures at Harvard University, at Oxford University, at Berlin, Heidelberg and elsewhere. He was also at different times president of the American Statistical Association and the American Association for the Advancement of Science. He was a member of many foreign societies. In 1902-3 he served as a member of the Anthracite Strike Commission, and his influence and advice did much toward securing the settlement reached by the commission. In 1905 Colonel Wright resigned his position as commissioner of labor, and was chosen president of Clark University at Worcester, Mass., but failing health prevented him from taking as active a part in that position as he might otherwise have done. His literary work is found mainly in his yearly reports.

Societies and Technical Schools

Canadian Mining Institute—The preliminary program for the annual meeting at Montreal provides for three sessions on each day of the meeting. On Wednesday, March 3, the morning session will be the business meeting, at which the reports of the officers and council will be presented. The afternoon and evening sessions will be devoted to reading and discussion of papers. On Thursday, March 4, the morning session will be devoted to the reading of papers. In the afternoon there will be one executive session to consider proposed amendments to the by-laws and in the evening a smoking concert.

On Friday, March 5, the morning session will be devoted to papers and discussions; the afternoon to any unfinished business which may remain. In the evening the meeting will close with the annual dinner.

College of the City of New York—Prof. Charles Baskerville, director of the Department of Chemistry, which has excellent laboratory and other facilities, gives notice that a special course in physical chemistry is offered to properly qualified persons. The course which is given by Dr. Leo Frank Guttmann, instructor in physical chemistry, involves 15 lectures Wednesday afternoons, accompanied by laboratory practice on Thursdays. The lectures, which begin Feb. 24, will cover the following topics: Introductory and Theoretical Foundations; Changes of State and the Kinetic Theory; Thermal Chemistry; the Phase Rule; Relation between Physical Properties and Chemical Constitution; Solutions and Osmotic Pressure; Atoms and Radioactivity; Faraday's Law and Electrolytic Transport; Influence of Mass and Temperature on the Progress of Reactions; Applications of Dissociation Theory; Electromotive Force. The laboratory work includes experimental verification of the above principles. The only expense attached is the actual cost of chemicals used and breakage.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Goldfield, Salt Lake City, Denver, London and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 17—The gold-dredging men have taken a leaf out of the hydraulic miner's book by adopting the use of water under pressure through nozzles to break down cemented banks into the dredge buckets and have greatly expedited their work thereby. Indeed, they are now increasing the size of the giants. They at first used 4-in. giants, but are now adopting 6-in. ones. By the use of three-step centrifugal pumps they get about 160 ft. head of water for use against the cemented banks. Two streams are kept playing, one on each side of the digging end of the bucket ladder, and these are moved as the ladder and line of buckets move, so as to play close to the buckets in the banks. The plan is quite effective where the gravel is at all cemented. And now some of the hydraulic miners of Trinity county are going to adopt a dredge to assist their operations. The higher banks will be piped as usual, and, as a supplementary appliance, a dredge will be installed to work the low benches of the hydraulic property. This is quite a concession to the cheapness of dredge work, for hydraulic mining has usually been considered the cheapest method of gaining gold. However, late work of large and heavy dredges is showing a very low cost, especially when the machines are new and repairs not necessary.

E. O. Miller, of Visalia, has brought suit against the Edison Electric Company, of Los Angeles, for damages to his mining claim in the upper Kern river cañon, by the erection of the electric company's big dam. Senator Miller's Hard Rock claim embraces the entire channel of the river and a strip on each side. The dam erected below the claim flooded it to such a depth that mining for gold is no longer possible. Hence the suit.

Attention is again being called to the deposits of chrome iron in Humboldt and Del Norte counties. One large deposit in the latter county was worked years ago and shipments made through Crescent City, but the expense of transportation was found to be too high for profitable working, and nothing has been done for the past 10 years. The deposits are owned by Philadelphia people. There are known to be several good sized deposits in the neighborhood of Bear river and in the Horse mountain copper district, near Willow creek, in Humboldt county. The Bear river deposit appears to be now coming into notice owing to the nearness of the new shipping point established at the mouth of the Mattole river.

State Senator Caminetti, who, when in Congress was the author of the act establishing the California Débris Commission, has a bill in the legislature which has been reported favorably, in relation to caring for hydraulic mining débris. The bill calls for the appointment of a consulting board of five members to the department of engineering who shall devise plans for preventing débris from mining or other causes from encroaching on navigable streams or the lands adjacent thereto; to select sites for settling reservoirs and storage of débris; to inspect hydraulic mines and pass upon their methods of storing débris; to determine the effect of hydraulic mining carried on by or under permission of the California Débris Commission; to construct restraining barriers and dams and other works as may be authorized by law jointly with the United States government. Three of the members of this consulting board are to be actively engaged in gravel mining in the hydraulic mining regions.

Goldfield, Nevada

Feb. 16—It is reported that George Wingfield is working on a consolidation to include the Booth, Columbia Mountain, Nighthawk, Ethel, Oro, Kewanas and Berkeley companies. The sums in the treasuries of the various companies would give a working capital of over $70,000 to the merger company, and the property would contain more than 300 acres of mineral ground adjoining the Consolidated on the north.

On March 1 the case between the Goldfield Consolidated and the Frances Mohawk Leasing companies will come to trial before Judge Stevens, of the District Court. The amount involved is $125,000 and arises from the contention of the Consolidated company that the mining operations of the leasing company were not performed in a miner-like fashion and that the workings were left in a dangerous condition due to the robbing of the mine. When the leasing company deposited $125,000 in a local bank some time ago, the Consolidated company filed a damage suit and attached the funds, whereupon the leasing company furnished bonds for the release of the same; this was contested in turn by the parent company which questioned the responsibility of the sureties.

A Tonopah miner was arrested in that city last week charged with high-grading from the Broken Hills mine, where he had been employed. A search of the quarters occupied by the prisoner disclosed about 600 lb. of rock averaging $3 per pound. High-grading has been suspected by the management for some time, and it is thought that the arrest will lead to the detection of several others similarly implicated.

Ore shipments from Tonopah for the week ending Feb. 13 were: Tonopah Mining Company, 3200 tons; Montana Tonopah, 640; Tonopah Belmont, 700; Jim Butler, 250; MacNamara, 200; Tonopah Midway, 100; and West End 100 tons, having a total estimated value of $130,000.

A deal was recently closed in the Pioneer district whereby E. S. Giles and W. B. Milliken assume control of the Indiana group. The new owners have started a working shaft about 200 ft. distant from the main shaft of the Pioneer. A hoisting plant will soon be installed. The Mayflower mill is now practically completed and on the arrival of the pump will be placed in commission.

The first dividend to the employees of the Ophir and Consolidated Virginia companies at Virginia City was paid Feb. 11. The dividend, amounting to $1956, was for the last three months and was divided among the employees according to their wage-earning capacity. This is an innovation in Nevada and its operation will be watched with interest.

Salt Lake City

Feb. 19—The Conkling Mining Company has filed supplemental proceedings in the Federal court against the Silver King Coalition Mines Company. The Conkling affidavit states that the King company shipped 14,400 tons of ore worth about $40 per ton, or a total of $576,000, besides 18,720 tons of concentrating ore, which when treated gave 6240 tons of concentrates valued at $40 per ton or $249,600. This gives a total gross value of $825,600. The cost of mining, milling, etc., is given at $421,440, leaving an alleged net value of $404,160 said to have been taken from the Elephant stope. The Conkling company, owning three-fourths interest in the ground, in which the Elephant stope is said to be, brings suit for $303,120. Mr. Treweek states that the Conkling company will sink a three-compartment shaft on the Conkling claim and expects to strike the ore near or over the Elephant stope at a depth of approximately 850 feet.

It is rumored that the United States

Smelting, Refining and Mining Company is trying to purchase the Knight smelter and the Colorado mine at Tintic.

Another test run of the Fink smelter will be made at Garfield as soon as Mr. Fink returns. Heretofore, coal was employed as fuel, but in the coming test oil will be used.

On account of the heavy storms, the Utah Copper Company has been experiencing considerable difficulty in getting ore transported between the mine and the mill at Garfield. The company will probably build a line of its own in the near future.

The annual report of the Ohio Copper Company for the year ending Jan. 1, 1909, which was published this week shows the following: Assets—Development, $75,151; mine surface equipment, $33,645; mining properties, $11,257,625; Columbia shaft, $38,142; treasury bonds, $129,000; treasury stock, $1,797,500; accounts receivable, $5317; construction concentrator, $778,034; cash, $60,540; miscellaneous, $19,538; total, $14,194,492. Liabilities—Capital stock issued $13,000,000; first-mortgage bonds, $1,000,000; accounts and bills payable, $194,492; total, $14,194,492. Authorized capital, 1,500,000 shares; held for conversion of bonds, 200,000 shares; $2,000,000 bonds are authorized, but only one half issued.

A body of low-grade ore was cut last week by the east drift of the Iron Blossom, about 140 ft. east of the north shaft. A raise from this drift has developed 15 ft. of black carbonate ore, high in lead and carrying considerable silver. This strike in the Iron Blossom made Feb. 15 the biggest day on the Salt Lake Stock Exchange since last June. This stock, which sold at $2.80 on Feb. 13, went as high as $3.25, and nearly 25,000 shares were sold. On the same day, 180,000 shares of Tintic Central sold at 20 to 25c. During the day 464,764 shares, having a value of $100,327, were sold. With the Iron Blossom stock selling at its present price, the property is worth about $3,200,000.

The Tintic ore shipments for the week ending Feb. 12 were: Centennial Eureka, 46 carloads; Eureka Hill, 5; Yankee, 2; May Day, 2; Eagle and Blue Bell, 1; Bullion Beck, 2; Sioux Consolidated, 15; Iron Blossom, 2; Ajax, 2; Dragon Iron, 23; Colorado, 20; Brooklyn, 6; total, 126 carloads.

Butte

Feb. 18—E. F. Frisbie, president of the Raven Copper Company, in a circular letter to stockholders, has placed the critical position of the company before them and has made a further appeal for subscriptions for the 63,000 shares recently offered. In the letter he states that unless a better showing is made by the stockholders by Feb. 24, the money already subscribed will be returned and the property closed down permanently until a plan of reorganization can be perfected. At the continued hearing of the case of Bliss against the Anaconda Copper Mining Company, held before Judge Hunt at Helena last Monday, the possibility of further abating the injurious effects of the Washoe smelter fumes was taken up. Superintendent Matthewson and J. R. Faulding, a chemical engineer from New York City, gave testimony on behalf of the company to the effect that the methods now employed by the smelter were the most advanced known to science and that the installation of any other method would mean the expenditure of several millions of dollars with merely problematical results. Further hearing was adjourned until Feb. 19.

At a recent meeting of directors of the Butte-Montana company, held in Pittsburg, an offer of Duluth capitalists to finance the company was favorably considered and the plan will now be put up to the stockholders. The plan contemplates the purchase by the Butte Alex Scott company of the property of the Butte-Montana in exchange for 50,000 shares of the former company's stock. The Butte-Alex Scott company is a Delaware corporation with a capital of $1,250,000, divided into shares of the par value of $10 each. In addition to giving the Butte-Montana company 50,000 shares of stock the Butte-Alex Scott company will also agree to pay off all indebtedness of the old company.

Deadwood, S. D.

Feb. 20—Notwithstanding the severity of the winter, mining and milling in the Black hills has been little affected. The North Homestake Company has temporarily suspended operations. It is generally reported that a change will be made in the method of ore treatment. The Gilt Edge Maid has also closed down, awaiting the completion of financial arrangements for enlarging the mill. The large slime tonnage handled by the Homestake company is soon to be increased by the addition of two new Merrill presses. The addition being made to the building will accommodate four presses, which should increase the total capacity to above 2000 tons.

The Golden Reward Mining Company is installing Moore filters for the treatment of the slimes. The present treatment is: Gates crusher to rolls, to Chilean and Huntington mills, to classifiers. The sand from the classifiers goes to leaching vats, and slime is treated partly in a Chamberlin press and partly by decantation. In the remodeled mill the slimes will go to a Dorr thickener, from which the underflow will go direct to the Moore filters. Stearns, Roger & Co., of Denver, Colo., are putting in the new equipment. The Moore process of filtration will also be used in the new mill now under construction for the Golden Crest Mining Company. Here the pulp from the stamps will go to the Dorr classifiers, the sand being reground in tube mills; the tube mill discharge joining the slime overflow from the classifiers, will go to Dorr thickeners, from which the underflow will be agitated by a Gordon worm. The feed from the latter will flow direct to the Moore filters.

Denver

Feb. 20—Work in the tungsten belt in Boulder county seems to be increasing, but operators in general appear to be awaiting the action of Congress on a revision of the tariff, and a hoped-for duty to be imposed on foreign imports of that metal. The fight for the control of the Daly-West mine at Park City, Utah, which has been waged in Denver for some days past, between McCornick, the Salt Lake banker, and his friends, and J. J. Daly, the discoverer, and his friends among the Cincinnati stockholders, has resulted in defeat for the Daly party, and the old management remains in control. Charges and countercharges of mismanagement and fraudulent intent were freely made on both sides. It was stated that there is $320,000 in the operating fund, and that owing to the low price of silver and lead, no dividend was paid last year—the first time in nine years that a dividend has not been declared.

There is now a good deal of activity in what is known as the Rangely oil district, in Raven Park, Rio Blanco county, and on the projected line of the Denver, Northwestern & Pacific railway, now under construction. Some years ago six test wells were drilled, and oil was struck in several of these wells, which were put down as deep as 2000 ft., and have 200 ft. of oil in them, and of such fine quality that the people in the vicinity burn it in their lamps instead of buying refined oil. Owing to the then uncertainty of a railway, and other causes, work ceased. Now, however, the Gilson Asphalt Company has a drill in there, with a capacity of 6000 ft. depth, and a private syndicate of Vernal, Utah, men has installed a drill with a 2500-ft. capacity, commencing operations on Jan. 19, and are now down 1000 ft. The activity in railway construction in this part of the West is the stimulus for these and many other mining operations.

Indianapolis

Feb. 22—The prospects for a good summer's work at the mines in the Jasonville field was never brighter than at the present time. It is stated that the Lattas Creek, Island Valley and Bogle mines, three of the largest in the field, have closed contracts for sufficient orders to

keep the mines running at full time for at least four months.

An important sale of mining property in Greene county was closed by the transfer of 560 acres in Stafford township to a Chicago syndicate. The land is underlaid with a 4½-ft. vein of the best coal that has been discovered in the Linton district for several years.

The coke ovens at Black creek mine in Greene county will soon be placed in operation. Fires have been kindled in the ovens, and it is asserted that a big contract for coke for Gary is promised if the product proves satisfactory.

Victoria, B.C.

Feb. 16—A bill was recently introduced into the provincial legislature of British Columbia with the object of protecting miners and other wage earners against a class of men, chiefly foreigners, who obtain options or working bonds on mining properties, employ men to do work, and then fail to pay them. The bill required such an operator to obtain from a responsible banker a certificate that he had on deposit in the bank sufficient money to pay two months' wages to the men he employed. While the government admitted that in some cases men were defrauded of their wages by irresponsible operators, in the way indicated by the supporters of the bill, it was not deemed advisable to pass the legislation asked for, since it could be carried to extremes, for it should not be applied to miners only, but to all classes of labor. Other serious objections were also raised to the measure, which was voted down by a vote of 22 to 13.

An attempt made by a socialist member of the provincial legislature of British Columbia to secure the enactment of a measure providing for the extension of the provincial eight-hour law, which limits the work of miners underground to eight hours per day, so as to apply to men working in open-pit mines, has been defeated. The premier, who is also minister of mines, argued, first, that there does not exist a general demand throughout the province for the enactment of the proposed amendment to the existing law, and, second, that it is not necessary for the physical protection, as had been claimed it is, of any large number of men. The socialists, the premier added, would like to have the eight-hour law made applicable to all phases of industry, which would greatly retard industry in the province. Particularly with the mining industry, as proposed in this instance, would it prove a drawback, and that industry, owing among other things to the considerable fall in the price of copper, needed encouragement rather than more restrictive legislation. Under the circumstances, therefore, it was necessary for the provincial government to move slowly in making changes. The bill was rejected by a vote of 23 to 14.

London

Feb. 13—During the six months ending Dec. 31, 1908, the report of the Dolcoath mine, Cornwall, shows that there were raised and milled 49,869 tons of tin ore, producing 902 tons of black tin or 40.52 lb. per long ton. The average price of black tin during this period was £77 17s. 2d., and the amount realized £70,238. The average receipts per ton of ore were 28s. 11d., and the total working costs 24s. 8d. per ton. The lords' royalties amounted to 1s. 11d. per ton, so that the company's net profit amounted only to 2s. 4d. per ton, or a total of £5891.

Some good ore is being met with at the bottom of the mine, a depth of 2940 ft.

The new vertical shaft being sunk to cut the lode at the 490-fathom level was down 2274 ft. at the close of the year, when there were still 666 ft. to sink. During the last six months the rate of sinking has been only 42 ft. per month, owing to trouble with water. Progress had been previously at the rate of 60 ft. per month. The cost of sinking during the last six months has averaged £30 per foot. The scheme of equipment for the new shaft has not yet been finally decided on, but it is understood that the pumping and hoisting plant will be electrically driven. To meet the capital expenditure required to complete the shaft the company has over £50,000 in cash or investments. The company's issued capital is £340,000 in £1 shares, which are valued today in the market at about 15s. Deducting the cash reserve, the mine may be said to be valued at £200,000.

If this is a fair value for the most famous mine in Cornwall, which is making some profits, and which promises to do much better in the future on account of the facilities for cheaper working that the new vertical shaft will afford, one wonders how it is that people can be found to buy shares in undeveloped mines in the same locality capitalized at double the amount. Yet at the present time business is being done, at prices that make the property far more valuable than Dolcoath, in the shares of a company that has acquired some of the old tin mines in the St. Ives district. The foundation of the boom in these particular mines is the occurrence of pitchblende, the radium contents of which are in some vague way to bring immense riches to the shareholders. How much pitchblende there is and what its commercial value is are questions that those who are buying the shares at high prices do not apparently stop to inquire. They must not, therefore, be surprised to find some years hence that mining for radium is not so profitable a business as the company promoter would have them believe.

Paris, France

Feb. 5—The government of the Régency of Tunis is going to receive bids for the last portions of the line of the Nefzas. This line—length 75 km.—will secure an outlet on the Bizerta harbor for the rich iron mines of Kroumirie. The concessions, covering 5437 hectares, belong to the Compagnie des Mines de Fer de la Kroumirie et des Nefzas, which was promoted in 1906 by the Compagnie de Mokta-el-Hadid and the Compagnie des Mines de Fer des Nefzas. The mines were discovered early in the French occupation, but the presence of arsenic, though in small quantity (0.07 per cent. on an average) for a long time prevented their opening. They are mostly workable by open pit, rich, generally above 55 per cent. iron, and free from sulphur. They consist of very irregularly shaped lenses of partly hydrated silicious hematites, having generally an interstratified appearance, under the upper Eocene sandstone and over marl deposits of the same age. These ores will secure a return freight for the steamers that supply the important military harbor of Bizerta with coal. The absence of sulphur and phosphorus makes them compare favorably with the Bilbao ores.

The Nefzas line will also serve important concessions of zinc and lead, especially the Djebel-el-Grefa, belonging to the Compagnie Royale Asturienne des Mines. The ore appears as clayey lead carbonate of an almost constant average of 10 to 12 per cent., cementing together beds of conglomerates resting on Trias and of a thickness ranging between 100 and 200 m. The concentrating plant now erected has a capacity of 200 to 220 metric tons of ore per 24 hours.

A company is being formed to work alluvial gravels and auriferous laterite in Vakinankaratria province, in Madagascar. This company proposes to use Turner gold-saving tables in place of the old-fashioned *batea*, or pan.

It is also reported from Madagascar that an English engineer, Mr. Burls, has just discovered bituminous deposits in the Mevatanana region, at 200 km. from the coast, which may be evidence of the presence of oil deeper down.

The Compagnie des Chemins de Fer du Congo Supérieur aux Grand Lacs Africains has discovered a chalcopyrite bed of high tenor at 7 km. from Pontierville station. The last steamers from the Congo brought over specimens of ore, the average yield of which is said to be 30 per cent. copper. The company has started prospecting to determine the importance of this bed.

The French Chambers are about to discuss the matter of the Ouenza iron mines, Algeria, belonging to a syndicate in which some important French, English and German firms are concerned.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

ETOWAH COUNTY

Quinn furnace at Gadsden is to be sold at public sale April 17. It has not been in blast for some time.

FRANKLIN COUNTY

Eureka Mining and Development Company—This company has sold its brown ore mines near Russellville to a syndicate represented by Henry B. McCormack, of Pennsylvania, for $180,000. The property consists of 420 acres of ore lands and two mines which can ship 500 tons daily.

JEFFERSON COUNTY

Woodward Iron Company—Contracts have been let for grading and stripping at No. 2 iron mine at Red Mountain. A large tipple and crushers will be put up and the shipping capacity increased to 1000 tons of ore daily; at present it is 500 tons.

California

AMADOR COUNTY

Central Eureka—The main shaft is now 2120 ft. deep. The bottom of the old caved shaft will be reached in about four months.

South Eureka—Twenty stamps of the Central Eureka Mining Company's mill are working ore from this mine. The ore is conveyed from mine to mill by electric overhead tramway.

BUTTE COUNTY

Francisco—A stamp mill will soon be installed at this property at Enterprise where a rich vein was found some months ago.

DEL NORTE COUNTY

Oro Del Norte—This company, Dr. T. R. Heintz manager, has purchased the Dowdle property on the ocean beach near Crescent City, and an electric plant for saving the gold from the black sands of the ocean beach will be installed.

EL DORADO COUNTY

Sherman—Handsome specimen rock is being taken from this mine, near Placerville. Thos. Clark is superintendent.

Union—M. L. Effinger, resident manager of the San Francisco company which recently took charge of this mine at El Dorado has kept 10 stamps running during January and will soon start up the other 10. This is a very old mine which has only been worked intermittently of late years.

HUMBOLDT COUNTY

David Minor has found a bed of talc 2 ft. thick at Glendale in the northern end of the county.

INYO COUNTY

Custer District—A new railroad is being built within 15 miles of this new mining camp, which is in the Argus range northwest of Death Valley and east of the Mohave desert. A great number of locations have been made and numerous prospectors have gone into the district in the past two months.

MONO COUNTY

Casa Diablo—The drifts which have followed the Dawn of Hope and Dry Bone veins have come together at about 300 ft. in from the tunnel. The ledge shows about 20 in. of good ore.

NEVADA COUNTY

Banner Ridge Drift—This company has been formed at Grass Valley with S. H. Dille as president and J. M. Wiley as secretary, to develop claims on the Wallace Macdonald ranch on Banner Ridge. There is already a hoisting and pumping outfit in place and an incline is being run to tap the gravel channel.

Brunswick—This company, with J. W. Pew as president, will sink a new vertical shaft to the east of the old one. The mine was formerly a producer; C. H. Mallen is now superintendent.

Last Chance—This mine near Maybert has been bonded by J. M. Fly, of the Marcotte company.

Oustomah—Operations have been partially suspended and the mill has been closed. Certain development work, however, is to be continued. The mine has reverted to its owners, the bondees having quit.

PLACER COUNTY

Southern Cross—The dam went out about two weeks since and it was impossible to run the mill, while the dam could not be repaired until spring. Therefore a gasolene engine was purchased and hauled with great difficulty over the narrow mountain trail through the snow from Gorge.

PLUMAS COUNTY

Star Spangled Banner—This group, including the Flagstaff and Pennant claims, on Rush creek not far from Greenville, is about to be thoroughly prospected.

SHASTA COUNTY

Hazel—The company, operating the Gladstone mine at French Gulch, has purchased an electric locomotive for use in its 4000-ft. tunnel.

SISKIYOU COUNTY

Gardner & Weed—Water has been turned into the ditches at Fort Jones and a full crew is now handling the three giants.

Granite & Crosscut—At the Granite mine on Humbug creek, Chas. A. Mitchell manager, very good ore has lately been taken out. The mill has been overhauled and put in order.

TRINITY COUNTY

Trinity Gold and Timber Company—This company, W. V. Whipple manager, operating the Beaudry mines at Minersville, has installed three giants and has an abundant water supply. The company is making arrangements to install a dredge on the low benches of the property.

TUOLUMNE COUNTY

McCormick—The property near Jacksonville, Edward Butt superintendent, has a new pipe line, and high-grade ore is being taken out.

Springfield Tunnel—This mine, near Columbia, has had considerable trouble with water and heavier machinery has been installed, including a new air compressor.

Gold Ship—At Groveland, Wm. Graham superintendent, arrangements for working on a large scale are being made. It is owned principally by Kansas City and Boston men.

Colorado

LAKE COUNTY—LEADVILLE

Alice Placer—A new shaft is being sunk on this ground, Carbonate hill, by lessees and when sufficient depth is gained, drifting toward the Penrose will be started. A large body of iron ore exists on the Penrose line.

Baby Shaft—A large body of low-grade iron ore has been opened in this property,

Iron hill, but as work proceeds on it the value increases.

Cleveland Shaft—This shaft, South Evans gulch, is now down 760 ft., leaving 65 ft. to be sunk to complete the present contract of 200 ft. The shaft is being sunk in porphyry and but little trouble is encountered from water.

Coronado—The lessees on this property, Down-town section, have opened up a large body of argentiferous iron, and during the week put on a double shift of men. Shipments at the rate of 30 tons daily are being sent to the smelter.

Ibex—Connections have been made between shaft No. 3 and No. 4 from the lower level of the latter shaft. This permits the ground between the two shafts to be thoroughly drained, and will also allow development work to be carried on at greater depth in No. 3 shaft.

Lilian—The lessees on this property, Iowa gulch, are shipping ore that will run high in gold. The work is being carried on at the lower levels.

Yak Tunnel—Ten drill holes have tapped the water in the Resurrection and it is being lowered at the rate of 12 ft. per day. The tunnel is now being driven ahead into Big Evans basin.

San Juan County

Ross Mining and Milling Company—This company is now operating the old Congress mine at Red Mountain. Development work has been begun on the 270-ft. level of the old shaft. J. B. Ross is manager and Patrick Lonergan, superintendent.

Florida

Prairie Pebble Phosphate Company—The Holmboe Company, Louisville, Ky., has taken the contract to build extensive additions to this company's plant at Mulberry.

Georgia

Lumpkin County

Liberty Bell Gold Mining Company—A new ditch, 22 miles long, is being built to carry water to this company's mine near Auraria.

Indiana

Sullivan County

Following the suit for a receiver for the Hudson Coal and Mining Company, other suits on account are being filed. The debt was supposed to be about $3000, but the amount has grown to nearly $50,000, and other claims and assets are to follow.

Fire broke out again in the Shirley Hill Company's Clover Leaf mine, in the east part of the county. The fire is the fifth in a few months in that mine. The coal contains an unusual quantity of gas.

Warrick County

Patrick Bartley, boss of the Menden coal mine, near Boonville, has been arraigned before Justice Youngblood on three charges prepared by the State mine inspector. The charge of acting as his own fireboss was sustained and a fine imposed. The charge of not having his mine inspected on Aug. 10 was continued for a future hearing.

Michigan

Copper

Winona—This company has levied an assessment of $1 per share payable March 9. This is to furnish additional funds for development work and the erection of a stamp mill, which will be owned jointly by this and the King Phillips company, now under the same management. This will be a four-head mill located on the banks of the Sleepy river and near the working shafts of the two companies. The lower levels of both companies are encountering good ground and the Winona has sufficient ground blocked out to ship about 800 tons daily to the mill, for a number of years.

Isle Royal—The shaft that this company is sinking to open up the Baltic lode is down about 110 ft. At No. 6 shaft the new boiler house and the air compressor have gone into service and will soon be followed by the new high-duty hoisting engine.

Lake—Sinking continues below a depth of 460 ft. in good, copper ground. Preparations for the third level have been made at a depth of 415 ft. Drifting continues on the two upper levels.

North Lake—Diamond drilling continues at this property making two parallel cross-sections of the tract.

Seneca—This company has driven the crosscut from the first level, a distance of 250 ft. from surface, a distance of 75 ft., and the formation indicates close proximity to the formation. Diamond-drill cores taken from the site showed mineralization.

Ahmeek—The erection of the structural steel for the new stamp mill is to be rushed so that the building will be ready in the early spring. At the mine alterations are being made at the central crushing plant to take care of the increased production that will be made when its mill is ready to go into commission. Sinking has been resumed at No. 3 shaft after completing the concrete collar which extends through the overburden a distance of about 70 feet.

Missouri

Wayne County

Wayne Iron and Lumber Company—Development work has been begun on a large deposit of iron ore near Greenville. W. N. Mitchell, of Chicago, is president.

Zinc-lead District

Kenmore—This company has been incorporated with a capital stock of $100,000 to operate near Carl Junction. H. D. Hanway, manager, D. V. Sholl and other Joplin parties are the stockholders.

Little Princess—This company has sold the largest pile of reserve ore in the district. The sale amounted to 1,991,920 lb. of jack.

Little Maxine—A contract for a 200-ton mill on this lease near the Emma Gordon, has been let. J. L. Call is manager.

Maltes Brothers—The new 500-ton mill west of Joplin has started grinding ore.

Sarcoxie—This camp is taking on the appearance of a boom; 21 shafts have been sunk since the middle of December. The Optimo company has let six subleases on its ground.

Montana

Butte District

Amalgamated—At the St. Lawrence, Never Sweat and Anaconda mines operations are still considerably retarded by gases from the mine fires. On the 1600 level of the Anaconda a connection has been made with the Belmont shaft. The Belmont is being sunk for the purpose of enabling the working of the Anaconda group at a point below the fire zone, the plan being similar to that being put in execution at the Tramway shaft of the Red Metal Company, where the Minnie Healy mine is being worked at a depth below the fire-zone. Although there has been no recent reduction in the force employed in the Amalgamated properties, the number is only about two-thirds as great as that of two years ago. Production in comparison to the number of men working is greater than ever before.

Butte-Montana—The mine was shut down the latter part of last week for the purpose of installing new machinery, the present plant being no longer able to do the work at the depth reached.

Reins—It is reported that this property is shortly to be opened up.

Jefferson County

Corbin Consolidated Mining Company—The entire outstanding stock of the company is under option to J. L. Meixell, of Butte. This property directly adjoins that of the Boston Corbin Company and comprises four claims.

Nevada

Esmeralda County—Goldfield

St. Ives Lease—This lease, managed by A. A. Codd and located on the St. Ives claim of the Goldfield Merger Company's ground, shipped 15 tons last week to the

Nevada Goldfield Reduction Company; the ore averaged about $60 per ton.

Great Bend Diadem—Recent developments in connection with the strike reported on this property last week have proved it to be one of very great importance, since examination has shown the orebody to be associated with dacite. This fact has great bearing on the question of permanency, as in no instance in Goldfield, excepting the Sandstorm, have permanent orebodies been found unassociated with the dacite. A shipment is now being prepared.

Goldfield Daisy—Sinking is to be resumed in the No. 2 or Truett shaft, and carried on from the 400-ft. to the 700-ft. level. At present most of the ore shipped is taken from the old shoot on the 200-ft. level, and a lesser amount from the 300-ft. level. The crosscut on the 400-ft. level is being pushed to get under the oreshoot.

Esmeralda County—Palmetto

Palmetto Death Valley Mining Company—Work has been resumed on this ground by men holding an 18-months' lease on the mine and mill. Ore is being taken out and hauled to the mill, five miles distant. The ore is of milling grade averaging about $18 per ton.

Esmeralda County—Gold Mountain

Nevada Empress—It is reported that the mill will be placed in commission by March 15. In a well recently sunk, sufficient water has been developed to supply a 30-ton mill; a pipe line connecting the well and mill has been laid, and an engine and pump installed. A new vein, 3 ft. wide, was recently cut; samples from it assay $20 per ton. Fifteen men are now employed on the property.

Esmeralda County—Hornsilver

Great Western—The outlook for this property is favorable, as ore is being shipped from both levels. Development work is also being carried on. On the 200-ft. level ore is mined in both the east and the west drifts, the ore assaying well in gold and silver. On the 300-ft. level in a raise east of the shaft, a streak, 18 in. wide has been opened which also assays well in gold and silver. The ore is at present shipped to the Belmont mill at Millers.

Cottrell Group—A strike is reported on this property which lies immediately east of the Great Western. The property has been worked intermittently for some months. Ore was first found at a depth of 15 ft. in a shaft sunk to intercept a blind lode. The vein was lost, and a new shaft was sunk to prospect for it. In this new shaft at a depth of 55 ft. the vein was picked up and had been drifted upon for a distance of 35 ft. The vein is 4 ft. wide and contains much shipping ore. About ten tons of this gold and silver ore are now ready for shipment.

Esmeralda County—Rawhide

Rawhide Queen—The company has found the orebody in the Kerns No. 2 lease which was abandoned some time ago by the leasers after considerable prospecting for the oreshoot. This shoot of ore is rich and contains considerable visible gold, some large specimens of native gold having been found in the vein. The Kerns No. 1 lease continues to ship a good grade of ore. The Domiac lease also continues to ship a good grade of ore. The shaft at this lease is to be sunk deeper. At the St. Ives lease, also on the Queen property, a drift is being driven to catch the oreshoot worked in the Kerns No. 2 lease. Lately a body of rich ore was struck in this lease.

Murray Lease—The mill is running regularly on the ore from the lease. Recently a streak of rich ore was found on the 200-ft. level of this lease.

Marigold Lease—A good body of rich ore was found on the 130-ft. level last week. The Marigold lease and the Grutt Hill-Truitt leases are worked through the same shaft.

Grutt Hill Mint—Rich ore has been found on the 320-ft. level of this lease on the Coalition property. The orebody has been crosscutted for 6 ft. without reaching the footwall. This company has acquired the Grutt Hill Coalition lease which adjoins the Mint lease. The two leases will henceforth be worked through the Coalition shaft, which is vertical, instead of through the Mint shaft which is an incline.

Nye County—Tonopah

Jim Butler—This property shipped 250 tons of ore during the week ending Feb. 13. This ore came from the 100-ft. and the 200-ft. levels. No development work is carried on at present.

MacNamara—At a meeting held Feb. 6 a dividend of 1c. per share was declared payable March 5, the books of the company closing for transfer Feb. 20. Sinking was resumed Feb. 10 in the main shaft, now 500 ft. deep. This shaft is to be sunk to a depth of 800 ft., at which point a drift will be started to find the body of quartz cut by the drill at a depth of 785 feet.

Tonopah Mining Company—At the Mizpah shaft the water column was placed in position last week from the 1200-ft. level to the surface. The station has been completed, and work has commenced on the foundation for the pump. The usual amount of development work was carried on in all the levels, 360 ft. of new ground being broken. At the Silver Top shaft, the drill hole from the 740-ft. level is now 435 ft. below that level; 126 ft. of new ground was broken during the week. At the Red Plume shaft, sinking was resumed on Feb. 10; this shaft, now 500 ft. deep, will be sunk to a depth of 700 ft. On the 600-ft. level, prospecting for the quartz cut by the drill at that depth will be done. At the mill 3170 tons of ore, valued at $21.50 per ton, were crushed during the week; 64 bars of bullion worth $53,760 and 52,000 lb. of concentrates valued at $12,300 were shipped.

Tonopah Belmont—In a raise from the west drift on the south vein on the 1000-ft. level, 4 ft. of good milling ore was opened last week, and in a raise from the west drift following the Mizpah fault on the 1000-ft. level another orebody 4 ft. wide and containing good milling ore has been found. The stope from the 1100-ft. level shows a big orebody of good milling grade, more than 10 ft. wide.

Nye County—Round Mountain

Round Mountain Mining Company—The clean-up for the month of January, during which month 2770 tons of ore was treated, amounted to $33,600. The company will increase the capacity of the mill to 110 tons; it is negotiating with the Nevada Electric Power Company for an extension of its lines from Millers to Round Mountain.

Humboldt County—Seven Troughs

Harris Lease—In sinking a winze from the 200-ft. level an oxidized vein was cut which shows a good milling ore for a width of 10 ft. In drifting on an east and west vein that was cut in a crosscut on the bottom level of the property, a round of shots disclosed the entire breast to be of high-grade shipping ore.

Wihuja Lease—This property is preparing a shipment to the Kindergarten mill. This ore comes from the 375-ft. level and is the best ore ever taken from the mine.

Mazuma Hills—At the Prior-Chadbourne lease, a rich strike is reported on the 250-ft. level where 15 in. of rich ore has been opened. Three inches of this is very rich talc, and the remaining 12 in. black quartz of shipping grade. The oreshoot is on the Reagan vein from which one carload sent to the smelter averaged $1030 per ton.

Pennsylvania

Bituminous Coal.

Pittsburg-Westmoreland Coal Company—This company is offering $500,000 in 5 per cent. first-mortgage bonds, part of an authorized total of $6,000,000, of which $3,325,000 are outstanding. The company owns 16,500 acres of coal lands, and has eight large mines in operation, with two others being opened.

Texas

Llano County

The rich deposits of iron ore in this county are being examined by Dr. William B. Phillips, of Birmingham, Ala. The

property will be prospected by diamond-core drilling, test pits and shafts. Steam drills will be used and a thorough examination made; the work will probably take several months. The ores are magnetites and hematites, in granite and gneiss, and are known to be rich, carrying 60 to 65 per cent. iron, and not over 0.05 phosphorus. The property belongs to R. H. Downman, of New Orleans, and the Wakefield Iron Company, of Minneapolis. It is about 15 miles northwest of the town of Llano, which is 100 miles northwest of Austin. The chief object of this examination is to determine the commercial value of the deposits.

South Dakota

Lawrence County

Burlington—It is reported that development work is to be resumed upon the property. The shaft is down 180 ft., and will be sunk 250 ft. before drifting is commenced. The vein followed dips almost vertically.

Rainbow—At the annual stockholders' meeting, held at Deadwood Feb. 15, the following directors were elected: John Baker, W. H. Bonham, Clara D. Coe, E. M. Dale, J. H. Gerard, W. A. Ickes, E. P. Peterson. E. P. Peterson was elected president; E. M. Dale, vice-president, and Clara D. Coe, secretary and treasurer.

Utah

Juab County

East Crown Point—The shaft, now 140 ft. deep, will be sunk to a depth of 300 feet.

Tintic Development Company—High-grade lead ore has been struck in the face of the north drift at a depth of 230 ft. Hoisting equipment and a four-drill compressor have been ordered.

Salt Lake County

Boston Consolidated—The annual report of the company shows expenditures during last year of $832,266 upon construction and development, of which $651,883 was expended upon the Garfield mill and $70,766 in steam-shovel stripping of overburden. A total of $937,658 was received from the sale of metal, which was all put back in the property for operating and construction. At the Garfield mill recoveries range from 70 to 72 per cent., and milling costs were reduced from $1 to 47.2c. per ton. About 2000 tons of ore are treated daily.

Philippine Islands

Benguet

Benguet Consolidated—This company reports for the month of November a production of 209 oz. gold and 310 lb. cyanide bullion.

Headwaters Mining Company—The prospect adits on this company's property are showing good ore, carrying free gold. On the northern lead the adit showed good returns, but to avoid trouble from floods it has been closed, and another started higher up the hill, where the entrance and dumps will be safe from flood waters.

Camarines

Another dredge has arrived at Paracale and as soon as the pontoons are erected and the machinery installed active operations will begin on the headwaters of the Paracale river. J. H. Jones is in charge of the installation. This dredge is the property of New Zealand men.

Paracale Gold Dredging Company—This company, operating on the Paracale river, reports a saving of 626 oz. gold in November.

Tumbaga—This old mine has been pumped out and prepared for the installation of machinery. Samples taken out have proved satisfactory, and much of the old machinery is in good condition. This will be reinforced by additions to the equipment and it is expected that the mine will be in operation and milling started in February or March.

Canada

British Columbia

A statement of the revenue and expenditure of the province for six months ended Dec. 31, 1908, recently submitted to the local legislature, reports that the revenue from the mining industry during that period was as follows: From free miners' certificates, $11,067; general mining receipts, $58,890; mineral tax, $58,134; tax on unworked Crown-granted mineral claims, $21,362; royalty and tax on coal, $82,950; sundry receipts not specified, estimated at $17,000; total, $250,403 for the half-year.

British Columbia—Trail

During 1908 there was smelted at the works of the Consolidated Mining and Smelting Company of Canada, Ltd., at Trail, ore as follows: In lead furnaces, ore and concentrates, 51,022 tons; in copper furnaces, 267,384 tons; total, 318,406 tons. The metal production was:

	Quantity.	Gross Value.
Gold, oz.	116,314	$2,383,327
Silver, oz.	2,100,457	1,102,843
Copper, lb	3,753,139	506,460
Lead, lb.	35,999,145	1,050,455
Total value.		$5,043,088

Included in the output was the production of the company's St. Eugene lead-silver mine at Moyie, Centre Star group of gold-copper mines at Rossland, Snowshoe mine (leased) at Phœnix, Boundary district, and custom ores and concentrates purchased.

British Columbia—Vancouver Island

The total output of coal in 1908 in the Coast district was 1,229,328 long tons. The greater part of this production was from the mines of the Wellington Colliery Company, at Cumberland and Extension, and of the Western Fuel Company near Nanaimo, all on Vancouver island.

The corporate name of the company heretofore known as the Britannia Smelting Company, Ltd., is to be changed to the Britannia Mining and Smelting Company, Ltd. The new company, the stock in which is largely held in New York, will be an amalgamation of the Britannia Smelting Company and the Britannia Copper Syndicate. The latter owned, and has been operating for several years, the Britannia group of copper mines, near Vancouver, and the former the smelting works at Crofton, Vancouver Island. T. Mason Adams will continue as general manager.

British Columbia—Boundary

At Vancouver, in the Supreme Court of British Columbia, Mr. Justice Clement has adjourned the case of the National Trust Company, of Toronto, Ont., acting as trustee for the bondholders, against the Dominion Copper Company, so as to give counsel opportunity to agree as to which of the assets of the defendant company are exempted from the plaintiff's security in connection with the bond issue made in June, 1905. Plaintiff asks for a foreclosure order to include all the assets, but defendant claims that certain of the assets are not included in the plaintiff's security.

British Columbia—Nelson

J. McMartin, well known at Cobalt, where he is interested in the La Rose and other mining properties, has arranged to acquire the Kootenay Belle and Mother Lode groups of mineral claims, in Sheep Creek camp, Nelson division. From half a dozen properties in this camp nearly $700,000 in gold has been produced, of which more than $100,000 was from the Kootenay Belle and Mother Lode. Hitherto development of these two mines has been on only a small scale. On the Kootenay Belle tungsten, occurring here in association with the gold ore, is stated to be in the purest form yet found in Canada.

British Columbia—Trail

A return made by the secretary of State for Canada shows that, beside gold and bronze coins made at the Canadian branch of the Royal Mint, Ottawa, Ontario, at which coinage was commenced last year, there has been coined $313,338 in silver, purchased from the Consolidated Mining and Smelting Company, of Canada, Ltd. This company supplied the mint with 387,859 oz. of fine silver, which was smelted and refined at its works at Trail.

BRITISH COLUMBIA—SLOCAN

Another stage has been reached in the Star Mining and Milling Company vs. Byron N. White Company litigation, the Supreme Court of Canada having dismissed the appeal of the defendant company against the judgment of the Full Court of British Columbia, which was in favor of the plaintiff company. This case has been before the courts for years. It involves questions of extra lateral rights.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 13 were as follows: City of Cobalt, 61,000 lb.; Crown Reserve, 41,970; La Rose, 194,140; McKinley-Darragh, 40,000; Nipissing, 128,957; Silver Queen, 65,000; Trethewey, 92,530; total, 623,597 pounds.

Cobalt-Majestic—This company, formerly the Abitibi & Columbia, has been ordered by the Provincial secretary again to change its name on account of the confusion arising between it and the Kerr Lake-Majestic.

Right of Way—At the annual meeting held at Ottawa Feb. 17, a dividend of 6 per cent. with a 9-per cent. bonus was declared for the quarter ending March 31. In was announced that the company would be placed on a 6-per cen. quarterly basis with whatever bonus in addition might be advisable. The value of the output for the year was $215,000.

Silver Queen—The directors have decided to pass the usual dividend of 3 per cent. per quarter. President F. L. Culver stated that the company had plenty of money on hand, but having run into a lean streak of ore, the directors considered it advisable to retain it in order to keep up development work until good paying ore was again reached.

ONTARIO—GOWGANDA

Bartlett—About 20 men are at work completing the construction of large camp buildings. Active mining work will begin in about two weeks.

YUKON TERRITORY—WHITEHORSE

The local board of trade has resolved to ask the Yukon territorial authorities for an appropriation of $5000 for the cable ferry over the Donjek river and for improving the road from Whitehorse by Kluane to the White river country, in which numerous copper claims have been located on both sides of the International boundary line. It is claimed that those in charge of International boundary survey parties support the Whitehorse-Kluane route as the best.

Frederick T. Congdon, recently elected member of the Dominion House of Commons for Yukon Territory, has announced his intention to endeavor to secure an adequate appropriation for more roads in the Yukon, especially along the White, Stewart and McMillan rivers, on which important mining enterprises have been undertaken.

Mexico

CHIHUAHUA

Bullion Shipments—Recent bullion shipments passing through the banks of Chihuahua include the following: Batopilas, 205 bars silver valued at 216,000 pesos; Watterson, 11 bars gold-silver of value of 26,000 pesos; Benito Martinez and Martinez & La Rive, each 2 bars silver valued at 2000 pesos each.

Naica—As the result of recent ore discoveries more interest is now evinced in this district and a number of the newer companies have increased the extent of development operations, among these being the Compañia des Mines de Chihuahua and Naica Mining Company. A recent directors' report shows that the Naica company shipped during 1908, 16,820 tons of ore and that there is still available for immediate extraction upward of 140,000 tons.

SONORA

Candelero—The mines, at La Barranca, have been acquired by this company of Oklahoma City and are opening up five different veins of gold-silver ore. A tunnel is being driven into Candelero mountain to cut the Candelero vein, the mother vein of the section. This tunnel is now in 500 ft. with 300 ft. to go. A compressor plant, concentrating tables, and a cyanide plant will be installed soon. S. Been Smith is superintendent.

Creston Colorada—The Colorada mill is treating 5000 tons of Colorada ores per month, which are running from $8 to $20 per ton. The old Grand Central mill, leased by this company, is regrinding by tube mill and is cyaniding in the old original Butters plant about 8000 tons per month of the old tailings of the Colorada mill. These tailings are from both Colorada and Creston ores. The Creston mine is closed down. These mines are at Minas Prietas, about 20 miles east from Torres on the Sonora railroad.

La Dura—The Cananea Rio Yaqui y Pacifico railroad has its construction camps as far up the Yaqui river as La Dura and in the five camps between there and the present end of the road has 1500 men at work on construction. The track-laying machine is expected to reach La Dura about April 1.

Las Gateras—The mine, one-half mile from La Barranca, is preparing to install mining and milling machinery. A telephone line is being constructed to connect San Javier, Las Goteras, Candelero, and Toledo, with La Dura. Fred Foreshaw is mine superintendent.

Minneapolis Copper Company—This company at San Antonio de la Huerta is running its mill on free milling ore recently opened up by the new management.

Sonora Mining and Development Company—The Las Animas mine of this company, in the San Javier district, is being pumped out. When this is accomplished experiments will be made on the ores in the bottom of the mine to determine the process of treatment best adapted and a plant will be constructed. Frank Davis, of Alamos, is the general manager.

Southern Republic Mining Company—The Southern Republic, operating west of Noria on the Sonora railroad, is prospecting for copper with churn drills.

Yaqui Smelting and Refining Company—It is reported that the company's silver-lead smelter at Toledo is to resume operations. Frank Davis, of Alamos built the plant but was obliged to close down on account of Yaqui Indian outrages.

Greene Gold-Silver Company—On Feb. 12 the concession to W. C. Greene, covering nearly 3,000,000 acres of mineral-bearing ground in Chihuahua and Sonora, expired by limitation. There was immediately a rush by prospectors and miners to secure many valuable locations on the then open territory, but to the disappointment of the denouncers the local officials refused to file the claims. The reason of this refusal has turned out to be that special orders were sent to the Chihuahua officials not to accept denouncements on that territory until further notice, on account of an investigation pending to determine whether or not Colonel Greene has fulfilled the terms of his concession.

Lista Blanca Copper—This company has been incorporated at Nogales under the laws of Arizona to hold the total capital stock of the Compania Minera de Cobre Lista Blanca, S. A., the Mexico corporation owning the Lista Blanca property in the Altar district about nine miles west from Caborca. The property has a great deal of development work and considerable ore blocked out and it is the intention of the new company to install a modern reduction plant. Henry Levin is resident agent.

Noria—This new town on the Sonora railroad is the distributing center for the Sonora Copper Company, La Cobriza Mining Company, and the Llano Copper Company. The first two are said to be contemplating the early erection of smelters.

Tribune—In the Rey de Oro mine beyond Cerro Prieto in the Magdalena district a shoot of high-grade gold ore has been encountered in the midst of the large deposits of low-grade ore being worked. A winze on the new strike is down 20 ft. The mill, which has been shut down for some time owing to a breakdown, will be ready to drop stamps again in about two weeks.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 24—The coal trade in the East continues on about the same level as by our last report. No special activity has developed, although in some sections there is rather steadier demand for coal, but not enough to affect the market to any considerable degree. In the interior bituminous-coal trade a somewhat greater demand for steam coal is beginning to develop, although progress is slow.

In the anthracite trade the main topic of discussion is the probability of a strike in April. While no public announcement has been made, it is generally accepted as certain that the anthracite-coal companies will not open discussion of the disputed questions with the representatives of the Miners' union, thereby rejecting at the outset the principal demand of the union. The other points raised about wages and minor details could probably be adjusted without much difficulty, but the companies seem determined to insist upon the open-shop principle. They are also opposed to the abolition of the conciliation board and to the limit of the agreement to one year. It is quite probable that they have accepted the present as a good time to try conclusions with the union. They have accumulated stocks of the domestic sizes of coal sufficient to carry them for some time, although the small steam sizes would probably run short very quickly.

In the West the coal trade is quiet, with a moderate increase in domestic trade owing to the prevalence of colder weather. The steam-coal trade shows very little variation except that several large concerns have shown considerable interest in yearly contracts and some of encouraging amount have been closed.

The coke business is showing a decided improvement and shipments over the various railroads have increased considerably since the beginning of the year.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 13, short tons:

	1908.	1909.	Changes.
Anthracite	658,927	598,696	D. 60,231
Bituminous	3,938,680	4,152,129	I. 213,449
Coke	876,939	1,205,309	I. 329,370
Total	5,473,546	6,956,134	I. 482,588

The total increase this year to date was 8.8 per cent.

New York

Anthracite

Feb. 24—Business continues quiet with no change in prices. The weather has not been cold enough to cause any increase in demand even in a retail way. Temporarily there is rather a scarcity of the small steam sizes. This is owing to the fact that operations at many of the larger collieries have been curtailed and in consequence less steam coal is made. Moreover, some consumers of the small sizes have been putting in stocks ahead in order to provide for a possible stoppage of mining, thus increasing the demand at a time when the supply was not over abundant.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal market continues quiet, although the aggregate quantity of coal handled is large, as it always is even in dull times. Contracts are still being talked about, but very few have been closed. The prices offered—and in some cases accepted—are lower than last year, but in most cases better than the current market.

Trade in the far East is dead and no coal is being taken for that section. Along the Sound there is some buying and it may be noted that this is steadier than it was recently. New York harbor is still dull, though some coal is being taken and consumers are showing a little more interest.

Prices show no material change. In New York harbor good grades of steam coal are selling at $2.40@2.50, f.o.b. harbor shipping port, while lower grades can be had at $2.20@2.30 per ton.

All-rail trade is better than tidewater and the interior cities are taking a fair amount of coal. Car supply is abundant and transportation good, with very few delays.

The Coastwise market is dull and vessels are still looking for charters. There is no change in freight rates, those quoted for large vessels from Philadelphia being: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Portsmouth, 80c.; Newburyport, 95c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Feb. 22—Further curtailment in production is noted in the coal-mining section of Alabama, several mines being closed down now or running on half time and less. There is no demand for coal. The larger furnace companies have stacked up enough coke to warrant a cessation at several batteries of coke ovens. There is but little domestic demand for coal. Prices are beginning to descend, but this does not bring about any business. The mining concerns do not look for any immediate improvement in the general conditions.

Chicago

Feb. 22—The coal market continues fairly strong, for both steam and domestic coals. Not only is the demand somewhat better, but the market is lightened by lighter shipments. Weather conditions have not been such as to predicate continuance of the existing conditions, however, and the coming week, with mild temperatures over Chicago territory indicated, will probably see a slack demand. Buying is so responsive to changes in temperature, for domestic coals, that consumers and dealers appear generally to have small supplies. Steam coals are evidently being bought close to current needs, and there is no apparent increase in these needs. The industrial situation, however, is bettering slowly. Eastern coals have improved in tone in this market, and smokeless is notably improved owing to lessened shipments, though still in large supply and with prices on run-of-mine 15@25c. under circular prices.

Illinois and Indiana coals bring, in car lots, $1.80@2.40 for lump, $1.60@1.75 for run-of-mine and $1.30@1.60 for slack. Smokeless sells at $2.75@3.15 for Pocahontas and New River run-of-mine, and $3.15@3.45 for lump or egg. Hocking is in much better condition, the demand being large and the supply not curtailed so as to remove demurrage sales, holding the price up close to $3.15, circular quotation. Eastern gas coals have a light but steady demand with stationary prices. Anthracite continues to have a good run of sales for small lots, but well distributed.

Cleveland

Feb. 23—The demand for domestic coal resulting from the weather still gives some activity to the market, though it is gradually falling off. Steam coal is in moderate demand, the tendency still being to buy slack rather than run-of-mine or lump. There is not much demurrage coal in evidence here, to depress prices.

Discussion of Lake rates is in order, but very little has been done so far. Much depends on the demand for iron ore and the number of ore boats going back light and ready to take coal cargoes.

Pittsburg

Feb. 23—There has been no change in operations during the week, production in the Pittsburg district being at the rate of about 35 per cent. of capacity of the mines. Prices are being firmly held at $1.15 a ton for mine-run coal at mine. Slack is quoted at 65c. The rivers were navigable the last few days of the week and fully 2,000,000 bu. coal went to lower ports, almost cleaning up the accumulated stocks in the pools and harbor. There are plenty of empty coal boats and barges here and all the river mines are in operation and will be kept going steadily.

Connellsville Coke—The coke trade continues dull and prices are weaker. Production has not been curtailed to a great extent. Large producers who had endeavored to maintain prices on foundry coke have made a reduction. Foundry coke for delivery in the second half is quoted at $2@2.15 and for spot shipment $2 is the lowest price named. Furnace coke is held at $1.75 for spot and $1.90 on contract but it is possible to shade these prices. The *Courier* gives the production of coke in both of the Connellsville fields at 268,958 tons. Shipments amounted to 9643 cars as follows: To Pittsburg district, 3490; to points west of Pittsburg, 5516; to points east of Connellsville, 637 cars.

Foreign Coal Trade

Nova Scotia Coal—Shipments of coal from Nova Scotia mines in January are reported as follows, in long tons:

	1908.	1909.	Changes.
Dominion	202,063	120,130	D. 81,933
Nova Scotia Steel	38,845	47,750	I. 8,905
Cumberland	27,015	27,294	I. 279
Acadia	29,433	24,852	D. 4,581
Inverness	.....	.....	.....
Intercolonial	24,948	19,767	D. 5,181
Total	322,304	239,793	D. 82,511

No report for the month received from the Inverness Coal Company. Total decrease this year, 25.6 per cent.

British Coal Exports—Coal exports from Great Britain, with coal sent abroad for use of steamers in foreign trade, for the month of January, long tons:

	1908.	1909.	Changes.
Coal	4,677,800	4,308,635	D. 369,165
Coke	108,506	75,761	D. 32,745
Briquets	132,324	110,108	D. 22,216
Total exports	4,918,630	4,494,504	D. 424,126
Steamer coal	1,608,253	1,500,743	D. 107,510
Total	6,526,883	5,995,247	D. 531,636

The larger exports this year were 803,725 tons to France, 712,891 to Italy, and 468,902 to Germany. Exports to the United States were 1158 tons.

Belgian Coal Production—The production of coal in Belgium for the full year was 23,824,499 metric tons in 1907, and 23,678,150 in 1908; a decrease of 146,349 tons. Unsold stocks on Dec. 31, 1908, were 917,330 tons, an increase of 475,712 tons over the previous year.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 13; Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 24—The iron and steel trades have shown a marked contrast to the inactivity of recent weeks. In our last report we mention that a general meeting of the steel trade had been held in New York and stated that reductions in prices were almost certain to follow. The announcement did, in fact, come two days later, but instead of taking the form of a new schedule of prices put out by the leading interest, it was announced that Steel Corporation agents had received orders to meet the cuts made recently by independent manufacturers and if necessary to go below them. This left the market an open one, with the assurance that the leading interest would not hold back, but would make such concessions as might be necessary to secure business.

Under the new order sales are reported at prices which imply a cut of from $6 to $8 per ton in plates, $4 in steel bars and at least $7 in structural steel. Bars had previously been rather demoralized and both iron and steel bars are now selling at around 1.20c. at mill, with some sales reported at 1.15c. and even 1.10c. is talked about. As to the extent of these sales it is difficult to make an estimate. Many reports are current and the market has hardly had time enough to adjust itself to the new conditions. One important point is that a number of contracts for buildings which have been held back for some time are being rushed forward, to take advantage of the lower prices of material now possible. In another week, probably, the real effect of the reduction will be manifest. The general belief is that a large amount of business will be placed.

One important point is that under the new orders two basing points have been adopted, rates being made on the basis of Chicago delivery as well as at Pittsburg. Whether this is intended to be permanent or not has not been stated. Probably it will be so and will refer to delivery from the Gary works as well as Chicago.

Steel rails were not included in the order for reduction and it is understood that prices are a subject of conference among the rail makers. It has been reported that one or two rail mills have made tentative offers to sell heavy sections at $25, but this cannot be confirmed.

Upon the whole—while as we have said, it is still difficult to appreciate the full effect upon the market—the indications are that a considerable revival in business may be expected and that consumers will take more interest than they have done for some time past, when they appreciate that their views on prices are being met, and that considerable economies can be secured by purchasing material at the present time.

There has been some improvement in the demand for pig iron. Furnaces generally appear to be ready to make concessions except on special brands. Southern pig iron has been cut from $13 to $12.50 Birmingham for No. 2 foundry and some sales are reported at even lower prices. Other concessions will probably follow.

It is intimated in many quarters that reductions in prices will probably be followed by equal reductions in wages. This is altogether probable and many such reductions will be made, though not perhaps immediately. In fact, wages in some important branches of the trade are governed by agreements which still have some time to run and which cannot be changed at once.

Baltimore

Exports for the week included 195,110 lb. spelter, 112,000 lb. lead and 3,051,000 lb. steel billets to Great Britain; 4773 tons steel rails to Panama; 758 tons steel rails and 352 tons track material to Mexico. Imports for the week included 1131 tons spiegeleisen, 1859 tons ferromanganese and 185 tons ferrosilicon from Germany; 4950 tons iron ore from Cuba.

Birminghan

Feb. 22—The pig-iron market in the Southern territory is dull. The sales being made just now are in small lots and the aggregate far from being satisfactory. A reduction in quotations has been made, No. 2 foundry being quoted at $12.50 per ton, against $13, which has prevailed for some time. There are no concessions being made on the $12.50 per ton rate, reports to the contrary notwithstanding. The Alabama Consolidated Coal and Iron Company during the past week announced the sale of 2500 tons of Clifton iron to the American Locomotive Company on a basis of $12.50 per ton, No. 2 foundry, immediate delivery practically stipulated. The shipments in the Southern territory are still quite steady though there is no telling when a change will be noted. Reports received here are to the effect that a number of consumers have very little iron on hand but are in no hurry to lay in stocks. The Southern cast-iron pipe con-

cerns have been a help to the manufacturers of pig iron; they are working hard and have orders in hand and in sight that will keep them busy for some time to come. There has been no curtailment in the pig-iron production in the Southern territory as yet, though the same is again under consideration. There is a half-way belief expressed that the change for the better will be noted just after the turn of the new month. There is no iron accufulating in this district, old orders on hand requiring steady shipments and the melt by the pipe plants being good. No change in conditions is noted at the steel plants. The general understanding here is that if there is no improvement in conditions the Ensley plant may be shut down.

Chicago

Feb. 22—The iron market continues unmarked by any significant changes. There is a fair sale of pig iron in small lots, for delivery almost wholly within the next 30 to 90 days, with everybody awaiting general developments of business. Northern No. 2 is nominally quoted at $17@17.50, and Southern No. 2 at $13 Birmingham, or $17.35 Chicago, but cuts of 25 and 50c. prevail, and some lots may bring still less. The market has no fixed prices on any considerable amount of iron.

That the Steel Corporation's reduced prices on its products will do much to stimulate business locally seems to be the sentiment of the market. In the last week as heretofore for several weeks, business in iron and steel products has been quiet. The average melter of pig iron has undoubtedly been conservative about purchases through a variety of causes, chief of which have been tariff agitation and slowness of the country to increase consumptive power. Consumption of iron, though not large, has been fairly steady and remains so. For the future there are a few inquiries for lots of good size and occasionally a sale is made, but furnace agents profess not to be anxious for much business at prices which appeal to melters. Coke continues in light to moderate demand, at $4.85 for the best Connellsville.

Cleveland

Feb. 23—There is no change in the ore situation. Shipments from docks are light, furnaces being reluctant to put in stocks in the present condition of the pig-iron market. Ore sellers are not doing anything about prices, as they believe that any buying movement this season will come late.

A few contracts have been made for season ore shipments at the rates which prevailed last year: 65c. from the head of the Lakes to Lake Erie ports; 60c. from Marquette, and 50c. from Escanaba.

Pig iron is dull, sales being small, while the inquiries received are of the tentative order entirely. The market is still based upon $16.25@16.50 Cleveland, for No. 2 foundry.

Finished material is dull, buyers being, apparently, still at sea on the question of the new reductions in prices.

Philadelphia

Feb. 24—Several transactions in pipe and foundry iron which have been hanging fire since the first of the month will probably terminate in definite orders by the close of the week for Pennsylvania pig irons, because of concessions made by makers. In a general way, very little business is being done. Consumers are mostly low in stocks. They are daily looking for a general concession in prices. A few of the stronger companies prefer to pile iron than lower prices. Somewhat greater activity prevails in the foundries and machine shops. Apart from the general disturbance in the steel trade, conditions are improving and consumers talk in a more hopeful spirit. A few small sales of forge just made show that prices are receding. No. 1 foundry alone holds up well. Basic has undergone a relapse.

Structural Material—The business has consisted mainly of extensions or additions to former contracts. The sharp reductions have not yet been followed by heavy ordering. The market is in a serious condition and a great deal is going on beneath the surface that does not find its way into print.

Scrap—Dealers report very little activity. Some railroad companies are parting with scrap on terms which they refused a few weeks ago. In light scrap a drop of 50c. is noted without much selling.

Pittsburg

Feb. 23—The readjustment in steel prices referred to in last report was decided upon at a meeting held Feb. 18, the form being that of declaring an open market on all steel products, with the exception of standard rails. Each manufacturer was allowed to quote any price desired, and was free to reduce his prices if lower prices should be developed. There had been considerable shading in various products and it was felt that the producers who were disposed to shade would continue to do so as long as any large interests held the umbrella; so that it would be best to put the umbrella away and let it be understood that any cut prices made would be met promptly.

The open market began Feb. 19 and since then the work has been that of developing prices. This work is not half through yet, some lines not having shown any new prices at all, while in others it is not settled that the new prices will hold. There are prospects, however, that they will. The market developments thus far are summarized below.

Plates and shapes, on which the official price had been 1.60c., but which had been shaded more or less for months, were first quoted at 1.40c., by some large interests, but as somewhat lower prices were named by some, a price of 1.30c. was promptly put out, and this has held. Merchant-steel bars, which had been officially 1.40c., with an inside price to large jobbers and some others of 1.35c., have settled at 1.20c., with no concession. This price has held, although there has been strenuous complaint on the part of large jobbers who have been accustomed to buying at $1 a ton under the open market. On Feb. 22 the National Tube Company announced to its customers a new list on steel pipe, five points or about $10 a net ton under the old list, making the official discount on "jobbers' carloads" 80 per cent. off list, against 75 per cent. off list. The trade custom has been to allow large consumers an extra half point, and large jobbers one point, with an extra 5 per cent. This makes the new inside price to jobbers in large lots 81 and 5 per cent. off list. The American Sheet and Tin Plate Company, while making no open announcement, decided to hold to former prices on sheets and tinplates, at least for the present. The American Steel and Wire Company announced this morning that on March 1 it would issue a new list of prices, and would adjust prices on all shipments of Feb. 19 and later according to the new list. Billets, sheet-bars and wire-rods have not been touched, absolutely no developments having occurred. Nothing has been done yet in iron products, such as bars and pipe. It is probable that iron pipe will be reduced by about the same amount as steel pipe, keeping it at about the same differential as formerly above steel pipe, this having been two points lately.

There have been no sales of consequence at the new prices. There was no large business hanging over the market, and the new prices have not been tested seriously. Indeed, they have been arrived at largely for the purpose of finding a basis upon which to adjust undelivered tonnages. All shipments made Feb. 19 and later are to be adjusted to new prices as developed, with the exception that a stand has been taken that when the material is for a definite job, on which the contractor's price has already been fixed, no concession should be given.

It is expected that as soon as the adjustment is completed there will be business placed which has been backing up, while in the course of two or three months there will be further improvement in tonnage, and that the second half of this year will show about as large a tonnage as in previous active years.

It is generally accepted that salaries and wages will be reduced, but no definite move is to be made until the full extent

of the price readjustment has been made known.

Pig Iron—The market has been stagnant, the readjustment in steel putting a final quietus upon any disposition to do business. In the pig-iron trade the opinion is strongly expressed that the present developments should help pig iron, by stimulating tonnage, but against this is the prospect that Lake Superior ore will come down. The ore interests insist that no consideration has been given to this subject, and in any event it is quite improbable that they would put out new prices for June, or perhaps July 1. Quoted prices are lower by 50c. in bessemer and by 25c. in basic, foundry and forge being nominally unchanged. We quote, f.o.b. Valley furnace: Bessemer, $15.50; basic, $15; No. 2 foundry, $15; malleable, $15.50; gray forge, $14.25.

Ferro-Manganese—The market is entirely nominal at last quotations, $45.50@46, Pittsburg.

Metal Market

New York, Feb. 24—The metal markets are still in a depressed and rather uncertain condition. Lower prices seem to be the rule in almost all directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1909..	$ 7,865,195	$ 3,412,583	Exp. $4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Year 1909..	7,865,196	3,412,583	Exp. 4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Silver:			
Jan. 1909..	4,542,254	3,660,052	Exp. 882,202
" 1908..	4,148,144	3,621,874	" 526,270
Year 1909..	4,542,254	3,660,052	" 882,202
" 1908..	4,148,144	3,621,874	" 526,270

Exports from the port of New York, week ended Feb. 20: Gold, $1,217,000, chiefly to Argentina; silver, $1,062,615, to London and Paris. Imports: Gold, $197,961, from Japan, the West Indies and South America; silver, $81,642, from Mexico and Panama.

Foreign commerce of the United States, month of January, reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 206,114,718	$ 156,767,714
Imports	84,997,514	103,524,028
Excess, exports	$ 121,117,204	$ 53,243,686
Add excess of exports, silver		882,202
Add excess of exports, gold		4,452,613
Total export balance		$ 58,578,501

The gold and silver movement in detail will be found in the table at the head of this column.

Gold—The price of gold on the open market in London has been unchanged at 77s. 9d. for bars; 76s. 4d. per ounce for American eagles. The Bank of England continues to take most of the gold arriving. The Bank of France is out of the market still. In New York there was some gold shipped to Argentina on London account, but none to Europe.

Platinum—Prices are unchanged, dealers asking $23.50@24.50 for refined platinum, $26 for hard metal and $19@21 for scrap. Business is quiet with demand running rather light.

Silver—The silver market was depressed by some speculative selling—chiefly China sales—and moderate buying only from other quarters. The price is fairly steady at the decline.

SILVER AND STERLING EXCHANGE

Feb.	18	19	20	22	23	24
New York....	51⅛	50¾	50¾	.....	50⅝	50⅞
London.....	23 7/16	23¾	23 7/16	23 5/16	23 7/16	23 7/16
Sterling Ex..	4.8705	4.8715	4.8735	.....	4.8750	4.8735

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shiments of silver from London to the East, year to Feb. 11, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India.....	£ 866,188	£ 529,560	D. £ 336,628
China.....	451,400	80,000	D. 371,400
Straits.....	.....	51,000	I. 51,000
Total.....	£ 1,317,588	£ 670,560	D. £ 647,028

Imports for the week, £3500 from Mexico, £6000 from the West Indies and £185,000 from New York; total, £194,500. Exports, £31,500 coin to the Straits, and £52,000 bars to India; £83,500 in all.

Copper, Tin, Lead and Zinc

Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
18	13 @13¼	12¾ @13	57 13/16	28⅛	4.00 @4.02½	3.85 @3.87½	4.67½ @4.72½
19	12¾ @13	12⅝ @12 7/16	57	28¼	3.97½ @4.00	3.82½ @3.85	4.65 @4.70
20	12¾ @13	12⅝ @12¾	....	28½	3.97½ @4.00	3.82½ @3.85	4.65 @4.70
22	.....	.....	....	....	.....	.....	.....
23	12¾ @13	12⅝ @12 5/16	56¼	29	3.95 @4.00	3 80 @3.85	4.62½ @4.67½
24	12¾ @13	12⅝ @12 5/16	56¾	28¾	3.95 @4.00	3.80 @3.85	4.60 @4.65

NOTE—Spelter prices given are at St. Louis; New York quotations, Feb. 18-24, were 0.15c. higher than St. Louis.

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market has been bordering on demoralization throughout the week. By making radical concessions some lots of copper have found a market in Europe. Home consumers so far are entirely indifferent to the lower prices that have been established; on the one hand, their business has suffered, and on the other, they are apprehensive of a further decline because they believe that such will be necessary to market the accumulations. The close is weak at 12¾@13c. for Lake copper; 12⅜@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12½@12⅝c., the price being 12⅜c. at the close.

Copper sheets are lower, 17.3@17.5c. for cold-rolled, large lots; 16.5c. for hot-rolled. Copper wire, 15¼c. base, carload lots at mill.

The market in London for speculative sorts declined rapidly the early part of the week, but since Monday it has held relatively steady, the close being cabled at £56 7s. 6d. for spot, £57 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £60 10s.; best selected, £59 10s.@£60 10s.; strong sheets, £71 10s.@£72 10s.

Tin—The London market has had a rather sharp advance during the last few days. There was a good deal of speculative buying, brought about no doubt by advices of shipments from the Straits which indicate a falling off for February and March. The close is somewhat softer at £129 10s. for spot, £131 for three months.

While not much business has been done in the domestic market, prices have followed closely the advance in London and dealers are asking 28¾c. for spot metal at the close.

Tin production of the Federated Malay States in January was 4213 long tons; a decrease of 1322 tons, as compared with January of last year.

Lead—Prices have declined further, and on Feb. 24 the American Smelting and Refining Company recognized the situation by reducing its figure to 4c. New York. The market closes weak at 3.80@3.85c. St. Louis, 3.95@4c. New York.

The London market has been well supported throughout the week and the close is steady at £13 10s. for Spanish lead, £13 12s. 6d. for English lead.

Spelter—Business has been of small proportions and whatever orders come into the market are eagerly competed for. The reductions in the price of iron and steel have so far not increased the demand from galvanizers. The close is weak and lower at 4.60@4.65c. St. Louis, 4.75@4.80c. New York.

Smelters in Kansas and Oklahoma are generally restricting their output by putting furnaces on dead-fire.

The London market is firmer, the close being cabled at £21 15s. for good ordinaries, £22 for specials.

Base price of sheet zinc is 7c., f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—No business is being done, and the market is at a standstill. In the absence of sales prices are nominally unchanged, and we quote 8½c. per lb. for Cookson's; 8c. for Hallett's; 7⅜@7½c. for ordinary brands.

Aluminum—Business is quiet, with no new developments. Foreign metal is still offered at 22c., New York, but no sales are reported. The Aluminum Company of America quotes 24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—Business continues small in volume. New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco quotations are nominal at $45@46 for domestic business and $43@44 for export. The London price is £8 7s. 6d. per flask, but down to £8 5s. is quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, month of January, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	12,842	6,089	Imp.	6,753
Copper, 1908	12,212	5,543	Imp.	6,669
Tin	3,564	2,067	Imp.	1,497
Tin, 1908	3,381	2,371	Imp.	1,010
Lead	18,613	2,765	Imp.	15,848
Lead, 1908	19,034	4,955	Imp.	14,079
Spelter	9,359	490	Imp.	8,869
Spelter, 1908	7,664	459	Imp.	7,205
Quicksilver, lb.	9,992	60,746	Exp.	50,754
Quicksilver, '08	18,375	234,055	Exp.	215,680
Ores:				
Tin ore and con.	1,305	.....	Imp.	1,305
Tin ore, 1908	2,005	.....	Imp.	2,005
Pyrites	64,636	.....	Imp.	64,636
Pyrites, 1908	97,073	.....	Imp.	97,073

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 15 tons copper matte, 1596 tons fine copper, and 2746 tons lead.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 20—The highest price paid for zinc sulphide ore was $40 per ton, the base price ranging from $35 to $38 per ton of 60 per cent. zinc, stronger at the week-end—$36@38, with increased demand for all grades. Zinc silicate sold at $26 top, on a base of $10@22 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $34.72. Lead opened weak at $50, declining to $49 and $48, with a falling demand, much of the ore shipped being from previous purchases.

The weather is admirable for outputting for the season, and the mine owners are again adjusting the wage scale and expense account to the market conditions, saving a panicky margin of profits to some, while others are merely trading even.

SHIPMENTS, WEEK ENDED FEB. 20

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,826,660	1,327,640	$102,069
Joplin	1,789,960	264,300	38,844
Galena	961,920	49,460	18,524
Duenweg	780,750	21,540	13,434
Alba-Neck	674,530	.....	12,478
Badger	655,590	.....	12,128
Prosperity	416,400	150,630	11,260
Miami	431,710	189,790	10,166
Spurgeon	470,690	102,000	9,606
Carthage	339,460	.....	6,097
Granby	364,000	5,600	6,049
Aurora	357,850	.....	4,777
Cave Springs	220,190	.....	4,184
Zincite	154,010	.....	2,772
Seneca	.....	48,190	1,156
Sarcoxie	59,650	.....	656
Everton	41,300	.....	414
Totals	11,544,710	2,139,050	$253,614
Eight weeks	84,524,190	13,550,750	$1,899,133
Zinc value, the week, $200,457; 8 weeks, $1,550,074			
Lead value, the week, 63,157; 8 weeks, 349,059			

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	Zinc Ore. Base Price. 1909.	Zinc Ore. All Ores. 1908.	Zinc Ore. All Ores. 1909.	Lead Ore. All Ores. 1908.	Lead Ore. All Ores. 1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	.....	34.92	.....	49.72	.....
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.63	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Feb. 20—The highest price paid for zinc ore this week was $38 per ton; the base price for 60 per cent. zinc was $36@37 per ton. There was less than the usual amount of high-grade ore available for competitive purchase, a number of roasting plants being idle. One car of lead ore brought $48 per ton; the base price for 80 per cent. lead was $46 per ton.

SHIPMENTS, WEEK ENDED FEB. 20

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Cuba City	386,855	75,240	74,600
Hazel Green	363,400	.....	.....
Strawbridge	352,000	.....	.....
Platteville	286,415	.....	.....
Linden	253,180	.....	.....
Livingston	190,000	.....	.....
Benton	179,500	.....	.....
Rewey	65,390	.....	.....
Harker	34,900	.....	.....
Total	2,102,640	75,240	74,600
Year to Feb. 20	16,141,466	521,240	1,390,200

In addition to the above there was shipped to the American Zinc Ore Separating Company from Rewey, 324,460 lb.; from Benton, 267,800 lb.; from Lancaster, 92,000 lb.; from Platteville, 168,820 lb. Shipped to the Joplin Separator Works, from Hazel Green, 305,400 lb.; from Linden, 76,670 lb. zinc ore.

Chemicals

New York, Feb. 24—Business continues quiet, and the situation is not changed. The general tendency seems to be to buy for immediate use only.

Copper Sulphate—Only a moderate business has been transacted. Prices remain, however, the same as last week at $4.60 per 100 lb. for carload lots and over; $4.85@5 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade remains easy. Prices are unchanged, spot nitrate being quoted at 2.15c.; for future business, 2.12½c. is asked.

Mining Stocks

New York, Feb. 24—The reduction in steel prices—which in the true light is really a bull argument—was taken up by the bears as a reason for forcing a general reduction. Beginning with United States Steel a sharp decline set in, which involved not only the industrials, but also Amalgamated Copper and finally many railroad stocks. The market was generally excited after the holiday on Monday, and on Tuesday the dealings were the heaviest of the year. The quotations were lower all around at the close, with the market still tending downward, and indications of a bear market likely to last for a time, with occasional rallies possible.

The Curb followed the course of the Stock Exchange, with general declines in quotations, some of a sharp order. There was, however, a degree of conservatism not always shown on the Curb. The copper stocks generally were heavy and rather weak, with much selling and a good deal of liquidation. In other mining stocks trading was not so heavy, but there was a general downward tendency manifest. The close did not point to an immediate recovery.

Boston, Feb. 23—Mining-share prices are the lowest of the year and considerably below the high levels of 1908. Each day the past week has seen lower prices, as a rule. Certain stocks have had their ups and downs and periods of activity, but prices are considerably off in the week's time. This is due to the fact that copper has weakened and the cut in the prices of steel products has had a depressing effect also.

Even the knowledge that A. S. Bigelow and associates will deliver to the Calumet & Hecla people this week something like 125,000 shares in the Osceola, Tamarack, Ahmeek, Isle Royale, Seneca and Laurium mining companies, could not stem the tide in today's selling and liquidation.

Calumet & Hecla directors have de-

clared a quarterly dividend of $5, the same as the four previous payments. The stock is off $20 net to $625. North Butte has gone off $9 in the week to $66.50 on persistent offerings of stock. Amalgamated has lost $7.50 to $68.75; Copper Range $4.75 to $71.25; Mohawk $5 to $60; Old Dominion $4 to $48; Quincy $4 to $88; Superior $3 to $41.75, and Utah Consolidated $2.87½ to $39. Dominion Iron and Steel touched $38.50, but is back to $30. Trinity broke $3.62½ to $12 on announcement that ore shipments to the Balaklala smelter had ceased on account of the low price of copper.

Isle Royale spurted to $33, but is off to $28.50. Osceola touched $138, but closed $8 below this tonight. La Salle has lost $1.75 to $15; Lake $2.62½ to $17; Tamarack $7.50 to $79.50; Allouez $3 to $41.

Old Dominion directors have declared the usual quarterly dividend of 50c. East Butte has been a strong feature, advancing to $14.25, but was off to $12.75 tonight. Boston Consolidated has been weak and fell to $11.50. This company will issue 50,000 shares, at tonight's closing price, making the total outstanding, 775,000 shares. The issue has been underwritten. The Victoria opposition to the present management appeared at the meeting today but the election was adjourned for the following day.

The Curb has been active and prices are slightly lower. Trading in Southwestern Development has been ordered to cease on the Curb temporarily.

STOCK QUOTATIONS

NEW YORK Feb. 23	
Name of Comp.	Clg.
Alaska Mine	.36
Amalgamated	68½
Anaconda	40
Balaklala	‡2¼
British Col. Cop.	6¾
Buffalo Mines	3½
Butte Coalition	22½
Colonial Silver	7/16
Cum. Ely Mining	7¾
Davis Daly	3 1/16
Dominion Cop.	½
Douglas Copper	3
El Rayo	3 1/16
Florence	3 1/16
Foster Cobalt	$.56
Furnace Creek	.11
Giroux	6⅞
Gold Hill	⅜
Goldfield Con.	7⅞
Granby	97
Greene Gold	¼
Greene G. & S.	7
Guanajuato	‡1¾
Guggen. Exp.	181
Hannapah	.15
Keer Lake	8
McKinley Dar.	.93
Miami Copper	13 1/16
Mienac	1¾
Mines Co. of Am.	7/16
Mitchell Mining	1 1/16
Mont. Sho. C.	2 1/16
New. Utah M. & S.	2 1/16
Newhouse M. & S.	4½
Nipissing Mines	9¾
Old Hundred	1 1/16
Silver Queen	.65
Stewart	1/16
Tennessee Copr.	37¼
Tri-Bullion	1
Union Copper	1 1/16
Utah Apex	6 1/16
Utah Copper	40 1/16
Yukon Gold	4 1/16

BOSTON Feb. 23	
Name of Comp.	Clg.
Adventure	7¾
Allouez	41
Am. Zinc	‡26¼
Arcadian	4¼
Arizona Com.	32½
Atlantic	15½
Boston Con.	11½
Calumet & Ariz.	99
Calumet & Hecla	625
Centennial	31
Con. Mercur	.30
Copper Range	71½
Daly-West	10
East Butte	12⅞
Franklin	13½
Greene-Can.	10
Isle Royal	28½
La Salle	15
Mass.	5¼
Michigan	11
Mohawk	60
Nevada	17
North Butte	66¾
Old Colony	.60
Old Dominion	48
Osceola	130
Parrot	27
Quincy	88
Rhode Island	14¾
Santa Fe	2 1/16
Shannon	14
Superior	41½
Superior & Pitts.	13⅞
Tamarack	80
Trinity	12½
United Cop., com.	12
U. S. Oil	30½
U. S. Smg. & Ref.	40⅞
U. S. Sm. & Re., pd.	44⅞
Utah Con.	39
Victoria	5
Winona	5 1/16
Wolverine	145
Wyandotte	2½

*Ex. Div. ‡Ex. Rights.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	35¾
Am. Smelt. & Ref.	80½
Am. Sm. & Ref. pf.	101
Colo. Fuel & Iron	29
Federal M. & S., pf.	‡84
National Lead	73
National Lead, pf.	‡108¾
Pittsburg Coal	11⅞
Republic I. & S.	16¾
Republic I. & S., pf.	67½
Sloss-Sheffield	68¾
Standard Oil	636
U. S. Steel	41¼
U. S. Steel, pf.	107
Va. Car. Chem.	41⅝

BOSTON CURB	
Ahmeek	165
Black Mt.	2¾
Chemung	20½
Globe Con	5¾
Hancock	12¾
Helvetia	3½
Keweenaw	‡4¾
North Lake	‡7⅞
Ojibway	13
Superior & Bost.	‡16¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Feb. 20		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.03
Center Cr'k	1.90	1.40
Cent. C. & C.	78.00	77.00
C.C. & C. pd.	80.00	79.00
Cont. Oil	105.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	105.00
Gra. Bimet.	.25	.17
St. Joe	12.00	11.00

LONDON Feb. 24	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton's Ind.	0 3 3
Camp Bird	0 15 9
Esperanza	3 1 3
Tomboy	0 17 6
El Oro	1 3 9
Oroville	0 11 3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 24.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.23
Best & Belcher	.33
Caledonia	.10
Challar	.09
Comstock	.28
Con. Cal. & Va.	.41
Crown Point	.30
Exchequer	.25
Gould & Curry	.13
Hale & Norcross	.17
Mexican	.68
Ophir	1.25
Overman	.12
Potosi	.09
Savage	.17
Sierra Nevada	.25
Union	.25
Utah	.02
Yellow Jacket	.39
TONOPAH STOCKS	
Belmont	.83
Extension	.67
Golden Anchor	.01
Jim Butler	.15
MacNamara	.35
Midway	.20
Montana	.77
North Star	.02
Tono'h Mine of N.	6.00
West End Con.	.33
GOLDFI'D STOCKS	
Adams	.02½
Atlanta	.13
Booth	.20
Columbia Mt.	.12
Comb. Frac	.99
Con. Red Top	.08
Cracker Jack	.04
Dia'dfield B. B. C.	.08
Goldfield Belmont	.04
Goldfield Daisy	.63
Great Bend	.18
Jumbo Extension	.15
Kendall	.05
Lone Star	.04
May Queen	.03
N. Y. C. O. D.	$.04
Oro	.10
Red Hill	.09
Roanoke	...
Sandstorm	.12

Name of Comp.	Clg.
Silver Pick	.08
St. Ives	.12
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.04
Homestake King	.04
Mont. Shoshone C.	1.87½
Tramp Cons.	.09½
MISCELLANEOUS	
Bonnie Clare	.04
Lee Gold Grotto	...
Nevada Hills	1.37½
Nevada Smelting	1.00
Nevada Wonder	.55
Nevada-Utah	2.75
Penn-Wyoming	.06
Pittsburgh S. Pk.	.70
Rawhide Coal	.44
Round Mt. Sphinx	.05

COLO. SPRINGS Feb. 19	
Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con.	3⅝
Dante	6¾
Doctor Jack Pot.	8⅞
Elkton	70¾
El Paso	49¾
Findlay	17
Gold Dollar	13¾
Gold Sovereign	‡3½
Isabella	24
Index	....
Jennie Sample	8½
Jerry Johnson	16
Mary McKinney	35
Pharmacist	3½
Portland	1.00
Un. Gold Mines	4⅞
Vindicator	78
Work	7½

Assessments

Company.	Delinq.	Sale.	Amt.
Addie, Utah	Feb. 15	Mar. 6	$0.004
Atlantic, Ida.	Feb. 20	Mar. 22	0.00½
Belcher, Nev.	Mar. 10	Mar. 31	0.10
Bullion, Nev.	Feb. 24	Mar. 18	0.05
East Hercules, Wash.	Feb. 15	Mar. 15	0.00½
Gould & Curry, Nev.	Feb. 15	Mar. 9	0.10
Lady Washington, Nev.	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
National, Mich.	Mar. 15	.....	0.40
Overman, Nev.	Feb. 18	Mar. 11	0.00
Reindeer, Ida.	Feb. 15	Mar. 15	0.10½
Seven Bros.-Pioche, Nev.	Feb. 1	Feb. 27	0.00⅛
Sierra Nevada, Nev.	Feb. 12	Mar. 5	0.10
Silver Eagle, Ida.	Feb. 1	Mar. 1	0.001
Socrates, Cal.	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal.	Feb. 11	Apr. 10	0.03
Temple, Ida.	Feb. 22	Mar. 15	0.005
Utah-United, Utah	Feb. 15	Mar. 1	0.01
Zeibright, Cal.	Feb. 15	Mar. 6	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	.....	25.855	.....
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.653	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	.....	13.098	.....	58.786	.....
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.969	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	.....	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	3.691	4.175	14.469	13.113
February	3.725	.....	14.250	.....
March	3.838	.....	13.975	.....
April	3.993	.....	13.469	.....
May	4.253	.....	12.938	.....
June	4.466	.....	12.600	.....
July	4.447	.....	13.000	.....
August	4.580	.....	13.375	.....
September	4.515	.....	13.125	.....
October	4.351	.....	13.375	.....
November	4.330	.....	13.538	.....
December	4.213	.....	13.156	.....
Year	4.200	.....	13.439	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.426
February	4.788	.....	4.638	.....	20.875	.....
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.600	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.039	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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The Standard Consolidated Cyanide Mill

The Pulp, after Crushing in Cyanide and Passing over Amalgamation Plates, Is Treated by Mechanical Agitation Tanks and Moore Filters

BY S. F. SHAW*

The ore from the mines is hauled to the Standard Consolidated Mill, Bodie, Cal., by mules in trains of five cars, each having a capacity of 1¼ tons, to an inclined track over which the cars are hoisted by a belted hoisting engine and dumped into a 100-ton bin. From the bin the ore is fed to a 9x15-in. Blake crusher, falling into another bin from which it is delivered to the stamps by Challenge feeders. There are four batteries of five stamps each; the stamps weighing 1000 lb., drop 96 to 106 times per minute, and have a drop of 4 to 6 in. The consumption of metal in the shoe is 0.63 lb. per ton of ore, and in the die 1.16 lb. Crushing takes place in sodium cyanide solution equivalent to 0.12 per cent. potassium cyanide, the pulp being discharged through a 30-mesh punched screen. The pulp falls on a lip plate 18 in. by 4½ ft.; then on two 4x8-ft. plates, and thence on two 4x4-ft. plates. The plates are of sheet copper, 3/16 in. thick and are plated with silver amounting to 2 oz. per sq.ft. An amalgam trap is placed at the end of the lower plate. When the ore contains any appreciable quantity of sulphides, which is rarely, the pulp from the amalgam traps flows to four 6-ft. Frue vanners after which it is elevated in three lifts by Frenier sand pumps to the flume in which it flows to the cyanide plant.

A 4x6x12-ft. sump receives the pulp from the flume and the material is elevated by a No. 2 Carson centrifugal pump to two 48-in. conical spitzkasten. The underflow from the spitzkasten flows through a launder beneath the feeder which delivers into the same launder tailings from the old stamp-mill ponds. These tailings are elevated in two-ton cars over a trestle to a 50-ton bin dumping on a grizzly 7x14 ft. with 1¼-in. openings. The material remaining on the grizzly is composed largely of pieces of clay which fall into, and are broken up by, a mixing pan at the foot of the grizzly, after which it joins the underflow from the spitzkasten and is carried directly to a 5x22-ft. Gates tube mill, driven at 24 r.p.m. The material discharged from the tube mill flows to the 4x6x12-ft. sump previously mentioned.

Agitation Apparatus

The overflow from the spitzkasten flows through a 4-in. pipe to the agitation vats of which there are five, 18 ft. in diameter and 15 ft. deep, and five 20 ft. in diameter and 11 ft. deep. Seven hours are required to fill a vat. Upon starting to fill, the mechanical agitators are thrown on and agitation is continued for 12 hours after the vat is filled. Air is also supplied during the agitation as long as is possible, depending upon the amount that can be delivered by the compressors. The pulp then is allowed to settle for about 40 hours during which time the average settlement is 26 per cent. of the total hight. Decantation then begins and all of the clear solution is drawn off to the strong solution tanks. The sweeps are then started, and after the pulp is well mixed, it is pumped by a 3-in. centrifugal pump to the filter vats. There are two of these pumps, one for each set of five agitation vats. Pipes 4 in. in diameter convey the pulp from the vats to the pumps and 3-in. pipes from the pumps to the filter vats. The 4-in. pipes are too small and frequently become choked.

BODIE, CAL., STANDARD CONSOLIDATED MILLS IN BACKGROUND

*Mining engineer, Pasadena, Cal.

The Moore vacuum filter press used has two baskets, each containing 45 leaves. The two filter vats and also the wash-solution tanks are each 24 ft. in diameter and 7 feet deep. These tanks were formerly used as percolation vats. During filtration a vacuum of 13 in. is maintained, although at first the relief valve on the pumps must be opened so as to obtain a vacuum of only 7 or 8 in., as the flow of solution is too great for the pump motor to handle. The greatest vacuum that can be obtained at this altitude is 21.7 inches.

The pulp in the filter vats is kept in agitation by sweeps operated by a shaft passing through the bottom of the vats. Air is also used, drawing the pulp from the bottom of the vat and discharging over the edge at the top. These filter vats frequently become stopped by the settling of the coarser sand to the bottom, especially when any stoppage makes it necessary to throw off the sweeps; as a rule the vats need to be sluiced out once a month.

After a cake is formed the basket is raised and carried to the wash tank and washed in a weak solution of 0.07 per cent cyanide. After washing, the cakes are discharged from the filter by compressed air introduced inside of the leaf, into a hopper having a bottom sloping 45 deg., and are sluiced to the tailings ponds. The average time of a cycle is as follows:

Making cake	150 min
Moving to wash vat	12 "
Washing, weak solution	166 "
Moving to discharge	10 "
Discharging	10 "
Moving to filter	12 "
Total	6 hr.

The thickness of the cake averages 0.83 in. and when discharged it contains 27 per cent. moisture. The loss of cyanide due to this contained moisture is 0.38 lb. per ton of ore. These two baskets handle 110 tons of dry pulp per day.

Precipitation

The solutions from the filter are discharged into gold solution tanks aggregating 4040 cu.ft. capacity for the strong solution, and 1780 cu.ft. for the weak solution. From these tanks the solutions flow to the zinc precipitation boxes of which there are three rows for the weak solution, each row having 20 compartments, and for the strong solution six rows having nine compartments and four rows of 10 compartments. There are also in the zinc room 12 rows of boxes, each having 10 compartments, which have not yet been put into service. The strong solution before precipitation averages 0.11 oz. gold and 0.3 oz. silver, and after precipitation 0.003 oz. gold and a trace of silver. The weak solution before precipitation averages 0.06 oz. gold and 0.27 oz. silver, and after precipitation 0.0056 oz. gold and a trace of silver.

The barren solutions are discharged into sump tanks having 540 cu.ft. capacity for the strong, and 750 cu.ft. for the weak solution. A No. 3 Gould centrifugal pump driven by a 15-h.p. motor elevates the barren solutions to the storage tanks above the plant, aggregating 4600 cu.ft. capacity for strong and 1230 cu.ft. for the weak solution. For every ton of ore treated two tons of strong solution and 0.7 ton weak solution flows through the zinc boxes.

The stamp mill is supplied with solution by a 5x8-in. Knowles triplex belted pump elevating to a supply tank at the mill having a capacity of 3100 cu.ft., from which it is drawn to the batteries.

Clean-up

A clean-up is made twice a month. The precipitate which passes through a three-mesh screen is hauled in tubs by wagon to the acid room where the unconsumed zinc is dissolved with sulphuric acid. Nine washings and decantations are then given to remove the acid, after which the precipitate is filtered on a blanket ejector using steam to obtain a vacuum. It is then dried, mixed with borax and soda, melted and cast into bars.

A 75-h.p. Stanley induction motor drives the tube mill, mixing pan, Rix air compressor, Knowles triplex pump, filter-vat agitators, and the agiators in five of the agitation vats. This motor is supposedly about 50 per cent. overload.

The Moore filter-press frames are each supplied with two 10-h.p. motors, one for raising and lowering the basket, and one for driving the Dow 12x12-in. wet vacuum pump. A 20-h.p. motor drives the agitators in five of the agitation vats and a 3-in. centrifugal pump which elevates the pulp from these vats to the filter vat.

During the time that I was in charge of the plant the tailings from the stamp mill flowing to the tube mill for regrinding averaged 0.39 oz. gold and 0.94 oz. silver, which, upon reaching the agitation vats, showed an apparent extraction of 70 to 75 per cent. The tailings fed from the old stamp-mill tailings dump averaged 0.29 oz. gold and 1.8 oz. silver. Sizing tests on material from the stamp mill averaged as follows:

+40 mesh	9 0 per cent.
40– 60 mesh	17 5 per cent.
60– 80 mesh	14 0 per cent.
80–100 mesh	12 0 per cent.
100–200 mesh	15 5 per cent.
–200 mesh	32 0 per cent.

The material from the tailings dump averaged as follows:

+40 mesh	8 7 per cent.
40– 60 mesh	23 7 per cent.
60– 80 mesh	20 6 per cent.
80–100 mesh	8 4 per cent.
100–200 mesh	19 3 per cent.
200– mesh	19 3 per cent.

CYANIDE MILL

TWENTY-STAMP MILL

The spitzkasten overflow going to the agitation vats sized as follows:

+40 mesh	0 5 per cent.
40– 60 mesh	4 5 per cent.
60– 80 mesh	7 1 per cent.
80–100 mesh	14 9 per cent.
100–200 mesh	24 8 per cent.
200– mesh	48 2 per cent.

The discharge from the filter press sized as follows:

+40 mesh	0 3 per cent.
40– 60 mesh	1 8 per cent.
60– 80 mesh	4 1 per cent.
80–100 mesh	6 8 per cent.
100–200 mesh	21 9 per cent.
200– mesh	61 1 per cent.

The average apparent extraction is 88 per cent. gold and 57 per cent. silver. Owing to the tonnage from both mine and tailings dump being estimated by volume, no exact extraction percentages can be given. There is probably an appreciable loss in the clean-up owing to inadequate facilities in the zinc and clean-up rooms.

The tube mill is lined with plates of soft metal 1¼ in. thick by 8 ft wide, lasting 10 months with a consumption of 0.5 lb metal per ton of ore. The pebble consumption is about 3 lb. per ton. Figures

for consumption of chemicals per ton of ore are as follows: Mercury, 0.22 oz.; cyanide equivalent to 1.16 lb. potassium cyanide; zinc oxide, 0.6 lb.; lime, 7.5 pounds.

The labor for two shifts of 12 hours is as follows: Two tube-mill men who attend to the tube mill, tailings feeder, compressor, triplex pump, and zinc shaving lathe; one tailings feeder at night; two basket men attending to the Moore filters, vat agitators, and the pulp, centrifugal pumps; one zinc-room man, who attends to the zinc boxes and clean-up; one night foreman; and one general foreman. Owing to the present arrangement of tanks, pipes, etc., two mechanics are constantly required for repair work.

I am indebted to Arthur Faust, manager of the Standard Consolidated Mining Company, for many of the figures used in this article.

Mine Legislation in California

Special Correspondence

One of the senators in the State legislature, now in session at Sacramento, has discovered that there is no State mining law in California, and has introduced a bill regulating the conditions under which mining claims may be acquired. This gentleman states that there are no statutory provisions upon the subject of mining in the State and that one may stake out a claim without recording it or putting up monuments. All that has to be done is to find the ore. Upon this announcement the daily papers take the matter up and agree that it is wonderful that the miners could have got along so many years without a specific State law, there never having been any. The fact is, notwithstanding these statements, that some years ago the legislature adopted certain mining laws relative to the taking up and recording of claims, but after a few years the law was found to be useless and was repealed. All that the law really did was to establish certain fees for certain officials, without benefiting the mining industry in the least. The Federal law was sufficient in all respects and remains law in this, as in other States. Upon the acquisition of this State and the exciting results produced by the discovery of gold, the Government found itself fettered by an ancient and illiberal law of reservation. The miners who came to California from all parts of the world adopted a system of mining regulations entirely voluntary. The system was not only adopted, without the authority of the Federal government, but all mining on public lands was forbidden. Subsequently the laws adopted by the miners became the laws of the State. The State courts followed the same principle, naturally adopting the code presented by the miners. While this code was in force Congress passed the act of July, 1866, which in effect confirmed the laws adopted by the miners of California.

Before this there has been a number of acts passed by the State legislature relating to mines, but mainly in the direction of taxation, especially of foreign miners. The first American mining law, that of 1866, was passed while Senator Conness of this State, who died last week, was chairman of the Committee of Mines in the Federal Senate, and was introduced by Mr. Sherman, of Ohio. That act remained in force until May 10, 1872, when the act at present in force was adopted by Congress. The miners of this State, as elsewhere, have acquired their titles and conducted their operations under this law. It has been interpreted in all its phases by the courts and seems to answer every purpose, so there does not seem to be any necessity of a special law for the State of California. Doubtless if one is adopted by the legislature it will benefit certain officials by fees for recording, etc., but there is little doubt that the miners do not want any new laws on the subject.

Another innovation is that proposed by an assemblyman from Nevada county, which is a mining county, by the way. His bill provides for a State inspector of mines who shall visit all mines in California to examine machinery and other appliances and inspect shafts, drifts and other underground works. If the inspector rules that anything is dangerous to life, the owners are notified and they must apply certain remedies. The inspector is only to get $2400 per annum and his two assistants $500 each. This seems an absurdity. No competent men could be obtained for such salaries and there would be much chance of blackmail against the mineowners. This looks like a miners' union bill, but as several measures of similar object have been killed in previous legislatures, it is probable that this one will be also. The men from the mining counties will unite to prevent any such legislation. There are not half a dozen coal mines in the State and the gold mines are not subject to explosions or accidents from which great loss of life may result.

Another measure which is to be discussed in the legislature is a method of regulating by law the system of boring oil wells. It is proposed to form oil districts, similar to the reclamation districts, which shall have the power of electing trustees to make laws governing the boring of wells and other vital matters, and to penalize violators of the regulations if necessary. It is desired to make the drilling records public, instead of keeping them secret from other drillers in the same district. With the drilling record or log made public in oil districts there would be less danger of coming upon unexpected water strata and consequent flooding. The new bill makes it compulsory to shut off by proper means all such water strata encountered.

Los Lamentos Mine

The Los Lamentos mine, 55 miles from Ahumada, Chihuahua, Mexico, on the Mexican Central Railway, is at present producing from 10 to 20 tons of zinc-silver-lead ore per day. George B. Squires, formerly of the El Paso smelter, is manager. Water is hauled 9 miles. Sufficient fuel for all needs are found close at hand. The mountain is steep and sinking will not be necessary until a depth of 500 ft. is attained. All the work is now done from adit levels.

Geologic Conditions

The Los Lamentos mountains, in which the mine is situated, form a small range in the center of a plain 60 miles wide and 200 miles long. These mountains are made up of limestone and it is probable that they are in the same Cretaceous belt in which are found the Mexican mines of Mapimi, Vallardena, Sierra Mojada, Almoloya, Rio Florida, Naica, Santa Eulalia and others toward the south. In most of these districts, notably Santa Eulalia, great bodies of zinc ore occur in the limestone in close proximity to the lead-silver ores, and such is the case at Los Lamentos.

The surrounding country is eruptive. Float is found in the valleys on each side of the range; this doubtless had its origin in the adjoining ranges, which are formed of basalt, granite, porphyry and lime. The limestones of the Los Lamentos strike in a generally east-west direction, but mineralization is encountered chiefly in north-south folds of the rock. The orebodies are found where the fracturing is most pronounced. Natural caves are characteristic of the district.

The Ore

When the present operators began work on the mine it was thought that the ore was entirely silver-lead, but soon it was found that for every ton of lead-silver ore there was mined about seven tons of zinc ore. The zinc ore so far mined is oxidized, no sulphide as yet having been encountered. The lead-silver ore runs high in iron and low in silica and makes a desirable smelting material. The zinc ore carries about 43 per cent. zinc.

The ore is packed from the lower workings by peons in *zurrones* (rawhide buckets of from 100 to 200 lb. capacity each). The ore from above the adit levels, however, is wheeled out in barrows to the loading patio.

The mine has the appearance of stability. Development work is based on the hypothesis that there is here a regular system of ore deposition such as occurs throughout this lime belt.

Mining and Milling Florida Phosphates

The Mineral Is Mined by Means of Monitors, Dredges or Steam Shovels, and After Crushing, Screening, Washing and Drying Is Ready to Ship

BY C. A. STONE*

The phosphate deposits of Florida are divided into three classes, hard-rock, land-pebble, and river-pebble deposits. Land-pebble deposits are the most extensive, and the phosphate rock mined in the districts where these are found ranges in size from that of very fine bird-shot up to pieces approximately the bulk of an egg. The method of recovery is as follows:

When a deposit has been located, the overburden, varying in thickness from 4 to 25 ft.—seldom more—is usually removed by means of a steam shovel. Then a stream of water from a hydraulic "gun," Fig. 3, is turned upon the deposit and the pebble matrix washed down into a sump hole, shown in Fig. 4 at the right of the gun. At the mine where the photographs illustrating this part of the article were taken, that of the Pierce Phosphate Company, Bartow, Fla., a 2½-in. stream is thrown by the gun, under a pressure of 100 to 125 lb. per sq. in. at the pump. There is nothing regular about the deposits, as will be seen from the illustration, and the scene of operations is being constantly shifted.

From the sump hole the material is lifted by means of two 10-in. centrifugal gravel pumps to the top of the washer, appearing in the upper left-hand corner of Fig. 4, a distance of about 80 ft. The first of these pumps is located at the bend of the pipe line, near the center of the illustration, and discharges into the other pump installed at the foot of the washer. Throughout the pebble district 10-in. centrifugal pumps are used almost exclusively for this service. Each of those above mentioned is run by an induction motor operating at 450 to 600 r.p.m. Fig. 5 is a closer view of the washer shown in the preceding illustration, and with Fig. 6 it is typical of those erected in the land-pebble districts, for all are of the same general construction.

The matrix washed from the mine, carried by about seven times its weight of water, discharges from the pipe line at the top of the washer and is spread over a flat screen. Thence it passes to a revolving screen, where the lumps of clay, large pieces of rock and other foreign matter are removed; the material is then discharged into a pair of 24-ft. log washers. From these the partially cleaned rock is fed to another revolving screen, which in turn discharges to a flat screen, from which the material passes to a wet bin. Rejections from the various screens are separately treated in a sluice box, marked

FIG. 1. STEAM SHOVEL LOADING PHOSPHATE ROCK INTO CARS IN LAND-PEBBLE DISTRICT

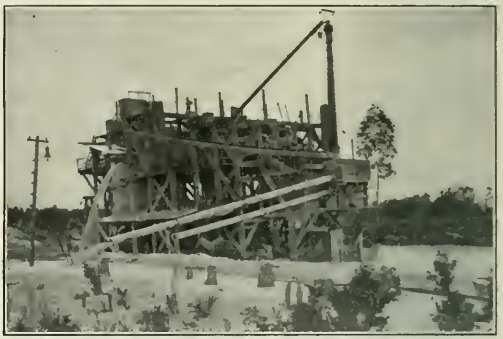


FIG. 2. DREDGE USED IN WORKING RIVER-PEBBLE DEPOSITS

FIG. 3. WASHING PHOSPHATE PEBBLE INTO SUMP HOLE

FIG. 4. LIFTING MATERIAL TO WASHER FROM SUMP HOLE BY MEANS OF CENTRIFUGAL PUMPS

*Baltimore, Md.

SB in Fig. 5, in order to recover the finer particles contained in the refuse. Throughout the entire operation fresh water at a pressure of from 50 to 70 lb. per sq.in. is used to aid in washing the rock and clay from the matrix.

From the wet bin, shown in Fig. 6, directly over the railroad track, the rock is drawn off into side- or bottom-dump cars and hauled to a central drying station, illustrated in Fig. 7, where the material is elevated by means of a grab bucket, having a capacity of about two tons, and either emptied into wet bins, or if the latter are full, temporarily dumped on a pile outside.

From the wet bins the rock is fed into 6x60-ft. rotary dryers; each pair of these discharges into an elevator. The rock as it goes to the dryers contains approximately 15 per cent. moisture, and when discharged contains only 2 per cent. moisture. The rock is discharged from the elevator into a hopper scale and then passes to a cross-conveyer, marked *CV* in Fig. 7, which takes the rock to a conveyer running lengthwise of the dry bin, whence it is drawn off into covered cars for shipment. All of the details of the wet bins, dryer house, conveying system and dry bins are very clearly shown in the end- and side-elevation drawings, Figs. 9 and 10.

For a panoramic view of one of the leading phosphate company's operations the reader is referred to Fig. 8. Here *A* represents the mine ready for opening, *B* the washing plant, *C* the pump house, *D* the wet bins, *E G* wet rock (temporarily stored under the telepher track *F*), *H* the dryer house and stacks, *I* a strip of ground being mined, *J* an orange grove soon to be uprooted, *K* the cross-conveyer from the wet bins to the dryer house, *L* the dry storage bins, *M* the stack of the power plant, *N* the track for carrying away strippings, *P* the wet bin of the washing plant, and *Q* a reservoir from which rock has already been mined.

An idea of the value of the output may be gained from the statement that at the time this photograph was taken the pile of rock *E G* was worth $125,000 on the spot. Fig. 11 is a plan showing the arrangement of the buildings of the main plant, furnished by courtesy of the Pierce Phosphate Company. This was designed by H. L. Pierce, president, and A. D. Shaw, engineer of the phosphate company, and the engineers of the Link-Belt Company, of Philadelphia.

In the phosphate districts one finds power plants of the most approved construction, so far as equipment is concerned. The power plant of the Prairie Pebble Phosphate Company consists of seven 300-kw. polyphase generators for alternating current, each belt driven by a pair of three-cylinder Diesel oil engines operating at 164 r.p.m. All of the machinery in the plant mentioned, including pumps, screens, dumps, elevators, telephers, conveyers, air compressors, driers, etc., are driven by motors, either singly or in groups, these being of the standard squirrel-cage induction type.

Large quantities of clean water are required for washing the phosphate, so that during a dry season the miners are put to a great deal of trouble, and sometimes they are unable to operate in consequence of the scarcity of water. This led to forcing the matrix, by means of centrifugal pumps, through pipe lines from the different mines to a central washing and drying station; but experience has shown that it is more economi-

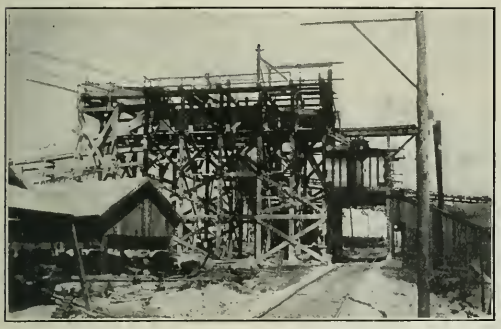


FIG. 5. VIEW OF WASHER SHOWN IN UPPER LEFT-HAND CORNER OF FIG. 4

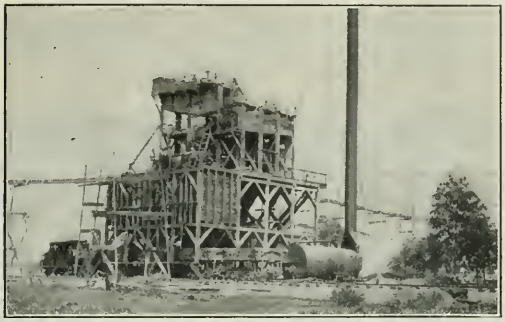


FIG. 6. ANOTHER WASHER TYPICAL OF THOSE RECENTLY ERECTED IN LAND-PEBBLE DISTRICTS

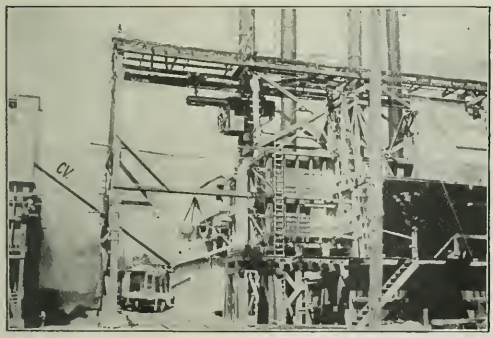


FIG. 7. CENTRAL PLANT FOR DRYING PHOSPHATE ROCK

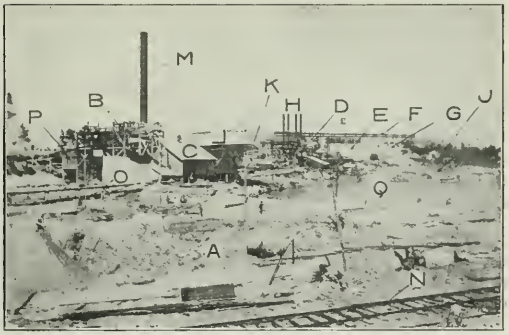


FIG. 8. PANORAMIC VIEW OF A LEADING PHOSPHATE COMPANY'S OPERATIONS

cal in the long run to have the washer located at the mine, even though the washed rock has to be hauled to a central drying plant.

Methods of operation in all of the districts are practically the same as described in this article, with the exception of the fact that the hard-rock phosphate, which is found in pieces up to several tons in weight, has to be excavated, crushed and elevated to the washer, and that in the river-pebble district a dredge takes the place of steam shovel and hydraulic gun.

Fig. 1 shows one of the steam shovels at work, and Fig. 2 a dredge, the latter carrying its own washing plant, quite similar to those used in the land operations. Dredges are sometimes used in the hard-rock and land-pebble districts where pockets of the phosphate are found under water.

The hard rock yields from 77 to 80 per cent. phosphate of lime and the pebbles run 62 to 70 per cent. The cost of getting out the former varies between $2 and $2.50 per ton, and that of the latter from $1.50 to $2.25 per ton. Drying is done at an expense of 14 to 22c. per ton. For fuel wood, coal, or oil are used, this being determined largely by local conditions.

Rock for domestic use is shipped to the fertilizer plants, mainly for combination with other ingredients forming by-products of various industries, such as offal from the packing houses. For foreign consumption the washed and dried rock is loaded mainly at Port Tampa, Fernandina and Jacksonville, Fla., where extensive dockage and loading facilities have been provided, or at Savannah, Ga.

The phosphate industry in Florida, where the most extensive deposits are found, is controlled by 12 companies, four in the hard-rock and eight in the pebble districts. The total phosphate output in 1907 was 1,350,000 tons, valued at $6,750,000 f.o.b. cars at the mines. Among these companies in Florida the largest operators are the Prairie Pebble Phosphate Company, of Mulberry; Dunnellon Phosphate Company of Rockwell; Pierce Phosphate Company, of Pierce; Dutton Phosphate Company, of Gainesville; Cummer Lumber Company, of Jacksonville; Camp Phosphate Company, of Istachatta; and Swift & Co. Recently a combination of the principal interests has been entered into for the purpose of more economically handling and marketing the future product of the mines.

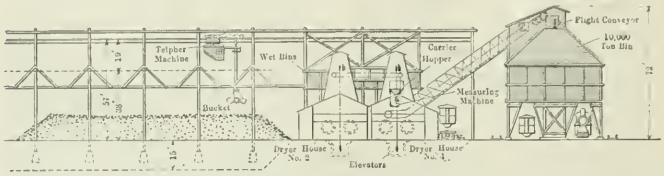


FIG. 9. END ELEVATION SHOWING PRINCIPAL DETAILS OF A PHOSPHATE DRYING AND STORAGE PLANT

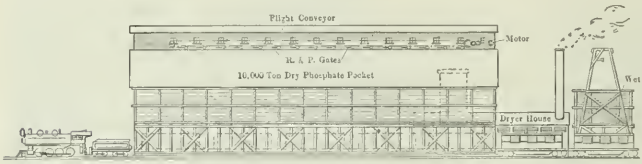


FIG. 10. SIDE ELEVATION OF PLANT SHOWN IN FIG. 9

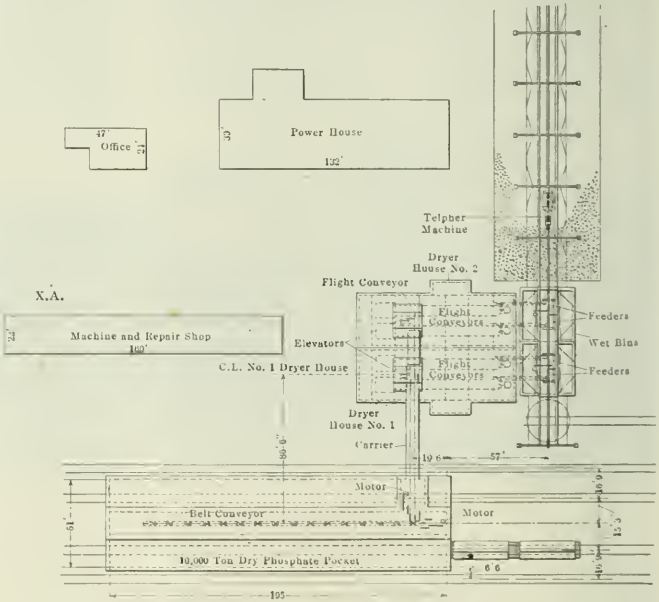


FIG. 11. PLAN OF A TYPICAL PHOSPHATE DRYING AND STORAGE PLANT

Gold in Rhodesia

The general impression that Rhodesia is a high-grade goldfield is disproved by the report of the Rhodesia Chamber of Mines for the year ending March 31, 1908, which shows that prior to April, 1908, only £10,000,000 had been obtained from the 6,300,000 tons of ores crushed; in other words the ore has yielded only 30s. 11d. per ton, or less than the average obtained from the ore now treated on the Rand. For the year ending with March the ore yielded an average of 27s. 9d., or $6.66 per ton. The fall in grade is due to the low grade of ore treated at a profit by tributers and by the lower-grade ore treated by the larger companies owing to the considerable decrease in cost of mining effected in the last two years.

The cost of mining and milling at the Simmer & Jack property on the Rand, South Africa, during the year ending June 30, 1908, was 16s. 2.646d. per ton of ore crushed. Mining cost 8s. 7.3d. per ton; pumping, 3.474d.; transportation, crushing and sorting, 6.08d.; stamp-milling, 1s. 4.337d.; tube-milling, 7.668d.; sand treatment, 1s. 2.262d.; slime treatment, 5.681d.; general charges, 1s. 3.371d.; development redemption, 1s. 8.918d.; total, 16s. 1.091d. per ton; renewals and replacement of plant, buildings, etc., 1.555d.; grand total, 16s. 2.646d. per ton of ore crushed. During the year 785,310 tons of ore were treated, yielding £1 12s. 3.768d. per ton.

Close Sizing of Dry Finely Crushed Ores

The Construction and Advantages of the Vibromotor Sizer for Dry Ores Are Discussed, and the Results of Tests on it Are Given

BY E. GOODWIN STEELE*

No other element is more essential to successful ore concentration than perfect sizing of the ore prior to treatment by suitable jigs, tables or other concentrating machinery, and the truth of this is becoming more and more apparent to the uptodate millman.

Close sizing is especially important in the treatment of what is usually termed the refractory ores; for instance, either lead or copper ores carrying much zinc, or zinc ore with considerable iron or copper in it. On account of the slight difference in specific gravity of these minerals it is usually necessary to crush these ores to 18 mesh, or finer, to free the minerals.

Simple as the sizing problem seems to be at first sight, the ordinary methods of screening or, more properly speaking, sizing now generally employed, gives poor results when the attempt is made to size accurately in the finer sizes.

Screens for dry sizing can be divided into three classes: screens that have the screening surface set on an angle of approximately 45 deg. from the horizontal and which depend on gravity alone to keep the pulp moving over them; screens that have screening surface set at a much less angle, and which have a mechanical motion to assist gravity in moving the ore; and finally screens that have the screening surface horizontal and which depend entirely on mechanical means to prevent the screen cloth from blinding.

Each of the three general types has advantages, although for perfect sizing the nearer to the horizontal the screening surface is set, the nearer in size will be the ore particles to the openings in the screen cloth. For instance, when a screen cloth is set at an angle of 45 deg., the horizontal wires cover a portion of the next strand below, and for this reason, it is necessary to use a much larger mesh cloth than the product desired. This tends to slightly prolong the life of the screen, and if it was possible to cause each of the ore particles to strike the cloth at exactly the same angle, close sizing could be accomplished. This is impossible, however, and therefore, the heads show an unsized product.

On screens set at a less angle, it is necessary to have a jar or bump not only to move material along them, but also to prevent the screen cloth from blinding. This sets up a vibration in the screen, which in time, causes the wires of the cloth to crystallize and break at the inside edges of the screen frame. This vibration of the screen cloth also causes the pulp to travel faster over the middle of the frame, or over the middle of each longitudinal section, than at the edges, and produces a thickening of the pulp along the central line of travel. These lens-shaped streams, being thicker and traveling more rapidly in the center, carry the small and lighter particles on their surface, and many of these fine particles are thus carried over into the oversize bin. This type of screen, also, usually has a vertical vibration of the screen frame which produces an upward current of air through the screen cloth on the down stroke, thus floating the lighter particles on the surface of the streams and preventing them from reaching the screening surface. Indeed, I have seen minute particles of ore travel entirely across a screen without once coming in contact with its screening surface.

When studying the various methods of sizing dry material employed in ore milling, as well as in the other arts, it was found that in the flour-milling industry a much higher state of perfection had been attained. While, of course, the evolution of this art to its present plane was reached upon an entirely different class of material, yet it is interesting to note that in the early methods employed, reels and vibrating screens were used and that these machines have been displaced by the more efficient gyratory bolter, which has been adopted by the leading millers of today. Success in fine sizing in the flour-milling industry was attained by the use of machines of the gyratory type and flour milling is today far in advance of its sister art, ore milling.

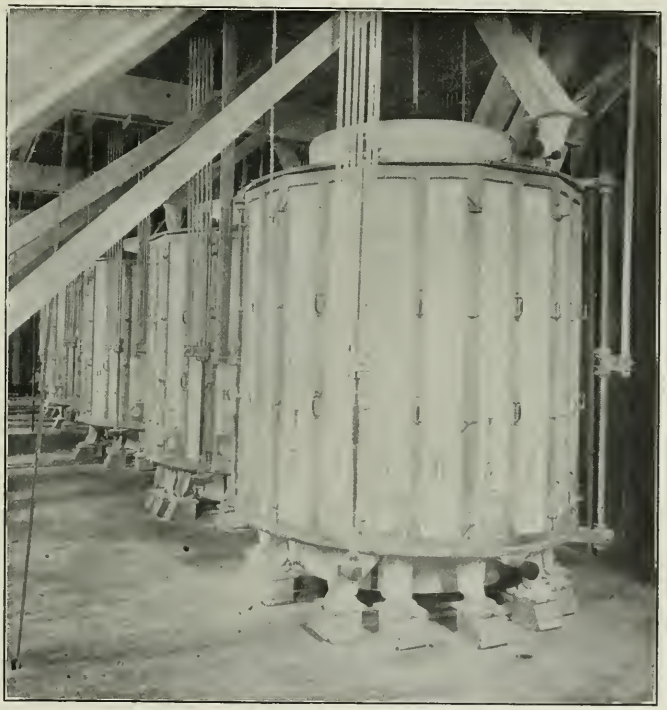


FIG. 1. SUTTON, STEELE & STEELE VIBROMOTOR ORE SIZER

*Secretary-treasurer, Sutton, Steele & Steele, Dallas, Texas.

Gyratory Screens

Fine sizers of the gyratory type have many advantages over vibrating or pulsating screens. There is no vibration of the screen cloth, which is set perfectly horizontal and consequently permits the utilization of the full size of the screen openings. The machine requires less power as the motion when once set up is not interrupted or reversed. There is absolutely no vibration imparted to the supporting framing and the means for preventing blinding of the screen cloth does not wear the cloth or cause a vibration of the screen wires. This accounts for the large capacity of the Sutton, Steele & Steele vibromotor ore sizer, a name given to it on account of its peculiar drive.

This machine was designed along the lines of the gyratory flour bolter with horizontal sieves, though made much stronger and heavier for ore sizing. Fig. 1 shows a view of the exterior of the sizer and method of supporting the body of the machine, which is hung on 24 one-inch wooden reeds.

The body of the sizer is made in eight sections with a door to each section. The screen frames are arranged in descending spirals, each frame being set perfectly level but dropped slightly below the one preceding it in the same spiral. The pulp travels easily and smoothly without pounding and its condition is not disturbed from the feed to the discharge of the system. Any arrangement of the screen frames can be made and any number of products taken from the machine up to 17. By having more than one feed inlet, the machine can be arranged as a duplicate or triplicate sizer, each section delivering the same mesh products or they may differ from each other as may be desired. This flexibility permits of the sizer being especially designed for the material, or ore, to be sized. After careful hand-sizing tests have been made, a flow-sheet for the sizer is drawn to suit the conditions and more or less area of screen cloth is given to each size as may be required. The sizer is made in two sizes; one rated at 50 (No. 3½) and the other at 75 tons (No. 4½) per 24 hours. The 50-ton machine has screen frames having an area of 124 sq.in. each, or a total of 117 sq.ft. of screening surface, and the 75-ton sizer has 169 sq.in. in each screen with a total screening surface of 178 sq.ft. The fact that each square inch of this surface is kept open and active at all times accounts for the high efficiency of the machine.

Each screen frame has a coarse mesh (¼-in. openings) cloth on its under side (Fig. 2) and between this screen and the upper screening cloth is placed a small circular brush. This brush, which is about 2 in. in diameter, has three small bosses or spurs, on its under side and as these spurs travel over the coarse mesh screen, they give the brush a continual tipping motion, which causes the stiff bristles to push upward the ore particles that are blinding the screen cloth. As this brush travels continuously over the entire under side of the screening surface blinding is effectively prevented. This permits of very fine sizing; as fine as 200-mesh cloth can be used in the machine without the slightest blinding of the meshes.

The Rotating Mechanism

The driving pulley is carried on a short vertical shaft above or below the sizer as may be most convenient. Between this shaft and the main shaft of the sizer is a short intermediate shaft with universal couplings of a simple design. When the machine is running, the connecting section of the shaft revolves exactly in line with the shaft on which the driving pulley is placed, and the flexible couplings, therefore, act like common couplings; the universal couplings being used simply to allow the machine to take its own motion in starting and stopping, as when running, it centers itself with the driving shaft.

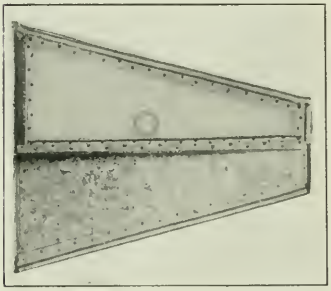


FIG. 2. TOP VIEW OF SCREENS USED IN THE VIBROMOTOR ORE SIZER

The intermediate driving shaft is attached to the sizer shaft at approximately 1½ in. from its center, which is half the usual throw of the machine. To the sizer shaft above and below the body of the sizer are attached heavy counterbalances, which exactly balance the weight of the sizer and its load. A proper amount of weight is put in the counterbalances when the machine is set up in the shop and these weights never need changing nor adjusting, unless it is desired to increase or diminish the throw of the machine. This is done by simply taking out or putting in small iron plates. If the load varies the machine will take care of the variation automatically as it is absolutely self-balancing and requires no attention whatever from the operator in this respect. The vibromotor drive causes the sizer to travel in a true circle, approximately 3 in. in diameter, with absolutely no vibration, at 195 r.p.m.. About 2 h.p. is required to start the machine, and ½ h.p. to run it after it is started.

The pulp is fed to the sizer by gravity from a small bin through a chute having a small metal box attached to it. This box is placed to one side of the opening in the sizes so that the pulp accumulates in it up to the angle of rest. When the machine is started, the gyrations crowd the pulp over to the sizer inlet, the feed being regulated by the distance from the end of the chute to the bottom of the feed box. This automatically cuts off the feed when the sizer is stopped. The pulp, after entering the sizer, immediately begins its travel around the descending spirals until it has passed over the desired number of screens when the first oversize enters a spout in one of the doors, there being two spouts in each door. The undersize continues its travel around the sizer until the required number of oversize products have been taken out; the final fines pass out at the bottom of the machine. Each oversize product after entering the chutes in the doors drops down to the bottom of the machine, reenters the sizer and passes out into its proper chute. The entire interior of the sizer is protected from wear by soft rubber as it has been found that rubber is the only material that will withstand the abrasion of moving granular ore pulp.

When the sizer is used in connection with the Sutton, Steele & Steele dry concentrating table, it is usual to make ten products when treating an ore that needs to be crushed to 18 or 20 mesh in order to free the different mineral particles; the sizes taken out are on 24 mesh, 24 to 30, 30 to 36, 36 to 48, 48 to 68, 68 to 97, 97 to 129, 129 to 140, 140 to 173 and through 173 mesh.

The Efficiency of the Vibromotor Ore Sizer

On a recent test run made with a No. 3½ sizer on a zinc ore that assayed approximately 27 per cent. zinc, 1½ per cent. copper and 3 per cent. iron with a silicious and garnetiferous gangue, with the sizer arranged as a single unit, and so as to deliver ten products ranging from on 24 mesh to through 173 mesh, the machine gave a capacity of 54.86 tons per 24 hours and careful hand sizing showed the following results; one pound of each of the products being taken:

Size Product.	Screen Used.	Amount Through.
On 24 mesh	30 mesh	0.035 oz.
24- 30 mesh	36 mesh	0.035 oz.
30- 36 mesh	48 mesh	0.018 oz.
36- 48 mesh	68 mesh	1r.
48- 68 mesh	97 mesh	1r.
68- 97 mesh	129 mesh	none
97-129 mesh	140 mesh	0.12½ oz.
129-140 mesh	173 mesh	0.75 oz.

In the capacity and efficiency test made on a vibromotor sizer at Tiro General mill at Charcas, San Louis Potosi, Mexico.

during April, 1908, the vibromotor was arranged in two duplicate sections with separate feed to each of the sections which contained a series of screens with openings of 1/26 in., 1/34 in., 1/46 in., 1/60 in. and 1/80 in., and called for convenience 26-, 34-, 46-, 60- and 80-mesh screens.

The upper section was running at a capacity of 20.2 metric tons in 24 hours and the lower section at the rate of 42.7 metric tons per 24 hours; the efficiency tests were made on samples of each product while running at this rate. The ore that was fed to the vibromotor had previously passed a 16-mesh screen.

RESULTS OF TEST OF VIBROMOTOR SIZERS AT THE TIRO GENERAL MILL.

PRODUCT ON 26-MESH SCREEN.

	Upper Section.	Lower Section.
Weight sample taken..	500 grams	500 grams
Remaining on 26-mesh hand screen.....	380 grams	420 grams
Through 26-mesh and on 34-mesh hand screen.....	105 grams	70 grams
Through 34-mesh hand screen.....	10 grams	10 grams

PRODUCT FROM 26-MESH AND ON 34-MESH SCREEN.

	Upper Section.	Lower Section.
Weight sample taken..	500 grams	500 grams
Remaining on 34-mesh hand screen.....	400 grams	425 grams
Through 34-mesh and on 46-mesh hand screen.....	85 grams	65 grams
Through 46-mesh hand screen.....	15 grams	10 grams

PRODUCT FROM 34-MESH AND ON 46-MESH SCREEN.

	Upper Section.	Lower Section.
Weight sample taken..	500 grams	500 grams
Remaining on 46-mesh hand screen.....	475 grams	400 grams
Through 46-mesh and on 60-mesh hand screen.....	15 grams	70 grams
Through 60-mesh hand screen.....	10 grams	30 grams

PRODUCT FROM 46-MESH AND ON 60-MESH SCREEN.

	Upper Section.	Lower Section.
Weight sample taken..	500 grams	500 grams
Remaining on 60-mesh hand screen.....	455 grams	480 grams
Through 60-mesh and on 80-mesh hand screen.....	35 grams	15 grams
Through 80-mesh hand screen.....	10 grams	5 grams

The test was not carried farther on account of not having hand screens of finer mesh openings. The cloth on the hand screens used was in each case exactly the same as that used in the vibromotor.

It was noted that the largest portion of the product that went through the hand screen, but that went over the same screen in the vibromotor, was made up of elongated pieces of ore which had more time and opportunity to get on end and so pass through the hand screens, than the screens in the vibromotor.

The following extract from a letter received by me on the subject explains the difference in capacity of the two halves of the sizer:—

"Regarding their efficiency, I give the following tests made by Mr. Emerson: From one section of the screen, which was taking a feed of 42½ tons per 24 hours, an average efficiency of 97¼ per cent. was obtained and from the other section, which was taking a feed of 20 tons per 24 hours, 97½ per cent. efficiency was obtained. In explanation of the difference in feed will say that the feed spouts on account of their location were not delivering equal amounts. Another test made on a feed, which figured 93 tons per 24 hours for the whole screen showed on the oversize an efficiency of 97 per cent. In figuring these efficiencies the next screen below the one being tested was used, which system is the fairest test I believe. Using the same screen, the efficiencies averaged 86¼ and 85½ per cent. respectively."

The Sutton, Steele & Steele vibromotor ore sizer is manufactured exclusively for Sutton, Steele & Steele, of Dallas, Texas, by the Allis-Chalmers Company, and is fully protected by United States and foreign patents.

Fast Driving on the Rand

The record on the Rand, South Africa, for driving with two machines made at the Van Dyk Proprietary mine, where an advance of 226 ft. was made in 26 days and nights, has been broken, and even the record speed for driving made at the Simmer Deep mine in April, where three machines were used, has been surpassed for at the Van Dyk Proprietary mine a drift has been advanced in 62 shifts, 9½ hours long, 323 feet.

The Van Dyk Record

One white man and five Kafirs worked each shift, using two 3¼-in. Ingersoll-Sergeant drills. One round was drilled and blasted each shift. The following were footages for each measurement period (Sundays, of course, being excluded): Oct. 26-31, 12 shifts, 55 ft.; Nov. 2-6, 10 shifts, 50.5 ft.; Nov. 7 and 9-13, 12 shifts, 66.5 ft.; Nov. 14 and 16-20, 12 shifts, 68 ft.; Nov. 21 and 23, 28 and 30, 16 shifts, 83 ft.; total, 62 shifts, 323 ft. The average number of holes drilled per round was 12; the average advance per round was 5.209 ft.; the average number of pounds of gelatin used per foot was 8.513.

No bonus of any description was attached to the work either for white men or Kafirs, the Kafir being paid 1s. 7d. per shift. No special conditions were used to aid the work, and no endeavor was made to secure specially long rounds, as ordinary length steel was used. This performance is certainly remarkable.

Comparison with the Simmer Deep Performance

It is interesting to contrast the details of this work with the figures for the Simmer Deep achievement. At that mine a drift was advanced 294 ft. in 61 consecutive shifts of 10 hours each. The size of the drive was 5x7 ft. One white man and six Chinese were employed on each shift, and they operated three Ingersoll-Sergeant drills on a bar. One round was drilled per shift, and the average footage per round was 4.82. The number of feet broken per case of gelatin consumed was 4.52; in other words, 11.06 lb. of gelatin were used per foot. Of the 61 rounds drilled, 59 had 14 holes each and two had 12 holes each. The air pressure at surface was 80 lb. per sq.in. It is interesting to note that special measures were taken to cool the drift after blasting and to eliminate dust. A water-pipe was connected with the air-pipe, so that the drive could be cooled, and the broken rock wetted without loss of time. After blasting the cut holes, water was forced by the air into the face, so that the contractor on returning to blast the round found the drive quite cool and free from dust.

Both these performances reflect the greatest credit not only on the miners, but also on the management and the Ingersoll-Sergeant drill. It should be taken into account that only two machines were employed at the Van Dyk, as against three in the Simmer Deep, and that the shifts worked at the former mine were half an hour shorter than those worked in the Simmer Deep.

Fast Driving at the Vogelstruis Consolidated Deep

At the Vogelstruis Deep during November, 1908, a drift was driven with two machines 272 ft. This was done by six white men and six Kafirs (both shifts). The drift was 6 ft. 6 in. in the clear above rails by 3 ft. 6 in. and 4 ft. 6 in. wide in the clear. This also is a notable performance, but it was surpassed in December when the same drift with two machines on a bar was advanced by six white men and six Kafirs 305 ft. in 31 days. Twelve holes were drilled to the round. The drift is at a depth of 3000 feet.

*Abstracted from *South African Mining Journal*, Dec. 2, 1908, and Jan. 9, 1909.

Rhodesia presents a striking contrast to the big gold mines of its neighbor, the Transvaal. It is a country of small mines. Analysis of a recent monthly return show that 33 per cent. of the gold reported came from mills of five stamps or less; 52 per cent. from mines having from 5 to 10 stamps, and only 15 per cent. from mines having more than 10 stamps each.

Oklahoma's New Zinc-Lead District

SPECIAL CORRESPONDENCE

In September, 1907, the New State mine made the first production from the Miami mining camp in Oklahoma. Ore had been found in drilling southwest of the Quapaw mines and, following a drilling campaign, the Miami mining camp was a reality. The new camp is located three miles due north of Miami, Okla., and four miles southwest of Quapaw in the northeast corner of the State. The country is flat prairie land with a slight slope toward Tar creek, two miles to the east.

CHARACTERISTICS OF THE OREBODY

The ore consists of zinc and lead, and is found at a depth of 100 to 125 ft.; a face of from 16 to 30 ft. has been developed. Some timbering is required, but the roof is good and machine drills can be used.

The formation in the Miami mines is, so far, unlike that of any other camp. Under about 30 ft. of top soil and clay is found about 5 ft. of loose river gravel, and under the gravel 30 to 35 ft. of Cherokee shale. Below the shale is about 20 ft. of black, oily limestone and flint. Below this cap rock the orebody is found, impregnated with bitumen or crude oil, in flint and limestone in old solution-channels; the orebody will average 10 to 30 per cent. mineral in the proportion of six parts zinc to one of lead. Fine-grained iron pyrites is scattered throughout the ore. The zinc concentrates assay about 52 per cent. zinc and 7 per cent. iron, and bring about $15 under base price for 60 per cent. zinc. The lead is of good grade and brings nearly base price.

The water problem was a hard one at the outset. Owing to the fact that it gave off hydrogen sulphide, it was feared that it had artesian head and would remain at about the same level. On the contrary, however, owing to the open nature of the ground, the first mine had to drain all the surrounding country; but with several mines pumping, the water supply was soon no more than sufficient for use.

There are now eight mills in operation, four mills contracted for and several shafts being sunk on drill holes. One square mile of territory has already been proved and 12 to 15 drills are at work in the camp thus extending its limits every day. The New State mine, with a mill that could not handle over 75 tons of ore per day, is the pioneer in the field, and is turning out 5 to 10 tons of concentrates per shift. The Tom Lawson, King Jack, Lucky Strike and Index are new modern mills of large capacity and are all producing. The Emma Gordon is a modern plant of 400 tons capacity. This company has 52 drill holes and five shafts in ore, and is operating on a 200-acre lease. It pays 12½ per cent. royalty.

Just south of the Emma Gordon is the Old Chief operated by Weis & Co. West of the Old Chief is the Buckeye of 200 tons capacity. The Muskogee, Golden Hen, Miami-Yankee and Dan Isley companies are erecting mills, and several companies are sinking shafts. J. W. Barnes & Co. have struck a run on the 10 acres west of the Emma Gordon from the 144- to the 165-ft. level. This is deeper than at any other mine, and the ore runs about 20 per cent. It concentrates, however, to about 57 per cent., which is high-grade ore and augurs well for the deeper runs.

CONCENTRATION DIFFICULTIES

Owing to the nature of the ore, the local concentration methods are not yet well adapted to handle the Miami product. The bitumen balls up in the jig beds and they require frequent cleaning. The fines float off in the oily water and are not saved by the tables as they should be. The richness of the ore is such that a great loss is entailed in handling too large a quantity and the tailings will, in every instance, have to be treated again. The iron in the concentrates is so great that roasting and magnetic separating will eventually have to be resorted to in order to raise the grade of the ore. One company is already reported to be planning to install roasters.

The camp is on Indian lands and is not owned in fee by the operating companies. The Miami Royalty Company and others have first leases on most of the land and pay about 5 per cent. royalty, subleasing to the different companies at the high royalty of 25 to 35 per cent.

PRODUCTION OF THE NEW FIELD

The result of the first year's work in the Miami field was a production of 6,202,390 lb. of zinc valued at $75,606 and 1,007,720 lb. of lead valued at $30,095; total, $105,701. The average price of zinc ore was $24.38, and of lead, $59.73. This record was made by an average of three mills, which were shut down from Nov. 1, 1907, to April 15, 1908, operating only five and one-half months of the year and with ore prices at the lowest level for several years.

The second year should see an average of at least 12 mills running full time and with better ore prices Miami should rank among the first six camps in the district, surpassed only by Joplin, Webb City-Carterville, Galena, Alba-Neck City and Duenweg; and with a production reaching the half-million-dollar mark. The ore is a revelation to one accustomed to sheet-ground mining.

The royalties are too high and will have to be reduced; other companies will follow the example of the Miami-Yankee and purchase a reduction of royalty, if it is not granted. The methods of concentration will be changed and improved as experience is gained in the field. The grade of the concentrates will be raised by removing some of the iron and bitumen.

Some of the companies are over-capitalized, and as their mills have been producing only about one-half of the claims they made and that with a value per ton of less than two-thirds of what they figured, the result has been that they have been unable to pay their guaranteed dividends. One cannot help seeing a great future for the youngest camp of the district, and with improved concentration, reduced royalties, moderate capitalization and wise management, the mines of Miami should be dividend payers.

Auriferous Alluvials of the Upper Amazon Valley *

By SIR W. MARTIN CONWAY

During my explorations in the perpetual-snow region of the Cordillera Real in 1898 and 1900, I came across points where veins of gold-bearing quartz were exposed, but always inaccessible so far as any possible working is concerned. A conclusion that at a very high level on the eastern face of the snowy range a considerable body of gold ore exists was confirmed when I discovered that all four of the principal tributaries of the Upper Beni, or Kaka, river bring down gold in their gravels. These rivers, in order from south to north, are the Coroico, Challana, Tipuani and Mapiri, on all of which natives wash gold out of the gravels; and set up riffles before the rainy season. The Tipuani rises at the crest of the Cordillera, and near its headwaters is a place called Yani. In the mountain side strong veins of gold-bearing quartz have long been known; and since the days of Pizarro it has been possible to pan gold all the way down the river. The richness of Tipuani gravels has been described by Weddell.

What is true of the tributaries of the Upper Beni is so of those of the Upper Inambari. Twenty-one rivers flowing into the Inambari bring down gold, and 15 are regularly frequented by Indian gold washers.

We have thus proof that the eastern slope of the Cordillera Real for over 100 miles yields gold, in all its river gravels, which must originally have come from the heart of the range itself.

From these upper tributaries of the Beni and Inambari the Incas doubtless obtained their vast supply of the precious metal. Then why has it never been worked on a large scale, with the assistance of modern methods of extraction?

The determining obstacle, in my

*From a paper read before the Royal Society of Arts, and published in the London *Mining Journal*.

opinion, is the rainy season. Tropical downpours of enormous volume—sudden, violent discharges—continue day after day, resulting in sudden and overwhelming floods, river after river; enormous landslips and mud avalanches scour the gullies—machinery in such a region is impossible. All attempts to set up hydraulic apparatus have failed, even lower down, to win gold from these rich Andes torrents. No one has succeeded since the Incas, who employed forced labor and got their gold by hand-panning.

Enriching Processes

For countless ages this transportation of gold from aloft has continued. The Andes have been piling their own débris about their feet since the Corderillas first rose out of the level plain. The foot hills of the Bolivian part of the Corderilla were discovered by Dr. Evans to contain gold in their slates and conglomerates. He observed on the Kaka river that those gravels were richest in gold which were found just below a gorge in the foot hills. At such points the gold has undergone a second concentration—sometimes, perhaps, even a third. It follows that the best sites for gold washing are not necessarily those nearest the source of first supply, but may be found considerably lower down. This gold almost invariably consists of flattened particles, like fat little grains of gold which have undergone pressure.

I now come to the important discovery to which my own observations and conclusions contributed somewhat. When I became thoroughly acquainted with the geography and gold-carrying properties of the tributaries of the Kaka, or Upper Beni, river, and realized that this gold could not be won, mainly because of the overwhelming rush of waters; and when I learned that the four great tributaries after uniting near a place called Guanay enter a gorge which is not wide enough for any considerable deposit of gravels to take place along its banks; it occurred to me that if anyone would descend this gorge, as can easily be done on a raft, he would be likely to find somewhere below the gorge, wherever the steep banks first receded, some extensive deposit of gravel rich in gold.

Incahuari Ground

In 1898 Dr. George Bridgman, then American minister to Bolivia, with whom I talked the matter over, procured an expert American gold prospector, who went down and passing through the long gorge below Guanay came out into an old lake basin, filled to the brim with gravel in the course of ages. He landed on the bank, and proceeded to wash a pan of gravel. To his astonishment it yielded gold at the rate of 17s. 6d. ($4.25) per cu.yd. He had never seen the like in all the years of his wanderings, and he hastened back to La Paz in a state of excitement, of which I was witness when I chanced to arrive a few days after he had come in.

That was how gold came to be discovered on the lower and quieter reaches of the Kaka (Beni) river. No one had ever thought of looking for it so far down; the possibility of a second concentration had not occurred to them.

Since then many expeditions have gone down, and the ground has been examined almost yard by yard over the areas that are now in possession of different owners. The most important one, from a scientific standpoint, was that of Dr. John Evans, formerly mining adviser to the Government of Mysore, and now geologist to the Imperial Institute. At that time difficulty of access was the great impediment. Since then a new good mule road has been made from La Paz to the kinder waters of the Coroico over which machinery can be, and has been, carried. The remainder of the way has to be negotiated by raft, but I understand that the government intends to carry the road itself down to the Incahuara dredging ground, as the lake basin mentioned is called, during the coming year.

Italian Asphalt

One chapter of "l'Industrie Minière et Métallurgique en Italie," by P. Nicou, published in a recent *Bulletin* de la Société de l'Industrie Minérale, treats of the asphalt deposits of Italy, with particular reference to those of Sicily.

Speaking first of the leading deposit on the mainland, situated at Tocco and other villages in the Abruzzes district on the east side of the peninsula, it is stated that the asphalt of this locality was known and utilized by the Romans. The principal operations are now conducted by the Neuchatel Asphalte Company, Ltd. The asphalt impregnates limestone and is also found in the form of veins traversing the rocks. The impregnated rock is treated in 10 two-retort furnaces at the works near San Valentino. The crude rock carries 10 to 16 per cent. bitumen, but only about 5 or 6 per cent. is recovered, since nearly two-thirds of the rock is consumed as fuel under the retorts. The average annual production has been about 500 tons of finished asphalt, derived from around 10,000 tons of rock. A small quantity of the richest crude rock is exported to Hamburg, at which place it is worth about 28 francs per ton. Other parts of the deposit, in which the impregnation is more regular, are also operated. Part of the output is sold in its crude condition to the State, part is pulverized to make asphalt blocks, and part is made into mastic. The annual output of this class of rock has been 25,000 tons. Another less productive mine on the mainland is the Filettino, at Amaseno, in the province of Rome.

By far the most productive locality is that of Regusa, in Sicily, the annual production of which has exceeded 100,000 tons. Certain parts of a very pure, fossiliferous, Miocene limestone are found to be regularly impregnated with bitumen, forming an asphaltic rock of the first quality. There are two such horizons, the first, the lower one, having a thickness of 5 m. containing thin beds of only slightly bituminous limestone, and the second, 15 to 25 m. above the first, having a thickness of 5 to 20 m. Elsewhere, without any fixed relation to the stratified deposits, are found irregular masses of asphaltic rock.

Most of the working is done in open cuts, but in some of the thickest deposits underground methods, with either drifts or shafts, are employed. Explorations to the south of Regusa have yielded very variable results; immediately south of the town, a strong, rich horizon was found at one point at a depth of 50 m., while elsewhere borings have found a less bituminous, argillaceous rock. Good rock was found at Scicli, while at Modica the results of exploration were poor.

In addition to the exports of crude rock, which go mainly to Germany, England and the United States, part of the output is manufactured into mastic locally. The Societa Sicula per l'Esplotazione dell' Asphalto and the Worwohle Rock Asphalte Company, Ltd., both have plants at Regusa, the former using partly Trinidad asphalt and partly bitumen extracted from the less regular local rock.

Determination of Antimony

L. A. Youtz (*Journ.* Am. Chem. Soc., XXX, pp. 975-979), has investigated the purity and volatility of precipitated antimony sulphide. Precipitation as the sulphide is one of the most used methods for the determination of antimony and, while accurate results are often obtained, this desired end many times is the result of a series of compensating errors in the work.

For preliminary investigation two portions of antimony trichloride of about 1.5 grams each were dissolved in 250 c.c. of water and 30 c.c. of concentrated hydrochloric acid, the antimony precipitated with hydrogen-sulphide gas, the solution diluted to 500 or 600 c.c., warmed nearly to boiling and saturated with the gas. The sulphides were thoroughly washed with water saturated with hydrogen sulphide until at the most only a trace of chloride was discernible in 10 c.c. of the washings.

The precipitate was then tested for chlorides by fusing with sodium carbonate in a porcelain crucible, the fusion taken up in water, acidified with sulphuric acid, the sulphide filtered off and the filtrate tested for chlorides after expelling the

hydrogen sulphide. Blank tests were run in every case. It was found that notable quantities of chlorides were present in the sulphides even when working with smaller amounts of the sulphides than in the two first tests.

To determine if tartaric acid was effectual in reducing the amount of adherent chlorides, 5 grams of the acid were added to the solution before precipitation of the sulphides, but the results in all cases showed that tartaric acid was ineffectual. In another trial the antimony sulphide was dissolved in ammonium sulphide and reprecipitated with acetic acid, but still appreciable amounts of chlorides were present. The enumerated tests are only a few of the many tried, which all yielded like results, chlorides being practically the only impurity considered.

The tests on the purity of the sulphide incidentally brought about an investigation of the volatility of the precipitated sulphide. Uniformly in these tests the precipitates were heated in an atmosphere of carbon dioxide at a temperature of approximately 250 deg. C. after drying to constant weight at usually 105 to 100 deg. C. in air. The precipitated sulphides were collected and washed in Gooch crucibles with asbestos filters, dried and placed within a small beaker covered with a watch glass and the air expelled with carbon dioxide. The beaker and contained crucible were heated in an asbestos oven and the temperature noted by means of a thermometer inserted through the perforated watch glass.

The many tests that were made proved conclusively that when chlorides are present in the precipitate, constant weight is impossible to attain. The loss in weight varies with prolongation of the heating and was due wholly to the presence of chlorides in the precipitated antimony sulphide.

Quantitative results are, however, attainable especially if the heating be not longer than 30 min., in which cases results, accurate enough for practical purposes, may be obtained. This is not so surprising if the fact is considered that the chlorides are present as SbOCl and $Sb_4O_5Cl_2$, and that the molecular weights of these salts and Sb_2S_3 are so nearly the same that several per cent. of either salt as an impurity would give practically the same weight as if present as the sulphide.

The total silver coined at the United States mint for the Philippine islands up to the end of 1907 included 37,302,358 pesos: 9,441,143 pieces of 50 centavos, or half pesos; 12,413,419 of 20 centavos, and 17,788,338 of 10 centavos. This coinage required 32,421,872 oz. fine silver, of which 26,568,707 oz. were new bullion, and 5,853,165 oz. were obtained from old Philippine and Spanish coins melted. Minor coinage included 9,999,884 five-centavo pieces, of nickel; 37,845,234 centavos and 17,752,884 half centavos, of bronze.

Great Falls of the Missouri

The accompanying illustration of the Great Falls of the Missouri is from a photograph in the program of the 22d annual meeting of the Montana Society of Engineers, held at Great Falls. These falls are situated about 12 miles below the city of Great Falls and development work for the utilization of the power which they afford is now in progress. The natural fall is 72 ft. The work will consist of a dam 700 ft. long and 26 ft. high, placed a short distance above the crest of the falls. The water will be carried from the dam to the power house by a penstock 22 ft. in diameter. The tail race will be excavated below the island or point near the foot of the falls and thus utilize whatever fall there may be in the river between the foot of the falls and the mouth of the tail race. The entire installation will result in a working head of 110 ft. The water wheels will be of the turbine type. The generators will be three-phase, 60-cycle, 60,000 to 100,000 volts, the exact voltage not having been determined upon.

GREAT FALLS OF THE MISSOURI, MONTANA

Impressions of Rawhide

SPECIAL CORRESPONDENCE

To the visitor to Rawhide, Nev., today, the most important point is the evidence that development work is going forward through the heart of the camp. Beginning on the property of the Rawhide Mining Company at the north center and extending for over a mile to the Rawhide Consolidated on the south, and from the Rawhide Queen estate on the east to the Rawhide Coalition on the west, there is presented mining activity along legitimate lines. Over 36 hoisting engines are now operating in the camp and the various workings vary from 400 ft., the deepest shaft, up to 250 ft., to which depth the greatest number of shafts are now sunk.

Mining engineers who have inspected the camp during the past few months report that the formation is favorable for the class of ore which is now being developed, and that the veins so far encountered bear indications of permanency. The past few months have brought decided relief to the various leasing companies operating in the camp. Mills are being established—some of them are already running—which are capable of treating the ores which are offered with a good degree of extraction. The milling era has arrived in the camp, and from now on it should improve from a mining standpoint as well as in a financial way.

The camp has had many difficulties to face. It was started during a serious financial panic; it received its first impetus from an unwarranted real-estate boom which soon collapsed, to be followed very shortly by the failure of both banking institutions in the camp, thereby entailing a serious loss to the operators; early in the fall the entire business section was destroyed by fire. With all these drawbacks, it required more than faith to keep the men at the camp and at work.

The value and permanency of Rawhide depend on the large veins of medium-grade ore encountered in the various workings. From time to time high-grade bodies of ore may be struck in the camp, but the main dependence of the operators there is their ability to develop in large quantities the lower grade ore with the facilities for rapid and economical treatment at hand.

Burning Wood under Boilers*

By E. G. Tilden†

Our boilers, two of them, about 60 in. by 16 ft., of the ordinary tubular type, were equipped with rather old-fashioned fronts, as indicated in Fig. 1. The grate was so near the shell of the boiler that in the middle of the furnace there was room for only one layer of logs, the fuel being 4-ft. cordwood. This was the seat of most of the trouble, for being thinnest at that point, the fire burned through quickly, requiring constant attention to keep the steam up.

It was finally decided to remodel the furnaces as shown in Figs. 2 and 3. The grates and bearers were removed, the grate level dropped to the floor line and only two 6-in. bars were used, these being placed in the middle as shown in Fig. 2.

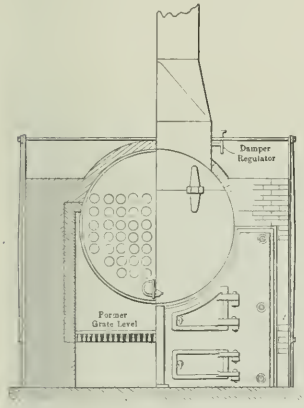


FIG. 1

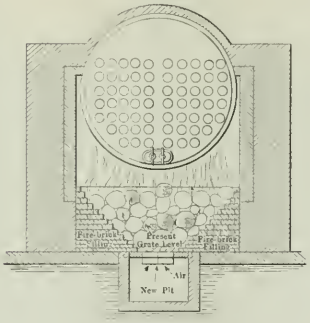


FIG. 2

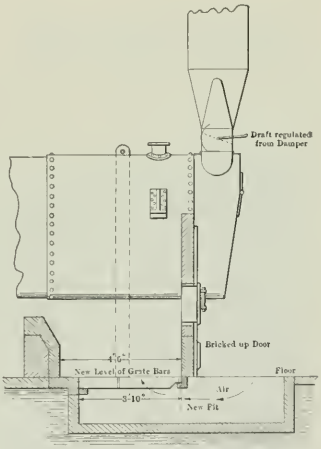


FIG. 3

The draft was governed or regulated mechanically by working the damper in the base of the stack, the ashpit opening being left full. These alterations reduced the fuel consumption fully one-quarter, besides saving the fireman a lot of work and bother.

Regarding the claimed advantage of a deep fire-box for burning wood, is it not a fact that the flow of unused cold air through the furnace and setting of steam boilers is the source of a great deal of fuel waste? Regulating the steam pressure by manipulating the ashpit doors is, I believe, conducive to this same overplus, or useless air trouble. Closing the ashpit doors will, of course, deaden the fire, but it also introduces another set of conditions that tend to cool off the boiler; that is, closing the ashpit doors increases the draft in the furnace, thereby increasing the flow of air through the leaky places in the setting above the fire; and as all this air leakage goes in at the temperature of the boiler room, and goes out the stack at or *above* the temperature of the steam in the boiler, a lot of coal is burned just to moderate the weather.

To those who think their boiler settings are practically tight, I suggest the following easy way to find out if they are: Make a "smoky" fire, say of soft coal and before the volatile matter has had a chance to get away, close the overhead damper tight, leaving the ashpit doors open. Black smoke will roll out through every crack and crevice in the setting. Now, reverse these conditions, open the stack damper and close the ashpit doors, and cold air will roll in through the same cracks and crevices. Ordinarily the conditions under which steam boilers are operated are such that it is impracticable to keep the settings air-tight, for which reason overbalancing the pressure in and outside of the furnace should be avoided as much as possible.

With the firebrick filling we made no attempt to smooth up the rough corners due to battering the courses of brick, but depended on the steep pitch of the furnace walls to roll the logs down to the center as they burned away. The side-wall angle was about 45 deg. and in service proved to be all that could be desired.

The original length of furnace, 4 ft. 6 in., was retained, but the two grate bars were cut off to about 3 ft. 10 in., to stop useless cold air from flowing through the furnace.

The front of the new furnaces, that part directly under the fire doors, was firebrick lined, the old ashpit doors being sealed up entirely, the narrow trench under the grates serving for the ashpit and an air inlet.

*From *Power*, September, 1908.
†Downers Grove, Ill.

Precious Metals Used in the Arts

According to the estimate of the director of the United States Mint, the quantities of gold and silver used in the arts in the United States in 1907 was as follows:

	Gold Value.	Silver Fine Oz.
Domestic bullion	$15,546,924	17,431,691
Foreign material	14,502,571	4,628,208
U. S. coin	3,500,000	77,344
Old material	7,177,575	2,232,541
Total	$40,727,070	24,369,784
Total, 1906	39,126,763	21,853,264

The quantity of coin used is entirely an estimate. Deducting this, the Government mints and assay offices furnished 91.7 per cent. of the gold bars and 20.1 per cent. of the silver bars taken for use in the arts; private refineries supplying 8.3 and 79.9 per cent., respectively.

This estimate does not take into account the old gold and silver melted down privately and used. It is probable that most of the gold remelted is passed through the assay offices in order to secure the government certificate as to its fineness; but a considerable quantity of silver may be used in this way without passing through either government or private refineries.

The quantity of the precious metals thus estimated as used in the arts was equal to 45 per cent. of the gold mined in the United States in 1907, and 43 per cent. of the silver. No estimate for 1908 has yet been made.

On the basis of such returns as could be obtained from foreign countries, the total quantity of the precious metals used in the arts in 1907, is estimated at $135,046,500 in gold, and 92,568,300 oz. of fine silver. This is 32.9 per cent. of the gold and 50 per cent. of the silver mined in the world in that year.

The Blanc Turbo-Classifier

The *Comptes Rendus* of a recent meeting of the Société de l'Industrie Minérale describes the construction and operation of a novel classifier designed by F. Blanc, and gives data on its capacity, water consumption and thoroughness of separation. In a general way the apparatus closely resembles a centrifugal pump, in that it both sucks in its own feed and discharges at an elevation, if desired. This classifier will separate two minerals whose specific gravities differ but little; the inventor states that it will make a clean separation of cerrusite from a lead-zinc ore containing cerrusite and calamine.

The moving part of the machine is a narrow drum, which is composed of two disks, bolted face to face. The disk *A* is a plain flat plate, rigidly attached to the driving shaft. The plate *B*, Fig. 2, has on one side a number of curved radial channels, enlarging outwardly. Through these flows the current of water carrying the ore in suspension. Toward the outer end of each channel, and on the side opposite to the direction in which the disk is to revolve, is a little pointed piece *P*, made of the hardest steel, and held in position by the screw *I*. The distance to which this point extends out into the channel can be adjusted by loosening and retightening this screw. Just in front of the pieces *P* are the holes *E* which extend through the plate. The front edge of the hole *E* is protected by the insetting of the flat piece *R* made of hard steel; this is to withstand the wear, which is severest at this point.

In operation it is found that with fixed conditions, only those particles with a certain specific gravity or higher will be caught by the points *P*; the particles thus retarded pass through the holes *E* into the chamber *D*, whence they are delivered through the discharge pipe *U*. The cock *Y* and the jar *X* are for the purpose of taking samples of the concentrate. The lighter particles, constituting the tailings, are ejected from the ends of the channels into the annular chamber *V*, whence they pass out through the pipe *T*, or through the cock *Z* provided for taking samples of the tailings.

The narrowest point of the channel is about 10 mm. square, which limits the size of ore particles to this dimension, but for good operation the ore should have been passed through a screen with 5-mm. holes.

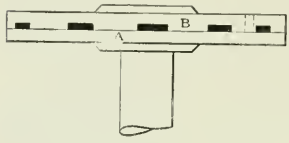


FIG. 1

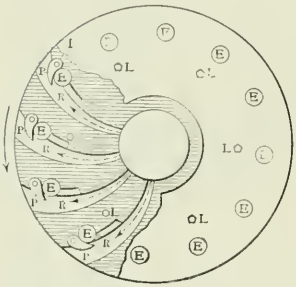


FIG. 2

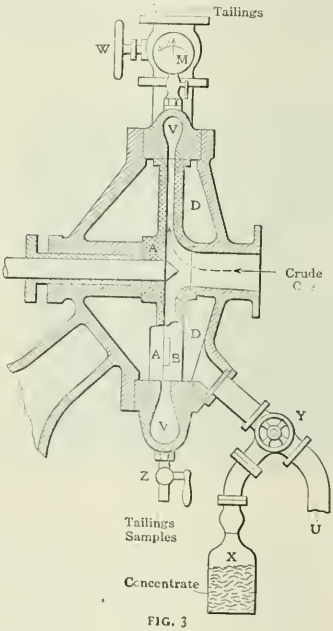


FIG. 3

THE BLANC TURBO-CLASSIFIER

In the operation of the machine three adjustments are possible: Speed of rotation; rapidity of discharge; and the width of the opening at *P*. The speed depends upon the type of driving power, and can be varied at will. The rate of discharge is regulated by the cock *W* and the pressure gage *M*; as the cock is closed the pressure recorded by the gage increases. The opening at *P* can be regulated by dismounting the disk and adjusting each of the points separately to the desired width.

The following results of a test on the machine are given. The ore, a mixture of cerrusite and calamine in a silicious limestone gangue, brought from Djebel Felten, Algeria, was crushed to pass a 6-mm. screen. It assayed 28.80 per cent. lead and 14.20 per cent. zinc. It was desired to make a concentrate carrying 50 per cent. lead. The opening at *P* was 11 mm., the average speed was 1200 r.p.m., with a pressure on the gage of over 3 m. of water.

Speed. R.P.M.	Pressure. Meters of Water.	Lead in Concentrate. Per Cent.
700	0 9	40
950	1	47
1200	1 5	47½
1200	3	55
1200	4 5	57½
1200	6 5	58
1200	8	67½
1200	9 5	68

The current of water passing through the machine will carry and classify about one-fifth of its volume of ore. At a speed of 1200 r.p.m., and with a discharge pressure equal to 5 m. of water, the machine will treat 5 cu.m. of ore, carried along by 25 cu.m. of water per hour.

The pressure created in the discharge pipe by the classifier can be utilized either for lifting the tailings up to settling tanks for further treatment, or to recover the water, or for carrying the tailings to a distance for dumping. In either case no elevator is required, and the pressure, once fixed, needs no further regulation at the cock *W*.

Radium in England

In order to encourage research work with radium a new institute is being formed to be called the Royal British Radium Institute. The council contains distinguished names in the medical and chemical world, such as Sir William Ramsay, Sir Frederick Treves and Prof. J. J. Thomson. The use of radium for medical purposes is but little understood, and there are differences of opinion among medical men, judging by correspondence that has appeared recently in *The Times*, as to its healing properties. An institute endowed with funds to enable exhaustive experimental work to be carried out with this very expensive and mysterious substance, cannot fail to secure knowledge of great benefit to humanity.

The principal source of radium is the mineral pitchblende, or oxide of uranium, which is found principally in Bohemia and Cornwall. It is noticeable that the publication of the formation of the new Radium Institute has produced paragraphs in the newspapers calling attention to the supplies of pitchblende in Cornwall that await exploitation. The company promoter may be trusted to make the most of a magic word like radium, and it is not unlikely that the public will be invited to subscribe for the opening of abandoned mines, where pitchblende has been known to occur, without the commercial possibilities having been closely examined. Radium mines should be treated with caution.

The Balaklala Consolidated Copper Company

A Comprehensive Statement of General Conditions and Summaries of the Mine, Smelter and the Aerial Tramway Operations During 1908

ABSTRACT OF OFFICIAL REPORT

The first annual report of the First National Copper Company gives a full and comprehensive statement of the operations of the Balaklala Consolidated Copper Company (the operating company) at Coram, Shasta county, Cal., for the year ending Dec. 31, 1908. Thomas J. Barbour, president of the Balaklala company, in submitting the report, states that the mine was operated for 60 days, and the smelter 52 days during the year. Difficulties are gradually being overcome and blister copper is now being produced. Indications are that the ore developed will average about 2.7 per cent. copper, 0.025 oz. gold and 0.75 oz. silver per ton. Costs will be materially reduced when the full capacity of 1250 tons per day is reached. Attention is called to the fact that operations were only conducted for part of two months and one full month, whereas expenses are figured for the full three months.

The balance sheet shows total assets of $10,822,034, in which the mines and property are valued at $8,688,777. Liabilities are as follows: Capital stock, $10,000,000; first mortgage bonds, $750,000; accounts payable and pay-rolls, $72,034; total, $10,822,034. The following entries under construction and property are of interest:

Mine Construction:	
Air drill equipment	$24,759 23
Locomotives and cars	18,056 23
Aerial tramway and connections	202,499 21
Buildings	44,985.49
Teams and equipment	1,699 43
	$292,899 59
Smelter Construction.	
Smelter	$873,682.30
Converter	102,512.60
Steam railroad	83,279.41
Teams and equipment	3,931.28
	$1,063,405 59
Property:	
Dwelling houses, mine	$23,447.03
Dwelling houses, smelter	49,348.74
Hospital	7,092.95
General office building	8,457.83
	$88,346.55

Mining

R. N. Bishop, mine superintendent, reports that previous to October, 1908, there were five men employed in the mine, it being necessary to have sufficient men as a precaution against fires. These men worked in the mine and did some development work on a new body of ore at the junction of the Weil tunnel and No. 2 south crosscut. This body proved to be high grade, but its limits have not been defined as yet. They also did some development work at the top of No. 2 upraise, endeavoring to find the eastern boundary of the ore.

On Oct. 1, a crew was put on at the mine and everything made ready to supply the smelter with about 300 tons of ore per day by Oct. 15. During the last three months of the year 18,751 tons of ore were mined. Of this, 17,450 tons were delivered to the smelter. Although operations have not been carried on long enough to arrive at what the average cost of mining will be, it is evident that it will be about $2 per ton.

In the mine ore is being blocked out and levels run every 25 ft., it being the intention, after the ore is blocked out to the roof, to start at the furthest wall and take a vertical slice off the pillars and retreat from the wall, leaving the roof unsupported. This method of mining will permit the extraction of all the ore without using any timbers and should permit of cheaper mining than if timbering were resorted to.

The Windy Camp deposit has been opened up, and it is now in shape to deliver as much ore as the Weil level deposit. Development work has been started at the eastern end of the Weil deposit.

SMELTER OF BALAKLALA CONSOLIDATED COPPER COMPANY, CORAM, CAL.

SUMMARY OF MINE OPERATIONS, BALAKLALA CONSOLIDATED COPPER COMPANY.

OCTOBER, NOVEMBER AND DECEMBER, 1908.

		Cost per Ton.
Development	$1,452 47	$0.077
Mining	29,866 14	1.593
Compressor	787.93	0.042
Air drills	1,199 62	0.064
Mine tramway	1,807 31	0.096
Timbering	1,620.97	0.089
Power	1,560.36	0.083
Shop's expense	245.64	0.013
General expenses, including taxes and insurance	4,250.02	0 227
Surface and road repairs	118.03	0.006
Repairs to buildings	197.31	0.010
Stable expense	438 10	0.023
Steel sharpening	666.36	0.035
Special construction	1,244.00	0.066
Total cost	$45,454 26	$2.424

Ore mined, 18,751 tons.

Experiments on the aërial tramway have demonstrated that with the present controller it is dangerous to operate at a greater speed than 450 ft. per minute, and the builders have been asked to furnish an additional controller so that a speed of 500 ft. per minute may be attained without risk. At this speed the tramway will deliver 75 tons of ore per hour.

Summaries of the mine and tramway operations are given in accompanying tables. Also there is shown a plan and sections of the mine, indicating the size and location of the orebodies developed.

General Conditions

R. T. White, manager, states that after a long period of development and construction work, the property has now been placed on an operating basis. The type of smelter to be constructed was decided upon at the meeting of the board of directors held in New York in March, 1906, but because of many unavoidable delays and the scarcity and poor quality of labor for constructing the necessary railroad sidings, it was not until Nov. 4 that the first carload of material for the foundation was delivered at the smelter site. The work was almost completed by the middle of October, 1907, when on account of the lack of funds all work was suspended. On April 1, 1908, the company's finances hav-

PLAN OF MINE SHOWING OREBODIES; BALAKLALA CONSOLIDATED COPPER COMPANY

LONGITUDINAL SECTION AND PROJECTION THROUGH A-B; BALAKLALA CONSOLIDATED COPPER COMPANY

ing been readjusted, a small force was put at work again, and continued during the succeeding months, finishing the various incompleted items and adding others not originally planned. The company had entered into a contract for the sale of its matte for a period of 15 years, and, therefore, the original plant did not include converter equipment. Upon the resumption of work this year, however, the matte contract having been annulled, a converter plant was planned and has since been installed.

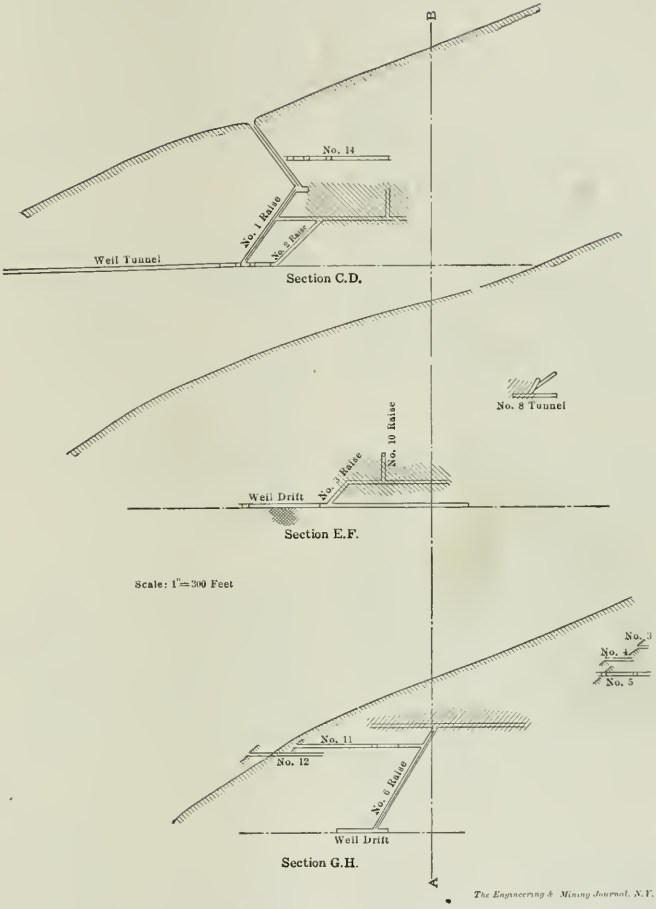
Smelter Equipment

The smelter equipment consists essentially of the following: Four 18-in. diameter McDougall roasting furnaces; three 55x240-in. water-jacketed blast furnaces, and one 17x92-ft. reverberatory furnace; 3 double casting machines for casting matte; 6 converter shells, 96 in. diameter by 150 in. long, 2 electrically operated converter stands; 1 sampling mill for custom silicious ores, capacity 25 tons per hour, 1 sampling mill for sulphide copper ores, capacity 10 tons per hour; storage bins of the following capacities: sulphide ore, 7000 tons; silicious ore, 6500; lime rock, 3600; coke, 4500; matte, 800.

The power plant has the following equipment: three 256-h.p. Stirling, oil-fired boilers; two 300-h.p. Stirling waste heat boilers connected to the reverberatory furnace; three 14 and 30x36-in. 450-h.p. tandem compound condensing engines, direct connected to: three pressure blowers having a capacity of 300 cu.ft. of free air per revolution; one cross-compound converter blowing engine, having a capacity of 11,000 cu.ft. of free air per min.; one 150-kw. A. C. generator operated by a direct-connected 225-h.p. A. C. motor; all necessary pumps and auxiliaries.

Ore Treatment

The coke, lime rock and silicious ores are received at the plant on railroad cars; the sulphide copper ores are received from the company's mine by way of an aërial tramway. At the discharge terminal of the tramway, the sulphide ore is screened, that smaller than ½ in. going to the fine, and the oversize to the coarse bins. The fine ore is first subjected to an oxidizing roast in the McDougal furnaces, and the resulting calcine, together with flue dust from the blast furnaces, is smelted to matte in the reverberatory furnaces. The coarse ore is smelted in the blast furnaces, together with silicious ore and lime rock, producing a low-grade matte, which is afterward concentrated, i. e., resmelted with more silicious ore and lime rock to a higher-grade matte. This high-grade matte, together with the matte from the reverberatory furnace, is poured direct into the converters, where it is oxidized and the shipping product containing 99 per cent. of copper is produced.



NORTH-SOUTH SECTIONS THROUGH MINE; BALAKLALA CONSOLIDATED COPPER COMPANY

SUMMARY OF AERIAL TRAMWAY OPERATIONS, BALAKLALA CONSOLIDATED COPPER COMPANY.

DECEMBER 31, 1908.

	October.	November.	December.	Total.	Cost per Ton.
Expenses:					
Labor	$916 63	$2,263 14	$1,657.20	$4,836 97	$0 185
Supplies	197.23	2,351 99	544 20	3,093 42	0.119
Total.	$1,113 86	$4,615 13	$2,201 40	$7,930 39	$0 304
Earnings:					
Ore at 15 c. per ton.	$646 65	$1,069 65	$2,186 98	$3,903 28	
Supplies	12 18	.	40.11	52 29	
Total..	$658.83	$1,069.65	$2,227 09	$3,955.57	
Deficit.	$455 03	$3,545 48	.....	$4,000.51	
Surplus			25 69	25 69	
Total deficit.		.	. .	$3,974 82	
Tons	4,311	7,131	14,580	26,022	
Cost per ton	$0 258	$0 647	$0 151	$0 304	

NOTE.—Tramway operating is credited with 15c. per ton, the balance to accrued accounts.

The ore is handled from the bins to the furnaces in scale charge cars drawn by electric locomotives, the slag is hauled from the furnaces to the dump by electric locomotives, and the matte is handled by electric traveling cranes. The entire plant is substantially constructed. The furnace units are all of large dimensions, and consequent capacity, and everything is arranged to handle material with machinery as much as possible, thereby eliminating labor to the lowest degree.

It is estimated that the plant when in full operation will treat about 1250 tons of copper sulphide ore per day. The first blast furnace was started on Oct. 21, and continued in operation until Nov. 4, when an accident to the aërial tramway caused the shipments of ore to be stopped and the furnace was, therefore, temporarily closed down. The tramway having been repaired, the furnace was started again on Nov. 23.

Ore Treated

The ore treated during the three operating months is shown in the following table:

	Balaklava Sulphide.	Trinity Sulphide.	Custom Ore.	Total Tons.
October	1,944	1,659	267	3,870
November	2,920	2,011	110	5,041
December	11,096	3,616	1,320	16,032
Total	15,960	7,286	1,697	24,943

SUMMARY OF SMELTER OPERATIONS, BALAKLALA CONSOLIDATED COPPER COMPANY.

October, 11 days. November, 11 days. December, 31 days.

		Cost per Ton.
Converters	$1,750.77	$0 070
Blast furnaces	51,095.00	2 035
Matte and slag casting	4,454.52	0.177
Repairs to plant buildings	1,444.51	0 057
Repairs to ore bins	2,110.78	0.084
Railroad, operation and maintenance	2,697.14	0.108
Unloading custom ore	1,190.72	0.047
Sampling mill for custom ore	887.75	0.035
Sampling mill for sulphides	2,253.35	0.089
Lighting, electric	1,148 75	0.045
Water supply and pumping plant	424.78	0.017
Assay office	800 44	0.032
General expenses, including insurance and taxes	3,199 48	0.128
Total expense	$73,457.99	$2 924
Ore smelted, 25,121 tons	66,961 50	2 665
Furnace products on hand—total cost	$140,419.49	$5.589

The converter department was started the latter part of December, since which time there was produced 58,140 lb. of blister copper. There remains on hand 5066 tons of low-grade matte that was made during October, November and December, before the converters were started. Operations thus far have not been of sufficient extent to demonstrate what the final cost of ore treatment will be, except that the tendency is to confirm previous estimates of about $2.50 per ton of ore reduced to matte, and about $15 per ton of copper converted.

Details and summary of smelting operations are given in accompanying tables. A view of the smelter is also shown

SMELTING OPERATIONS FOR YEAR 1908, BALAKLALA CONSOLIDATED COPPER COMPANY.

Materials Treated.	Dry Tons.	Assays. Au Oz. PerTon.	Ag Oz. PerTon.	Cu Per Cent.	Contents. Au Oz.	Ag Ounces.	Cu Pounds.
Sulphides (Balaklala)	15,960 404	0 016	0.71	2.53	256 843	11,282 74	807,543
Sulphides (Trinity)	7,286 118	0.032	1.02	2.78	235.656	7,459 03	404,587
Sulphides (Custom)	43 490	0.069	1.26	7.54	3.011	54.77	6,569
Custom ore (silicious)	1,654 158	0.140	0.40		222.107	656 23	
Total ores	24,944 170	0.028	0.78	2.45	717.617	19,452.77	1,218,699
Matte	1,240.970	0.10	2.20	7.47	124.097	2,730 13	185,400
Slag	828.680						
Limerock	2,960.070						
Total burden to blast furnaces	29,973 890	0.028	0.74	2 34	841.714	22,182.90	1,404,099
Silicious ores to converter linings	187.483	0.39	0.86		73.679	161.52	
Total treated	30,161.373	0.033	0.74	2.33	915 393	22,344 42	1,404,099
Materials Produced.							
Blister copper	29.070	3.62	41 63	99.07	105.233	1,210 18	57,599
Matte	6,307 000	0.11	2.69	8.75	700.290	16,959.20	1,103,781
Flue dust	535.000	0.023	0.50	2 69	12.550	267.50	31,400
In process					92.543	2,883.36	121,000
					910.616	21,320.24	1,313,780

Coke	1,762.790 tons.
Coke, per cent of total burden	5.90 per cent.
Coke, per cent. of sulphides.	7.58 per cent.
Sulphides per cent. of total burden	77.55 per cent.
Time run	1,583 hours.
Burden per 24 furnace hours	453.60 tons.
Sulphides per 24 furnace hours	352.30 tons.
Furnaces in blast, No. 1	947 hours.
Furnaces in blast, No. 2	636 hours.

Average Slag Assays.

Cu	0.19 per cent.
Ag	0.08 oz.
Au	trace.
SiO_2	40.90 per cent.
FeO	37.50 per cent.
CaO	9 90 per cent.
Al_2O_3	8.10 per cent.
ZnO	2.50 per cent.

STOCKS.

	Sulphides. Balk.	Trinity.	Custom Ores.	Limerock.	Coke.	Matte.	Flue Dust.	Blister Copper.
Receipts	18,025	8,572	7,154	5,849	5,986	6,307	535	29
Treated	16,411	7,357	1,886	2,960	1,773	1,241		
On hand December 31, 1908	1,614	1,215	5,268	2,889	4,213	5,066	535	29

A Georgia Graphite Deposit

An industry that is yielding fair profits to the operators is the mining of the graphitic schists that occur at Emerson, Carter county, Ga. The graphite is the amorphous variety and is disseminated in a schist in amounts varying from 5 to 15 per cent. The outcrop is on a high ridge, which has been cut by a small creek, leaving the deposit exposed to a depth of 200 ft. The graphitic schist is 100 to 200 ft. thick, and has been tested to a depth of 500 ft. below the present working face. The vein is practically vertical.

Mining was begun at the creek level, and is simply open quarrying. The exposed working face is more than 100 ft. high and increases in hight as the work progresses toward the hill. The schist is broken by blasting and shoveled into ore cars by hand labor; all material goes to the mill for grinding and drying.

Since the schist contains more or less talc, clay and moisture, the large lumps are crushed in a breaker. From here it goes to a calciner, where it is thoroughly dried, and more or less disintegrated by the generation of steam within the schist. From the calciner it passes through a 20-mesh trommel. The fines go direct to the storage room, or car for shipment, as the case may be. The oversize is sent through rolls and burs and ground to 20 mesh.

The cost of mining, drying and grinding is low, as the product is sold f.o.b. cars at mine for $1.25 to $1.75 per ton, and yields a profit at this price. The schists containing only a low percentage of graphite yield a light-colored material, while the higher the carbon content the darker the finished product. The value depends largely upon the color.

The American Chemical Company and the Cherokee Chemical Company are working this deposit, and during the year 1908 the combined output was approximately 30,000 tons

Chronology of Mining, February, 1909

Feb. 2—Explosion in slope No. 2 in Short Creek coal mine of Birmingham Coal and Iron Company killed 17 men.

Feb. 6—President Guggenheim, of Guggenheim Exploration Company, issued detailed report.

Feb. 8—Strike of men at Velardeña smelter, Mexico. Second explosion in Leiter mine at Zeigler, Ill., killed three men.

Feb. 10—First report of the Copper Producers' Association shows 144,130,045 lb. copper on hand Feb. 1. Stock of American Smelting and Refining Company transferred from unlisted to listed department of New York Stock Exchange.

Feb. 11—Marianna coal mine resumed operations.

Feb. 12—Three copper companies of Arizona, Copper Queen, Old Dominion and Detroit Copper, filed complaints against railroads for excess freight charges on coke.

Feb. 15—First steel made at Gary, Ind.

Feb. 16—Explosion in West Stanley coal mine, Durham, England, wrecked 700-ft. shaft and killed 120 men.

Feb. 17—Trinity copper mine shut down.

Feb. 19—U. S. Steel Corporation declared open market for steel products. Heavy cuts in prices of steel. Judge Hunt, United States Court of Montana, denied injunction to ranchers to stop dumping of tailings in creek by Butte companies.

Feb. 23—Break in price of copper.

Feb. 24—Annual meeting of A. I. M. E. opened at New Haven, Conn. Rolling mills at Gary, Ind., finished the first rails.

Feb. 25—Tennessee Copper Company and San Toy Mining Company annual reports both showed deficits. Possible fine in the Standard Oil rebating case reduced from $29,000,000 to less than one million.

Feb. 26—Settlement of dispute between Calumet & Hecla and Osceola announced.

Daly-Judge Mining Company

The annual report of the Daly-Judge Mining Company for the year 1908 shows receipts from the sale of all classes of ore during the year of $285,570, of which $14,167 were for zinc middlings. The interest earned on the surplus invested in securities was $6918, or 5.41 per cent. The surplus was increased by $4342. The total receipts were $420,144, and the total expenditures $288,147, leaving a balance on Dec. 31, 1908, of $131,997

Of the expenditures mine account absorbed $142,718; milling, $43,670; prospecting and dead work, $56,125; sampling, assaying and hauling, $14,822; construction, $9427; and general expense, $15,635.

Costs of ore extraction and concentration were reduced materially. The cost of mining was $3.03 as compared with $2.77 per ton for the year previous, and concentration 95c., reduced from 86c., the tonnage being less than during 1907.

The most important development work of the year was the advancement of the drain tunnel which parallels the Ontario-Daly fissure 1145 ft. Several crosscuts were driven to the vein three of which developed ore.

The plant at Park City for the treatment of zinc middlings was completed during the year. Its capacity is about 50 tons per day. The concentrating mill produces about 15 tons zinc middlings per day, and there are about 15,000 tons of the same product on hand.

The ore mined during the year amounted to 51,805 tons, of which 50,536 were milling ore and 1269 tons of shipping grade.

The Phosphate Land Question

Special Correspondence

F. B. Weeks (connected with the Geological Survey from 1890 to 1908) has made a lengthy statement concerning the phosphate-land question to the house committee on public lands. Mr. Weeks has made special inquiries in Utah, Wyoming and Idaho. His oral testimony was largely directed to the extent of the phosphate deposits of the United States and tended to refute the claim that they are so limited in character as to warrant special treatment of them by the Government. Mr. Weeks said that no survey of the South Carolina deposits which would render possible any definite statement about them has ever been made. The discovery of cheaper deposits in Florida was the reason why the working of the South Carolina fields declined. The introduction of better transportation has rendered the deposits more available than ever before. In Arkansas there is an extensive phosphate field and probably one of the largest phosphate fields in the world is in northern Africa. Some deposits occur in France and some in Australia. Large apatite deposits are found in Canada. At Cokeville, Wyoming, Mr. Weeks found fields of commercial value. In reply to questions from Chairman Mondell he criticized sharply the assertions of the Government authorities regarding 100,000,000 tons as the supply of phosphate in the Wyoming field. As to the question of exports, Mr. Weeks said that if a reasonable freight rate could be secured from the beds to San Francisco the phosphate could be commercially shipped to Japan and Australia, but that at present rates there was no profit in the business. The material could not be put on board the cars at Montpelier under $2.50 per ton. The witness added that if the deposits were to continue to be entered and located under the mining laws the location as placers would be preferable.

The Proposed Location Law

The Mondell bill as finally reported by the committee proposes two things—that the lode locator may take his claim, but without any extralateral rights beyond the perpendicular boundaries of his claim and that in passing upon the entries already made the Department of the Interior shall hold that either kind of location was valid at the time it was made if prior to any other location.

Chairman Mondell, on behalf of the committee on the public lands, has filed a report explanatory of the bill favorably acted upon by the committee defining the manner in which public lands containing deposits of phosphate and phosphate rock may be acquired. The report says that the necessity of the legislation became apparent some time before the introduction of the bill in May, 1908, by reason of the fact that there was much confusion among locators as to whether the lands containing phosphate deposits should be located under the placer- or lode-mining laws.

The fact that the Department of the Interior recognized as valid and patented phosphate lands under the lode laws naturally alarmed the placer locators, and in quite a number of instances the same parties located their land under both lode and placer locations so as to prevent possible claim jumping and complications. Many claims are thus held, the locators attempting to comply with both laws on the same tract of ground and uncertain under which law they ought to make application to enter.

The proposed legislation deals with two distinct problems: the question as to which of the mining laws best fits the conditions surrounding these deposits, and, what disposition should be made of the locations heretofore made.

The committee is of the opinion that inasmuch as there is grave doubt as to whether any lode locations should have been made upon these deposits, and in view of the fact that the extra-lateral right if recognized might be the basis of claims to very extensive areas of the deposits and lead to expensive litigation in support of these claims, the lode locator has no ground for complaint if his rights are limited to the deposits within the perpendicular boundaries of the lands claimed by him. According to the report there is little doubt as to the authority of Congress in this matter.

After describing the phosphate deposits at issue and estimating them at 4,300,000 acres, the committee points out that after the withdrawals were made the advisability of attempting to segregate phosphate-bearing lands from agricultural lands and to lease the phosphate lands was sug-

gested by various government officials. The suggestion of leasing the lands was based upon the statement that the phosphate deposits of the world at large and of the United States were more or less limited, and that the agricultural lands of the United States might eventually need all of the phosphates of the country, and that the plan of leasing would conserve the deposits and might prevent the exportation of the phosphate by provisions to that effect contained in the lease.

On this the report takes the view that there is no condition existing warranting the action proposed. There is said to be no necessity for alarm that the phosphate deposits of the country will be soon depleted or that there will ever be a phosphate famine or shortage.

Phosphate Resources

Returning to the question of exportation it is noted that outside of the United States there are very large phosphate deposits notably in northern Africa, in France, and in the South Sea islands. Our own western deposits are practically inexhaustible. The estimate made by the Geological Survey of 100,000,000 tons as the available phosphates in the field in Utah, Idaho and Wyoming was based merely on an estimate of the amount of rock contained in a 6-ft. seam on one consolidated claim multiplied by the estimate of the amount of the rock occurring in similar claims located on the outcrop of the deposits throughout the region.

"The estimate seems to have been very low," says the committee, "even for what may be called phosphate in sight—that is, phosphate on claims covering only the outcrop and extending but a short distance down the slope of the vein. Estimating on the basis of a 6-ft. vein, 16,000 acres would contain 100,000,000 tons, the amount estimated as available in this field. As above stated, upward of 4,300,000 acres of land were withdrawn from entry, and assuming that one-twentieth of this land contains a 6-ft. vein of phosphate, the available phosphate in the region would amount to 1,400,000,000 tons, which at the present rate of production in the United States, 2,250,000 tons annually, would furnish us with phosphate for over 600 years; or take the estimate that has been made by some that eventually we shall need 6,000,000 tons of phosphate annually for the fertilization of 400,000,000 acres of land, this field alone would furnish a supply for 233 years.

As the world's consumption of phosphate rock at this time is about 3,750,000 tons annually, it will be seen that the estimate of our possible ultimate use of 6,000,000 tons a year is high; besides we still have the deposits of South Carolina, Florida and Tennessee as well as other minor deposits in various other places in the West, and the probability of quite extensive deposits in Nevada and elsewhere in the Southwest. In short, there seems to be but little more prospect of the exhaustion of the phosphate deposits in the United States than of the exhaustion of limestone, gypsum, and cement-making material, for all of which the demand, present and prospective, is very much greater than the present and prospective demand for phosphate."

Quincy Mining Company

The annual report of the Quincy Mining Company for the year 1908 gives the output of the mine as 20,600,361 lb. of refined copper which brought $2,796,230 The profit from the year's operation was $504,160, out of which $50,000 was applied to the purchase of the Franklin lands. Four dividends were paid amounting to $495,000 in all. Since the organization the company paid 86 dividends amounting to a total of $18,450,000.

Much development, construction and reconstruction was carried on during the year. Six miles of opening work developed copper ground of about the usual quality. Although the output of the mine, both in ore and copper, was the largest in the mine's history, the reserves were increased. Sinking was carried on in all of the shafts and all proved average copper-bearing ground.

Platinum

The production of platinum in the United States in 1908 was 510 oz. According to the U. S. Geological Survey, the production in 1907 was 357 oz. Our report for 1908 is based upon the answers of all of the refiners in the United States to the inquiry as to the amount of crude platinum of domestic origin refined by them during the year. However, it is impossible to pronounce definitely that the metal reported was entirely of domestic origin.

Most of the domestic platinum passes through the U. S. mints. These do not make a business of refining platinum, but considerable of that metal is recovered as a by-product in the electrolytic refining of gold and silver bullion. The platinum is recovered in the slime, principally in the gold cells. There is no way of identifying its origin. It is associated with the gold bullion in such small quantites that its presence is not always noted; and inasmuch as the crude bullion comes into the mints from foreign as well as from domestic mines, it is probable that a portion of the platinum recovered is of foreign origin. The platinum is recovered at the mints in the form of sponge, furnaces for reducing it to bars not yet having been installed. Between 750 and 1000 oz. of platinum is recovered per annum. In 1908 only 500 oz. were sold, the price received being $16.32 per ounce.

The refiners of platinum in the United States are the following:

Baker & Co., Inc., Newark, N. J.
Crosselmire & Ackor, Newark, N. J.
S. S. White Dental Mfg. Co., Prince's Bay, N. Y.
Welsbach Company, Gloucester, N. J.
J. Bishop & Co., Malvern, Penn.
American Platinum Works, Newark, N. J.
Roessler & Hasslacher Chemical Company, Perth Amboy, N. J.

One of the refiners reported as follows: "We are in hopes that the day is not far distant when we may be able to obtain a dependable domestic supply, inasmuch as the manipulation of the market by foreign interests is decidedly unsatisfactory. That miners and prospectors are more than ever alive to the situation is evident by the frequent inquiries made of us and samples of domestic ore sent to us for examination, as a result of which we hope in the near future to be able to report materially larger purchases of domestic ore."

The business of platinum refining in the United States is of course much more important than the statistics of domestic production indicate, inasmuch as a great deal of foreign crude platinum is refined here, while a large amount of domestic scrap is refined or remelted.

Bureaucratic Intelligence!

Washington, Feb. 20.—Replying to a Senate resolution asking for a report showing the total amount of iron ore and pig iron produced and manufactured in the United States in any successive 12 months ending not earlier than June 30, 1908, the Secretary of Commerce and Labor, to whom the resolution was addressed, has informed the Senate that his department has no statistics on the production of iron ore or pig iron for any time since the census of manufactures of 1905, which covers the calendar year 1904, and, he says, the next census of manufactures will be for the calendar year 1909, and will not be taken until January, 1910, and will be ready for circulation about the summer and fall of that year. The secretary informs the Senate that compliance with the resolution would require several months' time and necessitate an enormous expense.

For detecting the presence of free lime in portland cement A. H. White (*Journ. Indust. and Eng. Chem.*, January, 1909) recommends the microscopic examination in polarized light for calcium phenolate, after crystallization has taken place, of a sample treated with a drop of special phenol solution (5g phenol in 5 c.c. nitrobenzol with two drops of water added).

A Digest of Recent Coal Literature

Suggestions of Great Value and Discussions of Important Questions by Engineers in Papers Read at Mining Meetings Held during the Winter

BY FLOYD W. PARSONS

It is impossible for the average man engaged in mining coal, to carefully read all of the many excellent papers written and presented by different authorities before the various meetings of coal-mining men, held in the different States. It is safe to say that all of these papers contain some points of vital interest to those engaged in the coal industry. The following digest is the result of an effort to condense the best thought in the different discussions. In many instances, the papers here referred to are most deserving of publication in full; however, this being impossible, it is hoped that some benefit may result from this method of brief treatment.

The Isolation of Certain Mine Areas from Contact with the After-Gases Created by an Explosion

By Neil Robinson*

After exhausting every known method for the prevention of accidents, we should endeavor to find some system whereby the effect of an explosion, when one does occur, may be localized. In almost every mine disaster, of which we have a record, the examinations have shown that the miners, alarmed by the concussion, have rushed for safety, only to meet death in the flow of the after-gas. Several hundred lives are lost from this cause every year. If the deadly gases generated by an explosion can be confined to the panel in which they originate, the men working in the other air currents may be saved. Further, if we can temporarily seal these free men in their panels, they will have an additional measure of protection until rescue parties can open the roadways to them. It is possible that this can be accomplished by a series of boiler-plate doors installed in the following manner:

Install near the main entry two boiler-plate doors on the intake and two on the air course of every panel. Recess the frames until they are flush with the ribs and roof. Face the frames with several thicknesses of canvas to make a close joint when the doors are closed. Hinge the doors on the overhead timbers and make a snug fit, swing the bottom of the doors to within 6 in. of the roof—one pointing to the right and one to the left—and support in this elevated position by a detachable counter-weight or a flat trigger that can be displaced by an air pressure slightly in excess of the regular current, or by tripping levers controlled from partings. The frame timbers should have a sill extending across the entry, capped with planks to the top of the rail and also capped between rails except a narrow groove the width of a wheel flange.

Assuming that an explosion should take place near the advance heading of a butt entry, 1000 ft. from the main, the action would be about as follows: Before the gas generated can reach the main entry, it must compress and drive ahead this column of 1000 ft. of pure air and this pure air would blow out the supporting device and allow both doors to fall shut, at the same time operating the doors in every other part of the mine.

It is reasonable to suppose that the inner doors in the explosion panel will be blown from their fastenings, but this cannot take place with the outer doors. If the doors in a single panel in the mine are closed, the men behind them will be saved. We have evidence of the fact that men have traveled from 500 to 1000 ft. after the shock of an explosion. This clearly shows that there are occasions when time is given in which to operate an electric or hand device for closing the iron doors. A shock that would not kill the men running in an entry, surely would not be great enough to tear out the boiler plates swung at the entrance.

The protection here suggested may be inadequate; however, the plan has not been completed in all of its details, and is submitted in the earnest hope that it may prove the beginning of a work that will enable us to find a certain method of protecting our men from the deadly after effects of an explosion.

*Mining engineer, Charleston, West Virginia.

The Use of Electricity as Applied to Coal Mining

By W. B. Spellmire*

The increased use of electricity in mines has developed the idea of centralization in the generation of power. In the consideration of the relative cost of transmitting power, it can be proved that the transmission can be made in the form of electricity over a wire with far less loss than it can be through a steam pipe, by compressed air or in any mechanical form.

Operators now realize that every ton of coal which is saved can be sold, and that it is a part of economy to save as many tons as possible. Where all power is generated in one power plant, one engineer and one fireman take the place of the same number in each of the many smaller plants. Coal and ashes can be handled more economically. Engines can usually be run condensing and repairs and maintenance are required for a few large power units rather than for many small units. It can be shown that the resultant saving is greatly in excess of the interest charges on the additional investment required.

Direct Current or Alternating Current

As to the choice in either the direct current or alternating current, the former can be used economically where the distance does not exceed a certain limit; beyond this specified distance, the cost of copper wire becomes prohibitive.

A given wire which transmits 250 kw. at 250 volts with a 10-per cent. drop, will, by raising the volts to 2000, transmit eight times the amount of energy, and this at only 1¼ per cent. loss. The cost of copper for carrying electric current depends upon the amperes to be carried; from this is apparent the desirability of keeping the current small. If it is desired to transmit a greater power at the lower amperes, it will be necessary to raise the voltage.

Direct-current generators cannot well be built to operate at higher than 600 volts. If a voltage greater than 600 is desired, it becomes necessary to use alternating current.

Cost of Transmission

If it were desirable to transmit 200 kw. to a mine one mile distant from the power house, the cost of copper for transmitting this at 250 volts direct current with 10 per cent. loss in transmission would be about $26,000, and would weigh about 130,000 lb. The cost of copper for transmitting this same amount of power the same distance, with 10 per cent. loss at 2000 volts alternating current would be about $400, and would weigh approximately 2000 lb. These figures show the

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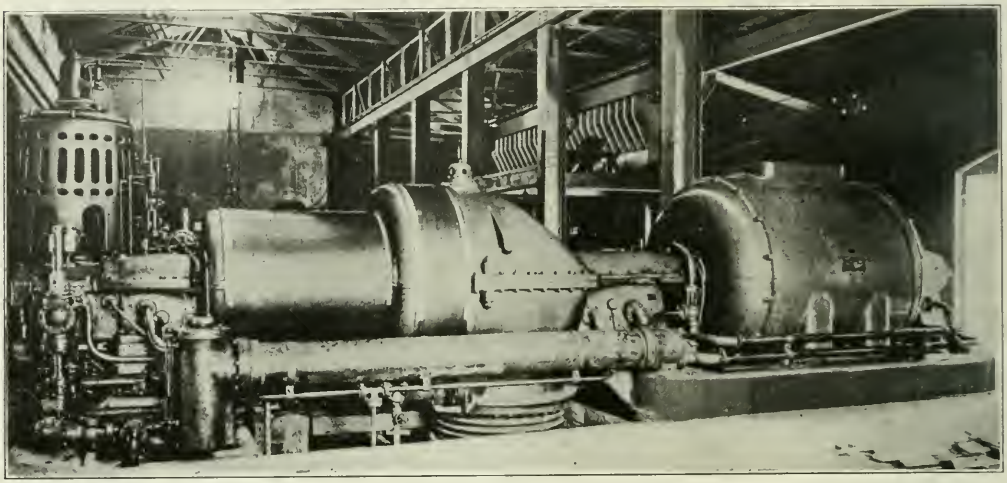
big saving in the cost of copper by the use of high-voltage alternating current. The cost of copper varies inversely as the square of the voltage.

Mining locomotives, coal-cutting machines, coke-oven larries, and coke-drawing machines are built only with motors for direct current. With alternating current delivered at the mine, it becomes necessary to change a part of this to direct current by the use of a rotary converter. For driving fans, pumps, crushers, and for rope haulage, alternating-current motors can be used to greater advantage than direct-current motors. In mining operations where compressed air is used, a compressor supplied with a large alternating-current motor can be placed at the pit mouth. The transmission of compressed air long distances is wasteful.

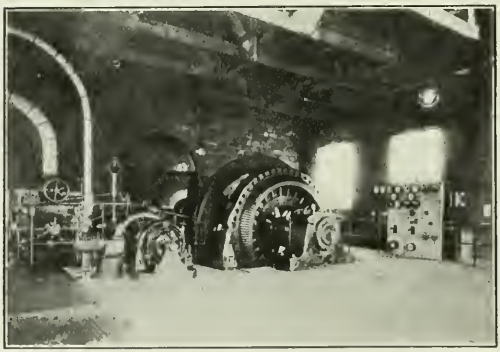
One of the most modern of central power plants has been erected by the H. C. Frick Coke Company, at Connellsville, Penn. This plant has a capacity of about 2000 kw. The heat for the boilers is obtained from a number of beehive ovens which are connected with flues so that the waste heat from the ovens is utilized. When the waste gases from coke ovens are utilized for generating steam, it is commonly assumed that each oven will furnish the equivalent of 18 h.p. This arrangement accomplishes a great saving and insures satisfactory results. The by-product oven will furnish about three times as much power as the beehive oven. The thermal efficiency of the gas engine is higher than that of the steam engine and boiler.

Where steam engines are used, it is best to centralize them making the individual unit large. The Corliss type of engine will secure the best steam economy, and naturally the conditions will be improved if the engines are made compound and operated condensing. Operators should not attach too great importance to first cost; the higher economy is secured by installing the most economical engine.

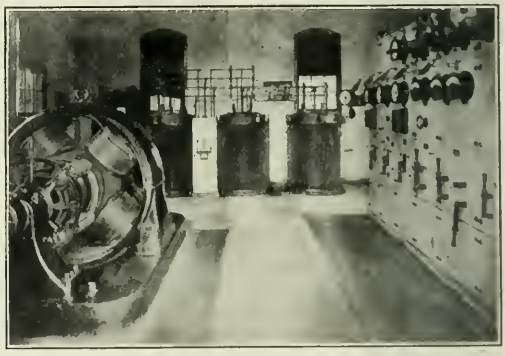
Steam turbines as prime movers are most desirable at coal operations. These turbines should be run condensing, and are not only economical in steam consumption, but combine large power capacity in small bulk; this reduces the cost of the power-house building, as well as the cost of foundations. Steam turbines can be satisfactorily used in connection with noncondensing engines. It is possible by supplying a low-pressure steam turbine and condenser to frequently dou-



STEAM TURBINE GENERATING UNIT INSTALLED BY THE DELAWARE, LACKAWANA AND WESTERN COAL COMPANY. THE MACHINE SHOWN IS AN ALLIS-CHALMERS 2000 KILOWATT TURBINE



INTERIOR OF POWER HOUSE OF THE MCKELL COAL AND COKE COMPANY IN SOUTHERN WEST VIRGINIA



SUBSTATION OF YORK RUN PLANT OF H. C. FRICK COKE COMPANY, SHOWING ALLIS-CHALMERS ROTARY CONVERTER

ble the capacity of the plant without adding any additional boiler capacity or requiring any additional fuel.

The Barren Zone of the Northern Appalachian Coalfield

By I. C. White*

Instead of a continuous sheet of coal measures underlying the entire Appalachian region, there is a great barren zone, which in the Allegheny series, begins a few miles north from Pittsburg, and embracing most of Allegheny county and large portions of Westmoreland, Washington, Greene and western Fayette, as well as southern Beaver counties, passes southwardly entirely across West Virginia and southern Ohio, thus reducing enormously the productive area of the Allegheny series, and its usually estimated coal resources.

This fact has been brought to light principally by the oil-well drillers in the search for petroleum and natural gas. The effect of this barren zone on West Virginia's productive coal area is to reduce it from 17,000 square miles to only about half that size, and the tonnage which has recently been estimated at 231,000,000,000 is reduced to about 60,000,000,000 of first-class available fuel. The 112,000,000,000 tons of bituminous coal originally existing in Pennsylvania, and 86,000,000,000 in Ohio, as estimated by Mr. Campbell, are also greatly reduced. It is quite certain that Pennsylvania will not furnish more than 40,000,000,000 tons, and Ohio probably not more than 25,000,000,000 of commercial bituminous coal.

The question as to why no valuable coal beds were formed in this great central trough is most puzzling. The reason for this condition appears to be due to the fact that the central region of the Appalachian coalfield was covered with water to such a depth that vegetation could not secure a foothold, and hence while sediments accumulated there to practically the same thickness as in other portions of the basin, they consist only of shales, sandstones and limestones, the latter being in greater proportion than where the coal accumulated in commercial quantities. Of course, there will be some islands of commercial coal in this long and broad barren zone, but they will be local and of small extent.

The Pittsburg region, therefore, instead of having a supply of coal sufficient to last for 200 years, has only enough coal to last 50 or 60 years, providing present wasteful mining methods continue. West Virginia has only about the same acreage of the Pittsburg seam as Pennsylvania, while Ohio's coal area will be practically gone in 25 years. It is possible, therefore, that Pittsburg industries, 50 years hence, will have entered upon the expensive method of mining coal by deep shafts to beds of inferior quality, and of only 1 to 2 ft. of thickness. This condition is as sure to come to pass, if present methods continue, as that the sun will rise tomorrow.

Some of the Sources of Waste

The citizens of Pennsylvania have already wasted more of their precious fuel supplies, both solid and gaseous, than they have ever used. More than 30,000 beehive ovens continue to waste approximately one-third of the fuel value of all the coal burned in them. As an example of waste, one oil well in West Virginia permitted 12,000,000 ft. of gas to escape each day in producing only four barrels of oil; this spectacle of wasting the heating value of 12,000 bushels of coal daily, together with the power to deliver itself free of charges for transportation, is not an isolated case. One great gas company operating in West Virginia put into its line nearly 100,000,000 cu.ft. of gas daily and delivered in Pittsburg much less than half that quantity, the larger portion having escaped into the air through defective joints of cheap and imperfect pipe-line construction.

Why should we permit the use of wasteful beehive coke ovens, which continue to vomit skyward such enormous volumes of precious gaseous fuel, which wasted energy will soon be needed by our great factories? The superiority claimed for beehive coke does not in the least warrant such waste. Why should we retain the steam engine to consume with frightful speed, our best fuel, when more power can be obtained by the use of the gas engine, from an equal weight of impure or low-grade coal? Fortunate would it be for our country's future, if some master genius could arise, and at one stoke, relegate both the steam engine and the beehive coke oven to the junk heap.

*State geologist, Morgantown, W. Va.

Conservation in the Coal Industry—Protection of Life and Prevention of Waste

By Glenn W. Traer*

After years of experience, I can honestly say, as far as my knowledge goes, that all laws which have been animated only by a sincere and honest purpose to protect employees from death and accident, from any cause under the control of the employer, have met with the prompt obedience of coal-mine owners. For all practical purposes, the Illinois mine law gives the present miners' organization in that State, an absolute monopoly of mining labor. The law provides that the examining board for the admission of new miners shall be drawn from the ranks of the miners only. No other interest is recognized in the appointment of such boards. Resentment and opposition to such laws will certainly continue.

The steam-engine method of producing power and the fearful waste of by-products in the manufacture of coke in beehive ovens are practices that should no longer be tolerated. It may be that certain regulations broadly and properly designed for the safety of human beings may also tend toward the conservation of coal. For illustration, a requirement that all coal mines opened after a certain date should extract the coal only from the outer boundaries of the property toward the outlet of the mine. This would avoid the existence of any gob, would lessen the danger of gob fires, decrease the number of accidents from falls of roof, would improve ventilation and lessen the danger of explosions spreading throughout the mine. This method would also insure a greater extraction of the coal area.

Higher Prices for Coal

The right of the present generation to use effectively of these coal resources, what it actually needs, carries with it a sacred obligation not to waste this precious heritage. We cannot expect the men of this generation to mine our resources in such a manner as to entail continuous financial loss; it is therefore reasonable to expect that the users of mineral products will pay for them much higher prices so as to make profitable their mining and preparation without serious waste.

Our present statutory anti-trust laws wholly ignore the natural principles that reasonable competition and reasonable combination are natural counter checks upon each other. The English nation maintains the only true protection against the evils of monopoly; this English law forbids only such restrictions or regulations of competition as are hurtful to the people as a whole. Unregulated competition does not result in the survival of the fittest, it is more often the survival of the most cunning and aggressive.

Each brief period of unusual prosperity results in an increase of the number of coal mines and in their production capacity, far beyond the public requirement. The excessive producing capacity of the mines now in operation in Illinois results in a loss of at least 50 days' work per annum to all miners and mine laborers on the pay-roll, more than 70,000 in number. This is equivalent to the absolute idleness for the entire year of at least 12,000 men.

The excessive number of mines kept

*President, Illinois Coal Operators' Association.

open, causes a scarcity of miners and makes it necessary to accept the services of inferior men. Such conditions in a great industry are a public evil, even though they result in lower prices to consumers.

Existing anti-trust laws should be amended so as to permit intelligent organization of disorganized industries, while preserving at the same time such a degree of publicity and public regulation as are necessary to protect the interests of the people as a whole. Wise economic results cannot be expected under unwise economic laws.

Progress in Coke-Drawing Machinery

By W. L. Affelder*

The introduction of coke-drawing machines has made it possible to effect a decided reduction in the first cost of erecting a coke plant. This economy results from the fact that where yards are built exclusively for the use of machines, yard-walls can be omitted as well as the expensive yard filling. Where machines are introduced upon old yards, it is necessary to widen the doors of the ovens to at least 42 in., and to grade the yards so that the machine track is 41 in. below the door-plate for the older type of Covington machine and 28 in. for the newest type.

The introduction of machines also effects a decided reduction in labor cost in drawing coke, inasmuch as coke can be watered, drawn and loaded, the ovens cleaned and a new charge leveled at a labor cost of but 35 to 40 per cent. of the cost of hand-drawing. Much of this saving, however, is offset by other items of expense, such as the cost of electric power and mechanical repairs on the machines. It is also true that where machines are used more coke is lost in the shape of ashes and braize.

To water, draw and level 40 ovens, 16 to 20 coke-drawers and two levelers would be necessary, while the same amount of work could be done satisfactorily with one waterer, two machine men, one oven cleaner and two levelers; that is, six men would do with a machine the work of three times their number under hand-drawing.

In an attempt to reduce the number of laborers required, as well as to overcome the defects of coke-drawing machinery, coke manufacturers have recently d parted from the long-established practice of building beehive ovens, and in several instances have built plants of rectangular ovens from which the coke is removed by pushing machines. The general practice has been to build these rectangular ovens about 5 ft. wide, with the discharge end 2 in. wider than the pushing end, 32 ft. long, 7½ ft. high to the bottom of the trunnel head and 26 to 29 in. between ovens. While it has been possible to make a good coke in these ovens, more economical and durable doors must be devised, lining brick better adapted to resist the effect of water and abrasion must be selected, and a satisfactory device designed to water the coke economically.

While much progress has already been made in the development of coke-oven machinery, the future field is still a promising one for ingenious inventors.

*Superintendent, Brownfield plant, H. C. Frick Coke Company.

The Installation of Electric Power in Coal Mines

By W. A. Thomas*

Electricity has often been blamed for accidents in coal mines, where many other causes might as consistently have been found. In the effort to determine precautionary measures for the safety of employees, it is a serious question as to what limitation should be placed on the use of electricity in coal mines. It is recognized that many of the suggested changes in methods of mining must necessarily increase the cost of coal production, and to adopt the changes in one State and not in another, must necessarily work to the disadvantage of the industry in the State making the most reforms. Some of the States have attempted to inaugurate reforms through legislation; however, in the majority of cases, the new rules have been found to be ineffective and inoperative. It may generally be considered that a safe voltage is anything up to 600 volts direct current.

Mines should be classified as follows: 1. Gaseous mines sufficiently dangerous to forbid the installation of electrical equipment. 2. Gaseous mines where the volume of inflammable gas generated is so small that it may be good practice to install safety lamps and safety powder, but will not preclude the installation of electrical equipment. 3. Non-gaseous mines where electric machinery is operated with direct current, and where 600 volts or less may be installed.

Where electrical equipment is installed, the tracks should be bonded and regularly inspected; they should also be cross-bonded every 200 ft. No permanent wire, either feed or trolley, transmitting 600 volts or less, should be insulated; the mine air soon affects the insulation and men are liable to be deceived, believing they are handling an insulated wire. It is better to teach men to keep hands off all wires. The trolley wires should be erected at a uniform hight from the rail and a uniform distance, about 6 in., outside the outer edge of the rail. As a guide to men traveling on the main road, lights should be placed and maintained every 200 ft. Where trolley wires cross the main heading, they should be protected by an inverted wooden trough and lights put at both ends of the trough.

Practical Suggestions

Switches should be of an approved type in boxes. Each motor and each locomotive should have an inclosed copper wire fuse on the main circuit. All forms of stationary motors should have the frames grounded in an approved manner. Controller frames on electric locomotives should be grounded to locomotive frames. Lightning arresters should be placed at the entrance of the mine. Where mining machines or drills are used in rooms, the frame of motors should be grounded to the frame of machines, and machines connected to the return circuit. Where it is necessary to install wires in rooms, have an approved automatic cut-out or switch, and have installed in the rooms in view of the miners, two lamps in multiple.

Where mines are ventilated by electric fans, an alarm should be so arranged in the power house that when fans stop the power-house engineer will get a signal. If the mine is gaseous, he should have instructions to cut power off the mine at once and immediately start an investigation as to the cause of the fan stopping. As much as possible, fan circuits should be separate from all other circuits.

Coincident with the adoption of uniform standards in installation and operation, steps should be taken to provide the State mining department with men especially skilled in the use of electric power in mines.

*Commercial engineer, Westinghouse Electric Company, Pittsburg, Penn.

Development of a Virgin Coalfield

By F. H. Palmer*

Prior to the expenditure of time or capital, there are three propositions which should be considered in the initial development of a coalfield: 1. Is the location of the tract such as will enable shipments to be made in an economical manner? 2. The competition to be met with in the available markets. 3. Is there an abundance of labor near the tract or can it be secured? If the above conditions are favorable, the work of prospecting should begin.

Having located the different seams on the tract, and opened them up at

*General manager, Olcott Coal and Iron Company, Olcott, West Virginia.

regular intervals, the next step is to discover the quality of the coal and to secure samples showing the true sections of the different seams. All partings which would be thrown out in mining, should not be included in the sections. If the coal is to be used for the manufacture of coke, it is best to secure a large enough sample to make a practical test, as this is the only positive way that coal can be judged as to its coking properties. When the coal seams are below water-level the property should be tested by boring.

The next step is to find the true dip of the different seams by a series of levels. The next consideration is the location of the railroad. If the seams are above water-level, the railroad should be located so that the different beds can be opened at the lowest point. This will reduce the cost of haulage and drainage.

Opening up the Seam

There are three methods in general use for opening up coal seams, namely: Shafts, slopes, and drifts. Shafts may be circular, square, oblong or rectangular. The latter is generally used in this country. The long side of the shaft should be as nearly as possible parallel with the line of dip, as this will necessarily place the ends of the cage in line with the strike of the seam, and the charging of the cages can be easily accomplished.

In sinking the shaft it is necessary to sink it 3 or 4 ft. larger each way than the actual size that has been determined. This size should be continued to a depth sufficient to secure a solid foundation for the side walls to rest upon. These side walls furnish a permanent foundation for the headframes. If water is encountered in sinking, it may be provided for by what are commonly known as "water-rings," from which, on the completion of the shaft, the water may be piped to the bottom.

Where the seam has a dip of 20 deg. or more and the outcrop is on the property, a slope may be started from the surface in the seam of coal to be worked. When the seam is comparatively flat and near the surface, it may be opened up by a slope driven through the overlying measures. When the slope is driven in the coal seam, the slope and air course are usually driven side by side; however, where the slope is driven through the overlying measures, a shaft is sunk nearby to serve as an airway.

If the slope has been sunk in the coal, it is usually desirable to drive to the limits of the property, and at this point, install the permanent pump, forcing the water through a borehole to the surface. Sinking the slope through the overlying strata is very expensive, and insures but little additional advantage.

Mining Methods of Western Pennsylvania from the Standpoint of the Mine Operator

By Fred C. Keighley*

There is as much room for improvement in mining methods today as there was 10 years ago. Some objection may be taken to the mine manager's seeming solicitude for the safety of the investment, but unless mining properties return the investment, there certainly would be no such properties in existence today. We must be fair to all when we consider the question of interest on investments; it is essential therefore, to treat labor and capital upon an equal basis; we cannot make a standard for one and not for the other.

The coal operator is chiefly concerned as to how he can secure the greatest tonnage of coal from his whole area with the greatest degree of safety to the miner and the highest return to the owners of the property. It is true that we are rapidly exhausting our resources, but we are not removing them exhaustively. We leave too much of the coal seam behind us.

We Should Educate our Miners

Our miners today are only so-called miners, and mine superintendents are continually thwarted in their purposes by the enormous proportion of raw labor material that is taken into the mines daily. This raw material is the real cause of waste and is largely responsible for the many disastrous accidents.

No further improvement in mining methods can be expected until we have better material from which to build up our miners. No great difficulty should be experienced in doing this, for in many other lines of industry, much good has resulted from efforts directed toward educating the worker. When this is done greater security and greater yield from our coal seams will result.

The Testing of Miners' Oil

By C. E. Scott†

Aside from the necessity of carrying out the requirements of the law, there are advantages in supplying the miners with the best oil obtainable. An oil of high viscosity does not flow freely and offers a greater amount of resistance than one of low viscosity. As a general rule, an oil of high viscosity will not keep lighted on headings and air courses where strong air currents are met; it is also hard to relight, and feeds up the wick very slowly.

The congealing point of an oil is an important factor in the winter months. The congealing point is the temperature at which the oil will solidify. Although the temperature inside the mines varies but little, the roadmen, drivers, motormen and others come in contact with air that is almost as cold as the outside atmosphere, consequently when buying winter oil, there should be a guarantee that it will not congeal at a temperature above 32 deg. F. The winter oil used by the Fairmont Coal Company shows a congealing point of 21 deg., which allows it to be stored and handled in cold places without freezing.

The hight of flame is also an important consideration in the purchase of oil. One company that has given this subject much attention, specifies that the oil shall give a hight of flame between 4 and 5.5 in., with the wick extending ¼ in. beyond the end of the lamp stock, with a 12-strand wick. This hight has been found to produce the best candle-power with the least amount of smoke; if the hight of flame is limited, the evolution of smoke is to some extent controlled.

The Smoke Problem

In testing miners' oil there is probably nothing of greater importance than the quantity of smoke it gives off while burning. An inferior oil always makes denser smoke. This point guides the mine inspector in his inspection of the oil used at different mines. When oil gives off an excessive amount of smoke, it may generally be assumed that it is adulterated and not up to the standard required. An oil to which kerosene has been added (which is common practice in most regions) is the greatest offender in this direction.

While it is true that drivers, motormen and trappers spend most of their time in an air current of high velocity, oil can be purchased for them that will burn with a long flame and hold to the wick under most severe conditions, and still come up to the standard specifications. The consumption of oxygen due to the burning of oil in a miner's lamp is very small in amount, since it has been figured that only one-seventeenth of the total pure air in a mine is required by the miners, horses and lamps. It is the quantity of smoke given off that causes the greatest vitiation of the mine air.

To measure the quantity of smoke given off by any particular lamp, use pure cottonseed oil as the standard of comparison. The size of lamp, length of wick, and quantity of oil should be the same in each case. The lamp should be placed in a box with a glass front and a white cloth, graduated in inches, to serve as a background on which to measure the length

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of the smoke pencil. The limit placed on the smoke is a pencil about 1.5 in. greater than that of the standard cottonseed oil.

The present specification on miners' oil as adopted by the Fairmont Coal Company reads as follows:

Density—24 deg. B. or under.
Congealing point—24 deg. F. or under.
Flash point 300 deg. to 425 deg. F.
Flame hight—Between 4 and 5.5 in.
Equivalent candle-power per gram per minute—8 or over.
Smoke—To be light in quantity.

Coal Mine Legislation

The mines committee of the Indiana Legislature held a number of sessions during the past week at which miners and operators appeared in advocacy and opposition to measures being advanced and placed for passage. The "Kayser bill" to create an examining board and the issuance of certificates for miners after an apprenticeship of two years, and the "Mugg bill" providing safer means of escape from mines in case of explosions were discussed. These bills were instigated by the mine workers and are opposed by the operators. The miners contend that the present means of escape from mines make it practically impossible to reach daylight in case of an explosion, and demand hoists in safety shafts.

A bill providing for heavy penalties for any dealer to sell fuel in which any foreign substance is contained, has brought coal and gas men to the capital to oppose the bill. Gas men say it is impossible to transmit gas entirely free from air and likewise the coal men declare it is impossible to produce coal absolutely free from impurities. An amendment to exempt coal companies was voted down and the bill passed the Senate. The fight will now be transferred to the House.

A bill prohibiting mine owners from taking out indemnity insurance against damages recoverable in case of injury or death to employees has been killed, and a bill passed allowing administrators to bring suit in favor of widows and children in case of death of the husband in a mine.

The Judiciary committee is wrestling with a bill calculated to prevent the rebuilding of the DuPont Powder mills at Fontanet, where an explosion a year ago killed 28 people. The terms of the bill are such as to make it impossible for the powder mill to be operated in Indiana. Strong efforts are being made to modify or defeat the bill.

A bill will be reported out of committee for passage this week which provides for the appointment of the Chief Mine Inspector by the Governor on recommendation of the miners, and operators of the State, instead, as now, being appointed by the State Geologist. This is regarded as a partisan measure and will not likely be approved by the Senate

Colliery Notes

Dust explosions occur in two stages: The ignition of the dust particles, and the explosion of the resulting and ready-formed gaseous products. These two phases follow in such rapid succession that they practically form one operation.

Recent experiments show that ⅓ oz. of coal dust per 35 cu.ft. of air will suffice for the production of an explosion. It was also found that it is more a question of fineness of the division of the dust, than the weight, that causes a condition of great danger.

It is well for coal operators that economic laws so largely govern the industry. Human devices may control prices temporarily, but in the end natural conditions must prevail. The more nearly prices and wages conform to economic conditions, the more speedily will business return to a normal basis.

In considering the distance to which currents can be carried through cable of a given size, the following rules should be remembered: First, the loss of voltage, other things being equal, is exactly proportional to the length of the cable; second, the loss of voltage on any given length and size of cable is proportional to the current as measured in amperes; third, the loss of power on any given circuit is proportional to the square of the current.

In electric shot-firing, the firing line must always be paid-out from the shot-hole to the place of safety. If the shot-firer has occasion to leave the firing line, even momentarily, after having paid it out, he should take the exploder with him. After a shot has been fired, the shot-firer should immediately disconnect both ends of the cable from the exploder, free it from any chance débris which may have fallen upon it, and coil it up. This routine should be followed even when a misfire has occurred.

The extent to which electric motors are applicable in the case of engines, such as winding, pumping, and haulage engines, is a question requiring careful thought. As a general rule, the electric motor is applicable to all small engines, and to large engines which run continuously, such as fan engines and pumping engines; however, when applied to haulage at high speed, where there is a continual starting and stopping, the advantage of the electric motor is less apparent. If the haulage is done by endless rope and is practically continuous for eight or ten hours a day at a uniform speed, then the electric motor is eminently suitable.

At a recent meeting of mining men at Cardiff, Wales, a prominent mining engineer propounded the theory that a huge force may be suddenly developed by the primary explosion in a coal mine, and that parts distant from the originating center, and free from gas, are devastated as the result of enormous pressure set up by the first explosion. The exponent of this theory stated that many men were instantaneously killed by an explosion before any sound reached them to warn them of danger. One instance was cited where a miner was found dead sitting with his food on his knee. Another instance was that of a man who was found dead actually standing with a drill in his hand after an explosion in the Universal pit, South Wales. Another instance upholding this percussion theory was that of two horses being killed, in whose blood no trace of carbon monoxide could be found.

The following table has been found to be approximately correct, and will be of use to those who test for gas with a safety lamp:

1 vol. firedamp to 60 vol. air = 1.66 per cent. It is just possible with very good eyesight or with the help of a magnifying glass to distinguish a minute cap above the small oil flame.
1 vol. firedamp to 50 vol. air = 2 per cent. An exceedingly faint cap, ⅛ in. high, the top having the appearance of being broken off.
1 vol. firedamp to 40 vol. air = 2.50 per cent. A conical cap, 1/16 in. to ¼ in. high.
1 vol. firedamp to 30 vol. air = 3.33 per cent. A conical cap, ⅜ in. high.
1 vol. firedamp to 25 vol. air = 4 per cent. A conical cap, ½ in. to ⅝ in. high.
1 vol. firedamp to 20 vol. air = 5 per cent. A cap 1 1/16 in. high, cap perfectly steady and more distinct than any of the others.
1 vol. firedamp to 18 vol. air = 5.55 per cent. A similar cap, 2 in. high, which burned rather more steadily.
1 vol. firedamp to 16 vol. air = 6.25 per cent. Gave a voluminous, waving, spindle-shaped, pale blue cap, 3¾ in. high.
1 vol. firedamp to 15 vol. air = 6.60 per cent. Inflammable.
1 vol. firedamp to 14 vol. air = 7.14 per cent. Slightly explosive.

The latest invention for indicating the presence of firedamp in coal mines, has been perfected by a German miner and depends upon the fact that the electrical resistance of selenium decreases when exposed to light. In using the apparatus in mines, a cell containing selenium is placed in an electric circuit containing a relay and a battery. Under normal conditions the selenium cell is exposed to the bright beams of a Davy miner's lamp. The rays of light from the lamp cause the selenium cell to offer a comparatively small resistance to the current of the battery with which it and the relay are in circuit, so that the relay exerts a comparatively powerful pull on its armature and keeps it attracted. If the lamp becomes surrounded by firedamp, its light becomes duller and the resistance offered by the selenium rises, so that the current flowing through the relay is weakened. In consequence of the decrease of attractive force of the electromagnet of the relay, its armature is pulled back by a spring against a contact which closes an alarm circuit. This causes electric bells to be rung at all the necessary points, thus indicating the presence of firedamp at the spot where the miner's lamp is placed.

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The Change in Feeling

It was not to be expected that the reductions in the prices for steel and copper would be immediately followed by a revival of the demand for those products. Insofar as ultimate consumption is concerned, we doubt if there has yet been any material change. In that phase of the question, the situation is still one of slow, but gradual, recovery. On the other hand, it is undeniable that during the last week there has been a perceptible change in the feelings of those who make it their business to discount the future.

Only a week ago nearly everyone was in the slough of despondency. Gossip was beginning to circulate about a curtailment of copper production. "I should not be surprised if the Butte mines were closed unless there be an improvement in the near future, although Mr. Broughton is a stumbling block which may prevent this action, for he takes the dog-in-the-manger position that somebody else may be benefited through such action," said a certain copper producer. (Why Mr. Broughton should be criticized for not closing mines which can produce copper at 10½c. per lb. is beyond our comprehension.) However, it appeared probable that some curtailment would be effected by the suspension of operations at those mines of which the cost of copper is 12½c. and upward, whereby supply would be gradually adjusted to demand.

The situation in the iron and steel industry was more or less similar. In short, trade was much in the position of the sick man, ailing for a long time, but unwilling to undergo the necessary operation. The latter having been finally performed, the vitality of the patient is low, and while recovering from the effects of the ether he feels sicker than ever, but this lasts for only a short time.

In the case of copper, it was obvious that the price was approaching the bottom, inasmuch as it was nearing the cost of production. The halt would naturally be caused when speculators and manufacturers felt that they were able to pick up the metal at a bargain. The beginning of such a movement occurred on Feb. 24, since when there has been large selling, chiefly for foreign account. Domestic manufacturers have so far continued reluctant to buy, although in some cases it is certain that their supply is becoming low. Whether they will be induced by the stiffer attitude of the selling agencies since March 1 to make haste remains to be seen. So far their continued inaction has been rather disappointing. Probably no one is afraid, in view of the large stock of metal on hand, that there will be any runaway market. On the other hand, the producers are now in a more comfortable position than 10 days ago. The present outlook is for a period of fluctuations within a comparatively narrow range, during which demand and supply will become adjusted, first of all by the retirement of the high-cost producers.

The Anthracite Miners' Demands

The labor situation in the anthracite region is becoming critical as the date for the expiration of the present agreement approaches. The demands for the new agreement have been formulated by the local unions and approved by the National association. As usual, they probably include much more than the miners expect to get. Briefly stated, they include the reduction of the working day from nine to eight hours; the substitution of the ton for the carload as a basis of payment to miners; the use of the short ton, of 2000 lb., in place of the long ton which has always been the customary measure; and an increase of 5 to 10 per cent. in wages of day-workers. Finally—and this is the main point—they insist that the operators shall deal with the union directly; that all questions arising under the agreement shall be settled with the organization; and they demand the check-off system, under which the operators deduct the union dues from the miner's pay-roll. That is, the open-shop system which has prevailed since the settlement of 1903 shall be abolished, and the anthracite collieries closely unionized. This is emphasized by the appointment of a committee including a number of soft-coal miners, headed by the president of the United Mine Workers, to present these demands.

While no official statement has been made, it is well understood that the anthracite companies will refuse all of these demands; and it is highly probable that they will refuse even to negotiate with the committee appointed, though they are willing to discuss the situation with actual representatives of the workers in the mines. They claim that the present agreement—which is practically that formulated

by the Anthracite Strike Commission in 1903—has worked well both for miners and operators. They object to the abolition of the Concilation Board, which has been a valuable feature of that agreement. Especially do they object to the exclusive unionizing of the region, which means to them practically the operation of the collieries subject to the dictation of the walking delegate. The wage increases are not considered as of importance—though they will hardly be granted under present conditions—as they are believed to be merely a makeweight and subordinate to the union demands. They also object strongly to an agreement limited to one year.

It does not appear that the anthracite miners have any substantial grievances to be redressed. The general conditions in the region have been better than ever before. The real reason for the demands is found in the fact that the unions have been losing heavily in numbers, many members dropping out by their failure to pay their dues. A new fight seemed to the leaders to be the shortest way, or perhaps the only way, to rehabilitate their organization. For this reason it is doubtful whether the movement will have any public support. On the other hand, the companies are in a strong position. The season is approaching when the demand for coal is comparatively light; and they have accumulated stocks sufficient to carry their trade for some time.

That there will be a strike in the anthracite region seems now to be a foregone conclusion. As to its probable duration only conjecture is possible. It is to be hoped, however, that the State authorities will take warning, and will be prepared, should the strike last, to prevent any repetition of the disgraceful disorder which has marked previous industrial troubles in the anthracite country.

"Open Markets"

It seems strange that the daily press cannot learn some of the simple facts of the metal industries. Last week the cutting of prices by the Steel Corporation introduced the phrase "open market," which caught the popular fancy. There had previously been an open market in iron and steel. All that the great corporation did was to enter into competition with the independent producers, who had been cutting prices and securing the business that was going. The market had been "open" enough.

Then it was announced that there was to be an open market in lead, the American Smelting and Refining Company being about to enter into competition with the National Lead Company. This was enough to make a blast furnace laugh. The National Lead Company produces some lead for its own consumption, but it is the largest customer of the American Smelting and Refining Company. The latter indeed has a stock interest in the National Lead Company and is represented on its board of directors. The smelting company controls a large production of lead, but in this metal also there has been decidedly an open market ever since prices began to crumble away, two years ago.

The same thing is true of copper. In this metal there is no trust and there never has been. There has been no understanding among the producers since the Secrétan affair, about 20 years ago. Some of the large interests in this industry at the present time are friendly; others are hostile; the relations are such that there is not, and has not been, any prospect of affiliation, or even any talk of it except in quarters where the wish may have been father to the thought.

The situation in copper is simply this: The Amalgamated Copper Company is a large producer. Its copper is sold by the United Metals Selling Company, in which the inner circle of the Amalgamated company is the controlling interest. The Metals Selling Company also handles the copper of other producers under contract and for a commission. In this way it has the disposal of a larger amount of metal than any other single interest. However, there are five other selling agencies of first magnitude (each disposing of upward of 100,000,000 lb. per annum), besides a large number of smaller concerns. These compete aggressively for business. The market is always open.

Such confusion as exists respecting this is fundamentally the result of concentration of business in comparatively few hands, and especially the development of a giant, who is at times of dominating influence, and again is comparatively helpless. The zinc industry has undergone concentration during the last 10 years, which has had an effect upon the spelter market, but no Goliath has appeared and consequently there has never been any suspicion of the market being otherwise than open. In the other industries—steel, lead and copper—the U. S. Steel Corporation, the American Smelting and Refining Company, and to a much less extent the United Metals Selling Company, have attempted to regulate prices. Their managers became intoxicated by their apparent success in that direction and failed to perceive that this was achieved on the general rise in the markets that coincided with the era of great industrial consolidations. However, in summing up the experience of the last 10 years, we are able to deduce an economic axiom as follows:

A corporation controlling a large percentage of production can regulate prices when consumptive demand is large and the trend of prices is consequently upward, and may continue to do so during a temporary setback, but it cannot govern prices when there is a serious or prolonged recession in business and a naturally downward trend of prices.

The Calumet & Hecla—Bigelow Settlement

The litigation which has been pending for some time between the Calumet & Hecla Company and A. S. Bigelow over the control of the Osceola Mining Company has been finally settled by something in the nature of a compromise. The Calumet & Hecla bought a large interest in the Osceola about two years ago; it was not a controlling interest by itself, but the company secured the support of other stockholders who had long desired to see the Osceola free from the Bigelow control. Mr. Bigelow, however, brought suit to enjoin the Calumet & Hecla from voting on its stock, and by appeals and other legal devices he succeeded in postponing the change of control up to the present time. It does not appear that he hoped for ultimate success, but chiefly that he wished to secure delay, and acquire a good strategic position for the sale of his stock. The judgment of the courts was for the most part in favor of the Calumet & Hecla, but the litigation could have been prolonged still farther, and the present settlement was made.

An incidental result will be that the sale of the copper from the Bigelow mines will pass from the United States Metal Selling Company as soon as existing contracts expire. The Calumet & Hecla selling agency will doubtless handle and market the product of all the mines.

American Institute of Mining Engineers

The ninety-sixth meeting of the American Institute of Mining Engineers opened on Tuesday evening, Feb. 23, in North Sheffield hall, Yale University, New Haven, with about 50 members present besides many professors in the Sheffield Scientific school and students who are taking the mining courses in that institution. Neither John Hays Hammond, the retiring president, nor D. W. Brunton, the new president, was able to attend, and Dr. James Douglas presided at the opening session. Director Chittenden, of the Sheffield school welcomed the members of the institute to New Haven.

Doctor Raymond announced that two honorary members and one honorary associate member had been elected by the council. These are Prof. Richard Beck, of Freiberg, Emil Schroeder, secretary of the German Society of Iron Masters, and James F. Swank, of Pittsburg. He also announced that the next meeting of the institute would be held next fall on the Pacific coast at Seattle. Before going to Seattle those who are to attend the meeting will go to Yellowstone Park, from there to Spokane and from there to Seattle, after that going to Salt Lake City, with a chance for a side trip to Goldfield, Nev.

Doctor Douglas then read a paper on "The Conservation of Natural Resources." The paper was confined to mineral resources and read in part:

Conservation of Natural Resources

"Complete recovery of every ingredient in an ore is impracticable, and it is a question for the conscience what to throw away and what to save. When I went to Arizona in 1880, the copper industry was in its infancy. Most of the companies wasted large amounts of copper with the refuse that was thrown away; it is only because of the advent of the railroad lines that the companies are being profitably conducted. There was a stripping of every hillside of its trees for fuel before the railroad brought coal there, and in every department there was waste of labor, capital and resources.

"There is great waste in anthracite coal, but this is being recovered today. I am not fond of trusts, but it must be admitted that great capital and costly experiments are needed for the conservation. All great improvements have been made under the direction of large corporations with large capital. We are in duty bound to help in the work of saving.

"Technical men for the past two generations have been seeking to save waste, and the criticisms of the public concerning our work will not reduce the waste at all. Looking back a generation or two we see how much has been done toward saving. This is shown in the pig-iron industry where early in the last century hundreds of square miles of forest timber were burned to make a relatively small amount of pig iron.

"People say that the coal resources will be gone in 150 years; that iron will be gone; it doesn't matter. Some substitute will be found for each, or our children will be greater fools than ourselves."

In discussing the paper Doctor Raymond said that the national executive and the national congress had destroyed a great deal which had been accomplished toward the conservation of natural resources. Ever since the first meetings of the institute committees had been working on the coal question, one of which was later made the official commission of the State of Pennsylvania. The corporations, mainly the railroads, secured control of the coalfields of Pennsylvania, and the natural desire to improve the property, and to have a transportation business even after the lease of the fields had expired, led to the expenditures of large sums to prevent waste and to utilize to the greatest extent the products. Then the national legislature decided railroad corporations could not own the coalfields. This, said Doctor Raymond, is what politicians and hysteria on the part of the public will do. Doctor Raymond also quoted from a paper presented by him and W. R. Ingalls, in collaboration.

E. W. Parker read a paper on "Coalfields of the United States." He said in part:

"The greatest reason for waste in the bituminous-coal region, was the idea of getting out the greatest amount in the shortest possible time. Today 70 per cent. is saved. I think that by the time the coal is exhausted, the need for it will have passed. But I do not think it a waste of time to have an inventory of what we have and see how fast what we have is being consumed. We have found that the coal supply will be exhausted by the middle of the next century. I do not think that it is right to export coal or other raw material, and this practice should be discouraged. Nothing has done so much to conserve the anthracite supplies as the corporation control in Pennsylvania, and it is to be regretted that other such corporations cannot secure the bituminous fields."

At the morning session, Feb. 24, Henry G. Granger presented an elaborate paper, outlining a new plan for the construction of the Panama canal on sea level. Gustav H. Schwab also read a paper in favor of a sea-level canal. These papers elicited an extended discussion, the general tenor of which was in favor of a sea-level canal.

At the afternoon session, Prof. John D. Irving read a paper on the "Technical Education of the Mining Engineer." He described the work at the Sheffield Scientific School and said that the course of school training for the mining engineer should be five years instead of four years, as at present. In the discussion following this paper, in which several well known educationalists participated, general agreement with the idea of Professor Irving was expressed. Prof. Louis D. Huntoon followed with a paper on the "Hammond Metallurgical Laboratory at the Sheffield Scientific School," which was a description of the laboratory and an account of the development of the metallurgical course at Yale. After the reading of this paper the laboratory itself was visited by the members of the Institute. The members were also taken about the grounds of Yale University in automobiles, in spite of the severe rain storm which somewhat interferred with the plans for the meeting of this day.

At the evening session W. L. Saunders read a paper on "Driving Headings in Rock Tunnels." This was an extremely interesting and valuable contribution. Mr. Saunders stated in the first place with great frankness that the general factor in determining the speed and efficiency of driving tunnels is not the type of drill, but rather the way in which the drills are used. He stated and established conclusively that European methods of tunnel driving are superior to American, and pointed out the reasons why. Mr. Saunders was followed by D. Foster Hewitt, who, in an intersting paper, described the "Vanadium Deposits in Peru."

Upon adjournment of the evening session, at about 10 p.m., the members were invited to the Graduates' Club, where they were entertained with music, conversation and supper. This was a very pleasant courtesy on the part of the members of the club, which was warmly appreciated by the members of the institute.

At the morning session, Feb. 25, E. W. Parker read a paper contributed by J. E. Sheridan on the "Stag Cañon Fuel Company's Mines at Dawson, N. M." Joseph W. Roe then read a brief paper on the "Graphical Solution of Kutter's Formula."

In the afternoon the members visited the plants of the National Pipe Bending Company, the Bigelow Boiler Works and the New Haven Gas Company. In the evening there was a reception at Byers Memorial Hall. Friday and Saturday were devoted entirely to excursions, including visits to Bridgeport and Ansonia where several interesting industrial plants were examined.

The meeting was a highly successful one and the members departed with a feeling of keen appreciation of the hospitality extended by the citizens of New Haven and neighboring towns through the instrumentality of the very efficient local committee.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machine

In some respects I agree entirely with the views T. R. Woodbridge has expressed in his letter on "Sampling by Machine" in the JOURNAL of Jan. 30. He shows at length that *mixing* a lot of ore composed of many sizes is not practicable. For that reason I have suggested that the end to be aimed at by feeding devices is *retardation*. Modern sampling is the art of taking a fair sample from a continuously moving stream of ore and the first cut made destroys that continuity. The 20-per cent. cut which goes on to a new sampling is followed by an 80-per cent. blank in the stream and it is essential to hold back the 20 per cent. and feed it to the next machine so slowly that its feed shall cover the whole time of the blank until a new cut joins the first. Vezin's cylinder is called a "mixer" and he thought that mixing was useful but I think he regarded its action as a retarding machine as much more useful than its mixing effect. His mixer and the whole class of shaking aprons and feeders are really continuously discharging storage vessels, while the intermittent form is seen in the fixed bin. And let us understand clearly that there is no theory that explains the use of these continuous feeders. They simply save manual labor. Probably the bin which is filled continuously and then discharged intermittently by the attention of a workman gives a more satisfactory service but it costs labor instead of power.

I find myself unable to agree with Mr. Woodbridge in another point he makes, that respecting the best number of cuts. He likens the ore to a ribbon 6 in. wide and 1000 ft. long and asks which would give the best results, taking every other 100 ft. or taking every other foot? As neither of these is done in practice, and the question as put is purely academic, we may go further and ask whether it is better to take every other 100 ft. or every other ½ in. The question does not by any means provide an obvious answer. The true answer is that the number of cuts, and consequently their size, should vary with the coarseness of the ore, and we find this is actually *the practice*.

Sampling an Art

He points out with entire correctness in other parts of his letter that sampling is one of the arts and is governed by cost and practicability. It must accept conditions as they are and not only make the best of them but do good work with them. Otherwise it is not an art. This is done by submitting to whatever laws of nature we use in the process, guiding ourselves also by experience with such machines as we have. I have mentioned a mill where the fall from one machine to another was so great that the operation of gravity destroyed all possibility of good sampling. As to experience why do careful samplers look with doubt upon the practice of sending every 20th car or bucket of ore to the sampling mill? This is judgment matured by experience.

The literature of sampling reveals many divergencies of opinion but there are some conclusions that are rarely doubted. I was surprised therefore to read the discussion on selective action of scoops. The idea that the loss of one 2-in. piece of ore from the cut can be made up by throwing into it another 2-in. piece that ought to have gone into the reject is a fallacy which has been pointed out by Brunton, Vezin, and I think Argall, and no doubt by many others. All insist, and with truth, that a stream of ore does not have the same assay value in all its parts, that is to say that it cannot be counted on to have the same value either on its two edges, or in successive second intervals, or in different fragments of ore. It was on this ground that Brunton rejected his first sampler and pointed out that a double-oscillation machine cannot possibly take a fair sample. His second machine has a single crosscut followed by a rest (reject time) and then a new crosscut in the contrary direction and rest. Oscillation in the sense of a continuous cut from the beginning of the movement to the return of the gate to its first position is inherently fatal to correctness because it gives undue length of cut to one side of a heterogeneous stream. Mr. Woodbridge's dictum "the fact is, theoretically and actually, that A and D (of his illustrations) are balanced by *B* and *C*" is true only for approximate weight. It is not true for value. If it were true for value, a 5-per cent. cut would be as good as a 20-per cent. and all sampling machines would have nearly the same degree of correctness.

Size of Cut and Condition of Ore

Another sentence in his letter, "I also think that it is the consensus of opinion that a rapidly moving machine takes a more accurate sample than the slower one," is undoubtedly true and I did not expect to have my doubts on this subject received with acclaim. The fact is that all the gentlemen who have joined in this discussion seem to look at the subject from a point of view that is different from mine. In my thoughts I look constantly at the first cut with its coarse ore while the other correspondents of the JOURNAL seem to be thinking of the later cuts, on fine ore.

Comparisons unfavorable to sampling at mines and smelters have been made in favor of public, or custom sampling, but the published examples give no ground for believing that the custom sampler would do better work under the same circumstances. Give one of them 500 tons a day, the first cutting to be on 2½-in. ore and I do not believe there is one of them that would do better work than a good smelter sampler, unless especial attention were given to the work; and in all I have to say I am not talking about especial efforts. In such discussions the best work a mill has the right to show is the work done when the "boss" is not around.

The conditions at the two kinds of mills are so different that I do not think they can be compared properly. Take for instance Mr. Woodbridge's resampling of purchased lots. In one case nine lots averaged 6480 lb.; in the other, 13 lots averaged 3870 lb. The largest lot weighed 28,620 lb. and if this is taken out of the first series the average weight of the eight lots remaining is 3700 lb. Seven lots out of 22 weighed less than 2000 lb. We all know that this means close sorting and the average of 2.76 oz. gold per ton, in the 13-lot series also indicates it. Such lots represent 5 or 10 per cent. of the original ore and the gangue which has been thrown out would have been the most disturbing factor if the sampling had been done on the raw ore.

Then such lots are always crushed fine and all the errors incident to sampling a mixture that ranges from 2½ in. down to 0.01 in. are avoided. I presume the custom samplers do their work well but they have no reason to boast over what I may call *home* samplers. The two are simply not in the same class and cannot be compared

Mine and Smelter Sampling

I think your readers will agree with me that sampling as a general art means principally sampling at mine, mill, or smelter and not custom sampling, which is merely one specialized branch of it, with the greatest difficulty that confronts the home sampler removed before the ore reaches the mill.

The last paragraph of Mr. Woodbridge's letter must be read between the lines. To ascribe, "the errors in sampling, or differences between samples and resamples," to, "faulty design or construction of the machine," can hardly mean Vezins made by the best shops in the country, and yet those machines have done bad work. It was for that reason that I have insisted that the true field for improvement lay in proper arrangement and system and not in the machine. Of the other causes of error cited I am interested to notice "neglect in repairing the cutting edges and keeping them to the designed shape." Mr. Brunton mentioned the same fault in a letter to the *Mining and Scientific Press* last year. I confess I have not been able to see the force of this reason. If a 10-per cent. scoop gets a blow that widens it to 11 per cent. or narrows it to 9 per cent., I do not see that the results can be affected. To me 18-, 20- and 22-per cent. cuts are all good, and practically *equally* good cuts. And so it is if an edge is worn down. It is worn for the gangue as well as for the "mineral" and though I do not advocate the use of worn out machines I cannot see how such an edge can discriminate.

"Loss of fines through leaks in spouts, etc." is not likely to keep the managers of Balaklala awake nights. Good work can be done in some home mills not only with, "lack of thorough cleaning between lots," but without one clean-up in a year! If a 10,000-ton lot of Trinity ore followed a 20,000-ton lot of Balaklala ore the best cleaning in the world would not make a difference of one mill per ton. But Mr. Woodbridge's explanations are reasonable for custom mills and show very well the great difference between the two kinds. These causes to which Mr. Woodbridge ascribes the errors in sampling are characteristic of the custom sampler and his point of view and we shall never agree in opinion because custom sampling, with its small lots of rich ore, is not what I am thinking or writing about.

None of your correspondents has shaken my belief that the most difficult part of the work in smelter sampling mills is the first cut when the ore is a mixture of sizes from 2- or 3-in. ring down to dust. If we postpone for the present the discussion of later cuts until the first one has been established properly I think it will be found that there is no consensus of opinion on size (and therefore frequency) of cuts. The whole body of information we have includes the later cuts on finer ore. Even when the coarse cut is mentioned the discussion is usually by a man whose experience has been mainly with fine ore only. Johnson is an exception because he was sampling for a furnace. The question of cutting a fair sample from such a mixture of very coarse and very fine is new in its present degree of importance because the building of mills at mine, mill and smelter is comparatively modern.

JOHN A. CHURCH.

New York, Feb. 13, 1909.

California Oil

In my general article on California mining published in the JOURNAL of Jan. 9, 1909, p. 122, the statement is made that all the oil companies of the State paid dividends of $574,556 in 1908. This is of course an error, that sum being about one month's dividends. In fact, in the same number of the JOURNAL, on page 93, a list of dividends is given of those companies listed on the California Oil and Stock Exchange, and those of some not listed. The total dividends of the listed oil companies in December, 1908, were $615,109, and up to that time these listed companies had paid an aggregate of dividends of $18,008,882. In January, 1909, these companies paid $405,638. It is not possible to get an exact statement of the dividends of all the oil companies operating in this State, many of the larger companies and some smaller private ones never making such matters public. The estimates of total dividends of California oil companies operating in California in 1908 run from $4,000,000 to $9,000,000, which shows a wide variance. However, the statement made by me in the JOURNAL of Jan. 9 was so much out of the way that even those not very familiar with the subject might have seen that it was an error, and a bad one at that.

C. G. YALE.

San Francisco, Cal.,
Feb. 20, 1908.

Mining Legislation at Washington

SPECIAL CORRESPONDENCE

Some action has been taken lately on several bills pending in Congress, and of interest to mining men.

MILL SITES

A report on the bill providing more liberally for mill sites has been filed by Mr. Bartlett, of Nevada, for the Committee on Mines and Mining, and it is expected that the bill will be passed either at the current or the special session of Congress. The committee notes that the bill amends section 2337 Revised Statutes by striking out all words in the section as it now stands which can be interpreted to require the non-mineral land to be non-contiguous or non-adjacent to the vein or lode, so it will read:

"Sec. 2337. Where non-mineral land is used or occupied by the proprietor of a vein or lode for mining or milling purposes, such land may be embraced and included in an application for a patent for such vein or lode, and the same may be patented therewith, subject to the same preliminary requirements as to survey and notice as are applicable to veins or lodes; but no location hereafter made of such land shall exceed five acres, and payment for the same must be made at the same rate as fixed by this chapter for the superficies of the lode. The owner of a quartz mill or reduction works, not owning a mine in connection therewith, may also receive a patent for his mill site as provided in this section."

The section as now in force is construed by the department of the Interior to limit claims for mill sites to lands "not contiguous" to the vein or lode and "non-adjacent" to the surface ground embraced in the lode claim, and in practice the term "the vein or lode" is held to mean any vein or lode for which claim has been asserted whether or not the proprietary right is vested in the mill-site applicant. The amendment has been submitted to the Department of the Interior and has received its approval, as is evidenced by a letter from Hon. Frank Pierce, Acting Secretary of the Interior.

SURFACE RIGHTS OF ENTRYMEN

The House of Representatives on February 15, passed an Act for the protection of the surface rights of entrymen reading in part as follows: "That any person who has in good faith heretofore located, selected, or entered under the non-mineral lands laws of the United States any lands which subsequently are classified, claimed, or reported as being valuable for coal, may, if he shall so elect, and upon making satisfactory proof of compliance with the laws under which such lands are claimed, receive a patent therefor, which shall contain a reservation to the United States of all coal in said lands, and the right to prospect for, mine, and remove the same. The coal deposits in such lands shall be subject to disposal by the United States in accordance with the provisions of the coal-land laws in force at the time of such disposal, but no person shall enter upon said lands to prospect for, or mine and remove coal therefrom, without previous consent of the owner under such patent, except upon such conditions as to security for and payment of all damages to such owner caused thereby as may be determined by a court of competent jurisdiction. . . ."

The Senate in Washington is discussing in a desultory way the transfer of the Tennessee Coal, Iron and Railroad Company to the Steel Corporation, but no new facts have been brought out. It is rather remarkable that in this discussion there has been little or nothing said about the control of iron-ore supplies, which was a very important element in the transfer.

Reasons for the Commercial Depression—Berlin as a Gold Market

E. H. Holden, M.P., chairman of the London City and Midland bank, gave his stockholders the other day some interesting facts about the effects of the American panic of 1907 upon trade conditions in England and Germany. He said, among other things:

"The first backward movement from the prosperity of 1907 to the adversity of 1908 took place when the credit of American railroads was restricted. So long as they could obtain credit to carry out their extensions, so long were they able to give out orders to other industries, but when that credit was stopped, then the orders to other industries were stopped also. This, taken with a subsequent contraction of credit, caused a large fall in prices there, which, in turn, caused a fall in prices abroad. Just as we benefited from the increase of prices by the increase of our exports, so, in 1908, we have suffered from the fall in price by the decrease of our exports.

Kinds of Credit

"There are two kinds of credit, one which is used for the purpose of carrying on commerce and industry and the other which is used for the purpose of holding securities. Experience has told us that these two kinds of credits cannot be maintained at a maximum at the same period, because there has not, up to now, been sufficient gold to support them. The year 1907 was a year in which the commercial credit was at its maximum, and the securities credit was at its minimum. The commercial credits have gone down with a shock, and the shock has been so sudden that it has thrown down the value of money in the principal countries of the world.

"The securities credits have not yet had time to increase so as to raise the value of money, but we see it is rapidly increasing. We are all hoping that trade will show some improvement, so as to create a demand for commercial credits, but we do not see much evidence of this at present, only, perhaps, to some extent in the case of the United States.

"The railways in the United States since the restrictions of 1907 have practically received all the money they have asked for. This has reacted on the other industries, and brought about a slightly improved trade. Does it not follow, then, that some demand must arise ere long, for the commodities, in respect to the large amount of loans which are being issued in this and other countries? It is in this direction we must look for improved trade and improved bankers' profits.

Extent of Industrial Depression

"We in Great Britain are not alone in industrial depression. The commerce and industry of Germany received a great blow from the banking débâcle of last year in the United States. The effect of this blow has been manifest during the whole of 1908, and it has been quite evident that in Germany there was too much lending to undertakings which looked hopeful at their inception, but which have turned out otherwise in their realization, and it appears, in order to increase the liquid assets of their financial concerns, there has been gradual pressure kept on their industries. However, the financial position of Germany has changed for the better since the end of 1907, which has been brought about by its national bank granting greater facilities for importing gold. The Reichsbank has not only offered greater facilities for the import of gold from other countries, but also it has made a new departure in the case of South African gold, which, if persisted in and farther extended, may prove injurious to the South African gold market in London.

Taking South African Gold

"Previous to last year, all South African gold was shipped to London for assay, sale, and transshipment to any countries requiring it, but during last year the ore from certain mines has been shipped direct to Germany, and there assayed. One cannot here refrain from examining the policy of the three great national banks during the last year—the Bank of England, the Reichsbank, and the Bank of France. From May 28 last to the end of the year the Bank of England rate was £2½ per cent. From Jan. 13, 1908, to the end of the year the Bank of France rate was £3 per cent. From June 18 to the end of the year the Reichsbank rate was £4 per cent. The result is an increase of gold in Germany of £13,798,000 and increase of gold in France of £32,482,000, and a decrease of gold in England of £1,811,000.

"Paris exchange on London has been so persistently low as to call forth all kinds of international explanations. We all know that the low exchange is due to the flow of credit to Paris, but the difficulty has been to explain correctly in what way this flow of credit has come about.

"During 1906 and 1907 the imports and exports of all countries were at their maximum. Paris took a great part in their financing, which she did through London and other centers, where of necessity she was compelled to maintain large balances. When we remember that in our own international trade we have had a contraction of about £150,000,000 of credit, and that other countries have also suffered, it follows that the contraction of the credit granted by the French banks must have experienced a large collapse, thus rendering it a loss to maintain credit balances in other countries if the rate of interest were not higher than in her own country. Also France is playing a constantly increasing part in the issue of new loans, and it is reasonable to argue that some of these credits are being attracted home to take part in the new issues."

The Rare Metals IX—Vanadium

By Charles Baskerville*

Vanadium is classed among the rarer elements, but it is widely diffused in nature. It is most common in ferromagnesian rocks, yet traces of it are found in rocks of nearly every class. However, the definite vanadiferous minerals are not very numerous, as will be noted in the following list of vanadium minerals:

VANADIUM MINERALS.

	Vanadium Pentoxide Content.
Vanadinite, lead vanadate combined with lead chloride	8–12%
Endlichite, arseniferous vanadinite	7–11%
Descloizite, lead and zinc vanadate	20–22%
Cuprodescloizite, lead, zinc and copper vanadate	17–22%
Roscoelite, a vanadium mica	20–29%
Carnotite, uranyl-potassium vanadate	19–20%
Ramirite, a variety of cuprodescloizite	19%
Tritochlorite, identical with cuprodescloizite	24%
Eusynchite, lead and zinc vanadate (descloizite)	17–24%
Dechenite, lead vanadate	45–49%
Volborthite, a hydrous vanadate of copper, barium and calcium	14%
Calciovolborthite, a hydrous vanadate of copper and calcium	37%
Brackebuschite, a vanadate of doubtful composition	24–25%
Psittacinite, a hydrous lead and copper vanadate	17–25%
Mottramite, a vanadate of lead and copper	18%
Chileite, an uncertain vanadate of lead and copper	13%
Vanadiolite, a doubtful substance	44%
Vanadic ochre, vanadic oxide	100%
Lavrovite, a vanadiferous pyroxene	2%
Ardennite, a vanadio-silicate of aluminium and manganese	0.5–9.2%
Argyllite, a sulpho-vanadate of lead	..
Eosite, lead vanado-molybdate	..
Fritscheite, a mangan-uranite containing vanadium	..
Pucherite, bismuth vanadate	22–27.3%
Vanadium-augite (lawrowite), a vanadiferous augite	2%
Vanadium-bronzite, a ferro-vanadiferous enstatite	..
Vanadium-gummite, an altered uraninite containing vanadium	..
Sulvanite, a double sulphide of copper and vanadium	..

Vanadium and the vanadates are extracted from roscoelite, vanadinite, descloizite and carnotite. The most important use of vanadium is in its utilization as an alloying material for iron and steel; it increases the malleability and hardness of steel after tempering, and is consequently used in the production of sheet and tool steel, and armor plates. Other alloys containing vanadium, as vanadium bronze, have been found useful in the arts. Vanadium salts are used as mordants, especially in the printing of calico and in fixing aniline-black on silks; in the preparation of vanadium black; and in pre-

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paring an indelible ink. The oxides of vanadium have been used in ceramic decorating, and as autocatalysts.

The demand for vanadium is very strong and the prices high.

Vanadinite

This mineral occurs sparingly with wulfenite and pyromorphite near Sing Sing, N. Y.; with wulfenite and descloizite in Arizona and New Mexico; and with uranium minerals in sandstone in Rio Blanco county, Colorado. It is found sparingly in Montana, and also in Mexico. The only commercial deposits are in Arizona and New Mexico, where characteristic crystals are often found. Phosphorus and arsenic are sometimes present, both replacing vanadium.

Vanadinite occurs in small, sharp hexagonal prisms, sometimes cavernous, of deep ruby red, light brownish yellow, straw-yellow or reddish brown color. It is also found in rounded forms, in parallel groupings like pyromorphite, and in globular masses or incrustations. The luster is resinous on the surface of fracture, and the streak is white to a pale yellow. The hardness is 3, and the specific gravity is 6.66-7.23.

Vanadinite decrepitates in a closed tube, yielding a faint white sublimate. Before the blowpipe, it fuses on charcoal to a black lustrous mass, which in the reducing flame yields metallic lead and a yellow sublimate. After the lead is completely oxidized in the oxidizing flame, the black residue gives an emerald-green bead in the reducing flame with salt of phosphorus; this bead becomes light yellow in the oxidizing flame. With strong nitric acid the mineral becomes deep red, then yellow upon solution. When fused with three parts of potassium bisulphate, it forms a clear yellow mass, which reddens on cooling, finally becoming yellow when cold. Vanadinite is decomposed by hydrochloric acid. Chlorine may be detected in vanadinite by the following method: Oxide of copper is dissolved in salt of phosphorus on platinum wire with the oxidizing flame, until the glass is opaque; a small particle of the mineral is then placed on the bead, which is now treated with the tip of the blue flame. So long as chlorine remains, an intense azure-blue color is imparted to the flame surrounding the bead. This is caused by the volatilization of copper chloride.

Endlichite differs from vanadinite mainly by its lesser percentage in vanadium pentoxide and its higher content in arsenic pentoxide. It gives an arsenic odor on charcoal.

Descloizite

This mineral is found in Sierra county, New Mexico, associated with vanadinite and iodyrite. It is also found with wulfenite in both New Mexico and Arizona. A variety is found in Beaverhead county, Montana. Copper is sometimes present, and arsenic often replaces vanadium.

Descloizite occurs in small purplish red, brown or black crystals, forming drusy surfaces or crusts; in stalactitic aggregates, and also in massive, fibrous forms. It is a brittle mineral, transparent to nearly opaque, and possesses a greasy luster. The streak is orange to brownish red or yellowish gray. Its hardness is 3.5, and the specific gravity is 5.9-6.2.

When heated in a closed tube, descloizite gives water. On charcoal it fuses to a black mass, and is partially reduced to a globule of lead enveloped in a scoria. When fused with borax in a reducing flame it yields a green glass; with salt of phosphorus, it gives a glass of chrome-green color in the reducing flame, which assumes a yellowish orange color in the oxidizing flame. It is soluble in cold dilute nitric acid.

Cuprodescloizite contains copper in amounts which are often considerable. It also carries arsenic. It is usually found in crusts or reniform masses of a fine columnar structure, somewhat radiating. The color is dull green to greenish black, sometimes yellowish brown. Its specific gravity is 6.1-6.2.

The vanadium reactions are the same as in descloizite and vanadinite.

Roscoelite

This mineral is the most important vanadium mineral. It occurs at Granite Creek, Eldora county, Cal., in the Magnolia district, Colorado, and associated with carnotite in Colorado. Its occurrence has been observed at Big Red Ravine, and at the Granite Creek locality, California.

Roscoelite is found in minute scales, and often in stellate or fan-shaped groups. The structure is micaceous. The color verges between dark clove-brown to greenish brown and dark brownish green, and the luster is pearly. Its specific gravity varies between 2.92-2.94. The mineral is soft, and is translucent.

It fuses easily to a black glass before the blowpipe, and gives a dark yellow bead with salt of phosphorus in the oxidizing flame; in the reducing flame this bead is emerald-green. Roscoelite is only slightly acted upon by acids.

Carnotite

This mineral is found as a canary-yellow impregnation in sandstone in western Colorado and eastern Utah. A vanadiferous silicate occurs along with carnotite; it is probably akin to roscoelite. In Utah the other vanadates, as calciovolborthite, are found. Carnotite occurs in Montrose county, Colorado, associated with malachite and azurite. It is easily separated by the fingers. Occurrences of carnotite have recently been described in Rio Blanco county, Colorado, and in western Routt county, Colorado. In the latter deposit the carnotite appears to contain some arsenic; it is in the form of a film of powdery or amorphous material of a bright canary-yellow color.

Carnotite is distinguished by the chemical tests for uranium (article VIII in this series) and vanadium.

Geological Survey Appropriations

Special Correspondence

A reaction in feeling on the part of House leaders is seen in the draft of the Sundry Civil bill reported to the House February 20, where appropriations for technologic work of the Geological Survey for fiscal years 1909 and 1910 are made. Comparison of the figures shows the following results:

	1909.	1910.	
		Recommended by Secretary of Interior.	Carried in Bill.
(1) For investigation of structural materials (products of the mine and the quarry) belonging to and for the use of the Government	$100,000	$150,000	$70,000
(2) For the investigation of the fuel resources of the United States, with a view to greater efficiency in mining, treatment and use of these products	$250,000	$200,000	.....
(3) For investigation of mine explosions.....	150,000	150,000	100,000
Total.....	$500,000	$500,000	$170,000

No increase in the total of the appropriations for this work was recommended by the director of the Geological Survey and the Secretary of the Interior; but a transfer of $50,000 was recommended from the appropriation for the fuel investigations to the appropriation for structural materials, thus increasing the appropriation for structural materials to $150,000, and decreasing the appropriation for fuel investigations to $200,000.

The basis for this recommendation of transfer was the supposedly greater need for increased work and equipment in connection with the structural materials investigations, and an unwillingness at the present time to recommend an increase in the aggregate of the appropriations.

In the House draft of the pending bill no provision whatever was made for continuing the fuel investigations; the appropriation for structural materials was reduced to $70,000, and the appropriation for mine explosions to $100,000.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

There is a vacancy on the editorial staff of the JOURNAL open to a young mining engineer, who should have had some literary experience. Candidates are requested to call in person.

James A. Macdonald has removed his office to 26 Exchange place, New York.

Reginald Meeks has returned to New York after a month spent in completing a mill at Quartzite, Arizona.

James McNaughton, general manager of the Calumet & Hecla, has been seriously ill at his home in Calumet, Michigan.

Horace V. Winchell, after having been for several months in Mexico and Florida, has now gone to Montana and California.

Whitman Symmes, San Francisco, has gone to Virginia City, Nev., where he will take charge temporarily of the Mexican mine.

John E. Rothwell, of Denver, Colo., is recovering from an operation for appendicitis, and hopes soon to be at work again.

J. W. Ponton has left Johannesburg in the Transvaal for a trip around the world, undertaken chiefly for the sake of his health.

G. A. Coenen has been appointed superintendent of the Walker Lake Gold Mining Company, with office at Sacramento, California.

Ernest Bamberger, manager of the Daly-West company, was in Denver, Colo., recently, attending the annual meeting of the company.

J. W. Evans, of Cobalt, Ont., has opened an office as mining engineer in the Lawlor building at King and Yonge streets, Toronto, Ontario.

S. E. Bretherton, of San Francisco, Cal., has been retained as consulting metallurgist by one of the large smelting companies in South America.

D. M. Ryan has resigned his position as superintendent of the Mexican, Sierra Nevada and Union Consolidated mines on the Comstock lode in Nevada.

Elton W. Walker, formerly at Tombstone, Arizona, has opened an office as consulting mining engineer in the Penobscot building at Detroit, Michigan.

J. Parke Channing has been chosen vice-president of the General Development Company, of New York. He has been consulting engineer of the company.

A. B. Neumann resigned his position as chief engineer of the Indiana Steel Company Feb. 1, and will take a few weeks' rest before engaging in a new line of work.

F. H. Moyer, formerly at the Clairton works of the Carnegie Steel Company, has been appointed chief engineer at the plant of the Indiana Steel Company, Gary, Indiana.

E. J. Franz, consulting engineer and manager of the Indian Valley Mining Company, has returned to Plumas county, Cal., after a month's absence on professional business.

C. E. Stafford, of Pittsburg, formerly with the Shoenberger Steel Company, has been appointed engineer and general supervisor of the Prassinos Copper Company at Casa Grande, Arizona.

Walter Fitch, formerly superintendent of the Calumet & Hecla, has been chosen president and general manager of the recently organized Chief Consolidated Copper Company, and has taken charge of the property at Eureka, Utah.

Frederick Lewisohn has been elected president of the Tennessee Copper Company to succeed J. Parke Channing. James Phillips, Jr., succeeds Mr. Lewisohn as vice-president. Mr. Channing remains a director of the company.

Cortlandt E. Palmer, of New York, has tendered his resignation as officer, director and consulting engineer of the Esperanza Company to take effect on April 1, terminating six years of continuous connection with the property in charge of operations.

Cecil Morgan, of London, Eng., has returned to Colorado, and takes charge as manager of the Next President group of mines near Central City, owned by an English company. In the early days of Leadville and Idaho Springs, Mr. Morgan practiced his profession there, and left to take charge of the Broken Hill mine in Australia.

W. D. Ryan, National secretary-treasurer of the United Mine Workers of America, with headquarters in Indianapolis, has gone to Kansas City to take up his active duties as commissioner for the Southwestern Coal Operators' Association. Mr. Ryan's term of office does not expire until April 1, but the operators were desirous of having him enter upon his active duties as commissioner as soon as possible. He will be succeeded as secretary-treasurer of the Miners' union by Edwin Perry.

Obituary

Elias Johnson Baldwin, better known as "Lucky" Baldwin, died at Arcadia, Cal., March 1, aged 81 years. He was born in Ohio, but had been a well known figure on the Pacific Coast, whither he went in 1853. His reputation in recent years was chiefly as a sporting man. He was never actually a miner, though he did some prospecting in California and Nevada. In the early days of the Comstock Lode he was prominent as a speculator and at different times owned large interests in the Ophir and other mines.

Charles Duncan, who died at Sparland, Ill., Feb. 18, aged 59 years, was born in Ireland, but came to the United States when a young man, after passing several years as a sailor. He worked at Braidwood and Streator for several years as a miner and mine foreman, and then went to Pittsburg, Kan., where he opened a coal mine and later had charge of it for several years. Some years ago he returned to Illinois as superintendent of the Devlin coal mines in and near Sparland, holding that position up to the time of his death.

Edwin Reynolds died at Milwaukee, Wis., Feb. 19, aged 79 years. He was born in Mansfield, Conn., and became a machinist. He was superintendent of various works, and finally of the Corliss Steam Engine Company at Providence, R. I. From those works he went to Milwaukee, to take charge of the shops of the E. P. Allis Company, now a part of the Allis-Chalmers Company. Here he introduced many notable improvements, chiefly in the design of blowing and pumping engines. His methods were at first considered revolutionary, but were later generally adopted. Some years ago he retired from active work, but remained with the Allis-Chalmers Company as consulting engineer.

Advices from the American Embassy at Buenos Aires, Argentina, state that Clement Rolla Glass, general manager of the Andes Tin Company in Bolivia, accidentally shot himself in that city Jan. 2 and died almost instantly. Mr. Glass was a native of Martinez, Cal., but had been in Bolivia and Peru for the past 10 years. He was educated at the University of California and at San Jose University. In the United States he held various positions of responsibility in the engineering department of the Southern Pacific and the Union Pacific railroad and was for a time deputy United States surveyor for the district of Nevada and in the United States Geological service. He spent considerable time in Alaska with mining companies and then went to South America where he spent about a year in exploring and then accepted the position of chief engineer of the Consolidated Copper Mines of Corocoro. Later he was manager of the Inca Rubber Company, of Peru; and at the time of his death was general manager of the Andes Tin Company, in Bolivia. He was a man of exceptional ability and did much toward placing the mining work of Bolivia upon a systematic basis. He was well known in South America and enjoyed a large circle of friends. He was 41 years of age.

Societies and Technical Schools

American Mining Congress—The executive committee has decided to hold the next annual meeting at Goldfield, Nevada.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Toronto and Johannesburg

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 24—Some concerted action is planned against the dredging industry of California by certain cities and towns in the valley region. The residents of the valleys who are inimical to mining on general principles, are now attributing all the present flood conditions to the operations of the dredges, and have agitated the subject until the mayor of Sacramento has arranged for a committee to investigate the whole subject of gold mining by dredges. He very frankly states that he will place upon the committee only those persons who are opposed to dredge mining, and will not put anybody there who may favor this form of the gold-mining industry. The whole Sacramento valley is to be represented. Maps are being prepared showing all the gold-dredging districts in the valley.

The land owners at Biggs, Butte county, have held a meeting and the consensus of opinion was that dredge mining is the direct cause of the clogging of the Feather river, causing the overflows which have damaged farms, railroad bridges and towns. The dredgers complained of are those at Oroville. There is an evident desire to put a stop entirely to the system of dredge mining.

Although the bill which creates the office of mine inspector for the State of California passed the assembly with very few dissenting votes, it has since been more carefully considered by the Senate committee, and it is not very probable that it will become a law. The passing of the act would have created a new office for which there is no demand from mine owners or superintendents, and given a chance for disgruntled employees to "get even" with the owners of the mines. The bill which is known as the employers' liability bill is not at all likely to become a law. It was vigorously opposed by the mine owners of the State.

Yuba county has a county ordinance against hauling wagons with loads over 3200 lb. on the county roads during the wet season. This may have been all right before the advent of the large dredging and machine-shop enterprises in Yuba, but it is working a hardship at present. Indeed, the manufacturers of dredge machinery at Marysville and the operators of dredges at Marigold and Hammonton cannot readily carry on business if this ordinance be enforced. Some of the wagons of these companies weigh up to the prescribed limit even without any loads. There are now at Marysville some 250,000 lb. destined for the dredges 10 miles distant, which cannot be moved by wagon. The companies have been forced to adopt the use of old-fashioned sleds and with big teams are now hauling freight over the mud. There are 12 dredges operating in the district and the largest company is making a test case as to the legality of the ordniance.

The settlement by compromise of the legal troubles between the Pacific Power Company and the Northern California Power Company which related to water rights and a power site, is good news for Shasta county. The Northern cannot now be impeded in developing its 14,000-h.p. plant.

The State legislature has made an appropriation of $400,000, and the governor has signed the bill for dredging the Sacramento, San Joaquin and Feather rivers as recommended in the special report of the California Débris Commission. The measure does not go into effect until Congress appropriates an equal sum for the same purpose. The California delegation in Congress has appeared before the Congressional committee in favor of this particular measure.

The Rutherford bill appointing a State mine inspector has passed the assembly of the legislature by a large majority notwithstanding the fact that the California Miners' Association reports unfavorably. Indeed, before the association had called the attention of the members of the legislature to the bad features the Assembly had taken action. The Senate has yet to pass on the bill. The author of the measure, Mr. Rutherford, has received many congratulatory letters from the miners' union and individual miners, but it is not to be noted that he received any from mine owners or superintendents. In fact, the mine owners are all opposed to the measure. Another measure which has also passed the Assembly is one which may be of service, as it provides a way by which the administrator of an estate of deceased or incompetent persons may bond a mine as well as sell it. Under present laws a mine may be sold, but there is no provision by which a bond may be granted upon it. The passage of this bill will facilitate matters in several estates in process of settlement now.

It is not thought that the very obnoxious measures called the employers' liability bill, where the negligence of a fellow servant shall not be a defense in case of injury, will pass the legislature. This and the proposed eight hour law for underground miners would have the effect of closing down a number of mines which are being now worked without profit. All such bills are considered by the mine owners and superintendents as labor-union bills. While the labor unions have a strong "pull" in the legislature, it is supposed that sober judgment will prevent the passage of such measures as are very much opposed by the owners of mining properties. If too much unfavorable legislation occurs numbers of mines will close down for good.

The rain storms continue all over the State and considerable snow is falling in the mountains. The gravel miners are utilizing the full streams, but the quartz miners are having more water than they care to handle and a number of mines have quit work. Considerable placer mining on a small scale is being carried on in all the ravines where water is now plentiful.

A postponed hearing is to be held on March 3 in the contested mineral land patent case of Harold T. Power, of Bullion, Placer county, who is endeavoring to patent certain drift mining ground in that county for the California-Nevada Consolidated Placer Company. The Forest Service has remonstrated against the issue of a patent to Power on the ground that the land is more valuable for timber than for mining and that he has not lived up to the law in the matter of improvement. Power traced this channel up by the rim from the side of the Hidden Treasure mine and has held it by possessory title for ten years or more. When he finally got capital interested to open the mine and asked for a patent the Forest Service officials said he wanted it for timber, not for mining, and that he could not show paying gravel. As he had not yet run his bedrock tunnel and there were some hundreds of feet of lava overcapping the channel, of course he could not show pay gravel except at one blowout. He took the rangers through his big drift mine and showed them how that was worked and how it was not possible to get out gravel until a tunnel was run; but they persisted the timber was worth more than the lava capping showed.

A. F. Ross has ended certain litigation involving valuable copper ground in Shasta county by giving a deed to Mrs. Ellen M. Rose, the heir of J. H. Stowall. That gentleman before his death gave a bond to Ross and as long as this bond stood the claims could not be sold. It is understood that the Balaklala Copper

Company, operating at Coram, may now buy the claims.

The mine owners and superintendents of California are objecting to two proposed measures pending before the legislature. One of these is that which provides for a State mine inspector, and the other is one relating to the liabilities of employers in and around underground mines, smelters, concentrators, coal washers, mills, factories, and workshops. The main and objectionable feature of this latter bill is that it provides that, in actions for damages for personal injuries by an employee, the fact that the injuries were due to the negligence of a fellow servant shall not be a defense. Neither shall contributory negligence be a defense, unless it be through reckless or grossly careless exposure to unnecessary danger. Under this law a written contract to the contrary would not be legal or binding.

Hornbeck, McQuistin & Cox are experimenting on the Sacramento river below Redding with a mining machine which has a tube or caisson lowered from a hull or boat to the bed of the river. The tube is 5 ft. in diameter, and material at the bottom is shoveled into buckets and hoisted. One of these machines is to be tried at the Nome beach the coming season, and it is reported that five more are contracted for.

The old Easzy Bird mine, near Mokelumne Hill, Calaveras county, has been placed under bond to Joseph King and Mr. Mandigo, of Seattle. There is a 10-stamp mill at the mine which will now be replaced with one of 40 stamps. The ore in this property carries a large proportion of sulphurets. The full extent of the ground will now be determined as extensive operations are to be commenced at once.

Salt Lake City

Feb. 26—The development work in the Mascotte tunnel is showing up a large deposit of copper-bearing porphyry in the property of the Ohio Copper Company. The shaft and upraise are now about 130 ft. apart, and connections should be made within two weeks.

Six feet of steel galena and 2 ft. of lower-grade ore were struck in an upraise from the 250 in the Butler-Liberal at Bingham. Assays give 62 per cent. lead and 20 oz. silver. The Butler-Liberal is controlled by the North Utah Mining Company, an English corporation.

The Utah Copper Company has declared its regular quarterly dividend of 50c. per share, 725,590 shares being issued.

The blower for the copper furnace at the Knight smelter has arrived, and as soon as it is installed the copper furnace will be started on ore from the Grand Central and Victoria. The three lead furnaces are smelting 750 tons of ore per day.

The shaft at the Centennial Eureka is down 2200 ft., and three shifts are at work deepening it.

The Little Chief Consolidated Mining Company has been formed by Michigan capitalists, with a capital of $1,000,000. Walter Fitch is president; F. W. Denten, vice-president; W. P. Seager, secretary and treasurer. M. M. Duncan, A. B. Meyer, J. H. Rice and J. R. Van Evera are directors. The holdings of the company comprise eight claims in the Tintic district, embracing the property of the Van Evera Company, and the control of the Little Chief. The Little Chief shaft is down 1400 ft., and the group will be worked through it. Mr. Fitch will manage the property.

The Cactus mill will be overhauled and remodeled by A. J. Bettles, the Newhouse mill expert. Half of the mill has been closed down and the other half will continue in operation until the required changes have been made, which should be early in April. This half will then be closed down and remodeled. The capacity will be increased to about 1200 tons per day.

Edward Fink with Howard P. Saunders has been effecting changes and improvements at the Garfield experimental plant for the Fink furnace. Within a short time a run will be made on copper ore from the Cactus mine.

For the week ending Feb. 19, the following Tintic mines shipped 20-ton carloads: Dragon Iron, 41; Colorado, 30; Brooklyn, 7; Beck Tunnel, 3; Swansea, 1. The following mines shipped in 50-ton carloads: Ajax, 1; Centennial Eureka, 40; Sioux Consolidated, 10; Iron Blossom, 1; May Day, 12; Yankee, 4; Eagle & Blue Bell, 1; Bullion Beck, 1.

Butte

Feb. 25—In accordance with its plans for using electrical power over the division of its road between St. Regis, Mont., and St. Joe, Idaho, the Chicago, Milwaukee & Puget Sound Railway Company has let contracts for the construction of two power plants to supply 30,000 h.p. One will be located at St. Joe, Idaho, and the other at a point on the Missoula river about 40 miles below Missoula, Mont. The South Butte Mining Company has instituted action on a judgment secured against the Butte Central Copper Company in the Federal circuit court last year. The several directors of the last named company are made defendants in the new action under the law making directors of corporations liable for all corporate debts when the corporation fails to file its annual statement. Notice has been given that the annual meeting of stockholders of the Barnes-King Development Company will be held at Kendall, Mont., on March 3.

In the case of Hugh Magone against the Colusa Smelting and Mining Company, the Parrot Silver and Copper Company, the Colusa-Parrot Mining and Smelting Company, the Butte & Boston Consolidated Mining Company, the Anaconda Copper Mining Company and the Montana Ore Purchasing Company, Judge Hunt of the Federal circuit court has recently adopted the findings of Master-in-Chancery Crane except insofar as they are adverse to the Anaconda company. The suit was brought as a test case to determine the liability of the companies for damages alleged to have been sustained by farmers along Silver Bow creek because of the pollution of the water by the smelters operated by the several companies. The master-in-chancery found complainants damages to be $1500 and divided it equally among the several defendants, but the judge found only nominal damages against the Anaconda company and apportioned the total amount equally among the other companies. Questions of law upon the findings will be argued on April 13 at Butte.

Denver

Feb. 27—Since last week the mining camps of Colorado have been in the grasp of a blizzard and its after effects, blocking railroads, causing snowslides, and hindering operations generally.

In the Cripple Creek district, the first bimonthly dividend of the year to Elkton stockholders, have been paid, amounting to $37,000, making a total of about $2,280,000 paid to date. The deep-drainage tunnel has reached a distance from the portal of 3625 ft. The mill built by the Isabella, below the dump at the mine, is turning out bullion, and the result of the last 30 days' run is a gold brick worth $6500.

Toronto

Feb. 25—Several more fines have been imposed on mining-company promoters for violation of the Ontario Companies' Act, in issuing prospectuses not containing the information required by the law. D. K. Martin, president of the Agaunico Mines Development Company, who pleaded guilty on two charges was fined $200 on the first charge and $100 on the second with costs in each case. E. D'Aguaro, of the Moose Horn Mines Company, and J. W. Garvin, of the Titan Montreal River Cobalt Development Company, paid $200 and costs each, the cases being settled out of court.

Sir William Meredith, chief justice, has delivered an elaborate judgment in test cases submitted to him to ascertain the meaning of the clauses of the act relating to prospectuses, clearing up some doubtful points. He ruled that the filing and issuing of one prospectus complying with the terms of the act, was not sufficient to justify the issue of subsequent ad

vertisements or prospectuses offering stock for sale not containing the information required, and that on every occasion on which a company issued a prospectus inviting the public to take stock or lend money. Such prospectus must be filed with the Government and must contain the specified information.

A new provincial mining division, to be known as the Gowganda Mining Division, has been created, consisting of territory detached from the Montreal River and Temagami Forest reserve divisions and including the townships of Gamble, Brewster, Corkill, Lawson and Chown. The head office will be temporarily located at Smyth (Elk City) but will later be removed to the Gowganda town plot now being laid out at the foot of Gowganda lake. Henry Sheppard, of Orillia, has been appointed mining recorder.

A great deal of wildcat prospecting has been going on in the Gowganda district all winter. Large areas covered with snow have been staked when discovery was impossible in the hope of making discoveries later. In many cases these claims have been sold to speculators or promoters, so that the frequent difficulties as regards title which characterized the early development of the Cobalt camp are likely to be repeated.

Machinery and supplies are being hurridly rushed forward to Gowganda, while the sleighing lasts, as with the opening of spring, it will be a difficult and expensive matter to bring in heavy freight.

A delegation headed by Thomas Cantley, general manager of the Nova Scotia Steel and Coal Company and A. Dick, general sales agent of the Dominion Coal Company, representing the leading coal-mine owners of Nova Scotia, interviewed Hon. W. S. Fielding, Canadian Minister of Finance at Halifax on Feb. 15 urging the re-imposition of a duty on American anthracite. They represented that there had been a falling off in shipments of Nova Scotia coal to Quebec province, caused by the importations of the cheaper grades of American coal. It was also asserted that the tariff was evaded by the importation of slack coal of a larger size than ¾-in. screen. Small sizes of anthracite, it was claimed, were replacing the Nova Scotia coal. Both English and American coal were being dumped in Canada at lower prices than those charged in the home market. Mr. Fielding made a non-committal reply, and in view of the record of the present government on tariff questions, it is not regarded as at all probable that any duty will be placed on anthracite.

Johannesburg

Feb. 2—Big electric-power schemes have long been under discussion upon the Rand, and the erection last year of central generating stations by the Victoria Falls Power Company enabled several companies starting up new mills in the East Rand to effect heavy economies in capital expenditure. But how far or how speedily this pioneer work of power distribution would lead to the "electrification of the Rand" has been a speculative question, owing to a complication of financial interests, until the publication of important announcements the other day. Contracts secured by W. A. Harper to supply power to the Wernher-Beit mines have been taken over by the Victoria Falls Company, a title which must appear misleading now that all thoughts of supplying the Rand with power from the Zambesi river have been abandoned, so that in two years fully a third of the Rand's tonnage will be drawn from mines operated with electric power. Existing steam plants will be maintained as reserves until the reliability of the scheme is safely established. The contracts, upon the strength of which it has been possible to arrange for the erection of a great central station, provide for the initial distribution of 270,000,000 units per annum, but it is hoped that it will be possible to double or treble the call in the near future. The new station to be erected will have a capacity of 90,000 kilowatts.

The importance of the scheme is increased by the further provision made for the installation of at least three central compressed-air generating stations, supplying air at 100 lb. pressure. No companies will profit from these innovations more substantially than those which are now in the developing or early producing stage, and have not yet put up large steam-driven reduction plants. But it is estimated that centralization of power will result in a reduction of about 8d. per ton milled in power costs upon the Werhner-Beit group, apart from a consideration of the certain economy due to the accurate metering of supplies.

The mineral output of the Transvaal for 1908 has been declared by the Government Mining Department at a value of £32,657,088, or £1,930,183 in advance of the previous year's total. Decreases and increases for each class of production may be tabulated as follows:

	1908. Yield.	Changes.
Gold	£29,980,526 I.	£2,579,534
Diamonds	1,549,815 D.	718,260
Coal	794,949 I.	21,300
Base metals, etc.	246,766 I.	54,470
Silver in gold bullion	85,032 D.	6,861
Total	£32,657,088 I.	£1,930,183

The annual meeting of the Premier Diamond Mining Company is to be held in Johannesburg Feb. 23, and the public awaits with interest the chairman's justification of the board's policy of maintaining a high rate of production in the face of prevailing market conditions. Not only must he explain the recent maintenance of the producing rate in excess of possible sales, but also the preparations in process for the speedy duplication of yield. To some extent, the directors' line of argument has been previously indicated by the publication of an annual report, in which their apparent opposition to any scheme of coöperative output regulation in conjunction with De Beers is explained by the expression of opinion that measures for the maintenance of an effective monopoly are only practicable under circumstances, allowing all producers to work in a fair ratio to their capacity and when the demand for diamonds extends to all qualities. It is reassuring to note that the directors declare their steadfast intention not to increase sales by lowering prices, and to hold in reserve the growing accumulations of stones of classes for which there is no demand. Still the fact remains that the diamonds of Premier mine quality have seen a marked depreciation in value, while those from Kimberley and Jagersfontein, owing to the keenly restrictive policy adopted, have held a steady price.

A series of exceptionally heavy rains throughout the Transvaal, lasting for several days, has resulted in much damage to mining properties on the Rand and in the outside districts. On Jan. 21, over 7 in. fell at Johannesburg, and this abnormal downpour was attended by considerable loss of life. The most serious sequence of the floods was the bursting of the May Consolidated dam, the water from which poured down a shaft of the Witwatersrand company and speedily filled the mine with water. There were 160 at work below, and they were at first believed to have been drowned, and after a few days of vigorous pumping and exploration almost all hope was abandoned. On Jan. 28, however, the unrelaxing efforts of the management were rewarded by the recovery of 25 natives, who had taken refuge at the top of a back stope, to which the water had not risen, owing to air pressure. Kafirs are well known to be endowed with great physical endurance, but it has been a cause of marvel to all that these "boys," entombed for seven days without food, should have been found, not only alive, but in several cases still in a condition of full consciousness and fair strength. Two of the natives met their rescuers by swimming many yards along the drive and nearly all recovered sufficiently, after a few hours' medical attention, to wish to return to the mine compound. Such wonderful fortitude, displayed by an average batch, provides unique testimony, not only to the natural capabilities of Rand unskilled workers, but also to suitability of the conditions under which they live upon the mines.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

California

BUTTE COUNTY

Fall River Section—In the Mooretown ridge there is much activity, and several mines are under process of development. One of the quartz mines will soon be equipped with a mill.

CALAVERAS COUNTY

Black Metal—This property, owned by San Andreas men, is yielding handsome quartz specimens, in addition to the "black metal" obtained.

Mauna—This mine at Jesus Maria has been bonded to men who will develop it.

EL DORADO COUNTY

Church Gold Mining Company—This company has sold to Seymour Hill the Golden Fleece claim in El Dorado district and the El Dorado claim in Mud Springs district, together with the 10-stamp mill, hoist, and other machinery.

Loveless—The claim near El Dorado, owned by the Lawless Brothers, which has been worked as a pocket claim, has been bonded to men from Missouri.

FRESNO COUNTY

Arkansow—G. W. Bruce has sold his interests in this mine at Trimmer to R. Sides, of Selma. The ore now being mined is quite satisfactory to the owners.

INYO COUNTY

Chrysopolis—This old camp is again attracting attention owing to the strike in the ground of Black, Stewart & Lochrie, where they have found high-grade ore. These men own nine full claims.

Four Metals Mines Company—The mines at Cerro Gordo are temporarily closed awaiting improvement of water supply. The springs from which the supply is drawn are low.

MARIPOSA COUNTY

Hotaling—This claim in Indian Gulch, with 12 men at work, has recently encountered a good body of ore. There is a five-stamp mill on the property.

Mariposa Commercial and Mining Company—The power plant of this company has had to close down, stopping all the mills of the company in the county. The high water has endangered the Bagby dam

MODOC COUNTY

Mountain View—The grade of ore being taken out of this mine in Hoag district is very high. Preparations are being made to erect a 40-stamp mill.

NEVADA COUNTY

California-Montana—It is intended to resume operations on this mine, Nevada City district, and a new Sullivan compressor has been put in and set at work.

Coan—At this mine, Nevada City district, Thos. Coan owner, high-grade quartz is being mined. There is a four-stamp mill on the property.

PLUMAS COUNTY

Crescent Hill—This company has been formed by Wilmington, Del., men including S. N., Shive, S. E. Robertson and H. W. Davis, to work the Crescent Hill mine south of Quincy and on the northern slope of the Middle fork of Feather river.

SAN DIEGO COUNTY

Two Flags Mining and Leasing Company—This company has been organized under Wyoming laws to work certain claims in Dulzura district. Among the directors are A. J. Elliott, Edmund Meyer and E. Strahlman, of San Diego.

Colorado

LAKE COUNTY—LEADVILLE

Catawba—Considerable work has been done on this property, Prospect mountain, during the last year, and a number of pockets of ore high in gold, have been found, but so far the main ore horizon has not been cut. A drift is being carried east, about 60 ft. from the incline, and will cut through the flint wall under which it is believed the main orebody will be found.

Dinero Tunnel—Prospecting has been carried on in the orebody opened at the breast of the tunnel and some high-grade ore has been found that is now being sent to the smelter. In the body of ore recent work has opened veins of high grade, several feet in thickness, within the main ore shoot. In addition to this the old Dinero vein has been caught in the upraise and ore from this is also being shipped to the smelter. Recently ore bins have been erected at the mouth of the tunnel and are now nearly full, as of late it has been impossible to ship ore on account of the heavy snow storms

Ibex Mining Company—Lessees working at the 1300-ft level of the Little Jonny recently opened a body of ore 12 ft. high, carrying gold, and fair quantities of silver, copper and lead. Before this body opened work was being done on a 4-ft. fissure vein. The depth and breadth of the shoot have not been ascertained yet. Other lessees on the property are shipping steadily, and the output from the mine reaches 7500 tons per month.

Lime—Two tunnels are being driven on this property, Iron hill, owned by the Iron Silver Company, by lessees, one above the California gulch road and the lower from the bottom of California gulch, into Iron hill. The upper tunnel is in 250 ft. and has opened a good body of iron from which shipments are going out steadily. The lower tunnel will drain the hill and cut the present oreshoot 200 ft. deeper.

Valley Shaft—This property, South Evans gulch, is averaging a daily output of 60 tons of an excellent grade of lead sulphide. While development work was being carried on recently in one of the lower levels another body of ore was cut.

OURAY COUNTY

Camp Bird—The London office reports that during January the mill ran 28 days, crushing 6592 dry tons of ore. The product was 11,637 oz. bullion and 554 tons concentrates. Sales of bullion and concentrates produced $226,088. Mine expenses were $51,257 and London expenses $1500, leaving a net balance of $173,331. Payments for construction were $453; development work, 734 ft during the month.

SAN JUAN COUNTY

Gold King—A large quantity of concentrates is piled up at this mine at Gladstone Efforts are being made to clear the road from snow.

Hercules Consolidated—At the Little Dora, near Silverton, the mill is treating 60 to 70 tons of crude ore daily. A new boiler and a large air compressor are the latest additions to the equipment.

SUMMIT COUNTY

Wellington Mines Company—A contract has been closed, under which the Central Colorado Power Company will deliver 100 h.p. electric to the Wellington mill at Breckenridge, beginning March 1. The new mill is expected to be ready for work early in March The capacity of its crusher is 200 tons per day, and it has three sets of rolls, with several screens. It has 58-ft bucket elevators, and three jigs of 12 compartments each. The latter are twice as large as any now in use

in the Breckenridge district. There are four tables and two motors. The building is electric lighted and steam heated, there being a separate building for the generation of the steam.

TELLER COUNTY—CRIPPLE CREEK

El Paso—Formal notice has been served on all lessees on El Paso mine on Beacon hill that their leases will not be extended beyond May 1 next. No statement of the company's plans will be made until the annual meeting on March 8, but it is supposed that the mine will be operated directly.

Henry Adney—High smelter returns have been received from recent shipments of ore made from a rich streak found next the footwall of the vein.

Hiawatha—At the annual meeting, to be held April 7, notice is given that the stockholders will be asked to decide whether the company will operate the mine, or whether proposals to buy or lease it shall be accepted.

Mohican—The Western Investment Company of Victor has taken over the lease formerly held by the Chief Mining and Development Company on the Mohican, on Battle mountain, owned by the Mohican Gold Mining Company. The original lease was for three years and has two years to run. The shaft on the Mohican has been connected with the 100-ft. level on the Ajax main shaft, and shipping ore has been developed at this depth.

Indiana

CLAY COUNTY

Vandalia Coal Mining Company—A mortgage on this company's property to the Union Trust Company, of Pittsburg, has been recorded. It is to cover an issue of $1,000,000 in 25-year bonds, the proceeds to be used in developing and opening new mines.

SULLIVAN COUNTY

Hudson Coal and Mining Company—The suits against this company have been settled by the payment of $31,000 debt, and the application for a receiver has been dismissed.

Louisiana

Petroleum production in January is reported at 22,800 bbl. Only three new wells were completed, of which two produced gas and one was dry.

Michigan

COPPER

Calumet & Hecla—It is announced that all differences between this company and A. S. Bigelow have been adjusted, and that details have been arranged for the transfer of all the Bigelow or "Sears Building" holdings in the Osceola, Tamarack, Ahmeek, Seneca, Isle Royale and Laurium properties to the Calumet & Hecla Company, the number of shares involved being, it is stated, about 125,000, and the amount involved approximately $8,000,000. All litigation by Mr. Bigelow against the Calumet & Hecla will be withdrawn, the injunction restraining the voting of the 22,671 shares of Osceola stock formerly owned will be dissolved and the annual meeting of that company will take place early next month, when the Calumet company will elect its board under proxies recently solicited and assume the management.

The Calumet & Hecla Company has sold to Lee, Higginson & Company, of Boston, $950,000 in three-year, 5-per cent. notes, and $1,000,000 in 10-year, 5-per cent. notes; the 10-year notes can be called in at par any time after three years. It is stated that the firm has resold the entire amount to investors.

Seneca—This company has encountered the Kearsarge lode in the crosscut from the first level of its shaft, and has exposed encouraging mineralization. Sinking has been resumed in the shaft at a depth of 250 ft. This shaft is in the footwall about 75 ft. behind the lode. It is equipped with machinery for a 2000-ft. depth.

Adventure—An inclined diamond-drill hole is going down near the proposed site of the new shaft to further check the data obtained from previous drilling. Three copper-bearing lodes have been penetrated, the drill cores in each showing good mineralization.

Atlantic—The crosscut from the 20th level of Section 16 shaft has entered an amygdaloid foundation carrying copper in epidote. Sinking continues in the shaft.

Franklin—This company is opening good ground at the 23d level on the Pewabic lode. Securing the Rhode Island property through stock ownership gives the company about 12,000 ft. on this lode. The shaft on the Rhode Island tract is down about 1300 ft. without showing copper-bearing ground.

Gratiot—This subsidiary company of the Calumet & Hecla is sinking two shafts on the Kearsarge lode. No. 1 is down below the eighth level and No. 2 below the 10th. Drifts are being extended. The company is at present without railroad facilities, but this will in all probability be provided the coming summer when a mill run will be made at one of the Calumet & Hecla mills.

LaSalle—This company, under the management of the Calumet & Hecla, is being opened on an extensive scale. Sinking is in progress in both shafts on the Caldwell lands. While the Tecumseh shaft is temporarily bottomed below the 17th level, drifting is going on both north and south at all levels below the ninth, and large quantities of ground are being blocked out. The Kearsarge lode at this point averages about 10 ft. thick. At No. 1 shaft of the Caldwell, which is down below 750 ft., a crosscut is being extended both east and west.

Montana

MONTANA—BUTTE DISTRICT

Butte & Balaklava—This property is now undergoing examination by F. H. Probert, a well known mining engineer. It is reported that the examination is being made for the Boston Stock Exchange with a view to listing the stock on the exchange.

Butte & Superior—The shaft has reached a depth of over 1400 ft. and a station has been cut on that level. From there a crosscut has been started to the vein which is supposed to be about 100 ft. distant.

Tuolumne—The shaft has reached a depth of 1300 feet.

North Butte Extension Development Company—Since the reorganization about $130,000 has been paid on debts and options on claims. Another payment is due April 1.

Davis-Daly—Payments on the company's options have been extended to April 1. It is expected that by that time the company will have received all of its stock assessments and will be able to meet payments and have a substantial balance left in the treasury for development work. The work is at present being concentrated on the Colorado shaft, which is being enlarged to three-compartments. Operating expenses do not exceed $15,000 monthly.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Yellow Tiger—Three shifts are engaged in sinking the main shaft from the 600-ft. to the 1000-ft. level. Laterals will be run at 100-ft. intervals in search of the orebody already opened on 600-ft. level.

Moore Lease—A strike has been made in the 500-ft. level of this lease on the south end of Combination No. 2 lode of the Goldfield Consolidated property. Assays across the ledge return from $15 to $170 per ton, and a streak 2 in. wide shows from $1500 to $2000.

Gottwaldt Lease—As a result of the strike in the Moore lease, work will be resumed on this property, which lies directly east. A great amount of exploration work has already been performed and though small stringers carrying good value have been found, ore in sufficient quantities for shipping has never been encountered.

Kewanas—The crosscut driven from the

450-ft. level to cut the oreshoot followed in the old incline shaft, is now in 300 ft., and it is expected that the vein will be intercepted soon for the indications of mineralization are better with every foot gained.

Goldfield Daisy—Small shipments, averaging two wagonloads a day are made from this property to the Nevade Goldfield Reduction Company; the output is curtailed by a large flow of water and heavy ground.

St. Ives Lease—Two small lots were shipped from this property Feb. 18, one of five tons returning $338 per ton, and six tons $59 per ton, the ore coming from the 100-ft. level. The company recently acquired six claims in the Walker River range which will be made a part of the Leasing Company's holdings. Little work has been done, though surface assays give from $8 to $35 per ton, gold, silver and lead.

Consolidated Red Top Lease—A carload shipment was made from this property on Feb. 16. Both raises, started recently, from the 300-ft. level are in ore, as is the crosscut, which has been advanced to the south to intercept the orebody pitching in that direction.

Little Florence Lease—The 75-h.p. double-drum electric hoist, and the 15-drill compressor are now both in commission; 22 men are employed on the lease and in prospecting. On the 357-ft. level, the big ledge, 37 ft. wide, recently encountered is being drifted upon to the east. On the 500-ft. level a raise has been started on a stringer, which though only 4 in. wide returns favorable assays.

Burns Lease—This lease was recently granted on a tract with a shaft already 200 ft. deep. A gasolene hoist has been installed and extensive development work will be done.

Commonwealth—The Wilbur lease on this property is doing considerable work on the 100- and 300-ft. levels; several small shipments were made from the tunnel level, and the crosscutting now carried on is for the purpose of locating the orebody at depth.

Esmeralda County—Hornsilver

Orleans—Two shipments from this property of 10 and 22 tons to the Nevada Goldfield Reduction Company returned $127 and $65 per ton respectively, chiefly gold with a small amount of silver.

Nye County—Tonopah

Montana-Tonopah—The east and west drifts on the 515-ft. level of the Martha vein were advanced 32 ft. during the week. In the face of the west drift 1 ft. of fair milling ore is exposed, and the east drift shows 2 ft. of a higher grade. The raise on the Triangle vein was carried up 20 ft. during the week and shows 5 ft. of good milling ore. Stoping is carried on from all the levels, and 210 ft. of ground was broken during the week. The mill treated 780 tons from the mine and 250 tons from the MacNamara with an average extraction of 89 per cent. The furnaces in the refinery plant are now completed and will treat the next clean-up of cyanide precipitates.

MacNamara—Six feet of milling ore is exposed in the face of the east drift from the south crosscut, 200-ft. level, which is being sent to the mill. In the east drift from No. 5 stope at 40 ft. above the 200-ft. level, 6 ft. of low-grade quartz has been exposed; this drift will be continued and connection made with the 150-ft. level near the west line of the property. The stope from the 300-ft. level is 50 ft. above the floor of the level and is producing 3½ ft. of milling ore.

Tonopah Extension—In a raise from the 400-ft. level for the purpose of connecting with the Tonopah Mining Company's workings, 5 ft. of milling ore was opened up. In the raise 100 ft. west ore also shows and the two will be connected at a hight of 70 ft. above the level.

West End—Development is being carried on the 200- and 400-ft. levels. The face of the west drift from the south crosscut on the 400-ft. level shows quartz carrying bunches of good ore.

Nye County—Bullfrog

Logland Lease—This lease on the Bullfrog National Bank estate made a 40-ton shipment to the smelter at Needles last week. Returns have not been received as yet, but mine assays give nearly $100 per ton.

Oklahoma

Petroleum output for the month of January is reported at 3,630,030 bbl. Deliveries were 3,142,851 bbl., and 487,179 bbl. were added to stock. Total stocks were estimated at 53,392,143 bbl. at the close of the month.

Pennsylvania

Bituminous Coal

Pennwood Coal Company—This company owns 1275 acres of coal land at Rockwood, in Somerset county, on which it has one mine in operation. It has made arrangements to buy two adjoining properties, 3900 acres in all. For this purpose, and to open additional mines, the company has decided to increase its stock from $150,000 to $1,000,000, and to authorize an additional issue of $850,000 in 5 per cent. bonds, making a total of $1,000,000 bonds outstanding.

South Dakota

Lawrence County

Elliptic—The diamond drill is now down 1,200 ft., the deepest drill hole in the Hills. The search for the quartzite has so far proved vain, but the drill is in a good porphyry.

Lucky Strike—Superintendent Allen has returned from Minneapolis, where he conferred with the large stockholders and was authorized to recommence work this spring on a larger scale. Development will be pushed and the mill will be operated all summer.

Rainbow—New officers were chosen as follows: President, E. P. Peterson; vice-president, E. M. Dale; secretary and treasurer, Clara D. Coe. The ground in the Maitland district is to be sold.

Portland & Clinton—Over 50 tons per day are shipped regularly, part to the mill at Terry and the higher grade to the Denver smelter. Machinery is being installed.

Cristoforo Colombo—This is a new company just organized by Italians to operate ground in the Two Bit district. The officers are: President, Victor Vigna; vice-president, A. R. Rizzuta; secretary, Martin Marchiano, and treasurer, Bart Trucano. Operations are to be started at once.

Pennington County

Dakota Calumet—Work has been resumed under Superintendent Overpeck, at Sheridan, and the shaft will be sunk deeper through the copper formation. The smelter is also soon to be blown in.

Burlington—Superintendent Taylor will resume operations at Redfern soon, when the shaft will be continued from 180-ft. depth to 250, where drifting will start. A 2½-ft. vertical ledge carrying good ore, has been followed down the shaft.

Forest City—Reorganization of the old Clara Belle company has been completed by the Cleveland interests and a settlement reached with Frank Hebert, former owner. Work at Oreville will be commenced within a few weeks.

North Star—Frank Coughron is running 20 tons per day through the small Chilean mill on the ground near Rochford. He is planning to sink the shaft deeper.

Texas

Petroleum output in the Coastal district in January was 57,935 bbl. There were 34 new wells completed, of which 19 were oil producers, one a gas producer and 14 were dry holes.

Utah

Beaver County

Honorine Extension—The first shipment from this mine shows 25 per cent. lead, 18.5 oz. silver and 60c. gold. This ore was taken from the 800-ft. level. The orebody has been explored for 80 feet, and as yet no walls have been found.

The Milford-Utah—Development work will be resumed shortly at this property, which is a low-grade copper prospect.

Red Warrior—This property is shipping ore at regular intervals from its orebody on the 200-ft. level. The shaft is being deepened and other development work is carried on.

King David—This property now has its complete plant in operation, and will proceed to prospect the most promising portion of its claims. The company expects to catch the continuation of the orebody on the 400-ft. level of the Horn Silver mine.

Cactus—Since introducing the caving system a great economy has been effected. The orebody has been developed as far down as the 900-ft. level. Between 800 and 900 tons of 2-per cent. ore are passing through the mill daily, giving an output of 75 to 100 tons of concentrates.

Indian Chief—A tunnel has been run to cut the main fissure on this property, which lies north of the Indian Queen group.

SALT LAKE COUNTY

Utah-Philadelphia—The upper tunnel has cut 2 ft. of good lead-silver ore, carrying also copper and gold. The lower tunnel will soon cut the ledge at a depth of 150 ft. below the outcrop. The property is in Little Cotton Wood cañon.

UTAH COUNTY

Whirlwind—The narrow iron streak recently found in this property has widened into a 3-ft. vein of carbonates, high in silver and lead.

JUAB COUNTY

Iron Hat—An option has been taken on practically all the outstanding stock of this company at 10c. per share. The property is in the southeastern part of the Tintic district, and has a strong surface showing.

Black Jack—The east drift on the 1400-ft. level has cut quartz and some ore. The property is now shipping iron ore to the Tintic smelter. The main shaft has a depth of 1400 feet.

Wisconsin

ZINC-LEAD DISTRICT

Benton—At the Corr, two shafts are being sunk to open up the zinc ground at the south end of the property. At the Etna the new superintendent is reopening the mine, and has already secured a big showing in lead. The Dall has declared a 5 per cent. monthly dividend, and the Franklin one of 2 per cent. The fee of the old Sally Waters has been sold to the New Jersey Zinc Company.

Cuba City—Milwaukee men have bought the Grizzly Six and the Raisbeck. The mines will be consolidated and reopened.

Hazel Green—The large shaft at the Cleveland is down 50 ft. Work has been stopped to wait the arrival of a larger pump. The power plant at the Murphy is being put in order, to furnish power to an adjoining mine. The Scrabble Creek mine is shut down while a pair of 16-in. Cornish pumps is put in, to replace the old 10-in. pumps. The Vinegar Hill lost its pump house by fire, and the mine is full of water. New pumps have been ordered.

Platteville—The Enterprise has been unwatered and is making a good showing in the lower ground. The owners of the Hodge have been thrown into bankruptcy on application of the creditors.

Canada

BRITISH COLUMBIA

R. L. Broadbent, of the department of mines of Canada, recently left Ottawa for British Columbia, where he will make a selection of mineral specimens from those collected by local boards of trades and others, so as to insure having at the Alaska-Yukon-Pacific Exposition a collection representative of the mineral resources of British Columbia. Hon. Wm. Templeman, minister of mines, before leaving Victoria on his return to Ottawa after his recent re-election, visited Seattle, Wash., and there conferred with the Canadian exhibition commissioner, William Hutchison, relative to British Columbia's position in connection with the general Canadian exhibit.

BRITISH COLUMBIA—EAST KOOTENAY

Aurora—Two new strikes of ore are reported from the Aurora mine, situated across Moyie lake from the well known St. Eugene. In the breast of the main tunnel, at about 450 ft. from its portal, 18 in. of ore has been encountered, and No. 1 raise from this tunnel has run into 3 ft. of ore.

BRITISH COLUMBIA—SIMILKAMEEN

Camp Hedley—The season is opening favorably, with arrangements already made or being made for development work on several properties, beside the Nickel Plate mine which the Yale Mining Company has been operating here for five years, producing during that period about $2,000,000 worth of gold from ore milled at the Daly Reduction Company's 40-stamp mill at Hedley. At the Golden Zone, where a small stamp mill was put in last year, work is in progress. The further development of the Kingston and Pollock groups, together with work on the Sacramento, Florence, and Apex properties, among others, makes the outlook for the year encouraging. In addition, material is being received at Keremeos for tracklaying on the Victoria, Vancouver & Eastern Railway, a Great Northern subsidiary road, the grade for which is practically finished to Hedley and is being made thence to Princeton, at which place lignite coal is being mined.

BRITISH COLUMBIA—SLOCAN

Whitewater Camp—On the Whitewater Deep property, a recently incorporated company known as the Deep Mine, Ltd., managed by J. L. Retallack, of Kaslo, is driving a 1500-ft. tunnel at the level of the Kaslo & Slocan railway, a depth on the incline of about 2000 ft. below the apex of the vein, and 600 ft. lower than the old workings.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 20 were as follows: Buffalo, 44,730 lb.; Crown Reserve, 103,500; City of Cobalt, 60,000; Kern Lake, 60,130; La Rose, 258,730; Nipissing, 256,481; Right of Way, 182,589; Temiskaming, 60,000; Temiskaming & Hudson Bay, 60,000; total, 1,086,250 pounds.

Badger—The new plant, including a 12-drill compressor and two 100-h.p. boilers, is in operation, in charge of A. A. Smith. The main shaft is down 223 ft. on a vein varying from 2 to 24 in. in width, and carrying high-grade ore.

Chambers-Ferland—The shaft on the vein crossing from the O'Brien to the La Rose is down 140 ft., at which point the ore assays 4037 oz. silver to the ton. A cross-cut is being run from the 85-ft. level across that portion of the property where two rich veins were discovered last fall.

Columbus—Operations at this mine have been interfered with by a heavy flow of water. When cross-cutting at the 250-ft. level water was struck, which flowed in such volume that the men had some difficulty in escaping. Four pumps are now at work.

Gifford Extension—The main shaft is down 86 ft., and 300 ft. of drifting and crosscutting have been done at the 80-ft. level. A promising cobalt-calcite vein was encountered in crosscutting. Diamond drilling will test at depth a vein traced 50 ft. on the surface near the Progress location.

Silver Leaf—A good find was made in the drift at the 100-ft. level, the vein being 3 in. thick and the wall rock also rich in silver.

Trethewey—A new vein has been discovered on the north end of the property. It occurs on the 150-ft. level in a drift from the workings, continued from the Temiskaming & Hudson Bay property, and is about 4 in. in width.

ONTARIO—GOWGANDA

Bartlett—A contract has been closed for the immediate delivery of a plant compris-

ing two 80-h.p. boilers, an air-compresser and 10 drills.

Ontario—Elk Lake District

Gavin-Hamilton—The shaft is down 25 ft. on a calcite vein 14 in. wide carrying native silver. Camp buildings to accommodate 40 men have been erected and a compressor plant has been ordered. There are 13 well-defined veins on the property.

Mother Lode—Two good strikes were recently made at this mine, one of them disclosing a vein of high-grade ore about 12 in. wide.

Ontario—Saulte Ste Marie

Lake Superior Corporation—Manager Franz states that the company will immediately commence extensive additions to the open-hearth furnaces of the steel plant. It is reported that the company will also erect new blast furnaces and a structural steel plant.

Ontario—South Lorain

International Portland Cement Company—The annual meeting was held at Ottawa, Ont., Feb. 16. J. S. Irvin, managing director, stated that winter shipments for December and January showed an increase of 10,944 bbl. over the corresponding months last year. Orders for 150,000 bbl. in excess of the capacity of the plant were received during the year. The financial statement for the year ending Nov. 30, 1908, showed net profits of $217,227. Two 5-per cent. dividends had been paid and $68,227 carried forward to credit of profit and cost account.

Tallen Claim—An option on this property has been taken by Henry S. Hill, representing L. O. Dennison, P. G. Lapey and H. C. Deuel, of Buffalo, who will develop the mine. A shaft is down 50 ft. on a calcite vein, and about 2000 ft. of trenching has been done disclosing about a dozen other veins.

Nova Scotia

Nova Scotia Steel and Coal Company—At a meeting of the directors in Montreal a statement of the year's business for 1908 was presented. The total steel shipments amounted to 44,421 tons, as compared with 50,053 tons for 1907. The quantity of coal produced was the largest in any year of the company's history, being 718,654 tons. The profits were $734,701, as compared with $944,790 in 1907. The expenditure on capital account during the year was $321,735.

Mexico

Chihuahua

Rio Plata—The production in January not including that derived from tailings amounted to 60,100 oz. silver. Smelter returns for the month, 60 days after shipment, were $27,569.

San Timateo—T. A. Ripperdan, general manager, is making regular shipments of 500-peso copper-gold-silver ore from the mine in the Urnachic section to the southwest of Chihuahua. Several thousand tons of 50-pesos ore is also accumulated on the dump which is to be reduced to a high-grade matte in a 25-ton smeltery now in progress of installation.

Parral Mill—The milling plant of the Parral Mining Company in the Parral camp has been purchased by the American Zinc Extraction Company, owning and operating the Tajo mine in the same district. The work of remodeling the plant into a concentrating mill of initial capacity of 100 tons is now under way.

Colorados—High-grade gold-silver ore is reported uncovered at a depth of 275 ft. at this property in the Allende district. Robert Wilson is in charge.

Sta. Eulalia Exploration Company—This company has resumed production, sending its ore to the Chihuahua plant of the American Smelting and Refining Company. The managing director is Dr. H. Nelson Jackson, and the superintendent, J. H. Gilmore.

Cerro Colorado—Considerable activity is reported in this section lying to the east of Villa Ahumada on the Mexican Central. Two lead-silver properties, the Mexicana and the Mosqueteros, are under development by Geo. B. Jacobs and associates of Chihuahua and good orebodies are said to be exposed.

Los Lamentos—Regular shipments of zinc ores are in progress from the Squire-Peterson properties in this section to the east of Villa Ahumada. The operators recently closed a contract for the early delivery of 5000 tons of zinc carbonates.

Cerro del Fierro—The opening up of considerable bodies of high-grade lead-silver ore in the Alpha mine of this section is announced. The property is that of Jose de Riego and the district lies to the east of Moctezuma.

Batopilas—Recent ore discoveries have resulted in greatly increasing the output during the past few months. The December production was 201,000 pesos and the January 216,000 pesos. It is also given out that experiments with a view to the early installation of a cyanide plant are being carried out. The present mode of treatment is lixivitation, with or without previous roasting.

Parral Output—The production of the Parral district for the first 14 days of February amounted to, approximately, 16,000 tons. The output for the month of January was nearly 44,000 tons, of which 30,000 tons were milled locally. With the advent of several new shippers in the Santa Barbara section an increased production will probably be recorded for February.

Hinds Consolidated—Ross B. Matkins has resigned the management of the affairs of this Santa Barbara company and is succeeded by the former superintendent, J. J. Hallister. A regular production is being made from the Reforma and Clarines mines.

El Rayo—The January production is given as $37,000. The new regrinding machinery should be in readiness now and the mill product thereby increased considerably. The upraise connections between the Pettit tunnel and Adela workings are about completed and this will increase the mine product. New ore discoveries are also reported on the lower workings of the Descubridora.

El Volcan—This company, organized and financed by Parral parties with Charles Gerhardt as president, is encouragingly developing properties in the San Juan de Minas district.

Sonora—Nacozari

Production—Ore shipments for January over the Nacozari railroad were: Moctezuma Copper Company, 11,290 tons; Churunibabi, 408; El Tigre, 238; Esperanza, 10½; El Temblor, 4; Fortuna, 98; Bella Union, 254; San Pedro, 81; Mina Alta, 41 tons; and silver sulphides from the Lampazos properties of Sr. Lopez of an estimated value of $10,000. The total estimated valuation was: Copper, $1,248,500; gold, $63,000; silver, $127,000; total, $1,438,500.

El Aguaje—A Mexican company has been formed by the promoters of this mine, the stock of which will be taken by an American corporation.

Capillo—The Silver Seal Mining Company is shipping ore from the mine to the Douglas smelter. F. O. Colson is superintendent, address Nacozari, Sonora.

Copper Plate—N. S. Finch has returned from Los Angeles, and will proceed at once on the development of this group of properties, east of Pilares.

La Caridad—The Minaret Mining Company is installing a diamond drill to develop this mine, east of Nacozari.

Monte Cristo—This property has been taken by the new holders, and will be equipped with a steam plant, which is now on the road from Nacozari. C. H. Jones is manager, address Moctezuma, Sonora.

Pura Plata—Geo. F. Woodward is shipping high-grade silver ore from this property, formerly worked by *antiguos*. It is being opened up by shafts and tunnels below the old workings.

Transvaal Mining Company—The company has resumed operations on its Transvaal and Ultima Chanza properties with 50 men and expects to increase its force. H. C. Beauchamp is manager and Tom L. Davenport, superintendent, address, Cumpas.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 3—The coal trade in the West shows very little change in conditions. Some closing of contracts for steam coal is reported in the western distributing centers, but the general statement is that consumers are not eager to make contracts believing that their chances will be better on an open market. Moreover, a good many consumers are still uncertain about their requirements. The weather in the West has moderated generally and domestic coal is dull.

The coke market in Pennsylvania shows some signs of overproduction, and prices for short deliveries have been lower. Quite a number of plants in the Connellsville district have been closing down temporarily. Shipments, however, show a considerable improvement over last year.

The Seaboard bituminous trade continues quiet and without special incident. Very few mines supplying that trade are able to run on full time, or with a full force.

In the anthracite trade the discussion of a probable strike is still the chief topic. No official statement has been made of the intentions of the anthracite companies, but it is pretty well understood that they will reject all the demands of the miners. A suspension at least, if not a strike, appears to be certain at the end of the present month. How long it will last is, of course, entirely a matter of conjecture. There is every probability, however, of a long discussion.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 20, short tons:

	1908.	1909.	Changes.
Anthracite	742,547	691,112	D. 51,435
Bituminous	4,581,516	4,864,380	I. 282,864
Coke	1,015,689	1,405,271	I. 389,682
Total	6,339,652	6,960,763	I. 621,11

Total increase this year to date is 9.8 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, year ended Dec. 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	22,499,973	3,115,903	25,615,876
Buff., Roch. & Pitts.	5,516,221	336,488	5,851,709
Buff. & Susqueh'na	1,194,816	212,934	1,407,750
Penn. lines, N. Y. C.	6,991,122	71,706	7,062,828
Pitts. & L. Erie	8,129,629	3,056,395	11,186,024
Norfolk & Western	11,207,943	1,953,869	13,161,812
Total	55,538,704	8,747,295	64,285,999
Total, 1907.	66,723,041	13,686,663	80,409,704

The total decrease in 1908 was 16,123,705 tons, or 20.1 per cent. In addition to the above the Baltimore & Ohio carried 1,020,274 tons anthracite in 1907, and 806,344 in 1908; decrease, 213,930 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, year ended Dec. 31, short tons:

	1907.	1908.	Changes.
Hocking Valley	4,093,672	3,304,002	D. 789,670
Toledo & Ohio Cent.	1,790,649	1,583,763	D. 206,886
Baltimore & Ohio	2,312,838	1,440,363	D. 872,475
Wheeling & L. Erie	3,473,378	2,721,723	D. 751,655
Cleve., Lorain & Wh.	3,004,162	2,417,814	D. 586,348
Zanesville & Western	1,575,129	1,289,135	D. 285,994
Toledo Div., Pen. Co.	2,342,883	1,570,416	D. 772,467
L. Erie, Alliance & Wh.	1,244,319	1,102,055	D. 142,264
Marietta, Col. & Clev.	40,091	56,166	I. 16,075
Total	19,877,121	15,485,437	D. 4,391,684

The total decrease in 1908 was 22.1 per cent.

Coal receipts at St. Louis for the full year were 8,145,308 short tons in 1907, and 6,890,286 in 1908; decrease, 1,255,022 tons.

Coal shipments by water from Seattle and Tacoma, Wash., were 700,628 tons in 1907, and 471,451 in 1908; decrease, 229,177 tons. These shipments are mainly to California and Alaska ports.

Coastwise shipments of coal from leading Atlantic ports for the year ended Dec. 31 were as follows, in long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York	15,069,981	10,247,014	25,316,996	62.5
Philadelphia	2,164,747	4,675,767	6,840,514	16.8
Baltimore	251,739	3,704,851	3,956,590	9.8
Newp't News	.....	2,742,294	2,742,294	6.8
Norfolk	.....	1,651,093	1,651,093	4.1
Total	17,486,467	23,021,019	40,507,486	100.0
Total, 1907.	19,431,494	24,584,619	44,016,113	.....

Total decrease in 1908 was 3,508,627 tons, or 8 per cent. The decrease in anthracite was 1,945,027, and in bituminous, 1,563,600 tons.

Sales of bunker coal to steamships in coastwise and foreign trade, year ended Dec. 31, at all United States ports:

	1907.	1908.	Changes.
Atlantic	7,114,224	7,095,623	D. 18,601
Gulf	684,659	616,676	D. 67,983
Pacific	936,291	583,325	D. 352,966
Great Lakes	2,564,471	2,235,979	D. 328,492
Total	11,299,645	10,531,603	D. 768,042

Of the bunker coal reported in 1908 vessels in Coastwise trade took 4,734,036 tons; in foreign trade, 5,797,767 tons. The large decrease at Pacific ports is mainly due to the increased use of oil as fuel on steamers.

New York

Anthracite

March 3—The market continued in about the same condition as last week. Business in prepared sizes is quiet and there is still some coal being stored. The demand for steam sizes keeps up to the usual level and supplies are not overabundant. Probably there will be no surplus as long as the mines continue to run on short time.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The principal occupation of the market seems to be the discussion of season contracts. Not many have been closed, as buyers are not disposed to offer more than current prices, and producers are reluctant to accept these.

Current business is moderate. The far East has not begun to take any coal yet, but the Sound is doing a little better, though quantities are not very large. New York harbor is very quiet, the disposition being to wait and watch for chances to pick up coal at a bargain. Shipments, however, are pretty well gaged to the demand. Prices f.o.b. New York harbor points continue about the same at $2.40@2.50 for good grades of steam coal, with lower grades at $2.20@2.30 per ton.

All-rail trade is fair—that is, it is better than Seaboard. Car supply is abundant and transportation good, cars coming through on schedule time or a little better.

The Coastwise market is dull and vessels are still looking for charters. There is no change in freight rates, those quoted for large vessels from Philadelphia being: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Portsmouth, 80c.; Newburyport, 95c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

March 1—The coal demand in Alabama is not extensive, and it does not take a large number of mines to produce enough to go around. The production in this State is at a low ebb, and there is no telling when improvement will set in. The coal operators are hopeful, though they have nothing to base their hope on.

The coke production is again at a low mark. There is small demand for the product.

Chicago

March 2—Conditions in the coal market continue fairly favorable to the wholesaler. Shipments have been in general

kept down, and the demand has not fallen off notably, despite somewhat milder weather. Steam coals are increasing in demand; this fact offsets the slackening in the domestic trade which comes with each mild-weather spell. The situation as regards smokeless is still one of too large supply for the maintenance of circular prices. Anthracite is hard to dispose of, and there is much independent coal in the market at cut prices, though dealers do not look for large sales at any prices through this month.

Illinois and Indiana coals bring $1.80@2.40 for lump, $1.60@1.75 for run-of-mine, and $1.30@1.60 for slack. The fine-coal sales are increasing with the expansion of steam needs; lump is falling off correspondingly. Domestic needs are expected now to become light in city and country trade for Western bituminous generally.

Of coals from east of Indiana, Hocking continues in good condition with little or no cutting of the $3.15 circular price, and with a fair demand. Smokeless brings $3.15@3.45 for lump and $2.75@3.15 for run-of-mine. Pocahontas and New River, with lower-grade smokeless, 10@20c. less. Youghiogheny is quiet and steady at $3.15 for ¾-in. gas; Pittsburg No. 8 is plentiful and not very active at $2.65@2.75 per ton.

Cleveland

March 2—The domestic coal market is less active, as milder weather has set in. Country dealers, however, are still taking a fair quantity of coal.

Steam coal is improving a little in demand, especially for slack, which is not in as free supply as run-of-mine. The market is looking rather better on this side.

Indianapolis

The Indiana Legislature made considerable progress during the past week. Among the bills relating to mines and miners that were advanced are the following: The Foos House bill, providing for weekly payments of wages in coal mines; the Bassett House bill, requiring lavatories or washrooms to be maintained at coal mines where 10 or more men are employed; the Kayser bill, to establish boards of examiners for coal miners to issue certificates upon examination, and providing that no miner shall be employed in any mine in the State unless he hold such certificate, except he be an apprentice; and a bill for reciprocal regulation of demurrage charges on loaded railroad cars. It is thought all of these bills will be enacted into law during the present week.

Pittsburg

March 2—The coal business has not improved since the prices in iron and steel products were cut and an open market declared, but the large producers have not made any change in prices. The regular price for coal for prompt delivery, however, has been a concession as the contract price is charged, small independents selling at a trifle less. The contract price remains on the basis of $1.15 a ton for mine-run coal at mine, and slack continues around 70c. Several fairly good contracts for coal have been placed with large interests by steel companies and more are expected as soon as conditions brighten up and confidence is restored for the future. The Monongahela River Consolidated Coal and Coke Company, the Jutte interests and other large river shippers have been doing a good business since the rivers became navigable several weeks ago. The last shipment of coal went out on Sunday night, and while there is a good, navigable stage, no coal is being sent out for the reason that all has been shipped and there is not sufficient coal in the harbor to make up one good tow. There are plenty of empty coal boats and barges in the pools and harbor and the river mines are running practically full. The railroad mines, however, are not being operated to more than one-third of capacity.

Connellsville Coke—New business likely to follow the open-market conditions in the iron and steel trade has not yet brought out the trade expected so far, and coke prices remain about the same. The asking prices for furnace coke for spot delivery up to July 1 are $1.75, and for foundry $2@2.25. It is reported that some furnace coke for spot shipment has been sold as low as $1.60, but foundry has not fallen below $2. The *Courier* gives the production in the two Connellsville field at 265,619 tons. The shipments aggregated 9366 cars as follows: To Pittsburg district, 3316; to points west of Connellsville, 5312; points west of Connellsville, 738 cars.

Foreign Coal Trade

United States Coal Exports—The coal furnished for the use of steamships in foreign trade at United ports for the year ended Dec. 31 is given below; to which are added the exports, previously reported:

	1907.	1908.	Changes.
Exports	13,152,749	11,853,177	D. 1,299,572
Bunker coal	5,754,176	5,797,467	I. 43,291
Total	18,906,925	17,650,644	D. 1,256,281

This shows a decrease of 6.6 per cent. in the total coal sold for consumption beyond the limits of the United States.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 20: Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 3—The iron and steel markets have not yet fairly adjusted themselves to their new bearings. There is some uncertainty existing, but an increase begins to be apparent in the volume of business, and in all probability another week or 10 days will see the trade established on a fairly stable basis.

No settlement has been reached about the rail question, and there is no change in prices so far. The Cambria Steel Company, at Johnstown, Penn., has begun work on a small order of 2500 tons of open-hearth rails for the Norfolk & Western railroad. These are the first open-hearth rails from this plant.

In pig iron the market is uncertain. Shading of prices on Northern iron is pretty generally reported, but it is difficult to ascertain its amount. Southern iron has settled down to a basis of $12.50 for No. 2 foundry, Birmingham, and some orders are reported taken at 25 and even 50c. less. The merchant furnaces, both North and South, are apparently in a state of uncertainty.

Structural material, after some fluctuation, has apparently settled down to a basis of 1.20@1.25c., at which price a number of contracts have been placed.

It is announced today that the New York Central has placed orders for 101,000 tons of steel rails, as follows: Lackawanna Steel Company, 51,000; Steel Corporation, 42,600; Algoma Steel, 5400 for use in Canada; Bethlehem Steel Company, 2000 tons open-hearth. The price is not made public, but is reported to be under $28 on the revised specifications.

It is announced today that the Lackawanna Steel Company has ordered a general reduction of 10 per cent. in wages. This action was not unexpected at this plant, and Buffalo dispatches say that it will be generally accepted by the employees—possibly under protest, but with no talk of a strike. The reduction is general in all branches of the works. The question raised by this action is to what extent it will be followed by other companies.

The Senate committee, which has been considering the merger of the Tennessee Coal, Iron and Railroad Company with the United States Steel Corporation, has decided to make no formal report at this session. The committee was nearly evenly divided in opinion.

Open-hearth Steel—The production of open-hearth steel in the United States in 1908 was 7,780,872 long tons; a decrease of 3,768,864 tons, or 32.6 per cent. from 1907. The decrease was much less than that in bessemer, and the open-hearth exceeded the bessemer production by 1,664,117 tons—the first time such an excess has been shown. Of the metal made in 1908 acid steel was 696,304, and basic 7,084,568 tons.

Baltimore

March 2—Exports for the week included 50 steel ore cars and 1,769,651 lb. structural steel to Nipe Bay, Cuba; 580,091 lb. tin scrap to Rotterdam. Imports included 38 tons spiegeleisen and 953 tons ferromanganese from Liverpool; 6300 tons manganese ore from Vizigapatam, India; 5800 tons iron ore from Cuba.

Birmingham

March 1—Very little change is to be reported in the pig-iron market in the Southern territory. The market is dull; there are very few orders being received and what are coming in are in small lots. The quotations in this territory are weak. No. 2 foundry is quoted at $12.50 per ton. There is still a good quantity of iron being shipped out on old orders, but it will not be long before these orders will be at an end.

The cast-iron pipe concerns in Southern territory are the only successful people. There is no cessation of operations at the pipe works, and the product is being shipped out as rapidly as it is manufactured, with good prices.

The conditions at the steel plants are not as prosperous as they might be, though all the rails produced are shipped out promptly.

Chicago

March 2—The pig-iron market continues quiet, with a feeling of uncertainty apparent among melters as to the effect of lowered steel prices. Probably nine out of ten melters are looking for a drop in pig iron; with such a feeling they continue to buy small quantities of iron and for delivery soon. The total volume of sales is doubtless increasing, even on these small lots, testifying to greater current needs and to the betterment of business. On such sales $12.50@13 Birmingham ($16.85@17.35 Chicago), and $16.50@17 are the prices for No. 2 iron; a large quantity of either Northern or Southern doubtless could be had at lower prices.

In the market for iron and steel products there is still much hesitancy and doubt on the part of buyers as to the effect of the Steel Corporation's new prices and consequently reluctance to buy heavily. There is also a tendency to look forward to tariff changes as a further cause of unsettled conditions and a disposition to hold off until those changes become known. It is largely, therefore, a waiting market.

Philadelphia

March 3—The only marked change this week over last is a cut in some standard grades which have been held up, regardless of all competition and all reason. Even the shadings offered have not up to present hour resulted in the placing of large orders. Some Southern makers have been making new efforts to unload pig iron in this territory, which they will probably do. The producing interests are anxious to reduce their accumulation but will have to wait a while longer.

Bars—Store people report this week a still further improvement in retail selling of merchant iron, particularly refined.

Sheets—Sheets of all kinds under the further reductions have begun to move more freely.

Pipes and Tubes—A further marking down has not developed much business, but large buyers are disposed to close soon at the reductions.

Merchant Steel—A fine amount of business has been done this week in the way of supplying stores throughout this territory.

Plates—Small orders for plates are more numerous. The plate mills are temporarily well fixed.

Structural Material—Construction requirements of a local nature are about ready for consideration and a number of fair orders will go to the mills, probably next week.

Scrap—The entire scrap market is in a chaotic condition over the general lowering of prices for finished material, and comparatively little is selling. A few dealers are caught with scrap that they cannot sell at present asking prices.

Pittsburg

March 2—The declaration of an open market in iron and steel products, with the exception of steel rails and tinplate, has not brought out any new business of any consequence. Consumers were not prepared for the move and had been looking for a straight cut in some of the commodities. They are now waiting to inform themselves of the real prices at which finished material can be obtained. The matter will be readjusted within the next week, or two weeks at the farthest, and producers are preparing for an active buying movement. It is possible that the tariff revision may cause a delay in buying, but there are hopes that when the special session of Congress is held the importance of prompt action will be realized and the new bill will be disposed of in short order. This, undoubtedly, will restore confidence to a certain extent and new spring orders will be forthcoming. The difficulty in obtaining new prices on finished material can be readily seen when the general sales manager of one of the largest interests said today: "If you want 10,000 tons and the order is a bona fide one I will give you a rate." It is generally understood that all prices are cut from $4 to $7 per ton, with the exception of merchant-steel pipe, which will run fully $10 per ton. There is no cut in prices of tinplate at present, as both the American Sheet and Tin Plate Company and the independent concerns are well filled with orders for the spring trade at the old rates. Business has been unusually good since the opening of the year and a number of large orders are in sight and will be closed as soon as it is known that tinplate is not included in the general slashing of prices. New prices in sheets being named by the American company are known. They are based on $6 per ton off on Nos. 29 and 30 gages of black sheets, $5 on No. 28 and $4 on No. 27 and heavier. On galvanized sheets the cut is $8 on Nos. 29 and 30, $5 on No. 28 and $4 on No. 27 and heavier.

One of the important finished lines where no reduction has been announced is wire and wire products. The old prices apparently prevail, but it is believed that if the jobbers can be induced to come into the market for their usual spring requirements and fill up their warehouses they will be benefited by some fairly good concessions. Active buying by jobbers is certain to come shortly, as the spring demand will be good despite the unfavorable conditions that have prevailed for over a year. No new price in steel billets is being given and the old rate of $25, Pittsburg, is still supposed to be the market on both bessemer and open-hearth billets, and $27.50 on sheet-bars. This is due to the fact that most of the billets and sheet-bars sold have been on sliding contracts. All the steel men here seem to take a cheerful view of the future, but in the absence of new business have nothing to give out but brighter prospects. The American Bridge Company has not taken on any new orders since the cut in structural shapes of $6 to $7 per ton, although there are known to be some large contracts for new buildings pending. The only cause assigned is that people are waiting for actual base prices.

Pig Iron—The market has not improved and dull conditions likely will continue until the steel situation clears. The bessemer average for February was $15.87½, Valley furnaces, or $16.77½, Pittsburg. The price named for spot shipment today is $15.50, Valley furnace, a cut of over 25c. per ton. Basic is lower and $15 can be shaded. Malleable bessemer and No. 2 foundry are quoted at $15 and gray forge at $14. These are practically cost prices and it is not likely that the market can go any lower.

Sheets—Black sheets are quoted at 2.20c. and galvanized at 2.30c. for No. 28 gage.

Ferro-Manganese—There has been a drop in prices, and 80 per cent. is now quoted at $44.50@45, Pittsburg.

Metal Market

New York, March 3—A greater activity is reported in the metal markets generally, and considerable sales of copper have been made. There has, however, been no material advance in prices.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1909..	$ 7,865,196	$ 3,412,583	Exp. $4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Year 1909..	7,865,196	3,412,583	Exp. 4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Silver:			
Jan. 1909..	4,542,254	3,660,052	Exp. 882,202
" 1908..	4,148,144	3,621,874	" 526,270
Year 1909..	4,542,254	3,660,052	" 882,202
" 1908..	4,148,144	3,621,874	" 526,270

Exports from the port of New York, week ended Feb. 27: Gold, $1,069,220, chiefly to Argentina; silver, $934,661, to London and Paris. Imports: Gold, $351,053, from South and Central America; silver, $48,627, chiefly from Mexico.

Gold—The price of gold in the open market in London has been steady at 77s. 9d. per ounce for bars, and 76s. 4d. per ounce for American eagles. In New York shipments of gold to Argentina on London account amounted to $2,650,000 for the week.

Platinum—Business is not active, although sales are improving a little. Dealers quote $23.50@24.50 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

SILVER AND STERLING EXCHANGE

Feb.-Mar.	25	26	27	1	2	3
New York....	50⅝	50⅝	50⅝	50¾	50⅝	50⅝
London.....	23 5/16	23 5/16	23 5/16	23⅜	23 5/16	23⅜
Sterling Ex..	4.8735	4.8760	4.8750	4.8750	4.8760	4.8765

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—Owing to frequent China sales, the market has scarcely been steady. The inquiries have been more than satisfied and silver has shown a slightly declining tendency, with inquiries at the close of business today at 23 1/16d. in London.

Copper, Tin, Lead and Zinc

Feb.-Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
25	12¾ @13	12¼ @12⅝	56 11/16	28¾	3.92½ @3.97½	3.77½ @3.82½	4.62½ @4.57½
26	12¾ @13	12¼ @12⅝	56 1/16	28⅝	3.92½ @3.97½	3.77½ @3.82½	4.62½ @4.57½
27	12¾ @13	12⅜ @12⅝	....	28¾	3.92½ @3.97½	3.77½ @3.82½	4.62½ @4.57½
1	12⅞ @13	12⅜ @12⅞	57⅜	28¾	3.92½ @3.95	3.77½ @3.80	4.55 @4.60
2	12⅞ @13	12⅝ @12⅞	57⅞	28¾	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
3	12⅞ @13	12⅝ @12⅞	56¾	28¾	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Beginning on Feb. 24, some large sales of electrolytic copper were made to Europe, and these continued to March 2, the aggregate of the sales being probably upward of 50,000,000 lb. The demand developed at first from foreign speculators at the lowest prices, which were established during the last three days of February. Subsequently manufacturers followed suit, buying larger amounts of copper than for three months previous. On March 1 sellers raised their prices, evidently thinking that news of the previous sales would stimulate purchases by the manufacturers in this country who are known to be low in their supplies. There did, indeed, result a more active inquiry, and some sales of moderate amounts were made to them, but so far the volume has been disappointing. However, there are bids in the market for domestic consumption at somewhat below the current quotations, which have not met with much encouragement, owing to the ready market in Europe. Some sales of Lake copper have been effected and certain large interests are now asking 13¼c. for this grade, at which price a few small sales of fancy brands have been made. The close is firm at 12⅞@13⅛c. for Lake copper and 12½@12⅝c. for electrolytic copper, in ingots, cakes and wirebars. The average of the week for casting copper has been 12¼@12½ cents.

Copper sheets, cold-rolled, are quoted 17.3c. per lb., large lots; and hot-rolled, 16.5c. Copper wire, 14½c. base, carload lots at mill. Wire has been reduced 0.75c. this week.

The London Standard market had a rapid rise which culminated on March 2, when the quotation reached £58 2s. 6d. for spot, £58 17s. 6d. for three months. Due to a weaker tendency, frightened holders endeavored to realize the following day, and when this was noticed by the alert bear element, it took the market away from the sellers and established at the close quotations at £56 15s. for spot, £57 10s. for three months.

Statistics for the second half of February show an increase in the visible supplies of 100 tons.

Refined and manufactured sorts we quote: English tough, £61; best selected, £60@61; strong sheets, £72@74.

Throughout February the copper market was dull and saggy. Sales were unusually small, manufacturers having well provided for their requirements by purchases in previous months, while the knowledge of the large stock of metal accumulated in the hands of American refiners caused both speculators and European buyers to hold aloof with the expectation that prices would go lower, which was indeed realized. The United Metals Selling Company, which at the beginning of the month was holding for 14½c. delivered, 30 days, later on reduced its price to 13½c., same terms, but the market being already a trifle below that figure, no good purpose was served by the nominal reduction on the part of the leadng interest. The small business that was offered was eagerly competed for by various agencies, wherefore the price declined still further. During the last week of February a basis of 12⅜c. was reached, which at last interested European buyers, and in the last four days of the month some fairly large sales for export were consummated.

Tin—The statistics for the end of February, which disclosed a decrease in the visible supplies of 1300 tons, were a favorable influence in the market in London. While bare of the usual spectacular movements, prices held firm and the close is cabled at £130 for spot, £131 10s. for three months.

In the domestic market an almost entire absence of demand on the part of consumers is again noticeable, but prices remain stationary at about 28.75 cents.

Lead—Business in this metal continues rather slow and the few orders which come into the market are eagerly competed for. The close is barely steady at 3.77½@3.80c. St. Louis, 3.92½@3.95c. New York.

The London market has been somewhat weaker, and the close is cabled at £13 7s. 6d. for Spanish lead, £13 10s. for English lead.

Spelter—There has been a much better inquiry throughout the week. It would appear that the distress lots which have had so depressing an influence on the market during the last few weeks have been eliminated. Smelters are reluctant to sell large quantities since they cannot make a new dollar for an old one, and all these causes combined have contributed to bring about a slow advance. Another factor in the situation has been the strong tendency of the London market, which has brought the quotation up to the export point. The close is firmer at 4.57½@4.62½c. St Louis, 4.72½@4.77½c. New York.

The price of spelter at New York, Feb. 25-27, was 4.67½@4.72½c.; March 1 it was 4.70@4.75c., and March 2-3, it was 4.72½@4.77½ cents.

The London market is again higher, the close today being cabled at £21 17s. 6d for good ordinaries, £22 2s. 6d. for specials.

Base price of sheet zinc has been reduced 0.25c. to 6¾c per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent discount.

Other Metals

Antimony—The market is still quiet, but a little more business has been done. Quotations are 8@8½c. per lb. for Cookson's; 7¾@7⅞c. for U. S., and 7½c. for ordinary brands.

Aluminum—Business is steady, with no change. The Aluminum Company of America quotes 24c. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is quoted at 22c. for ingots, but no business is reported.

Quicksilver—Business is rather better, and sales are increasing. The New York price is unchanged at $45@46 per flask of 75 lb. San Francisco quotations are nominal at $45@46 for domestic orders, and $43@44 for export. London price is £8 7s. 6d. per flask, with £8 5s. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

The Monel Metal Company has been incorporated with a capital stock of $1,000,000. It is a subsidiary of the International Nickel Company, and will, it is understood, handle the Monel metal made by the Orford Copper Company. This metal is an alloy of 70 per cent. nickel and 30 per cent. copper made directly from Canadian matte, and is being brought into extensive use.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 27—The base price for 60 per cent. zinc ore this week was $38. No premiums were paid. Lead ore, 80 per cent., sold at $46 per ton.

SHIPMENTS, WEEK ENDED FEB. 27

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	396,840	.....	100,000
Cuba City	302,380	68,440	.....
Linden	300,000	66,500	.....
Benton	290,800	.....	.....
Hazel Green	156,500	.....	.....
Harker	150,000	.....	.....
Livingston	120,000	.....	.....
Rewey	60,000	.....	.....
Total	1,776,120	134,940	100,000
Year to Feb. 27	17,917,586	656,180	1,490,200

In addition there was shipped to the Joplin Separator Works, at Galena, 206,800 lb.; to the American Zinc Ore Separating Company, 65,900 lb. zinc ore.

Joplin, Mo., Feb. 27—The highest price paid for zinc sulphide was $40 on a base of $38 per ton of 60 per cent. zinc, the base ranging down to $35 for slimes. The bulk of the ore sold on $37@37.50 base. Zinc silicate sold as high as $25 per ton, the base ranging from $19 to $21. Average all grades zinc, $34.66. Lead sold on $48 to $49.50 base, all grades averaging $48.80 per ton.

The shipment and output were large, the shipment being in excess approximately 200 tons, reducing the bin stock to about 6600 tons. The weather is as near perfect for mining operations as could be ordered, and a number of new mills are to be commissioned soon.

SHIPMENTS, WEEK ENDED FEB. 27

	Zinc, lb.	Lead, lb.	Value.
Webb City Carterville	4,285,840	517,230	$ 89,416
Joplin	1,987,920	311,340	44,402
Oronogo	991,300	116,820	20,143
Duenweg	1,047,660	37,750	19,418
Galena	944,040	69,250	17,874
Miami	192,350	239,410	7,777
Spurgeon	381,980	112,170	7,739
Alba-Neck	378,520	.....	7,004
Aurora	327,620	5,610	5,434
Badger	253,500	.....	4,875
Granby	395,000	23,000	4,790
Prosperity	180,030	29,530	3,963
Zincite	219,530	.....	3,952
Carthage	207,180	.....	3,832
Carl Junction	147,850	500	2,792
Sarcoxie	175,840	.....	2,715
Quapaw	126,650	4,870	1,889
Cave Springs	66,920	.....	1,266
Peoria	32,640	.....	326
Totals	12,352,290	1,453,380	$249,546

Nine weeks 96,876,480 15,004,130 $2,148,679
Zinc value, the week, $214,174; 9 weeks, $1,764,248
Lead value, the week, 35,372; 9 weeks, 384,431

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$11.25	$35.56	$38.48	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	35.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 3—While a little more business is being done the general market is still far from active. Consumers seem to be in considerable doubt about filling their requirements for any distance ahead.

Copper Sulphate—The market is unchanged, with business on a moderate basis. Prices are unchanged at $4.60 per 100 lb. for carload lots and $4.85@4.95 per 100 lb. for smaller parcels.

Arsenic—Business is on a moderate scale, and prices unchanged at 3@3⅛c. per lb. for white arsenic.

Nitrate of Soda—A little more business has been done and indications are for some improvement. Prices remain at 2.15c. for spot and 2.12½c. for futures.

Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on March 1 as follows, in long tons:

	1908.	1909.	Changes.
Stocks, Jan. 1	5,900	9,140	I. 3,240
Imports 2 months	32,900	47,100	I. 14,200
Total Supplies	38,800	56,240	I. 17,440
Deliveries 2 months	36,800	50,310	I. 13,510
Stocks, Mar. 1	2,000	5,930	I. 3,930
Afloat for U. S.	65,000	82,500	I. 17,500

Quantities afloat include all cargoes due to arrive at United States ports before June 15 next.

Mining Stocks

New York, March 3—The general stock exchange has shown a good degree of recovery from the low point of last week, although the advance has been spotty and irregular. Stocks, however, are selling on a higher level as a rule. The recovery seems to be due to several causes, among which may be named the covering of shorts; the fact that last week's recession went rather too far; some confidence in a future rise, and perhaps the determination to work up a bull market after the inauguration. As usual, the causes of the change are composite and it is difficult to give any one the preference. The liquidation, though short, was fairly sharp and there was a general dropping out of weak holders which leaves a rather stronger undertone.

Two sales of Homestake of South Dakota were recorded, 100 shares changing hands at $92.75 per share and 200 shares at $92.50.

On the Curb the copper shares, which displayed considerable weakness at first, rallied on reports of better sales and prices of metal. A considerable business was done in these shares on advances over last week's quotations. Miami and Cumberland-Ely were the leaders in the movement. Business in the Cobalt stocks was rather large, but prices were unsteady and several declines were evident. The Nevada gold stocks were rather dull, business being only moderate, but prices remained generally on about the same level.

Boston, March 2—It has been a week of violent fluctuations in mining shares, although in a majority of cases recoveries have been quite as rapid as the earlier declines. The much heralded deal between the Calumet & Hecla and A. S. Bigelow, which was made late last month, did not have the salutory effect on the market that many had looked for. As a matter of fact it proved a decided depressing factor, but on second sober thought sentiment completely changed. Previous to this announcement Osceola

sold up $5 to $133, but broke to $122 with subsequent recovery to $131. Calumet & Hecla broke $40 to $685 per share, but has managed to recover all but $5 of the decline. The fact that Calumet, in its settlement, saw fit to issue $5,000,000 of notes, running three, five and ten years, was the unsettling factor. However, the general demoralization of the copper market contributed to this result. There was a ready market for the notes.

By the sale, the Bigelow interests dispose of their entire interest in the Lake Superior mining region, including Osceola, Tamarack, Ahmeek, Seneca, Isle Royale and Laurium properties. The number of shares involved is about 125,000, Calumet paying partly in cash and partly in the notes. Tamarack shot up $10 to $90, went back to $82 and recovered to $86.50 again. Isle Royale rose $3 to $31.50, but closed tonight at $30.25. Amalgamated fell $5.50 to $65, which is its lowest for a long period; subsequently it rallied to $71.37½. Copper Range broke $3 to $68.50, but is up to $76.50 tonight, and North Butte broke from $69.50 to $67.25, touching $71.25 today. East Butte has behaved admirably and is up $3 to $15.75.

The Victoria contest resulted in two new directors from the opposition. Ahmeek held around $150 on the Curb. Private sales of Oneco are reported at $2, $3 and $4 per share, against a nominal value of 50c. to $1 for some years. This is due to developments on the Edwards tract, which it adjoins.

STOCK QUOTATIONS

NEW YORK Name of Comp.	Mar. 3 Clg.
Alaska Mine	.40
Amalgamated	71⅞
Anaconda	42¼
Balaklala	‡2 11/16
British Col. Cop.	7½
Buffalo Mines	3¼
Butte Coalition	24½
Colonial Silver	¾
Cum. Ely Mining	7 11/16
Davis Daly	3⅞
Dominion Cop.	1/16
Douglas Copper	2½
El Rayo	2¾
Florence	3⅝
Foster Cobalt	.36
Furnace Creek	.11
Giroux	8½
Gold Hill	¾
Goldfield Con	7⅞
Granby	95
Greene Gold	¼
Greene G. & S.	7
Guanajuato	1¾
Guggen. Exp.	181
Hanapah	.15
Kerr Lake	5 1/16
McKinley Dar.	.87
Miami Copper	13⅞
Micmac	1¾
Mines Co. of Am.	⅞
Mitchell Mining	⅛
Mont. Sho. C.	2
Nev. Utah M. & S.	2⅞
Newhouse M. & S.	4⅛
Nipissing Mines	9⅛
Old Hundred	⅝
Silver Queen	.63
Stewart	⅝
Tennessee Cop'r	3⅝
Tri-Bullion	1
Union Copper	1
Utah Apex	6⅛
Utah Copper	42½
Yukon Gold	4 1/16

BOSTON Name of Comp.	Mar. 3 Clg.
Adventure	8
Allouez	40
Am. Zinc	25
Arcadian	5⅝
Arizona Com	33½
Atlantic	15⅞
Boston Con	12½
Calumet & Ariz	103½
Calumet & Hecla	615
Centennial	30
Con. Mercur	.30
Copper Range	75¼
Daly-West	9¾
East Butte	15¾
Franklin	13¾
Greene—Can	10¼
Isle Royal	30¼
La Salle	15¼
Mass	5½
Michigan	11
Mohawk	64
Nevada	17¾
North Butte	71¼
Old Colony	.60
Old Dominion	51½
Osceola	130
Parrot	28¾
Quincy*	90
Rhode Island	4¾
Santa Fe	2
Shannon	14⅛
Superior	45¼
Superior & Pitts.	15
Tamarack	85
Trinity	13⅞
United Cop., com.	12⅞
U. S. Oil	29¼
U. S. Smg. & Ref.	41
U.S. Sm., & Ref., pd.	45
Utah Con	40
Victoria	5
Winona	5¼
Wolverine	142½
Wyandotte	3

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	36¾
Am. Smelt. & Ref.	84½
Am. Sm. & Ref. pf.	103
Colo. Fuel & Iron	33½
Federal M. & S., pf.	180½
National Lead	75½
National Lead, pf.	‡108¾
Pittsburg Coal	‡10¼
Republic I. & S.	20¼
Republic I. & S., pf.	74½
Sloss-Sheffield	472½
Standard Oil	647
U. S. Steel	43⅞
U. S. Steel, pf.	111¼
Va. Car. Chem	‡44⅜

BOSTON CURB	
Ahmeek	160
Black Mt.	2⅛
Chemung	22
Globe Con	6⅛
Hancock	11¾
Helvetia	3½
Keweenaw	‡4¾
North Lake	17⅛
Ojibway	13½
Superior & Bost.	15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS		Feb. 27
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	1.50	1.25
Cent. C. & C.	80.00	78.00
C.C. & C. pd.	80.00	79.00
Cont. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.25	.17
St. Joe	12.00	11.00

LONDON	Mar. 3
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'elnd.	0 2 6
Camp Bird	0 15 9
Esperanza	0 3 3
Tomboy	0 17 6
El Oro	1 3 9
Oroville	0 10 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 24
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.33
Best & Belcher	.35
Caledonia	.09
Challar	.09
Comstock	.26
Con. Cal. & Va.	.36
Crown Point	.35
Exchequer	.25
Gould & Curry	.13
Hale & Norcross	.18
Mexican	.59
Ophir	1.20
Overman	.14
Potosi	.10
Savage	.16
Sierra Nevada	.26
Union	.25
Utah	.02
Yellow Jacket	.37
TONOPAH STOCKS	
Belmont	.83
Extension	.67
Golden Anchor	.01
Jim Butler	.15
MacNamara	.35
Midway	.20
Montana	.77
North Star	.02
Tono'h Mine of N.	6.00
West End Con	.33
GOLDFI'D STOCKS	
Adams	.02½
Atlanta	.13
Booth	.20
Columbia Mt.	.12
Comb. Frac	.99
Con. Red Top	.08
Cracker Jack	.04
Dia'dfield B. B. C.	.08
Goldfield Belmont	.04
Goldfield Daisy	.63
Great Bend	.18
Jumbo Extension	.15
Kendall	.05
Lone Star	.04
May Queen	.03
N. Y. C. O. D.	‡.04
Oro	.10
Red Hill	.09
Roanoke	...
Sandetorm	.12
Silver Pick	.08
St. Ives	.12
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.04
Homestake King	.04
Mont. Shoshone C	1.87½
Tramp Cons	.09½
MISCELLANEOUS	
Bonnie Clare	.04
Lee Gold Grotto	...
Nevada Hills	1.37½
Nevada Smelting	1.00
Nevada Wonder	.65
Nevada-Utah	2.75
Penn-Wyoming	.06
Pittsburgh S. Pk.	.70
Rawhide Coal	.44
Round Mt. Sphinx	.05

Tonopah quotations not received

COLO. SPRINGS Feb. 27

Name of Comp.	Clg.
Acacia	6¾
Black Bell	....
C. C. Con	3¾
Dante	‡5¼
Doctor Jack Pot	9
Elkton	70¼
El Paso	48¾
Findlay	17
Gold Dollar	13
Gold Sovereign	3½
Isabella	25½
Index	....
Jennie Sample	7⅞
Jerry Johnson	‡6
Mary McKinney	‡35
Pharmacist	3¾
Portland	1.01
Un. Gold Mines	4⅞
Vindicator	76¾
Work	7½

Assessments

Company.	Delinq.	Sale.	Amt.
Addie, Utah	Feb. 15	Mar. 6	$0.001
Atlantic, Ida	Feb. 20	Mar. 22	0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
Caledonia, Nev	Mar. 16	Apr. 16	0.05
Challenge Con., Nev	Mar. 19	Apr. 9	0.05
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Gould & Curry, Nev	Feb. 15	Mar. 9	0.10
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
Overman, Nev	Feb. 18	Mar. 11	0.00
Reindeer, Ida	Feb. 15	Mar. 15	0.10½
Sierra Nevada, Nev	Feb. 12	Mar. 5	0.10
Socrates, Cal	Feb. 15	Mar. 16	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.005
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15
Zeibright, Cal	Feb. 15	Mar. 6	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.116	.....	24.514	.....
August	51.583	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	12.949	13.098	13.256	58.786	57.868
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.164	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.880	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Bost, good drill quality, carat.		$85.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs; Turkish flour	"	.01¾@.02½
Grains	"	.03¼@.04½
Naxos flour	"	.01¾@.02½
Grains	"	.03¼@.04½
Chester flour	"	.01¾
Grains	"	.03¼@.04½
Peekskill, f.o.b. Easton, Pa., flour	"	.01¼@.01½
Grains, in kegs	"	.02½@.03
Garnet, per quality	sh. ton.	25.00@35.00
Pumice Stone, Am. Powd.	100 lb.	1.60@2.00
Italian, powdered	"	.01¾@.01¾
Lump, per quality	"	.03@.20
Rottenstone, ground	"	.01½@.04
Lump, per quality	"	.05½@.20
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.021 up
Boric	"	.07
Hydrofluoric, 30%	"	02.¾@.03
" 30%	"	06
" 60%	"	.10
Hydrochloric acid, 20°, per lb.		1.25@1.50
Nitric acid, 38° per lb.		.03½@.04½
Sulphuric acid, 50°, bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.25
66°, bulk, ton		18.00
Oxalic	per lb.	.06¼@.06½
ALCOHOL—Grain 95%	gal.	2.63
Denatured	"	.45@.47
Refined wood, 95@97%	"	.50@.55
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.03¾@.04
ALUMINUM—Sulphate, com'l.	lb.	1.10@1.75
AMMONIA—2½ deg. lb.	"	.04½@.05½
" 26 deg. lb.	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.28
Carbonate	"	.07¾@.09½
Muriate grain	"	.05¾@.06½
Lump	"	.09½@.09½
Sulphate, 100 lb.		3.05@3.10
Sulphocyanide com	"	.30
" chem. pure	"	.40
ANTIMONY—needle, lump	"	.03¼@.04
ARSENIC—White	"	.03@.03¾
Red	"	.07@.07½
ASPHALTUM—		
Barbadoes	per ton	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.11@.14
Gilsonite, Utah ordinary	per ton	32.00
Trinidad	"	22.50@30.00
California	"	21.00@27.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated 96@98%	"	36.00@40.00
Powdered, 80@90%	lb.	.02@.02½
Chloride com'l	ton.	37.00@39.00
Nitrate powdered, in casks	lb.	.05½@.06½
Blanc Fixe	per lb.	.02¼
BARYTES—		
Am. Ground	sh. ton.	16.00@17.00
Floated	"	17.00@18.00
Foreign floated	"	20.00@22.00
BISMUTH—Sub-nitrate	lb.	1.45
BLEACHING POWDER—35%, 100 lb.		1.25@1.40
BLUE VITRIOL—copper sulphate), carload, per 100 lb.		4.60
BONE ASH	lb.	.02¾@.04
BORAX, sacks	"	.04½@.05
CALCIUM—Acetate, gray, 100 lb.		1.50@1.55
Acetate, brown	lb.	1.00@1.05
Carbinde, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.00
CEMENT—		
Portland, Am. 500 lb.	bbl.	1.55@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb.	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	17.50@20.00
Bricks, f.o.b. Pittsburg, M ton.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton.	8.00@9.00
Foreign	"	11.50@18.00
COBALT—Oxide	lb.	1.45@2.60
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground best sh. ton.		10.50@15.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	18.00
" No. 2	"	15.00
Extra	"	20.00@23.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
Domestic f.o.b. shipping port:		
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	11.50@13.50
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump,	100 lb.	.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02¼@.04
Dust	"	.02¼@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Largel ump	"	.08¼@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. best	lb.	.01¾
German	lb.	.02¼@.02¾
LEAD—Acetate (sugar of) brown,	lb.	.07¾
Nitrate, com'l	"	.08¼@.08¾
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	8.00@10.00
Calcined, powdered	sh. ton.	26.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.85@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01½
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	8.50@10.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
Sulphate, double	"	.06½@.08
NITRATE OF SODA—100 lb. 95% for '08		2.17½
95% for 1909		2.17½
95% for 1910		2.17½
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.06@.06½
English glassmakers'	"	.08¼@.08½
Lithopone	"	.03¾@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	$ 50@9.00
Best	"	16.00
Dutch, washed	lb.	.02¼@.03
French, washed	"	.01½@.02¼
Paris green, pure, bulk	"	21½
Red lead, American	"	.06¼@.07
Foreign	"	.08¼@.08½
Turpentine, spirits bbl., per gal.		.42½
White lead, Am., dry	lb.	.05¾@.05½
American, in oil	"	.06½@.06¾
Foreign, in oil	"	.10¼@.10¾
Zinc white, Am. extra dry	"	.05¼@.05¾
French, red seal, dry	"	.08¾@.08½
French, Green seal, dry	"	.10¾@.10¾
PHOSPHATES—Acid		.57@60c. per unit
*Fla., hard rock		$ 50@9.00
land pebble 68%		4.00@4.25
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock		7.00@7.25
" " river rock		5.50@5.75
POTASSIUM—		
Bicarbonate crystal	lb.	$ 08½@.09
Powdered or granulated	"	09@.09½
Bicromate, Am.	"	.08¼@.08½
Scotch	"	10¾
Bromide	"	.20
Carbonate (80@85%)	"	.03¾@.04
Caustic, ordinary	"	.04½@.05¾
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.09½@.09¾
Crystals	"	.09@.09½
Cyanide (98@99%)	"	18c.
Carloads (30,000 lb.)	"	18½c
5-ton lots	"	20c
Less than 5 tons		
Kainite, long ton, bulk, $.50; bags, 9.50.		
Permanganate	lb.	10@.11
Prussiate, yellow	"	.13@.13¾
Red	"	.30@.33
Sulphate	100 lb.	2.18½@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported, non-arsenical, furnace size, per unit		12½
Imported, arsenical, furnace size, per unit		12
Imported fines, arsenical, per unit.		.08½@.09
Imported fines, non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl.		.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry	lg. ton.	10.00@15.00
Silex, ground	"	13.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@6.00
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33¾@.36¾
SODIUM—		
Acetate	lb.	.04½@.05
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1.00@1.30c.
Soda, caustic, per 100 lb., 76/60		1.75@1.85
Soda, caustic, powdered		.02¾@.03¼
Salt cake, per 100 lb., bulk		40
Salt cake, bbl		.65@.85
Soda, monohydrate, per lb.		1.4@1.75c.
Bicromate	lb.	06½@.07
Bromide	"	20
Chlorate, com'l	"	.09@.09¾
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.	"	1.35 up
German	"	1.60@1.70
Phosphate	100 lb.	2.10@2.25
Prussiate	"	.08@.08½
Sal soda, f.o.b. N. Y.	"	.60@.70
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.75@.90
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.75
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07½@.08
SULPHUR—		
Louisiana (prime) to New York, Boston or Portland	lg. ton.	22.00 up
To Philadelphia or Baltimore	"	22.00 up
Roll	100 lb.	
Flour	"	
Flowers, sublimed	"	
TERRA ALBA—French & Eng.	100 lb.	.80@1.00
TALC—Domestic	sh. ton.	15.00@25.00
French	"	18.00@25.00
Italian, best	"	25.00@40.00
TIN—Bi-chloride, 50%	lb.	09 up
Crystals	"	20½ up
Oxide, lb.	"	.33@.35
URANIUM—Oxide	"	3.50
ZINC—		
Chloride solution; com'l 20°	"	02¼
Chloride, granular	"	04½@.04¾
Dust	"	.0@5.05¾
Sulphate	"	02@.02¼

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THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for $1.00, thirty-three for $5.00 and one hundred for $15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

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8639—USE of Asphaltum. H Larkin. (Journ. Assn. of Eng. Soc., Dec., 1908; 10 pp.) This paper relates to the various uses of asphaltum; gives a brief history of the industry. 40c.

CEMENT.

8640—ACTION OF FROST on Cement and Cement Mortar, together with other Experiments on These Materials. E. R. Matthews and J. Watson. (Proc. A. S. C. E., Jan., 1909; 14 pp.) This paper describes in detail a series of experiments extending over two years, made in order to ascertain the effects of frost and alternate frost and thaw on the tensile strength of cement when mixed with fresh water, also when mixed with sea water.

8641—SILICA IN PORTLAND CEMENT—The Determination of Silica in Portland Cement. W. P. Gano. (Chem. Eng., Jan., 1909; 1½ pp.) A series of experiments upon the determination of silica in Portland cement to show the errors that are to be met with in the usual methods used in its determination. 40c.

CLAYS.

8641a—CANADA—Our Visible Supply of Brick. M. B. Baker. (Can. Min. Journ., Feb. 15, 1909; 2½ pp.) Describes the chief types of brick clay in Eastern Canada with especial reference to economic value of each. Gives chemical analyses. 20c

8642—MISSISSIPPI—Clays of Mississippi. Part II. W. N. Logan. (Bull. No. 4, Miss. State Geol. Surv., 1908; 72 pp.) A description of the brick clays and the clay industry of Southern Mississippi. Illustrated.

COAL AND COKE.

3643—ACCIDENTS—Economy as Related to Mine Accidents. H. E. Coll. (Eng. and Min. Journ., Feb. 13, 1909; 2 2/3 pp.) Fearless discussion of the lax conditions that exist, showing that the coal operator eventually pays a heavy price for the present neglect. 20c.

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8645—CANADA—C. P. R. Collieries in the West. L. Stockett. (Can. Min. Journ., Jan. 1, 1909; 1¼ pp.). A review of the operations of the Hosmer Mines, Ltd., and the Bankhead Mine, Ltd. 20c.

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8647—CHINA—The Coal Mining Industry in China in 1908. N. P. Drake. (Min. Wld., Jan. 30, 1909; 2 pp.) Considerable advancement in coal mining has been made during the year, and the author describes the development of a number of the principal fields. 20c.

8648—COAL DUST PROBLEM—The Present Position of the Coal Dust Problem. James and John Ashworth. (Can. Min. Inst., Jan. 1909; 8 pp.) The authors submit the opinion that coal dust is the most dangerous factor in all collieries, particularly where fire damp is produced.

8649—COKE OVEN GAS PLANT—A Modern Coke Oven Gas Plant. (Elec. Rev., Jan. 22, 1909; 2 pp.) A description of the Bargoed Colliery installation of the Powell Duffryn Steam Coal Company. Illustrated. 40c.

8650—COLLIERY EQUIPMENT—Surface Plant at Crigglestone Colliery, near Wakefield. (Coll. Guard., Jan. 15, 1909; 1 p.) A description of the Lührig coal washers and the installation of Otto-Hilgenstock coke ovens. Illustrated. 40c.

8651—CONVEYING—Swinging Chutes for Coal Mines. Lestelle and Hyve. (Eng. and Min. Journ., Feb. 13, 1909; 1½ pp.) An illustrated description of the construction and the comparative costs of operating various chutes. Abtract from Bull. de la Soc. de l'Industrie Minerale, Mar., 1908. 20c.

8652—ELECTRIC SHOT FIRING in Coal Mines. D. Harrington. (Eng. and Min. Journ., Jan. 30, 1909; 4 pp.) A discussion of a system installed in Utah where all shots are fired from the surface after the works are clear of men. Illustrated. 20c.

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8660—PHILIPPINE COALFIELDS. J. B. Dilworth. (Trans. A. I. M. E., Jan., 1909; 12 pp.) The author deals with the markets, labor and mining costs, together with the geology of these coalfields. He also gives some chemical analyses.

8661—SCOTLAND—The Marine Beds near the Base of the Upper Carboniferous Red Barren Measures of Scotland. J. Smith and C. T. Clough. (Coll. Guard., Jan. 29, 1909; 1½ pp.) An account of the discovery of marine beds at Palacecraig, together with the collection of marine fossils which may be of service in correlating the strata in the coal measures proper. Illustrated. 40c.

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COPPER

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8701—ELECTRIC FURNACE—New Resistance and Induction Furnace. Alfred Gradenwitz. (Eng. and Min. Journ., Feb. 13, 1909; 1½ pp.) A description of the Röchling-Rodenhauser electric furnace recently installed in some of the German iron works which is a combination of the resistance and induction furnaces. Illustrated. 20c.

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8705—FOUNDRY PRACTICE—Preliminary Report of Committee on Prevention of Accidents in Foundries. (Am. Foundrymen's Assn., Sept., 1908; 8 pp.) Gives some statistics on accidents occurring in foundries, due to various causes.

8706—HIGH-SPEED STEELS—The Nature and Character of the New Steels. O. M. Becker. (Eng. Mag., Feb., 1909; 15 pp.) The article here presented deals with the physical constitution of high-speed steels, and the phenonema of tempering. Illustrated. 40c.

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8708—MALLEABLE CASTINGS—Production of Malleable Castings.—XI. R. Moldenke. (Foundry, Feb., 1909; 2¼ pp.) A discussion of various methods of cleaning and inspection; the annealing department and methods of packing the castings and charging the furnaces. 20c.

8709—METALLOGRAPHY—Notes on Metallography. W. G. Haldane. (West. Chem. and Met., Jan., 1909; 6 pp.) In this paper the author deals briefly with the metallography of iron and steel. Illustrated. 80c.

8710—OHIO—Mahoning Valley as an Iron Center. J. F. Froggett. (Iron Tr. Rev., Jan. 21, 28 and Feb. 4, 1909; 12 pp.)

This article gives an historical review of this district, including a description of the rolling mill development from the earliest days, the first tin plate made in this country, use of natural gas in the large rolling mills, the organization of the Ohio Steel Co., etc. 60c.

8711—RUSSIAN IRON TRADE CONDITIONS. (Iron Age, Jan. 21, 1909; 2 pp.) A discussion of the proposed pool of the South Russian Iron Works. Also some notes on the future of the Ural district. 20c.

8712—SAMPLING IRON ORES—Methods of Sampling Iron Ore. J. M. Camp. (Iron Tr. Rev., Jan. 20, 1909; 2½ pp.) A description of the systems of commercial sampling as adopted by the United States Steel Corporation, and described in a booklet issued by that company. Illustrated. 20c.

8713—SOUTHERN IRON ORE—A Great Southern Iron Ore Reserve. W. B. Phillips. (Mfrs. Rec., Feb. 4, 1909; 1¼ pp.) This article briefly describes a number of the ore deposits in the valley of the Tennessee river. 20c.

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8718—VANADIUM—The Use of Vanadium in Cast Iron. J. K. Smith. (Foundry, Feb., 1909; 2¼ pp.) A discussion of the action of this metal on gray iron for casting purposes and the methods of application in the ladle and air furnaces. 20c.

NICKEL.

8720—CANADA—The Nickel Trust. A. Gray. (Min. Journ., Jan. 16, 1909; 2 pp.) The author gives a review of the nickel mining industry in Canada, together with tables showing the production of nickel and copper in the Sudbury district. Also some notes on the operations of the International Nickel Company. 40c.

8721—ONTARIO—The Nickel-Copper Industries of Ontario in 1908. A. Gray. (Min. Wld., Jan. 30, 1909; 3 pp.) A review of this branch of the mining industry during the year, together with some notes on the output, dividends, etc., of a number of the larger companies. Also a table of the production of nickel and copper in the Sudbury district since 1886. 20c.

PETROLEUM.

8722—CALIFORNIA—Coalinga Oil District, California. R. Arnold and R. Anderson. (Bull. 357, U. S. Geol. Surv., 1908; 142 pp.) A preliminary report on the geology and oil resources of the Coalinga district, Fresno and King counties, California. Illustrated.

8723—GALICIAN PETROLEUM INDUSTRY During 1908. (Petrol. Rev., Jan. 30, 1909; 2 pp.) A review of the petroleum industry and statistics of the output of 1908. Illustrated. 40c.

8724—MEXICAN PETROLEUM; The Tuxpan Oil Well Fire. H. Floy. (Eng. News, Dec. 10, 1908; 1½ pp.) A short review of the development of the petroleum industry in Mexico. A description of the Tuxpan oil well, the fire and the method employed in extinguishing it. 20c.

8725—PRODUCTION of Petroleum in 1908. D. T. Day. (Min. Wld., Feb. 6, 1909; 2 1/3 pp.) A review of the industry for the year with notes and statistics on the various fields in the United States. 20c.

PHOSPHATE ROCK.

8726—UNITED STATES—The Present Phase of Phosphate Rock in the United States. J. Campbell. (Am. Fertilizer, Jan., 1909; 1½ pp.) A short review of the phosphate industry in the United States. 20c.

PRECIOUS STONES.

8727—DIAMOND MINING INDUSTRY of South Africa. O. Letcher. (Min. Wld. Jan. 30, 1909; 1 p.) A review of the depression in the mining industry; the effect of recent discoveries; the operations restricted at Kimberley, and the policy of the Premier company. 40c.

8728—DIAMONDS—Some Facts and Corrections Regarding the Diamond Region of Arkansas. J. C. Branner. (Eng. and Min. Journ., Feb. 13, 1909; 1½ pp.) A discussion of the article on the Arkansas Diamond Field by John T. Fuller, which appeared in the JOURNAL Jan. 16, 1909. 20c.

QUICKSILVER.

8729—PURIFICATION—An Apparatus for the Purification of Mercury. L. J. Desha. (Amer. Chem. Journ., Feb., 1909; 3 pp.) The description of an automatic apparatus which operates continuously for a given lot of mercury and requires absolutely no attention after once being started. Illustrated. 60c.

RARE METALS.

8729—URANIUM—Rare Metals.—VIII. Chas. Baskerville. (Eng. and Min. Journ., Jan. 30, 1909; 1 1/3 pp.) This article gives a description of a number of uranium minerals together with localities in which they are found. Blowpipe reactions are also given. 20c.

8730—VANADIUM AND URANIUM—Rare Metals. H. Fleck. (Quart. Colo. Sch. of Mines, Jan., 1909; 51 pp.) Results of an investigation of the vanadium deposits in the region of Placerville, San Miguel Co., Colo. The author gives some of the geologic conditions, describes a number of vanadium deposits and gives analyses of the ores. Contains also brief notes on the occurrence of uranium in Gilpin Co., Colo.

TIN.

8731—AUSTRALASIA—The Occurrence of Stannite in Australasia. H. Conder. (Aust. Min. Stand., Nov. 18, 1908; 1 p.) A description of this mineral, its analyses and geological occurrence; also a description of the Oonah mine. 40c.

8732—DETINNING INDUSTRY. The. (Electrochem. and Met. Ind., Feb. 1909; 3 pp.) A review of the detinning processes and a description of the Goldschmidt tin and chemical works in Essen. Illustrated. 40c.

8733—SOUTH AFRICA—The Tin Deposits of the Cape Peninsula. (So. African Min. Rev., Dec., 1908; 2 pp.) Some notes on the various companies that have been formed for mining tin in this district. A short description of the placer tin deposits. 40c.

8734—TIN DRESSING—Notes on Tin Dressing. C. Brackenbury. (Inst. of Min. and Met. Bull. No. 52, Jan. 14, 1909, 2 pp.) Contributed remarks in which the author gives a series of experiments showing a great variation between vanning assays and chemical assays of tin ore.

TUNGSTEN

8735—WOLFRAM ORES—Occurrences and Uses. Chas. Bogenrieder. (Aust. Min. Stand. Dec. 9, 16, and 23, 1908; 5 pp.) Continuation of a series of articles on the importance of these ores in Australia and to commerce in general. The author takes up the mineralogy, and mentions the locations in which the various minerals are found; contains also some notes on the metallurgy of tungsten. $1.00.

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8741—ORE DEPOSITS—A Theory of Volcanic Action and Ore Deposits, Their Nature and Cause. H. W. Hixon. (Inst. of Min. and Met. Bull. No. 52, Jan. 14, 1909; 12 pp.) The basis of the theory which is herein set forth is that the earth was at one time an incandescent sun, in which condition its temperature was above the critical temperature of all the matter of which it was composed. Illustrated.

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8746—WYOMING—Geology and Mineral Resources of the Laramie Basin, Wyoming. N. H. Darton and C. E. Siebenthal. (Bull. 364; U. S. Geol. Surv., 1909. 81 pp.) A preliminary report on the geography, geology, mineral resources, and underground waters of the Laramie district. Illustrated.

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(Eng. and Min. Journ., Feb. 6, 1909; 5 pp.) A discussion of accidents due to over-winding; accidents in shafts; accidents with explosives and those due to poisonous acids at metal mines. Accidents due to carelessness are preventable and it should be the duty of the superintendent to see that the miners are not careless. Illustrated. 20c.

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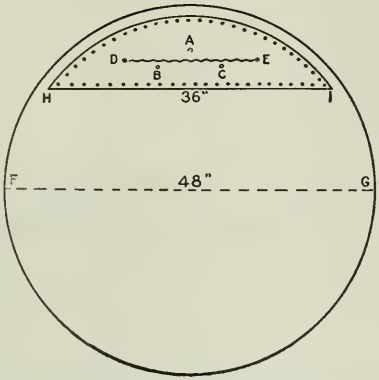

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Handling Ore at Copper Queen Mines, Bisbee

Ore Is Hauled, in Cars with Automatic Couplers, by Electric Motors, Hoisted in Skips and Loaded into Railroad Cars by Belt Conveyers

BY WALTER GARDNER*

The Copper Queen Consolidated Mining Company has recently introduced new methods of handling the ore at its mines at Bisbee, Arizona. Formerly, the small mine cars having a capacity of 13 cu.ft. were trammed by hand or hauled by mules to the shaft stations of the various mines, hoisted on two- or three-deck cages to the surface, and dumped into railroad cars from elevated loading stations; all of this entailed a comparatively high labor cost. The present system includes electric haulage underground and the transfer of the ore to railroad cars by means of belt conveyers, thus reducing the rehandling of ore to a large extent by the substitution of mechanical methods for hand labor, though mule haulage and tramming are not entirely eliminated. Instead of hoisting the ore from each mine through its respective shaft, the entire output is hauled to a main hoisting shaft, the Sacramento, in trains drawn by electric locomotives. Electric haulage is installed on alternate levels beginning at the 400-ft. down to the 1200-ft. level, the levels being 100 ft. apart.

The ore from the stopes above the 300-ft. level is drawn off into cars which are assembled into trains and drawn by mules to chutes, where the ore is dropped to loading stations on the 400-ft. level. From the 200-ft., main chutes extend directly to the 400-ft. level. The ore from stopes between the main haulage levels is handled in a similar way. All chutes are provided with gates of the arc type, made of ¼-in. steel plate. These not only allow easy control of the flow of ore, but in case of clogging in the chute they may be swung back out of the way, permitting free use of a bar to pry loose the obstruction. On the haulage levels the ore is run into self-dumping, side-discharge cars of the "gable," or "A" bottom type, built by the Arthur Koppel Company The body of the car is 4 ft. 8 in. by 2 ft. 6 in. by 2 ft. 9 in. deep, and has a capacity of 21 cu.ft. The over-all dimensions are 6 ft. 4 in. by 2 ft. 8 in. by 3 ft. 10 in. high. The gage of the wheels is 20 in. and the wheel base is 21 in., so that curves of 15 ft. radius can be passed. The couplings are of the automatic type.

At the main loading stations a double track and switches are provided. After loading, the cars are made up into trains; the length of the trains varies on the different levels, according to the conditions of grade, but the average haul is about 12 tons of ore to the train. The

FIG. 1. SKIP DUMPING AT SACRAMENTO SHAFT. FEED CHUTE TO CONVEYER SYSTEM ON LEFT

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trains are drawn to the Sacramento shaft by the Goodman electric locomotives at a speed of approximately six miles per hour. The over-all dimensions of the locomotives are 8 ft. by 2 ft. by 2 ft. 9 in. high; the wheel base is 24 in. The motor takes direct current at 250 volts from a trolley wire hung 6 ft. 6 in. above the center of the track. In untimbered workings the wire is suspended from 4x6-in. sprags; these are 3 ft. 6 in. long, supported by two 1-in. bolts let into the back of the drift and they are placed about 50 ft. apart in the straight drifts; around curves they are placed closer together to keep the wire in the center of the drift. The track is of 32-lb. steel laid on 4x6-in. ties; the rails are well bonded together by copper wires. The least radius of curvature employed is 25 feet.

Handling the Ore in the Shaft

On the arrival of a train at the Sacramento shaft the side doors of the cars are released and the ore discharged into pockets below the station. The train of empties then returns to the main track by a loop passing around the shaft. These ore pockets, which have a capacity of 50 tons, terminate in two chutes for loading the skips in which the ore is hoisted through a vertical shaft to the surface. In order to prevent overloading, the proper amount of ore for one hoist is determined by means of a measuring box, placed below the ore pocket proper. The skips have a capacity of 60 cu.ft. and are self-dumping. They are built of ½-in. steel plate and were constructed at the company's machine shop.

The hoist itself, built by the Nordberg Manufacturing Company, is of interest as it is the first of its type to be installed in the district. It is a tandem-compound, condensing, direct-acting hoist having 16x24x48-in. cylinders. The drums are 7 ft. in diameter and have 60-in. faces so that they are capable of carrying 2100 ft. of 1¼-in. round rope in two layers. The steam is generated in a central power house, situated nearby, from Stirling boilers equipped with Foster superheaters and Greene fuel economizers. It is at this power house that the electricity for the haulage system is generated. By means of rotary transformers the direct current for the mechanical traction is obtained by stepping down and transforming current at 2200 volts that is generated by Curtis vertical turbines. The economy of this central plant and of the type of hoist employed are large factors in reducing the cost of handling the ore, as the work of the simple, non-condensing hoists at the various shafts is now confined to hoisting and lowering men and timbers; the "dinkey" hoists, formerly used for this purpose, are now unnecessary.

Handling the Ore at Surface

When hoisted to the surface, the skip automatically dumps its contents into a steel hopper at the base of the head frame (Fig. 1). The ore is carried from the hopper to the first of the belt conveyers by means of a short steel link conveyer, the drive of which is synchronized with the speed of the belt. As may be seen in the accompanying illustration (Fig. 3), the belt-conveyer system consists essentially of a cross conveyer delivering the ore to one of two loading conveyers; these latter belts are approximately at right angles to the first and run on a light steel trestle above and parallel to the railroad tracks. The cross conveyer is 240 ft. long; the loading conveyers are each 330 ft. long; all the belts are 30 in. wide and are driven by electric motors. The ore from the short link conveyer is fed by means of a suitable chute or spout to the cross conveyer, which carries the ore down to the railroad tracks, passing through the light building near the headframe shown in Figs. 1 and 2. This building is the scale house and contains a Blake-Dennison scale which automatically weighs and records the amount of ore carried by the belt. By means of a tripper the ore may be delivered at will to either of the two loading conveyers. The railroad cars, having a capacity of 50 tons each, are drawn up in trains of ten cars on either side of the belt, which discharges the ore into them by means of a tripper traveling along the belt. This tripper is self-reversing; as soon as it reaches the end of the conveyer it automatically stops and begins to travel in the opposite direction. The spaces between the cars are bridged by inclined spouts, so that no ore falls between. In this way the ore is evenly distributed over ten cars and the contents of the tenth car may be taken as a sample of the train load. Suitable provision is made for switching loaded cars and empties, and ample accommodation is made for further strings of cars while waiting to make up a train to carry the

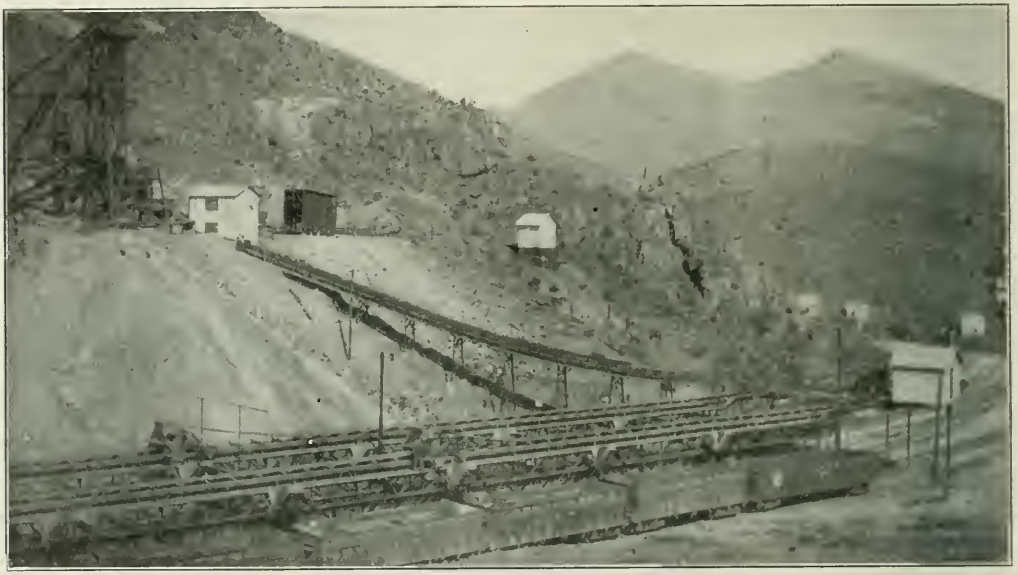

FIG. 2. CONVEYER SYSTEM FOR LOADING ORE TRAINS AT COPPER QUEEN MINES

ore to the smelter at Douglas. With a view to possible needs in the future, the belt-conveyer system, which was built by the Stephens-Adamson Manufacturing Company, is designed to handle 3000 tons per day, although the present output is considerably less than this amount.

Determination of Silver in Gold Bullion

E. H. Taylor (*Journ.* Chamber of Mines of West Australia, July 31, 1908), describes the method in use at the Great Boulder Perseverance Gold Mining Company, Ltd. mine for the determination of silver in gold bullion. The method involves the fusion of the bullion with metallic cadmium, solution of the fused alloy in nitric acid and titration of the silver in the solution with ammonium sulphocyanate. The method, although not a new one, does not seem to be generally known. The author claims that the amount of copper present in a bullion 900 fine in silver and gold does not interfere with the delicacy of the end reaction.

A standard solution of ammonium sulphocyanate is made by dissolving 1.6 grams of the pure salt in 1000 c.c. of distilled water. The solution is standardized against pure silver foil, 1 c.c., approximately, equaling 4.483 parts of silver per 1000. A check piece of bullion containing, approximately, the same amount of silver as that to be assayed, is fused with cadmium and treated in exactly the same manner as the assay.

A preliminary fire assay is first made to determine the amount of silver to be used for the check piece. Then 0.5 gram of the bullion is fused in a porcelain crucible with 1.5 grams of cadmium under a cover of potassium cyanide. The fusion period is about five minutes with an ordinary lamp during which time the cadmium must be completely covered with the cyanide. The fusion is allowed to cool, the cyanide dissolved away with a stream of running water, and the clean ball of alloy placed in a flask.

The alloy is covered with 20 c.c. of water and four successive additions of 10 c.c. portions of nitric acid are made. During the addition of acid the solution is kept boiling and the boiling continued for an hour. The solution is then diluted with water to 150 c.c., 10 c.c. of ferric alum indicator added, and the silver titrated with the standard ammonium sulphocyanate. To lessen the time consumed in boiling, the buttons may be allowed to digest over night with 10 c.c. of nitric acid.

Ore Treatment at the Giant Mine, Rhodesia

SPECIAL CORRESPONDENCE

In the November *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, Reginald C. H. Cooke contributes an interesting description of the reduction plant at the Giant mine. The process used is remarkable, owing to the absence of a cyanide plant. The gold is caught by amalgamation and on blanket and canvas tables. The ore is a heavily mineralized chlorite schist, intermixed with a good deal of ironstone and quartz, and the following is a representative analysis:

	Per Cent.
Iron as Fe_2O_3	18.0
Magnetite	14.0
Pyrite	14.6
Insoluble silica and silicates	46.0
Al_2O_3	6.0
Total	98.6

Specific gravity = 3.1.

The gold is of two kinds, (a) bright yellow gold, 30 per cent.; (b) refractory, of rusty appearance.

A very coarse screen is used in the battery, and consequently a large tonnage is put through—about 15 tons per stamp per 24 hours. There are 15 stamps, each weighing 1250 lb. In two batteries ⅜-in. screening is used, and in the third ½-in. screening. The reason given why ½-in. screening is not used in all batteries is that the ore crushed would then exceed the capacity of a single tube mill. About 30 per cent. of the gold is caught on the plates which are 4 ft. long and which are not injuriously affected by the coarseness of the material passing over them.

The following table shows the different results obtained as ⅜-in. mesh, or ½-in. mesh is used. The difference between Nos. 1 and 2 is due to the position of the grizzlies, No. 2 battery receiving most of the fines.

	Battery No. 1, ⅜-inch Mesh Screening. Per Cent.	Battery No. 2, ⅜-inch Mesh Wire Screening. Per Cent.	Battery No. 3, ½-inch Mesh Screening. Per Cent.
+ ⅜	.....	.....	3.12
+ ¼	2.50	0.62	7.22
+ 1/16	7.38	5.62	10.22
+ ⅛	6.15	5.00	8.00
+ 30	25.00	22.50	25.00
+ 60	12.50	13.78	12.45
+ 90	8.19	10.00	7.75
+120	5.00	5.62	5.21
—120	30.78	36.00	20.00
Total..	97.50	99.14	98.97

The pulp on leaving the tables flows through amalgam traps and then into a table-mill dewatering spitzkasten 4x4 ft. The coarse goes to tube mills which are 25 ft. long and 5 ft. in diameter, lined with silex blocks, which last 31 weeks. The discharge from the tube mill contains 87 per cent. less than 90 mesh.

The pulp from the tubes passes over blanket tables, consisting of 12 strakes—two of which are spares—12 ft. long by 2.5 ft. wide with a 12.5-per cent. fall. About 55 per cent. of the gold is recovered from the blankets, which are washed at short intervals, the frequent washing being considered an important feature. About 4 to 5 tons of concentrates are won per day, which are reconstructed on another blanket table until about half a ton of rich concentrate is obtained. This concentrate is treated in an amalgam barrel with about 300 c.c. of concentrated HNO_3. The acid cleans the gold and renders it amenable to amalgamation.

The total extraction averages 87.7 per cent., the tailings carrying about 1 dwt. The costs are about $1.20 per ton, but may be reduced from 6c. to 12c. per ton.

For the year ended June 30, 1908, on a total of 65,068 tons worked, the costs of all departments were: Mining, $1.24; milling, $1.30; sorting and crushing, $0.24; general charges, $0.48; mine development, $0.44; total, $3.70 per ton.

FIG. 3. CONVEYER SYSTEM FOR LOADING CARS, COPPER QUEEN MINES, SHOWING THE TRIP

FIG. 4. ORE CAR WITH AUTOMATIC COUPLING, COPPER QUEEN MINES

Richards Pulsator Jig and Classifier

A New Principle in Ore Dressing, That of a Current of Water Pulsating Rapidly in a Single Direction, Applied to the Jig and the Classifier

BY FRANK E. SHEPARD*

Dr. Robert H. Richards, the eminent author of "Ore Dressing," has for many years conducted exhaustive experiments for the purpose of determining the action of ore particles in bodies or currents of water and the results of these investigations form the subjects of various papers in the *Transactions* of the A. I. M. E., *The Mineral Industry*, and many technical papers. Particular attention has been given to practical devices for improvement in the jigging of ores and the hydraulic classification of ore pulps, previous to concentration.

The climax of all this great work is embodied in two remarkable devices, one, the Richards pulsator jig for the concentration of the coarser ore particles, and a machine separate and distinct from the jig, known as the Richards pulsator classifier, which effects a hydraulic classification of the finer ore pulps, previous to wet concentration.

The Richards Pulsator Jig

The field of the hydraulic jig is found in the concentration of ores in which the mineral occurs wholly or partially in comparatively coarse particles. For many years jigs have been most successful in the treatment of coarse products and they are also efficient in the concentration of fine pulps; they are sometimes, though rarely, used for slime products, but commercial practice seems to place the limit of the smallest advisable pulp particle for jig treatment at 1 mm., or about 12 mesh No. 19 wire.

Heretofore, jigs have been designed along two general lines: (1) Jigs with movable sieves, which produce the hydraulic currents by pushing the screen up and down in the water. (2) Jigs with fixed screens in which the hydraulic currents up and down through the screen are produced by a plunger, actuated by eccentrics, tappets or other mechanical equivalents.

In both these types of jig the concentration of the mineral portions of the ore is effected by an upward and downward current of water alternating with each other and acting upon a bed of the ore particles supported on a wire screen, having openings depending on the size of the ore particles treated. During the upward movement of the water called "pulsion," through the screen aperture, the various ore particles arrange themselves according to their specific gravities, those of greater specific gravity arranging themselves in the lower strata just above the screen, while the particles of lesser specific gravity are found in the upper strata, farthest from the screen. During the downward movement of the water called "suction," ore particles possessing a greater specific gravity are drawn downward through larger particles toward and sometimes through the screen.

The valuable mineral portions of the ore are usually of a high specific gravity and thus settle down on the jig screen and are sometimes drawn off from above the screen by means of a device known as a "cup discharge," or under certain conditions are drawn down through the jig screen into that portion of the machine known as the "hutch," and giving a concentrated product called the "hutch" product. The tailings, or ore particles containing little or no value, being of less specific gravity, are found in the upper strata, most remote from the jig screen, and by various designs of gates are discharged from the jig.

This suction portion of the water current, while serving as a benefit under certain conditions, proves a serious defect in the successful continuous operation of the jig, on account of the "blinding" of the jig screen, caused by ore particles being drawn into the screen opening during the suction cycle of the water current. This suction also tends to pack tightly the layers of high specific gravity just above the screen, and thus tends to prevent a free arrangement of the ore particles, which is absolutely necessary for a best possible separation of concentrates from tailings.

The jig most generally used in the concentration plants of the world is of the fixed-screen type, known as the Harz jig. The Richards jig has its feed box, screen compartments, concentrates discharge and tailings spout in the same relative positions as found in the Harz jig; it has a hutch for each compartment, of the same general design as found in the Harz; the water current enters the hutch in the same general direction, and, generally speaking, the principles employed in the Harz jig are found in the Richards jig. The distinguishing feature of the Richards jig is in the novel application of a pulsating water current, first applied successfully by Doctor Richards. The hydraulic water is delivered to the jig under a head of about 30 ft., and passes to a special design of rotating valve, which is balanced in all positions. This valve is driven by a 3-in. belt and pulley from any suitable mill shaft which has a fairly constant speed. The shaft driving the concentrating tables will serve. The valve is usually driven at the rate of from 75 to 150 r.p.m., and being double-ported, delivers a water current of from 150 to 300 intermittent pulsations per minute. An air chamber is used in connection with the rotating valve and serves to intensify the action of the water current in the jig. This pulsating current of water is delivered to a manifold equipped with suitable adjustable valves, which serve to increase or diminish the intensity of hydraulic water in any one compartment. Thus we have an intermittent pulsating current of water passing *up* through the screen in each compartment, and not being drawn down through the screen again, as in the Harz jig.

Effect of the Pulsating Current

The effect of this pulsating water current in the treatment of ores in the Richards jig is most remarkable. The four-compartment jig has four compartments, each having a screen area 4x4 in., making a total jigging screen area of 64 sq.in. A jig of this size and type treated Butte copper ores, previously screen-sized through 8-mm. and on 2½-mm. screens, at the rate of 90 tons per 24 hours; the quality of concentrates and tailings meeting the requirements of the system. To accomplish equivalent results with the common Harz jigs would require three double four-compartment Harz jigs having a total screen area of 12,000 sq.in., as compared with 64 sq.in. in the Richards jig; or 1 sq.in. in the Richards system does as much work as about 200 sq.in. in the Harz system.

Following out the comparison we have the following parts requiring attention and lubrication in the Harz system for the tonnage quoted: 6 tight pulleys, 6 loose pulleys, 30 babbitted bearings, 24 eccentrics and straps, or 60 places to lubricate as against one pulley and two bearings in the Richards jig.

A most important discovery in the development of the Richards jig was found in the small amount of fresh water required. The average amount of water required in the Harz system of jigging, as determined from 30 mills in American practice, is 4700 gal. per ton of ore treated. The average amount of water required in the Richards system is only 1000 gal. per ton of ore treated; furthermore, of this 1000 gal. of water delivered to the jig, 500 gal. of perfectly clear water

NOTE—From *Proc.*, Colo. Sci. Soc., Vol. IX. A description of these machines and the methods of operation appeared in the JOURNAL of Sept. 26, 1908.

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is discharged with the concentrates and may be returned for use in the mill system. In the Harz jig pulp beds of only 3 or 4 in. depth above the screens are maintained and the layer of concentrates is but 1 in. and often less; while in the Richards jig, ore beds of 12 and 14 in. are maintained and the layer of concentrates is 8 or 9 in. in depth. This greatly increased thickness of the concentrates bed acts as a filter and the water discharged with the concentrates is perfectly clear.

The feature of being able to carry such a deep bed of ore renders the operation of the Richards jig less subject to fluctuations in the ore feed, and having been suitably adjusted for a certain class of ore, the jig will operate hour by hour without any change of adjustment.

In jigs, using the pulsion and suction type of water current, large screen areas are necessary and in many cases artificial beds are required to treat the ores successfully. These large screen areas and the repeated grinding action of the mineral particles in the artificial beds or on the screen wires produces an abnormal amount of rich slimes, which greatly hinders, if it does not absolutely prevent, a successful recovery. In the Richards jig, no artificial bed is required; the jig makes it own bed; and further, there is not any passage of concentrates down through the screen into the hutch, the concentrates being discharged through a gate above the screen. The rapid action, the small screen areas, and the attrition reduced to a minimum, are reasons for reducing the slime losses in the Richards jig, and the sharp edges of the concentrates are a marked contrast to the same product from jigs of large screen areas with hutch products.

Field of Operation

The field of operation for this Richards jig will be the treatment of any possible jigging ores in any screen-sized product from ½ in., possibly as large as 1 in., down to 1/32 in. in diameter. Commercial practice seems to place the lower limit of jig feed sizes at 1 mm., corresponding to about 12-mesh No. 19 wire. Any mill pulps finer than this may better be treated on shaking tables or belt vanners, if properly classified previous to concentration.

Two and three mineral separations may be made under reasonable conditions of jigging. Recent tests have proved that the Richards jig will successfully separate slate and refuse from good coal, which fact opens a wide field of operation, with great possibilities in a marked saving in clean coal, as well as a great improvement in the cokes manufactured from washed coal. Tests made at the Government coal-testing plant, on Illinois and local bituminous coals, indicate that the 4-in. four-compartment size will treat such coal at the rate of 70 tons in 24 hours.

Statistics show that of the refuse thrown away in prevailing coal-jigging methods, from 10 to 50 per cent. is good coal. Tests made on the Richards jig indicate that a loss of good coal in the refuse of less than 5 per cent. may be realized.

This system of concentration for coarse ore products has developed not only a remarkable efficiency in the jigging system itself, but has created great possibilities in the economy of attendance, size of plant, power and water required. The Richards jig has been found to be automatic under working conditions and even with an irregular feed will still continue to deliver for hours a satisfactory product without any change in adjustment.

Capacity

The 4-in. four-compartment Richards jig, when treating Butte copper ores, carrying from 2.5 to 3.5 per cent. copper, recovered 37 per cent. of the copper in the feed at the rate of 90 tons in 24 hours. The concentrates are of a grade suitable for delivery to the copper smelter; the tailings are reground for subsequent table and vanner work. This means that 1 sq.in. of screen surface in the Richards system treats 1.4 tons of ore in 24 hours.

Reports of a 4-in., six-compartment Richards jig operating in Rico, Colo., on a difficult ore composed of galena, iron sulphides and zinc blende, gave a lead product of 76.7 per cent. lead, with only 3 per cent. zinc.

A 4-in., four-compartment Richards jig operating commercially on a lead ore carrying about 10 per cent. in the crude, in Boulder county, delivered a 60-per cent. lead product.

Numerous tests have been made on a 2-in., four-compartment Richards jig at the testing plant of Henry E. Wood & Co., Denver, Colo., and the results from a great variety of ores prove that good commercial results may be accomplished on this laboratory size, having only 16 sq.in. of screen surface.

The Richards Pulsator Classifier

Following the concentration of coarse ore products by jigs, is the recrushing of the jig tailings and often the jig middling products by means of rolls, stamps, tube or roller mills. Various forms of hydraulic classifiers have been used to grade these recrushed pulps into different classes previous to their being delivered to tables or vanners, but the results have been far from satisfactory. In cyanide systems it becomes necessary to make a good separation of slimes from sands, and in tube milling the delivered product is usually classified previous to being delivered to the leaching or agitation systems. A study of Doctor Richards' "Ore Dressing" will show the types of hydraulic classifiers which were designed in the long search for a successful system and the argument for classification previous to table and vanner work is ably presented in Doctor Richards' paper entitled "The Wilfley Table," *Trans.*, A. I. M. E., 1907 and 1908. Even now we find advocates of a mixed feed for good concentrating table work, and it is difficult to understand how such practice prevails, when test after test shows marked advantages due to a proper grading of ore pulps before table work.

The Richards pulsator classifier overcomes the difficulties found in the older forms of hydraulic classifiers and delivers a quality of pulps to tables which not only admits of greatly increased capacity, but improves the quality of work performed. Screen-sized pulps show a great improvement in table or vanner work when compared with an untreated or mixed feed, but there are so many mechanical difficulties attending the use of fine screens that the maintenance of such a plant becomes a serious factor in milling operations.

In the Richards classifier, the mechanical moving parts have been reduced to a minimum and the adjustments are simple, while the saving in space occupied is a marked advantage. The classifier consists of six compartments, all 4 in. wide and varying in length. This classifier delivers six graded pulps varying from the finest, which issues from the first and highest discharge gate, to the coarsest grade which issues from the last and lowest discharge gate. The same types of pulsating valve, air chamber, manifold, adjustable water valves and hutch are found as in the Richards pulsator jig.

Nearly all the old forms of hydraulic classifiers are modifications of the Rittenger type, called spitzkasten, in which classification is accomplished by a change in the velocity of the current of water carrying the ore. The pulp is fed to the first compartment, an inverted pyramid, having the smallest cross-section. The first compartment has a sectional area much larger than the launder delivering the pulp, hence the velocity of water current is reduced, with the result that the heavier particles of ore settle to the bottom of the compartment, where they are drawn off for treatment. The succeeding compartments of the classifier have a greater and greater cross-section, hence there is accomplished a further decrease in water currents with a resulting settling of finer and finer ore particles until the finest slimes pass out of the last compartment. The pulps delivered by these various compartments consist of small particles of mineral and larger particles of gangue material, equal-falling particles in water and diameters depending on the specific gravity of the particle. For example, a particle of galena 1 mm. in diameter falls in water with a quartz particle whose diameter is 3½ mm. If a concentrating table were fed with such classified pulps the result would be

a great improvement over the mixed feed, but the form of the spitzkasten is such that eddy currents are set up and the discharge of the partially classified pulp establishes more currents and the result is that fine slimes are delivered with the coarse pulps.

In screen sizing the attempt is made to deliver mineral and gangue particles of the same diameter or cube. But here again through imperfect washing, or insufficient screen area, a large proportion of slimes is delivered with the coarse pulps.

The Richards classifier is so designed and operated that the fine slimes are delivered from the first one or two discharge gates, leaving the coarse pulps clean and free from fine slimes to discharge upon the concentrating tables with practically clear water. It is often possible to catch from the last discharge gate a sample of pulp which will settle to the bottom of the sample dish, leaving the water clear.

Advantage of Classification

If for purposes of illustration we assume fed to the Richards classifier a simple ore composed of galena and quartz, all the discharge gates will deliver a product in which the galena particle is one unit in diameter, while the diameter of the quartz particle issuing from the same compartment, will be 6½ times that of the galena particle. The first compartment will discharge the fine slimes and the last, or sixth compartment, will discharge the coarsest particles, but from every compartment the quartz particle is 6½ times the diameter of the accompanying galena particle.

Suppose these pulps are fed to any of the well known concentrating tables or vanners—with the pulps from the old form of classifier known as spitzkasten, the small diameter of mineral particle lies on the table surface in the lower strata of wash water, where the velocity of wash water is the least, owing to its retardation due to friction between the water and the table surface. The quartz particle being 3½ times the diameter of the galena particle, projects farther up into the stream of wash water where the velocity of water current is greater; the quartz particle also presents an exposed area of more than 12 times the exposed area of the galena particle; consequently the quartz particle is washed down with the water current, leaving the galena particle to travel on to the concentrates box. Unfortunately the spitzkasten delivers with the coarse pulps, a slime product which does not belong with the coarse pulp, and the result is that a wash-water current suitable for the coarse mineral particle will be too violent for the slime particle and the slime value is washed away with the tailings and lost.

Suppose a screen-sized pulp is delivered to the concentrates surface. The mineral particle is the same diameter as the gangue particle; they both project up into the wash-water stream the same vertical distance; the areas exposed to the wash water are the same, and we have only one property, the greater weight of the mineral particle, which tends to retard it and allow the gangue particle to wash away to the tailings discharge. It is easy to comprehend how the classified product, with its small particle of mineral and its large diameter of gangue particle will produce a more positive separation.

Now suppose we deliver the pulp from the Richards classifier, the product from which gives, for example, a galena particle one diameter and a quartz particle 6½ diameters; then we have a quartz particle with an exposed area 42 times the exposed area of the galena particle. Note that the ratio between the diameters of galena and quartz particles of the pulp delivered by the old form of spitzkasten is 1 to 3½; whereas the ratio between the diameters of galena and quartz particles of the pulp delivered by the Richards classifier is 1 to 6½. In other words, the quartz particle delivered by the Richards classifier is nearly twice the diameter of the quartz particle delivered by the old form of spitzkasten, and presents more than three times the exposed area to the current of wash water.

Practical Results

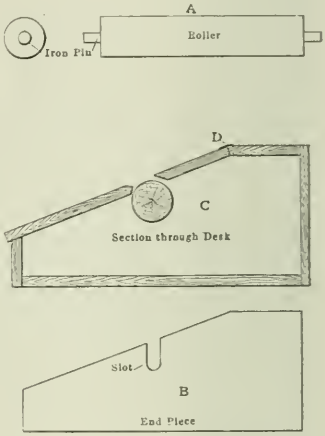
This very important point of increasing the ratio of equal settling grains allows a most interesting use of fine screens as concentrators. The Richards pulsator classifier makes it possible to select a screen of such opening that the mineral particle will fall through the screen, thus making a concentrate, while the larger gangue particle passes off as tailings. Sometimes a middling product is produced from Richards classifier pulps which carries large mineral particles and small gangue particles. In this case the screen may be selected to deliver the mineral as an oversize, while the gangue particle being smaller, drops through the screen. Both the results mentioned have been accomplished in actual milling operations.

Heretofore it has been considered that concentrating tables should not treat pulps coarser than 1 mm. or about 12-mesh No. 19 wire. In one instance a copper-ore pulp as coarse as 2.5 mm. was successfully treated on a concentrating table, with greatly increased capacity and improvement in quality of work as compared with former methods. It is not advisable, however, to treat a pulp as coarse as this on shaking tables, on account of the increased wear of the table surface.

The maximum capacity of the 4-in., six-compartment Richards classifier when treating thickened pulps is, from present knowledge, 180 tons per 24 hours for copper ores and 200 tons per 24 hours for lead ores. The fresh water required is from 1000 to 1200 gal. per ton of ore treated. With a regular rate of feed the adjustments are very seldom changed and the classifier requires no more attention than may be given in the regular rounds of the millman.

Keeping Engine-room Reports Clean

In engine-rooms it is difficult to keep the reports of the daily run clean unless some provision is made to protect the report from becoming smeared with dirt and oil, and so rendered unfit for filing. The desk described by C. L. Greer shown in the accompanying illustrations, taken from *Power*, Nov., 1908, is a handy means of protecting such entry sheets. It consists



DETAILS OF DESK FOR KEEPING REPORT SHEETS CLEAN

of a roller, *A*, large enough to carry the report sheet and an ordinary desk, the top of which is hinged at *D* and which has a slot in the top under which the roller with the report is placed in slotted bearings in the side of the desk. The slot is made narrow so that the top of the desk prevents the hand from touching the paper. The space below the roller can be used for extra report sheets and charts.

The present weight of the Philippine silver peso is 308.64 grains, 800 fine. The minor silver coins—50, 20 and 10 centavos are respectively one-half, one-fifth and one-tenth the weight of the peso, but are 750 fine. The peso first authorized was 416 grains, 900 fine, but it was found that these coins were exported to China for their silver value. To retain the coins in the Philippines it was necessary to reduce their bullion value The peso contains 246.9 grains fine silver, or about two-thirds as much as the United States silver dollar.

Ontario Mines and Iron Deposits

SPECIAL CORRESPONDENCE

The latest report* issued by the Ontario Bureau of Mines opens with a comprehensive statistical review of the mining and metallurgical industries of Ontario in 1907, the details of which have already been given. The revised figures, however, show some changes, principally under the head of nonmetallic products, bringing the aggregate value of the year's output up to $25,019,373 in place of $24,697,775, as previously stated. This, as compared with $22,388,383, the total for 1906, shows an increase of 12 per cent. In accordance with the practice recently adopted, to admit of a fair comparison between the mineral production of Ontario and that of other provinces where a different method of computing values has been used, the report contains another table showing the production on the basis of the value of the refined metals—the first figures presented being the values at the mines or as smelter products. By this method of computation the "refined value" of the metallic products is given at $28,213,934, which with the nonmetallic values —$10,468,538—makes a total of $38,682,472 for the year.

ONTARIO MINE OPERATIONS

E. T. Corkill, provincial mine inspector, furnishes a report on the mines of Ontario, with detailed descriptions of the operations and condition of the principal gold, iron, copper-nickel and other mines; the mines of the Cobalt district being dealt with in another publication. Arthur L. Parsons treats of the geology of the portion of Thunder Bay district adjacent to the Algoma boundary, his contribution being of scientific rather than practical interest.

THE NIPIGON IRON RANGES

The iron ranges east of lake Nipigon are described in two reports, one by Prof. A. P. Coleman assisted by E. S. Moore, and the other by E. S. Moore. The first deals with the ranges in the Poplar Lodge and lake Wendigokan districts. Practically all the iron formation extending from Poplar Lodge, on the shore of lake Nipigon to lake Wawang, 21 miles inland, has been taken up in claims with the exception of a few breaks and a band of diabase which cuts across the range about 7 miles from lake Nipigon. The earlier found of the iron range outcrops were along the shores of lake Nipigon, where a northern, a southern and a central range were located. The Northern range has a length of about a 1¼ miles running northeastward. It reaches in one place a width of 240 ft. but is seldom more than 50 ft. wide. Both magnetite and hematite occur but the range is too narrow and lean from the admixture of silica and slate to be very promising. The Central range lies 3 miles south of the Northern, and is first seen 1½ miles inland from Poplar Lodge. That part of the region is mostly covered with sand plains and swamp, so that the solid rock does not crop out frequently rendering it difficult to prospect without doing much stripping. A good deal of work has been done in this way, and three diamond-drill holes put down, but undoubtedly much of the range remains covered. The range has a length of nearly 3 miles with a breadth of about ¾ mile in the widest part. There are four known outcrops, one of which has been thoroughly prospected showing a widespread series of bands of iron foundation over a length of ½ mile and a breadth of ¼ mile. The ore is entirely hematite and the associated silica is jasper, often bright red. The Southern range has a length of 7 miles, including interruptions of drift and barren rock, and its greatest width is 500 ft. though generally not more than one-tenth as wide. It is separated from the nearest point of the Central range by ¾ mile of greenstone and schist. This range contains much magnetite and resembles the Northern range, though more extensive and richer in iron. For some miles eastward of the diabase hills which separate these ranges from those farther inland, it is no longer possible to distinguish three ranges. The more important outcrops occur west of lake Wendigokan, and southeast of it near Still lake. In the western area the iron formation is wide and consists of banded jasper and gray slate, but there is much schist in portions of the range. The length exposed is about ½ mile. The Still Lake area is a little shorter, but has a width of 450 ft. in the middle, part of it, however, being hidden by drift. The iron range is here very silicious, the last assays of samples running from 35.75 to 36.86 per cent. of iron. Farther to the east are two narrow parallel bands of the iron formation, the longer of which runs from the northeast end of Watson lake for nearly 2 miles with a maximum width of about 100 ft. The iron-bearing rock consists of magnetite and jasper with green slaty schist on each side. The richest specimen of magnetite collected from it runs 48.9 per cent. iron. The general character of these outcrops resembles those of the Northern and Southern ranges near Poplar Lodge, always containing more or less magnetite, yet with some hematite and jasper. The materials of the iron formation in the Nipigon region are always silica in some form, and an oxide of iron, magnetite or hematite, never siderite nor sulphides as in the Michipicoten region. There are two types of the formation, one consisting of interbanded quartzite or cherty silica with magnetite, the other of jasper with hematite, but there are mixtures of the two in many places.

THE ONAMAN IRON RANGES

E. S. Moore's report deals with the Onaman iron ranges, occurring in the vicinity of the Hight of Land east of lake Nipigon near the headwaters of Johnson creek and Red Paint river. Little was known concerning the geology of this region until survey parties for the Transcontinental railway began work through northern Ontario, and a number of prospectors entered the field. During 1906 a considerable iron range was located for R. H. Flaherty, whose success attracted others, most of whom were unsuccessful. There are two distinct iron ranges and some scattered outcrops of the iron formation in this region. One of these ranges extends from the twelfth portage on the Red Paint river eastward across the Hight of Land and down Johnson creek for a distance of about 6 miles. The range is not represented by continuous outcrops, and the strike of the formation in different places varies on account of irregularities in the folding of the sedimentary rocks, caused by the massive igneous rocks associated with them. Since the iron formation lacks the great troughs formed by folding of thick strata of sedimentary rocks, it will probably prove shallower here than in other regions where schistose and sedimentary rocks are abundant. There seems to be one syncline extending along the north side of the range on the Miller claims. If any ore is found in this range it may be looked for in this syncline and a short distance north of the southern edge of the range.

The other range occurs between 2 and 3 miles south of the first, running nearly parallel to it. It has not been traced to its limits, but it is exposed for 2 miles and then runs into a swamp, where its extension can be followed by means of the dip needle. The rocks and iron-bearing minerals of the formation in these ranges are slate, green schists, jaspilyte, specular hematite, magnetite and silica. The report gives an account of some of the development work done on the ranges and isolated outcrops, but so far the discoveries appear to have been of slight commercial value. On the Bain claims, about three miles south of the Hight of Land portage, stripping and trenching have disclosed a formation having magnetite and specular hematite contents, which in some cases form a sufficient percentage to make low-grade ore.

THE IRON AND STEEL INDUSTRY

The concluding portion of the volume consists of a paper by George C. Mackenzie on the "Iron and Steel Industry of Ontario," giving a large amount of statistical information both as to the mining and metallurgical departments, with data as to the iron ores and producing mines, which will be found comprehensive and

*"Seventeenth Annual Report of the Ontario Bureau of Mines, 1908." By Thomas W. Gibson, Deputy Minister of Mines. Pp. 356; illustrated; 9½x6¼ in., paper. Toronto, 1908: Government Printing Office.

valuable. The problem of the magnetic concentration of iron ores is dealt with at length, and descriptions are furnished of the best known and most successful types of magnetic separators. In the course of his investigations the writer visited a number of large plants in the United States, obtaining at first hand information as to the methods of magnetic concentration in operation. In order to show that low-grade Ontario magnetites are amenable to concentration by means of the electromagnet, and with the view of ascertaining the per cent. of separation efficiency that might be expected in actual commercial operation, samples of ore were obtained from various localities in the province and submitted to preliminary testing in the mining laboratory of the Kingston School of Mines. The tests do not appear to have been conclusive, some of the ores requiring finer grinding than that to which they were subjected, but the results pointed to the conclusion that the concentrates obtained from the ores experimented with would require either nodulizing or briquetting before they could be used for smelting purposes. An elaborate description of the iron and steel plants of Ontario and the various processes in vogue is given.

The Rare Metals X—Zirconium

By Charles Baskerville*

Zirconium is allied to titanium and is rather widely diffused in igneous rocks. Zirconium compounds are almost always present in nepheline syenites.

ZIRCONIUM MINERALS.

	Zirconia Content.
Zircon, zirconium silicate	61-67%
1. Compound zircons:	
(a) Eudialyte, a complex zirconium silicate	11-17%
(b) Eucolite, a complex zirconium silicate	12-16%
(c) Polymignite, a niobate and zirconate of cerium, etc	30%
2. Gem varieties:	
(a) Azorite, zirconium silicate	64%
(b) Hyacinth, zirconium silicate	64%
(c) Zirconites, zirconium silicate	61-67%
(d) Jargons, zirconium silicate	64-66%
3. Altered zircons:	
(a) Cyrtolite, containing yttrium earths, etc	41-67%
(b) Anderbergite, related to cyrtolite	41-42%
(c) Malacone containing various metallic oxides	60-63%
(d) Tachyaphaltite, containing rare earths	40%
(e) Oerstedite, containing titania, etc	69%
(f) Auerbachite, almost pure silicate	55%
(g) Alvite, containing large amounts of yttria	4%
Rosenbuschite, a complex silicate	20%
Lavenite, a silico-zirconate of iron, manganese, etc	29-32%
Hainite, a silicate of zirconium, titanium, sodium, etc	
Wöhlerite, a silico-zirconate of calcium and sodium	16-23%
Hiortdahlite, a silico-zirconate containing fluorine	22%
Catapleiite, a hydrous silico-zirconate of calcium, etc	30-40%
Elpidite, a hydrous sodium zirconium silicate	20%

*Professor of chemistry, College of the City of New York.

Arrhenite, a heterogeneous decomposition-product	3- 4%
Sipylite, a niobate of erbium, cerium metals, etc	2- 3%
Zirkelite, a complex zirconate	53%
Baddeleyite, zircon dioxide	96-97%
Tritomite, a fluo-silicate of thorium, cerium, etc	1- 2%
Erdmannite, a mixture of homilite and another mineral	0- 5%
Cerhomilite, an altered homilite	2- 4%

Zirconia is extracted from zircon, which is mined in large quantities for technical purposes in North Carolina, especially near Green river, Henderson county. Cyrtolite is abundant in Baringer Hill, Llano county, Texas, and the deposits await development.

Zirconia possesses great radiating power and is very refractory. Cylinders of zirconia have been used in the Drummond light instead of lime and magnesia cylinders, and zirconia is in demand for producing refractory compounds suitable for incandescent illumination. With thorium and yttrium, zirconium enters into the manufacture of Nernst lamps, and filaments of zirconium are used in "Zirconium lamps." Zirconia yields with alizarin a color like one produced by chromium material. The use of zirconium nitrate as a food preservative has been patented.

Various zircons are classed among the gems; they often possess beauty and splendor. Transparent, red and brown varieties of zircon are cut and sold under the name hyacinth.

The market is well supplied with zirconium compounds at present.

Zircon

Zircon occurs in square prisms and pyramids, also in irregular forms and grains. It is found in crystalline rocks, especially granular limestone, chloritic schists, gneiss, syenite; also in granite, iron-ore beds, and alluvial deposits. It is one of the earliest minerals to crystallize from the cooling magmas, and the first one among silicates. The luster of zircon is adamantine and the color is colorless, grayish, yellowish, or brown. Its hardness is 7.5, and the specific gravity is from 4.2-4.86. It is brittle, and the streak is white. Zircon usually contains a small percentage of ferric oxide.

Before the blowpipe zircon is infusible, but the red varieties become colorless and the dark-colored varieties are rendered white; some specimens glow and increase in density on ignition. It is not acted upon by salt of phosphorus. Pulverized zircon is decomposed when fused with soda on the platinum wire, and the product gives the orange color characteristic of zirconia when tested with turmeric paper in a dilute hydrochloric acid solution. Zircon dissolves with difficulty in borax to a clear glass. It is insoluble in acids.

As mentioned above, zircons are especially abundant in Henderson county, N. C. Other specimen localities are: Maine, Vermont, Connecticut, New York, New Jersey, Pennsylvania, Colorado and California. Eudialyte and eucolite occur in Arkansas.

Baddeleyite

Baddeleyite is found associated with magnetite, apatite, perovskite, ilmenite, microlite, and zircon in Ceylon and Brazil. It is of variable color, being from colorless to yellow, brown, and finally black, and has a vitreous luster. Its hardness is 6.5, and the specific gravity is 5.5-6.02. The streak is brownish white, sometimes white.

Baddeleyite is infusible, but glows brightly. It reacts faintly for iron with borax. It is insoluble in acids, and is only slightly decomposed by sulphuric acid in the powdered form. It is decomposed by fusion with acid potassium sulphate.

Eudialyte

Eudialyte occurs in tabular and prismatic crystals, also massive and sometimes reniform. Its luster is vitreous, and the color is rose-red, bluish red, brownish red, or chestnut-brown. It is brittle, and the streak is uncolored. The hardness is 5-5.5, and the specific gravity is 2.92.

Eudialyte yields a little water in the matrass. Before the blowpipe it fuses to a greenish gray bead, and gives an intense yellow flame. It is dissolved by borax to a clear glass which shows a little iron. It is easily decomposed by salt of phosphorus; and when oxide of copper is added a chloride of copper flame results. With hydrochloric acid it gelatinizes, and the dilute acid solution imparts a deep orange color to turmeric paper even after the iron in solution has been reduced to colorless chloride by boiling with metallic tin.

Indian Gold Mines

The mines of the Kolar goldfield in Mysore produced 45,314 oz. bullion in January, showing a decrease of 5360 oz. from December, but a gain of 1411 oz. over January, 1907. The bullion reported this year was equal to $842,985, or 40,783 oz. fine gold.

The production of two mines outside the Kolar field—Hutti Nizam's in the Deccan and Dharwar Reefs—was 1717 oz. gold in January, which compares with 1735 oz. in December. The output of these mines for the year 1908 was 21,215 oz. gold against 17,406 oz. in the preceding year.

Safety-catch devices that depend upon their action on the guides for gradually stopping the cage, according to *South African Min. Journ.*, Jan. 16, 1908, have been proved by experiment to be failures because of variations in dimensions of the guides, difference of condition of the timber in the guides, and the loss of equilibrium caused by inequality of brake action on the guides due to these causes.

Ways of Improving Piston and Hammer Drills

Efficiency in Piston Drills Can Be Increased by Using Heavier Steel, a Shorter and Quicker Stroke, Better Lubrication and Improved Chucks

BY EUSTACE M. WESTON*

This paper contains several extracts from my reply to the discussion on my paper "Notes on Small Stope Drills" read before the Chemical, Metallurgical and Mining Society of South Africa, but I have added some new matter and, through the courtesy of Mr. Mauss, its inventor, a description of the Konomax automatic piston drill. In my paper I raised the query as to what in machine drilling is the best ratio of foot-pounds of energy to an inch width of the cutting bit. The South African mines stope-drill contest, an account of which has already appeared in this JOURNAL, seems to show that in piston machines this ratio may be with advantage a very high one, the limit being reached only when the drill bends and breaks. But with hammer drills this limit is reached much earlier owing to the breakage of bits, pistons, anvil blocks and shanks of the drill steel. The Chersen machine with piston having a diameter of 2¾ in. and a 6-in. stroke exceeded this limit for ⅞-in. steel even when the air pressure was only 50 lb. per sq.in., and bent drill steel and broken bits resulted.

TABLE I. RESULTS OF SOUTH AFRICAN MINES STOPE-DRILL CONTEST.

Name of Machine.	Type.	Size of Starter Bit. Inches.	Cubic Inches Rock Per 1 In. Drilled.	Rate of Boring Inches Per Minute.	Size of Finisher Bit. Inches.	Cubic Inches Rock Per 1 In. Drilled.	Rate of Boring Inches Per Minute.	Percentage Decrease of Rock in Smaller Hole Compared with Larger.	Increase Per Cent. of Speed in Smaller Hole as Compared with Larger.
Kimber	Hammer	1⅞	2 76	1 13	1¼	1 22	2 01	55 8	77 8
Little Wonder.	2-in. piston	1¾	2.40	0 80	1¼	0 99	1.30	58 7	62 5
Gordon	Hammer	1½	1 76	1 61	1⅛	0.99	1 89	43.7	16 7
Kid	2-in. piston	1½	1 76	1 23	1⅛	0.99	1 71	43.7	47 2
Ingersoll	2¼-in. piston	1½	1 76	1.73	1¼	0.99	3 30	43.7	90 7
Flottman	Hammer	1½	1.76	0 97	1⅛	0 99	1 73	43.7	78.3
Holman	2-in. piston	1¾	2 40	1 45	1⅜	0.99	2 29	58.7	58.0
Chersen	2¾-in. piston	1½	1 76	1.60	1⅜	0 99	3.63	43.7	127.0

Effect of Size of Bit on Drilling Speed

Nothing is more striking than the great increase in drilling speed corresponding to a reduction in the diameter of the cutting edge. With piston of the same size while using the same air pressure, the speed of drilling bears a fairly definite ratio to the size of bit used, the area of hole excavated, and the amount of rock broken. This is shown by comparing the speed attained by competing machines on the water holes when boring with starters and with finishing bit. Table I accompanying this article shows a remarkable rate of increase in drilling speed corresponding to the reduction of the diameter of the hole drilled, and it will be seen that the most powerful machines benefit most. By looking at Tables I and II it will be seen that most of the value of the results of this test as published was lost for comparing the boring speeds of hammer and piston drills owing to a misunderstanding of some sort as to the sizes of bits to be used and the distance to be bored by each bit. Table II shows this clearly, when a comparison is made of the first six completed wet holes bored in this test. It will be seen at once that the Kimber hammer drill and the Little Wonder and the Holman piston drills, all having a piston diameter of 2 in. and a 5- and 6-in. stroke, respectively, were hopelessly handicapped from the start by the mistake made in selecting wrong sizes of bits, for the Kimber machine had to excavate 67 per cent. more ground than the Gordon drill. The Little Wonder drill, whose performance in the test disappointed its agents, had to excavate 17.6 cu.in. more rock to gain only 3.7 in. extra depth of hole, and the Little Holman drill had to excavate 24 cu.in. more for a hole only 3 in. longer. The Gordon hammer drill put in holes 40.7 in. deep with only 52 cu.in. excavated. Of this 40.7 in. only 6 in. was bored with the starter, 8.8 in. with the second, 10.5 in. with the third, and 15.35 in. with the 1⅛-in. finishing bit. In actual underground work the steel used would be somewhat bigger.

TABLE II. RESULTS OF SOUTH AFRICAN MINES STOPE-DRILL CONTEST. WET HOLES.

Name of Drill.	Boring Rate on all Completed Wet Holes Average Inches Per Minute.		Average Depth Hole in Inches.	Amount of Cubic Inches Rock Excavated, Average Per Hole, no Allowance for Wear of Bits.	Percentage Depth Hole Bored with Bits 1¼ In. and Over.	Inches Depth Bored with 1¼-In. Bit and Over.	Percentage of Rock Excavated with 1¼-In. Bit.	Sizes of Bits Used in Inches.
	50 Lb. Per Sq.In.	60 Lb. Per Sq.In.						
Kimber	0.89	1 46	40 83	86 778	100	40.83	nil	1⅞, 1¾, 1⅜, 1⅛, 1⅜, 1¼
Little Wonder	1.25	1 43	44.39	63 606	78.2	34.69	13.7	1¾, 1⅜, 1¼, 1⅛
Gordon	1 57	1 89	40 77	52.023	62.45	25.41	29 3	1¾, 1⅜, 1¼, 1⅛
Kid	1 21	1 89	41 52	57.636	73.65	30.59	20.5	1¾, 1⅜, 1¼, 1⅛
Ingersoll	2.08	2.57	42.60	57.325	69.10	29 44	22.6	1¾, 1⅜, 1¼, 1⅛
Flottman	1 70	1 90						
Chersen	2 35	2 94	42 96	58 275	58.275	32 83	17 6	1¼, 1⅜, 1¼, 1⅛
Holman	1.23	1.52	43.50	76.289	76 650	32.17	16.25	1¾, 1⅜, 1¼, 1⅛

I thought before the test that, owing to the use of an arm, bar and clamp being necessary, the difference in the ratios of actual boring time to total working time for hammer and piston drills would not be so marked on these fields as in America. On the surface in these trials, the highest average for a hammer drill was about 86 per cent. of the actual time and for the piston drill about 79 per cent. In narrow underground stopes the difference would be greater in actual practice, but chucks of piston drills have been so much improved lately that drills are changed almost as rapidly as with hammer drills.

*Brakpan, South Africa.

Comparative Merits of Hammer and Piston Drills

I must again, in the light of the results of this competition and other later evidence, review the comparative merits of hammer and piston drills for work in hard rock under the conditions existing on the Witwatersrand. Generally these trials are held to have shown that the hammer drill is a more efficient machine than the piston drill; in other words a larger percentage of the total kinetic energy of the blow is spent in the useful work of cutting rock. This may be true, but in a hammer drill quite a large percentage of the total kinetic energy of the blow is spent in heating the steel and in overcoming the elasticity and inertia of the drill steel and of the striking pin or anvil block. The longer the steel, the greater is this loss, though in a piston drill it is not noticed so much as it otherwise would be since on the longer drill steel the cutting edges are narrower and so have less work to do in excavating the hole. That this loss is serious is well shown in Table I.

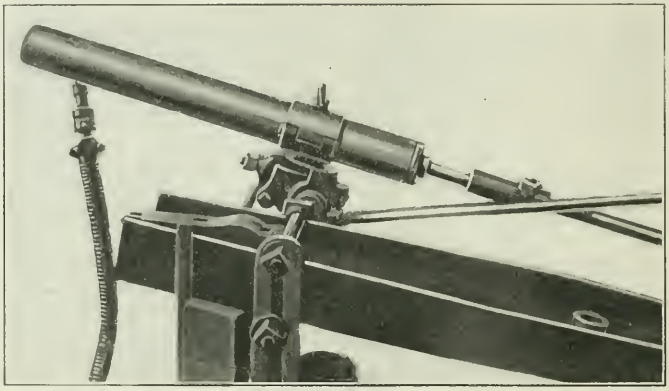
It will be noted that the increase of drilling speed of the Gordon drill with 1⅛-in. bits is not nearly as marked as with the piston drills owing to this loss being greater with long steel. This increase amounts to only 16.7 per cent. in the Gordon drill against 90.7 per cent. with the 2¼-in. Ingersoll. What the actual amount of these losses is with hammer and with piston drills is hard to determine experimentally. Gillette states that in driving piles 60 per cent. of the energy of the blow of the falling hammer is lost.

Losses of Power in Piston Drills

The losses of power are many in piston drills. There is friction in the machine itself, due to bad fit, poor lubrication, tappets, auxiliary valves and piston rings as well as slackness and leakage owing to wear. There is the friction of the drill-steel during its stroke on the sides of the hole which prevents rapid reciprocation and causes a portion of the force of the blow to be uselessly expended against the side of the hole. This wears away the wings of the drill bit and causes more loss by these vibrations' increasing the vibration of the mounting, that was originally caused by a variation between the axis of the drill bit and the true axis of the machine. This vibration causes a bit on starting a hole to strike every time in a different place, thus throwing bending stresses upon everything and causing more rock to be cut than is necessary. This tends to cause rifled holes and increases the losses in friction. The chief causes of friction losses are bad design and undue wear of the chuck, chuck bushings and guides. Speaking from experience in Australia and on the Rand these losses are appalling; machines are allowed to remain below month after month until, many times, a starter placed in the chuck and tightened up tends to describe a circle having a diameter ½ in. or more larger than that of the bit. This is no exaggeration. A rigid inspection of all chuck bushings should take place every fortnight, and a starter should be tested for its eccentricity in all machines when tightened up.

Another cause of rubbing against the sides of the hole is unequal length of the wings of the cutting edge. Machine sharpening and the introduction, if practicable, of detachable bits tend to remedy this. The accompanying illustrations, taken from a paper by Mr. Mills in the *Journal* of the Mechanical Association of the Witwatersrand, show these conditions well. There is also loss due to lack of rigidity of the striking tool in the shaft and shank, as shown by Mr. Anderson's experiments which will be referred to later. Loss of power is also due to pulverizing rock already broken from the bottom of the hole and to churning up mud or dry cuttings in a hole. Working too long with blunted tools is another cause of loss for it causes the rock to be crushed rather than to be chipped from the bottom of the hole. The amount of this loss has to be balanced against the time lost in changing steel more frequently, and the cost of providing and sharpening extra steel. The amount of these losses in a piston drill is great, and it is said that a piston drill indicating 5 h.p. in cylinder uses only 1½ h.p. in useful work cutting the rock.

Difficulties in using air expansively are not so great in hammer drills, as in piston drills, and indeed in many of the valveless drills expanding air causes the forward stroke, but it was not until recently that a piston machine had succeeded in combining the necessary drilling speed and power to reverse the stroke with the use of air expansively. That is another loss of power, as is the fact that the length of stroke in the piston drill is controlled by the operator.



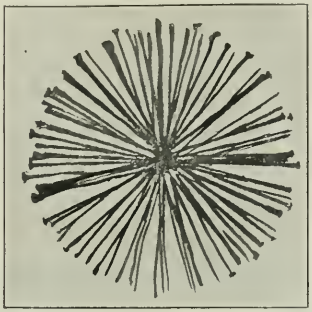
KONOMAX AUTOMATIC PISTON DRILL

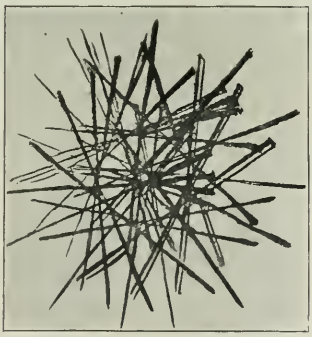
Loss of Power in Hammer Drills

Now the hammer drill as exemplified in the best types has not so many possible sources of lost power. Besides the loss of power due to the fact that greater expansion of the air is not effected, more power is required to produce rotation in a hammer than a piston drill, as the bit is pressed against the bottom of drill hole all the time. In most hammer drills there is not much room for improvement in theoretical efficiency, for the rock cuttings are ejected either by air, or by air and water, as soon as detached so that the bit meets solid rock every blow. Drills can be changed oftener with less loss of time and thus during drilling the bits are on the average sharper. The bit is kept cool. Friction on the sides is reduced as the bit is not withdrawn at each blow struck. In addition, there appears to be a better chance of applying the more efficient and economical force of electricity in the hammer than in the piston type of drill; indeed, the Box drill has been devised on this principle. Various practical difficulties, however, have so far retarded the successful development of electric drills.

I have now reviewed the chief losses of power in piston and hammer drills, but before inquiring how the work of the piston drill can be improved I must refer to the hammer drill as a practical economic machine for use in hard ground. The hammer drill is evidently a success in certain mining districts in North America, but so far as I know, the large size has not been able to gain and keep a place in competition with piston machines in the hard-ore mines of Australia, Rhodesia and the Transvaal. Improved types are, of course, always coming out, and I do not wish for a moment to state that it cannot compete successfully. But I have with me

letters from mine superintendents in Victoria, Australia, and others in Rhodesia, and all tell a story of failure. In the 1903 trials held in Johannesburg, the Leyner drill failed to cut hard granite with the same relative air consumption as the best piston drills. When I last made inquiries it was in use in only two mines on the Transvaal and that in a small way. The trouble has been said to be that on the Rand the air pressures in use were not high enough for the attainment of maximum efficiency. Yet even with the low air pressure there has been much breakage of chucks and other parts, resulting in much lost time and increased cost of maintenance.





PHOTOGRAPHS OF BOTTOMS OF DRILL HOLES; 1, WINGS OF BIT OF UNEQUAL LENGTH; 2, DRILL STEEL, SLIGHTLY BENT; 3 AND 4, DRILL STEEL BADLY BENT

Nor has our experience with small hammer drills on the Rand to date been a satisfactory one. There is no field for its use "Cripple Creek style" with solid steel and vertical or nearly vertical up holes. Here it must have a water or an air-and-water feed. The Leyner small drill (Rock Terrier) came and has apparently gone again. The No. 3 Murphy drill with water feed a year ago was going to solve our problem, but I cannot find any number in use anywhere here; so with the Hardsocg Wonder and others. The Gordon drill was tried, condemned and then improved with parts made by perhaps the foremost engineering firm in its line in the world, and then brought back. It performed well in the recent trials, showing a good boring speed and was introduced to Rand rock and Rand mining conditions after the trials. The results so far have been disappointing so that at the present time the Gordon drill is used in very few, if any, mines on the Rand. As far as I can learn the troubles have arisen partly from drills' breaking and sticking in the holes and from unfinished holes, but mainly, however, from valve troubles, such as sticking, wearing and breaking of the valves, and from the breaking of striking pins, anvil blocks and even the pistons under the blows delivered with high velocity necessitated by the long stroke. Trouble regarding the supplying of water to the drill has not been wanting; not only because the mines could not always supply water free from grit and at just the right pressure, for excessive pressures cause leakage, but also because the water in the mine is acid and it always manages somehow to get into the machine with which it is used. The results of corrosion are most surprising even after a relatively short time. Then there was the added expense of hollow steel and of water pipes and water hose which are a nuisance in stopes, and of the water itself which, when many machines are used, becomes in time a considerable item. The drill appears as simple as it is possible to make it; but I believe strenuous efforts are being made to improve the drill and eliminate the weak points. Personally I think that it was a mistake to use a light piston hammer, weighing 1¼ lb., and working under a high velocity due to a long stroke (8 to 10 in.), which delivers its blow on a tappet or anvil block having a diameter of only 1 3/16 in. Indeed, one leading engineer on the Rand has figured that the force of this blow is more than any steel can bear. A shorter stroke and heavier hammer is, I believe, mechanically and theoretically a better arrangement, but the other arrangement had to be adopted to give the drill the shape and form it has.

Ways of Improving Piston Drills

Here on the Rand we are turning to our old friend the piston drill, and are asking where it can be improved and what can be done to increase its efficiency and reduce the losses mentioned. Friction in the machine itself can be reduced by improved design and by introducing some scheme for automatic or more continuous lubrication. This can be done. It is being tried in America by the Western Lubricating Valve Company, while here on the Rand one machine has an attachment which uses a semi-solid lubricant, and in the machine described later there is a special oil chamber. The Ingersoll ball-valve attachment makes lubrication when set up for running easier; but the kind of "miners" that are often intrusted with the running of machines on the Rand is shown by the remark: "I want an Ingersoll, as you can give it one dose of oil and it will run for the rest of the shift while the other must be oiled often," made by a former employee of the company for whom I am working when he refused to work with any other make of machine than an Ingersoll. This is no doubt a compliment to the Ingersoll, but the remark serves more to show the conditions under which too often rock drills have to work.

In machine drilling loss by vibration of the mounting must always exist, but it can, I think, be reduced by shortening the stroke and by increasing the number of blows per minute, and also by increasing the rigidity of the boring tool. This last can be effected by increasing the diameter of shanks employed by making all shanks up to 1¼-in. diameter; by doing this, it is said that a gain in boring amounting to 20 per cent., as compared with ordinary steel, can be attained. Using a very solid turned-steel shank and shaft and a mathematically true detachable bit of his own invention, Mr. Anderson obtained results better than this. He claims to have increased the boring speed at the property of the May Consolidated Gold Mining Company from 6 holes to 12

holes per day, and, Mr. Cameron, an American engineer, has, I believe, given an order to equip the whole mine with this device. Whether it will in practice prove suitable and manage to avoid the fate of other detachable bits does not concern us at present.

The chief loss of efficiency on the Rand is in boring up holes at a flat angle in drives. Owing to the accumulation of broken particles in the hole the bits have to do the work twice over. The advertising columns of the JOURNAL show that an attempt on very sound lines has been made to increase the efficiency in this respect by means of lugs on solid steel. Hollow steel, as used in the Climax Little Wonder drill, with live air passing down it also bores such holes more rapidly, and again attempts are being made to pass water or water mixed with air down hollow steel in piston drills. The fact that the United States of America Patent Office has granted patents for such devices goes to show that there are no legal difficulties in the way. The Konomax drill, described in my paper in the JOURNAL, May 23, 1908, p. 1045, shows that it is possible to reduce the air consumption of piston drills at least 20 per cent., thus bringing them on a level with the claims made in regard to large hammer drills. The use of higher air pressures will also, on this field, enable a smaller machine to do the work at present done by larger sizes, and if any assistance can be given to the ejection of broken rock particles, the machine can be lightened by working on a shorter stroke.

THE KONOMAX AUTOMATIC, PISTON DRILL

The inventor of the Konomax drill has been working along these lines in endeavoring to design a successful light drill for stoping on these fields. An accompanying illustration shows the general appearance of this drill. The sectional drawing is intended only to show the general idea and is not correct as to detail. It will be noted that the general appearance is similar to that of the Gordon hammer drill; it weighs about 85 lb. The machine is a piston drill, having a 2-in. piston and uses a short stroke, only 4 in. long. It will be noted that the inventor has evidently adopted views similar to those laid down in a former article of mine. This drill works on the Konomax principle, for air at constant pressure acts on the back of the piston producing the forward stroke, while the back stroke is produced by air acting on a portion of the piston of double the area, the air being cut off at half stroke and then used expansively, thus reducing the air consumption.

A former type of this machine had a valve working in the piston and an exhaust along a hollow tail rod at the rear. This was subject to some disadvantages. Exhaust now takes place through the hollow piston rod to the chuck, and, if required, along hollow steel. The exhaust ports in this machine are longer than in the large drill, and there would be danger of their "freezing up," were it not that the jar of the blow detaches any ice and keeps the ports open. It will be seen that the outer case of the drill is a pipe held in a band clamp. This drill case can be easily moved forward or backward in this clamp so as to get the right distance from the rock face or to use a drill for a longer period than the forward feed of 12 in. allows. This pipe has an oil nut leading to an oil chamber at the back end. This oil chamber is fitted with an automatic appliance for feeding the oil. At the side near the rear end is a two-way cock for admission and exhaust of air. At the front end, the end of the cylinder proper projects, as shown in an accompanying illustration. The spring valve regulating the exhaust of water is also plainly seen. The chuck is a simple one, having a solid bushing and bolt with an ordinary key or pad for tightening the drill. The diameter of all shanks, even with 7/8-in. steel, is 1 in. This, as before stated, has a most important effect.

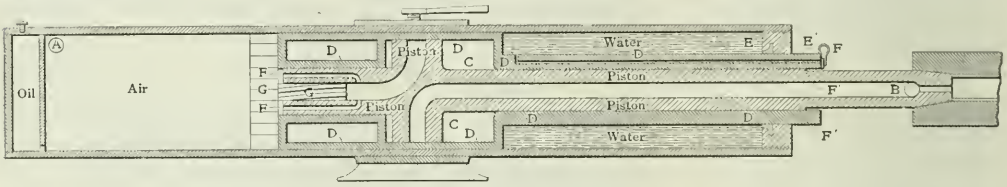
The cylinder itself, which is made of phosphor bronze, is of the shape shown, but no packing rings are shown. Water is admitted at the front of the cylinder under slight pressure until the cylinder is driven right into its cover, as shown in an accompanying illustration. Then the admission cock for water is turned off. When air is turned on the water under pressure tries to pass along passage E' and escape past the spring valve at F. This spring device is not final, and probably a small piston under air pressure will be found better than the spring.

This machine is valveless, but probably works, as is shown, by an arrangement of holes in the piston and some grooves or ports in the cylinder walls. On the piston is a circular projection F', which, when the designed stroke is exceeded, engages the end of the valve F and allows water to escape feeding the cylinder forward as the drill cuts the rock. The drill is thus automatic in its forward feed and one man could change steels in two machines easily. Unless all the water is out the machine cannot possibly hammer the front head.

While I was watching this machine at work it bored suddenly through the block, and the water buffer gave ample time to turn off the air before any damage was done. Part of the exhaust passes up the hollow steel; there is also an arrangement, which is not shown, whereby water can be mixed with the air if desired, or water alone can be injected in the type having a rear exhaust. While I was watching it, the machine bored more than 3 ft. in granite in less than half an hour, and it is said that this machine has drilled 18 in. in this hard granite in six minutes, using only one drill steel. It is reckoned that eight holes, 3 to 4 ft. deep, can be bored in one shift in Rand banket and quartzite. The drill appears most simple on account of its valveless action. This is much easier arranged in this type of drill than in others, since admission and exhaust of air occur on one side only of the piston, and only once a stroke; consequently piston and cylinder wear will not affect the regulation of the action as much as in some other designs.

The only apparently weak point I noted was the water-escape valve F; but a better one could be devised. Gritty water might choke the passage E', and there must be a supply of water from mains or a pressure tank to work the drill. The drill should be cheaply made as it has very few parts, and I think deserves the remarks I made in my paper that it is most ingenious and simple. One of the defects of the Gordon drill was that it was too foolproof, and it was impossible to effect even simple repairs to it without the aid of a fitter and his tools.

In this machine the ratchet box is certainly inaccessible, but well designed rotation devices now give little trouble; all the holes I inspected were of good shape, showing no signs of rifling. What the results will be when the machine is used in actual work underground remains to be seen, but the machine surely looks promising.



KONOMAX AUTOMATIC PISTON DRILL

A New Plan of University Development

Details of Scheme for Amelioration of Social Conditions at Columbia Submitted to the Applied Science Alumni and Graduates in Architecture

BY JAMES F. KEMP*

The alumni of the School of Mines of Columbia University and of the allied Schools of Engineering and Architecture held a joint dinner at the Hotel Astor, Feb. 17. Between 200 and 300 graduates were present, and addresses were made by Professors Van Amringe, Chandler, Munroe, Hutton, Hamlin and Kemp, and by Dean Goetze, and John B. Pine, of the board of trustees. The contribution of Professor Kemp touches upon some hitherto neglected phases of the university problem and as it may involve points not without interest to the many graduates of our other technical schools and universities, the paper is placed before the readers of the JOURNAL.

A PLAN FOR IMPROVING CONDITIONS IN COLUMBIA UNIVERSITY

For a long time past I have been impressed with some anomalous features in the social life of Columbia University, and after serious meditation upon the subject, I have concluded to maintain silence no longer, but to submit to the Applied Science alumni and especially to the graduates in architecture a plan for improvement. We are very much in the position of the shoemaker's children who go unshod—or, expressed in another way, we are confronted with abundant charity and yet none of it beginning at home—or in still different form, we have a dozen or so of preachers and no one of them practicing his doctrines in his own parish. Thus, year after year our professor of sociology discusses the amelioration of conditions downtown, or in the crowded quarters of London or in Mostar, Herzegovina, but whoever heard him refer to the Columbia faculty and its present disadvantages.

We have, again, several professors of economics and political science, all of whom and with some repetition among themselves discuss at great length tariff and free trade in China, Thibet and German New Guinea, but who never utter a syllable about the principle of protection as applied to their fellow members in the teaching staff. Therefore, as we all know the severity of conditions involving food, lodging, clubs and amusements in this city, I have addressed myself to the problem, and I now have the honor to present to this august and influential body the aforesaid plan for betterment.

In order to improve the conditions of living I have passed in review all sorts of schemes. We might consider, for example, transplanting the teaching staff in a body to the hights of the palisades in New Jersey, just across the river, and starting a colony in the woods of the neighboring State. One or two of our courageous pioneers have already gone thither and the movement might appeal to our manliness in that it resembles the work of forefathers who cleared the wilderness. But it has the disadvantage of taking some people to the frontier who are not accustomed to its methods of life. What success, for instance, could my colleague the professor of dramatic literature expect to have, if he were forced to wield a real ax instead of a figurative one? And how could our grubbers after Greek and Latin roots make headway with those of an oak tree? Worst of all, how could we still maintain existence, even though our physical health were greatly improved if we were cut off from the life of the metropolis by the waters of the Hudson and nobody knows how many feet of silt and gravel on its bottom? When we turn to the hills of Westchester the same objections arise, or if we look toward Brooklyn—but of course Brooklyn would not answer.

Therefore Manhattan island alone remains, and on Manhattan the only available site is the southwest corner of the university grounds. Therefore, secondly, I propose the erection upon this site of a 45-story apartment house to be called the Cosmos. With the actual details of size I will not trouble you beyond saying that it should be 150 ft. (46.15 m.) square, and should have a well or hollow space in the center 50 ft. (15.3 m.) square, leaving thus a hollow rectangle 50 ft. (15.3) wide all around. The ceilings should be 10 ft. (3.07 m.) from the floors, and this hight with a 1-ft. (0.3 m.) thickness of floors would call for a building only 500 ft. (153.8 m.) high, a very moderate altitude as buildings now go in this city. There is an excellent rock foundation, a magnificent view, nearness to the university, subway, trolley cars, Pabst's in Harlem—in fact all the advantages one could desire. Into the Cosmos I propose that all the teaching staff of the university and the librarian and president be gathered as a part of the terms of their appointments, and that they be provided with quarters rent free, but in accordance with the following general scheme. In the scheme the reward of good service is constantly held out in the form of advancement in the social scale. This advancement, always upward, takes place with one or two exceptions in a regular and systematic way, and is suitably recognized and recorded in official titles.

At the bottom we should naturally begin with the assistants and the necessary space in the form of individual suites of two rooms each should be assigned to them. The senior assistants should have, of course, the outside rooms, and especially those in front. The newly appointed should have the darker rooms opening into the central well. This has the great advantage of making the home surroundings of these young men not too attractive. It is very bad policy to constantly tempt away from their duties those whom the weight and experience of years have not yet steadied into habits of industry. At present I have often observed that the fine views from the windows of the two dormitories, Hartley and Livingston, lead these young persons to spend too much of the day dreamily puffing a pipe and gazing off into space, without I have felt confident, having their minds fixed on eternal verities of science or mathematics, but presumably on the eternal feminine. If a young and impressionable instructor could look only into a well 500 ft. (153.8 m.) deep he would remain by preference at his desk in the laboratory or museum where anxious seekers after knowledge or fossils or minerals could find him.

OFFICIAL TITLES

The official titles of these young persons should also correspond. Thus we would have duly recorded in the catalog used in our official relations: First-Floor-Back-Entry-Assistant Rogers, Second-Floor-Front-Entry-Assistant Kirk, etc. As we rise in the scale to the tutor's and instructor's grade, on the next floors it would be necessary to have larger suites, in fact, those of sufficient extent to give each man at least one outside window. Instructors in particular should be provided with suitably commodious and extensive quarters. In official life titles similar to those just mentioned would, of course, be employed. Thus, Third-Story-One-Front-Window-Tutor Morrison; Third-Story-Two-Front-Windows-Tutor Doctor Jouet; Fourth-Story-Two-Back-Windows-Instructor Judd; Fifth-Story-Front-Bay-Window-Instructor Berkey, etc. You all see how it would naturally develop—just like the Mandarin of the yellow button, Cheng Fong Wing, or the Mandarin of the three green buttons and the yellow jacket, Ting Tang Tong. We have abundant familiar precedents.

*Professor of geology, Columbia University.

Next above would come the adjunct-professors with properly expanding accommodations. If you should hear, for example, Eighth-Floor-Front - Adjunct-Professor Campbell, you would know at once that said incumbent was in his second year as adjunct-professor and had reached the front apartments. Tenth-Floor - Front - Adjunct - Professor Mayer would imply quite long service.

Next above would come the professors again with expanding quarters and, of course, with fewer to the floor. Thus if we heard the title Sixteenth-Floor Five-Back - Windows - and - Portico - Professor Walker, we would know that Professor Walker was new at the business, but that he had one of the finest suites assignable under the rules. Twenty-Fifth-Floor-Southern-Exposure-Professor Peele would imply a moderate number of years, but of distinguished service. And so on to the top of the professors' stories.

Now all of these apartments thus far mentioned being assigned by seniority, it would be necessary when anybody was promoted, or died or resigned, to all move up one, two, or five places as the case might be. Within the grades care would be exercised to have the apartments sufficiently similar in size and arrangements to facilitate the removal of furniture, since, of course, with promotion from a lower grade to a higher every man naturally expands. Statistics show that an assistant has, as a rule, two ordinary chairs, a morris chair, three sectional bookcases, three framed photographs, and an iron bed. A tutor adds a rocking chair, two ordinary chairs and three sectional bookcases, but usually the framed photographs by some strange process are now reduced to one, and almost always the occupant of the frame is a girl. An instructor adds various articles of furniture often including a high chair; an adjunct-professor still more, while a professor has a notable quantity especially of bookcases, which he seldom, if ever, opens. By a little ingenuity a scheme could be readily devised whereby the rooms could be divided off into imaginary squares like a map in an atlas, so that a tag on a chair reading *G* 12, would enable the skilled force of janitors to put the chair away at once.

Advantages of the System

There is one additional great advantage in this progressive system of titles which makes them infinitely superior to the one now prevailing. We have, as you know, the Lieber professor of history, the Jay professor of Greek, and others of similar character. Now when in the faculty meetings the president calls upon the lieber professor of history, it is objectionable for two reasons. In order to have his German correct the president ought to say, "the lieber herr professor," and not so doing he sets a bad example to those professors who, not being well trained in German, might make the mistake outside. In the second place it draws objectionable comparisons. Why should one individual be the president's or university's one lieber professor and all the other be grouped in a bunch not dear to him or it? How much better to say, "The Thirty-ninth-Story-Front-Professor of History."

Again, imagine the distressing experience of our colleague who is addressed month after month and in the most public way, as the jay professor. How much better to say, the Fortieth-Story Front-Corner Professor of Greek.

There are thus many minor arguments in favor of the plan and others would doubtless occur to one on reflection. But you will say no mention has been made of the deans of the several faculties. That is true, and at the outset I was much puzzled myself. If they were placed on the floors above the professors what could we do with them when they resigned and now that so many terms of office are so short, how could we provide for them in a plan that is fundamentally progressive? How provide, moreover, for our numerous acting deans? But all these difficulties have recently been dissipated because, as we all know, the deans, like the snakes in Ireland, have begun to swallow each other, and in a year or two there will not be any at all.

The Theodore Roosevelt professors on their return ought, however, to have the 41st floor, and with them should be quartered the Kaiser Wilhelm professor in a fine and suitable suite, the best the university could provide. Somewhere in this region should be the librarian. I have hardly known where to classify him; but then, for that matter, neither did the president and trustees for quite a good many years. Next above should naturally be placed the president with the entire front of the house and so much of the sides as might be necessary. In the rear might be placed the secretary of the university.

The Crowning Feature

There remain still two or three stories, and these are, of course, to be reserved for those venerable men of emeritus grade who have retired on the Carnegie foundation. At present they are forced to seek the fresh air, fine views and reduced rents of the country. But in the upper stories of the Cosmos they would have all the fresh air and the views without any rent whatever. It is but proper to recognize long service by assigning to these officers the most desirable quarters in the entire structure. Besides this arrangement leads naturally to the final feature in the plan; I am led to suggest this feature by three important considerations: (1) From deep interest in the work of my colleagues in archeology, Egbert, Wheeler and Gottheil, I desire to see their successors a few milleniums hence provided with good and significant records for the study and reproduction of these times. The records should take the forms with which archæologists are generally familiar and which they understand. (2) I have often been impressed as I have walked round and round this campus with the anomalous condition that now prevails, in that we have a long row of cinerary urns and not a sinner in them. (3) All the philanthropists and benefactors of today have been so exclusively wrapped up in aiding people to live that they have overlooked the extremely serious situation which arises when a man in New York is confronted with the bills for his funeral and interment. Cemetaries are fearfully expensive things, and there is no Carnegie foundation on which we may fall back. Therefore I propose that every person on accepting an appointment in Columbia University should express his or her approval of cremation. A crematory should then be constructed on the roof of the Cosmos building to which all should naturally come. The department of metallurgy should be requested to compound an absolutely resistant and indestructible alloy, such as phospho-molybdenum bronze or several others which will occur to some of you. From these, suitable cylinders can be prepared with caps that screw tightly on. Upon the outside is to be engraved a sketch of the life and services of him whose ashes repose within. The inscription should be so expressed as to throw light on the history of the times.

I propose to recompense the department of metallurgy for their invention by turning over to them all the gold and platinum which would be caught in the crematory furnace from the fillings of teeth, etc. The cylinders are then to be stored away as follows: Presidential ashes in the bowls of the fountains in front of the university; Theodore Roosevelt professors and librarians in the urns on One Hundred and Sixteenth street; professors and adjunct professors in the urns on Amsterdam avenue and Broadway; instructors in the urns on One Hundred and Twentieth street. Holes are to be drilled in the granite and the cylinders, which would be naturally about a foot long by an inch in diameter, will be hermetically sealed therein by some indestructible cement. The funeral services will be simple. For presidential funerals all the staff would be ordered out. For others only their colleagues in rank. They would march in gowns and with hoods either inside out, or upside down, like reversed muskets, and the chaplain would perform a service like laying a corner stone on a small scale.

But some one remarks what about the ashes of the tutors and assistants? Well that does not seem to me a very serious question, but I would suggest that they be strewn on the grass of the campus, so that after decease everybody could continue to walk all over them, just as has always been the case in life.

The Coal Mining Industry in Bengal

The Indian Miner Is Paid 12c. per Day and Can Save 4c. from this Income. With Help of His Wife and Family, He Mines 96 Tons per Year

BY GLEN- GEORGE*

Coal occurs in India over a widespread area, ranging from the hill coalfields of Assam in the north to that of Hyderabad in the south. The coal measure formations are exposed over a large part of this area. There are some 37 fields having an estimated approximate area of 30,000 square miles. But of these, only 8 are worked to any extent, while of the total output of India 85 per cent. is raised from the three coalfields in Bengal, those of Raneegunge, Jherria and Giridih. In view of the importance of these three Bengal fields compared with other districts, the following remarks will refer primarily to them.

Regarding the geological horizons on which coal occurs in India, the adopted classification of Indian strata differs from that of Europe and America, so that any correlation must be approximate. The following is taken from a paper of T. H. Holland, Director of Geological Survey of India:

Indian Strata.		European and American Equivalents.
Gondwana System	Jubbulpore series	Jurassic
	Rajmehal series	
	Panchet series	Triassic
	Damuda series	
	Talchir boulder bed.	Permian

The great coal-bearing strata is the Damuda series, called from the river Damuda, in whose valley the coalfields of Bengal lie. The total thickness in these fields is 8400 ft. The Damuda series in Bengal is subdivided as follows:

Upper or Raniganj (coal bearing,	5000 ft. in Raniganj field.
Ironstone shales (no coal seams)	1400 ft.
Lower or Barakur (coal bearing)	2000 ft. in Raneeganj. 3800 ft. in Jherria.

*Deputy chief mining engineer, Raneegunge, Bengal, India.

History and Growth

Coal was worked in Bengal in the Raneegunge field as far back as 1777, while by 1830 several small collieries had been opened out. In 1843 the Bengal Coal Company was formed, which, from a small beginning has risen to an output of 800,000 tons a year and holds a large area of coal lands. In 1868 a railway line was carried to the Giridih field, which was then opened up chiefly by the East Indian railway, which company now produces about 750,000 tons per annum. The third field, that of Jherria, is of more recent development and the growth of its output has been a remarkable feature in recent years.

The situation of these Bengal coalfields near Calcutta and the cost and the better quality of the coal have been factors which have caused their rapid development in the last decade. In 1898 their total output was:

	Tons.
Raneegunge	2,216,000
Giridih	653,000
Jherria	750,000
Total	3,619,000
In 1907, Raneegunge	3,980,035
Giridih	750,374
Jherria	5,179,185
Total	9,909,594

Development is still in progress and the output must farther increase.

General Characteristics of Indian Coals

The seams are thick on the whole, the majority of the seams worked being 12 to 18 ft. In a few cases beds 30 ft. thick are being developed, while in limited areas, seams 60 to 90 ft. thick exist, owing to the amalgamation of several beds. The seams are almost always inclined, but not at steep angles, the dip being, as a rule, 1 in 10 to 1 in 5. Faults are not so frequent as to be vexatious. Igneous dikes, on the other hand, give a great deal of trouble and a considerable area of one of the best seams has been spoiled by them. They are of two types, dolerites, and mica-peridotites. They vary in thickness from 3 to 100 ft. or more, burning the coal on either side. Mica-peridotites have a tendency to flow along under the seam and consequently are more destructive.

As regards quality, the best Bengal coals are good. The defect of Indian coal is the rather high percentage of ash. On the other hand, the percentage of sulphur is low. The seams with the best reputations are the Sanctoria, Desherghur and Seebpore, of the Raneegunge field, Giridih coal and Nos. 14 and 17, of Jherria. Then follow a considerable number of seams slightly inferior, but still of fairly good quality. Following are some typical analyses, the figures representing percentage content:

SURFACE PLANT AT BENGAL COAL COMPANY'S NO. 5 MINE

A NATIVE OWNED AND MANAGED MINE IN BENGAL

(a) Desherghur Seam.

(1) Proximate analysis:	
Fixed carbon	54.33
Volatile carbon	33.77
Ash	9 47
Moisture	2 43
(2) Ultimate analysis:	
Carbon	69.19
Hydrogen	5.10
Oxygen	11 83
Nitrogen	1 59
Sulphur	0.37
Moisture	2.43
Ash	9 47

Calorific value, 6580 B.t.u.
Evaporating capacity, 8.88 lb. water per lb. of coal.
Specific gravity, 1.321.

(b). Sanctoria Seam.

(1) Proximate analysis:	
Fixed carbon	55 15
Volatile carbon	32 76
Ash	9.65
Moisture	2 44

(2) Ultimate analysis:

Carbon	71.93
Hydrogen	5.00
Oxygen	8 76
Nitrogen	1.82
Sulphur	0 40
Moisture	2 44
Ash	9 65

Calorific value, 6884 B.t.u.

THE BENGAL COAL COMPANY'S NO. 7 MINE SURFACE PLANT

Evaporating capacity, 8.55 lb. water per lb. of coal.
Specific gravity, 1.366.

(c) SEEBPORE SEAM.

(1) Proximate analysis:

Fixed carbon	56 73
Volatile carbon	29 65
Ash	8 69
Moisture	5 02

(2) Ultimate analysis:

Carbon	70 67
Hydrogen	5.02
Oxygen	8 48
Nitrogen	1 62
Sulphur	0 55
Moisture	5.02
Ash	8 69

Calorific value, 6781 B.t.u.
Evaporating capacity, 8.43 lb. water per lb. of coal.

The above are probably the best seams in the Bengal coalfield. An average analysis of the second-class coals in the eastern half of the Raneegunge field, is about as follows:

Fixed carbon	46.70
Volatile carbon	31 65
Ash	16 60
Moisture	5 05

A considerable number of seams coke well, but the percentage of ash in the coke is high. The method of coke manufacture is crude and wasteful—burning in open kilns—and yields only some 40 tons of coke per 100 tons of coal. A range of by-product ovens is being erected by the East Indian railway at its Giridih collieries. Although a great deal could be done to improve the sale and price of second-class coals by picking, so far no systematic system of cleaning has been adopted.

DESCRIPTION OF COALFIELDS

The Raneegunge coalfield lies 130 miles northwest of Calcutta, and the exposed area is approximately 500 square miles. On the east, the coal measures dip under newer rocks and their exact extent is unproved. That they soon reach unworkable depths has been shown by a recent deep bore hole some 10 miles east of the coalfield. On the south, west and north the coal measures abut against metamorphic rocks. In shape the field is an irregular rectangle—the large diameter lying east and west—40 miles long by 5 to 17 miles in width. The coal deteriorates in quality in the extreme east.

The Raneegunge coalfield is nearer to Calcutta and the seaboard than those of Jherria and Giridih by some 40 miles and being well served by railways, has a slight advantage in the matter of freight. The Upper or Raneegunge measures are well developed (5000 ft. in thickness) and contain the best seams, the Deshergur, Sanctoria and Seebpore, besides a number of seams not quite as good in quality. The Barakur series also contain a few seams of fairly good quality. The Ironstone shales yield a fair amount of iron ore.

While the exhaustion of the Raneegunge field is far off, yet outcrop coal specially in the better seams has gone a long way to that stage. Future workings must be deeper, which will necessitate working larger areas from a single shaft or pair of shafts, and the employment of better machinery. All of this will tend to increase the capital expenditure and working costs.

GIRIDIH OR KURHURBARI COALFIELD

The Giridih field is situated some 70 miles or so northwest of Raneegunge on the Barakur river, a tributary of the Damuda. It is 11 square miles in area, only 7 of which are productive coal measures. In spite of its small area, this field had an output of 830,000 tons in 1905. Of this production, 700,000 tons came from the collieries of the East Indian Railway Company.

WORKING ON THE OUTCROP OF AN 18-FT. SEAM, REMOVING THE OVERBURDEN

The main seam is 18 ft., while there are several other beds less in thickness. The quality of the coal is good and it ranks among the best Indian coals.

Jherria Coalfield

The Jherria field, although the youngest of the Bengal districts, is now the first as regards output. It is situated on the Damuda river, some 40 miles west of Raneegunge. It is an irregular rectangle, about 17 miles east and west, 7 to 9 miles north and south, and is 200 square miles in area. The Lower or Barakur division is here greatly developed, being 3800 ft. in thickness and containing 18 seams. This field being comparatively new, only the shallow coal is at present worked, and costs are low. The quality of the fuel is good as Indian coals go.

The Upper or Raniganj series is not so well developed and contains four or five seams, none thicker than 8 ft., one of which—the lower—is considered first-class coal. The Jherria coalfield is well served by railways and a new Chord line, lately opened, has given it a greatly improved access to the up-country districts.

Methods of Working

The usual method of working is simple. The poor quality of available labor, the high cost of timber, the thickness of the seams render longwall out of the question, or even any method of taking out a very large proportion of the coal is difficult. The almost unvarying method consists in driving two sets of galleries at right angles, splitting up the coal into square pillars. The usual width of the galleries is 12 to 16 ft., while the size of the pillars varies from 30 to 70 ft. square, according to the depth. Roofs are good and timbering is the exception. On reaching a boundary, or in any favorably situated area, the pillars are split and worked as much as possible before the area collapses. The average percentage of extraction is about 60 to 70 per cent. of the seam.

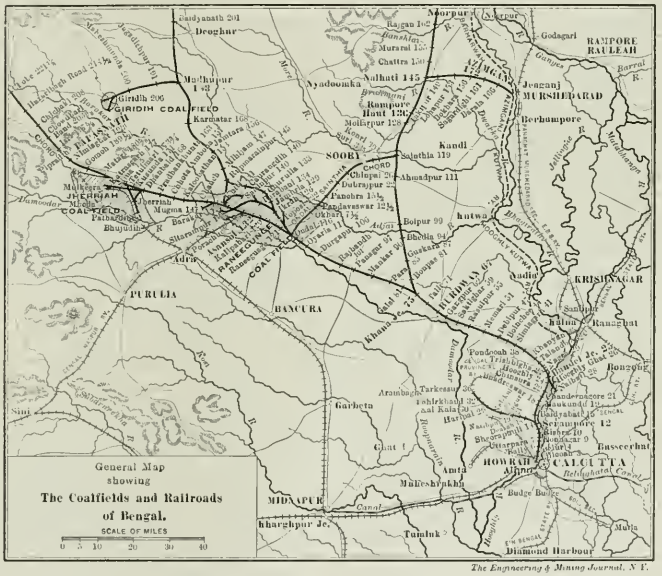
During this operation, spontaneous combustion is apt to occur, and in several cases considerable areas have been lost by fire. In the Giridih coalfield the exceptionally good roof has led to a more scientific method:

When the pillar, say 40 ft. square, is to be worked, the lower 5 ft. of the 20-ft. seam is worked with the exception of four blocks or "chowkidars," each 6 ft. square, one at each corner of the pillar. Any timber is then withdrawn and the four "chowkidars" are blasted out, causing the upper 15 ft. over the whole pillar to come down, and bringing 1000 tons of coal on the ground. Where this method is used, the wastage of coal is as low as 2 per cent. So far workings are of a moderate depth only, a 400-ft. shaft being considered deep. However, some 800-ft. shafts are at present being sunk and the exhaustion of shallow coal will soon lead to deeper workings and to some rearrangement of the system of working.

The occurrence of firedamp is rare, and safety lamps are the exception. The large size of the galleries and the number open, make the drag of the air currents small and in almost all cases natural ventilation, or turning the exhaust steam from pumps into a shaft, is found sufficient. In eight cases only have fans been erected, but soon deep workings must lead to a large increase in their number. Water is usually met with in fair, but not great quantities. In brief, it may be stated that coal mining in Bengal, so far, has presented no great difficulties from the engineering point of view.

The death rate of persons employed is low—0.76 per thousand miners above and below ground, as compared with the American 1.69, and the English 1.24. Steel headframes are preferred to wood, good timber being expensive. Tipplers and screens are comparatively rare, hand loading into wagons (the coal is carried in baskets by women) being the usual method. Some of the large companies, however, are using tipplers, and an elaborate sizing and screening plant is being erected at one of the East Indian railway's Giridih collieries.

The factor of safety in winding and haulage ropes is high owing to the poor class of men (natives) looking after them. Underground haulage is not common, while horse haulage is almost unknown—the miners pushing their tubs long distances. Outputs of collieries are small in comparison with their individual area. A production of 200 tons a day per shaft would be a fair output. When the exhaustion of shallow coal necessitates


General Map showing
The Coalfields and Railroads of Bengal.
SCALE OF MILES
0 5 10 20 30 40
GIRIDIH COALFIELD
JHERRIAH COALFIELD
RANEEGUNGE COALFIELD
PURULIA
BANCURA
MIDNAPUR
HOWRAH
CALCUTTA
DIAMOND HARBOUR
KRISHNAGAR
RAMPORE BAULEAH
MURSHIDABAD
Berhampore
Jeangunj
Godagari
Nadiah
Ranaghat
Bolpur
Burdwan
Asansol
Bankura
Midnapur
Kharagpur Jc.
Tumluk
Garbeta
Sonamukhi
Bishnupur
Raniganj
Giridih
Dhanbad
Jhalda
Purulia
Chandrakona
Tarakeswar
Serampore
Budge Budge
Mahisadal
Mahishadal
Sitai
Sitarampur
Chandpur
Bhagirathi
Hooghly
Ganges
Damodar
Kasai
Rupnarayan
Subarnarekha
Mayurakshi

eral mining equipment. All machinery must be simple as the class of labor employed is poor, and engines must be designed to bear ill usage. A company has just been formed to supply electrical power from central stations and a large amount of electrical machinery will be required in the future.

Labor

While Indian coal mining presents no great engineering difficulties as yet, the problem of securing intelligent labor is most perplexing. Labor is obtained locally and consists chiefly of the two low castes—the Bowries and Santhals—who are an aboriginal race. The Indian native is an agriculturist and has an almost passionate attachment to the land, and regards coal mining only as a disagreeable necessity, in spite of the fact that he can earn four to six times as much at the latter as at the former. This has led to the absence of the formation of any craft skill and the Indian miner is as bad a workman today as he was 40 years ago. He cuts only 96 tons per year, as compared with 572 of the American, and the 279 of the English miner.

The ordinary laws of wages and supply of labor do not affect him, as the idea of saving and accumulating money is altogether beyond him. He and his family can live on 3 or 4 annas a day (6 to 8c.), and as long as he has a little over for "grog" he has no thought for the morrow. In spite of the large increase in the number of mines, there has been but little increase in the amount of labor available and the competition between the various companies is keen.

The Indian miner takes down with him, his wife and family. He hews or rather beats out the coal and his wife and children carry it in baskets on their heads to the nearest tram line and tubs—often 500 ft. away. He gets paid 6 annas (12c.) per car of about 13 cwt., and while he could cut 4 to 6 cars per day, he refuses, as a rule, to cut more than one. He works on an average, 3 or 4 days a week. The present Indian mines, without any further development, if assured of a full and regular supply of labor, would probably be able to increase their output 50 per cent.

Working costs are fairly low, ranging from 48 to 56c. per ton exclusive of royalty. Where royalty has to be paid, it is usually 4 annas (8c.) per ton. Prices until of late have been low—as low as 64c. per ton at the pit's mouth. During the past two years, prices have risen considerably and $1.60 at the pit's mouth is probably the average at present.

The coal trade suffers greatly from the lack of rolling stock of the railway companies and the complaints in Calcutta are loud and insistent at present. To give an idea of the magnitude of the industry, it may be stated that the capital of the limited liability coal companies(excluding private concerns) is $17,000,000, while the present market value of their shares is nearly $90,000,000.

A National Bureau of Mines

During the recent annual convention held in Indianapolis, by the Mine Workers of America, a resolution was passed favoring the establishment of a national bureau of mines and mining. It was said that the dominant political parties had placed in their platforms strong declarations favoring such a bureau, but nothing had been done by the United States Senate to ratify the House bill passed in that body last May. The miners claim they have had reason to believe the measure would come through the Senate immediately upon the convening of Congress. Meanwhile, it is asserted that the death rate in mining is steadily increasing and the growing frequency of disasters due to poorly equipped mines are discreditable to the nation.

The plea of the miners is that congress inaugurate this work without further delay and restore confidence in political declaration as well as to accomplish what is universally believed should be done. It will be the duty of the bureau to investigate the causes of disasters and to seek out and enforce the means by which they can be prevented.

Coal Mining in Nevada

The principal supply of fuel used in the State of Nevada has heretofore been shipped from the mines in Utah and Wyoming; however, the new coal operations at Coaldale, Nev., are showing up so well that it is probable the State will soon have a considerable fuel output to supply part of its own needs. At one of the Coaldale operations a shaft is down 208 ft., and at the bottom shows about 42 in. of coal. It is stated that a thorough analysis made of this coal shows 57 per cent. carbon, 0.5 sulphur, and about 25 per cent. volatile matter.

The seams are not uniform in composition, since there are several streaks of good coal varying in thickness from 3 to 5 ft., and separated by partings of less desirable coal. On the surface in this same district, there are seven parallel seams which average in width from 8 to 80 feet.

If the Nevada operators succeed in producing a good grade of fuel, there is no question as to a ready home market. It is estimated that the Coaldale mines can transport coal to Blair Junction, the nearest railway point, for not more than $2 per ton; the railroad will haul the coal to Tonopah and Goldfield for $1.50 per ton. This would, therefore, enable the consumers to purchase coal at a price of approximately $10 per ton, which would be considerably less than the average price now paid.

There are many indications of coal throughout the entire region, and when the many oil concerns that are now drilling in the district have finished their borings, it is almost certain that their development work will disclose good coal seams of considerable area. It is stated by those who have visited the region that the coal here found will make a good grade of coke, and that the product will not slack when exposed to the elements.

The Instruction of Miners in Rescue Work

At the experimental station established by the United States Geological Survey at Urbana, Ill., the miners are taught how to escape from a mine when an explosion occurs and breathing is made impossible. Escape is effected by using a helmet which is kept near at hand, and a jar of oxygen, which is strapped on the back.

In making experiments the Government experts burn a quantity of sulphur in an air-tight room, which makes the atmosphere so obnoxious it is impossible for anyone to breathe. Men who enter wear helmets on their heads and carry enough oxygen in jars on their backs to last for two hours. As long as this oxygen lasts they are able to remain in the room without discomfort. Without this preparation a man could not enter the room and live to exceed one minute. Those who have entered the "death chamber" with helmet and oxygen breathed freely all the time.

The Indiana officials and operators are greatly interested in the rescue apparatus and will go to Urbana and visit the experimental station.

According to T. H. Holland, director, Geological Survey of India, coal is the most valuable mineral product of India. Fully 90 per cent. of the output is consumed in developing home industry, in 1906 the total valuation of the output at the mines being above $9,000,000. With the exception of about 5 per cent., all the coal produced comes from the Peninsula region where it occurs in the lower division of the Gondwana system. This corresponds approximately to the upper Carboniferous horizon. In other parts of India small bodies of coal are found in rocks of Tertiary age. The eastern Himalayan fields are the only known occurrence of Gondwana coal not in the peninsula

Such items as government taxes, etc., that are out of the control of the technical management should be segregated from the operative costs that are used for comparisons of working costs.

Working Costs on the Rand

By W. Fischer Wilkinson*

There was at the Transvaal mines during the year 1908, a general reduction in the cost of working calculated on the tonnage basis. The statistics of the mines probably exaggerate the improvement in the economic conditions. In comparing, for instance, the working costs of any mine with those of previous years, it will be noticed that in many cases part of the improvement is due to charging a lower amount than formerly for development redemption. The average grade of ore worked was lowered and consequently a larger tonnage is available for mining for the same cost of development. The cost per foot may not have been reduced during the year, but the cost per ton has declined automatically owing to the lower grade extracted. It is important to remember, in considering the industrial situation, that the ton of today is not the ton that was mined last year or in former years. Part of the reduction, too, shown in the statistics is due to the increased scale of operations, the fixed charges, for example, being proportionately less per ton.

Making allowance, however, for these points, which made a reduction in costs more apparent than real, there was no doubt a general reduction in the costs due to increased efficiency. The policy now generally adopted of working on a large scale and of mining ore down to a minimum of profit certainly produces very low costs. Whether equally good results or better could not be obtained by raising the grade is an open question upon which the *South African Mining Journal* published during the early months of the year an interesting series of articles.

The accompanying table, compiled from the monthly statistics of the Chamber of Mines, shows the reduction in costs that was effected between January and September. This is the first year in which the Chamber has published costs and profits. They are, of course, costs and profits on working account and must not be taken to represent net profits.

There is, as remarked above, generally a wide difference between the working profits and the dividends, owing to deductions for profit tax, depreciation, interest on loans, debenture interest, etc. The real working costs are rather difficult to arrive at, owing to variations in practice in bookkeeping, but they are considerably more than the costs on working account, and have been estimated on an average at about 75 per cent. of the working profits.

An acompanying table, compiled from the returns of the Witwatersrand mines only, i.e., exclusive of the outside mines, illustrates the reduction in grade that has taken place since 1897 and gives the dividend profits per ton and the cost of working calculated as the difference between dividend and yield. It is, of course, not an accurate figure, as no allowance is made for profits appropriated to capital, and the figures have, therefore, only a relative value.

COSTS AND PROFITS, WITWATERSRAND MINES.

1908.	Tons Milled.	Yield.	Working Costs.	Working Profit.
		s.	s.d.	s.d.
January	1,416,139	31.91	19.5	12.7
February	1,343,672	32.43	19.5	13.1
March	1,456,375	31.57	18.8	13.3
April	1,418,687	32.05	18.6	13.7
May	1,490,952	31.37	18.1	13.5
June	1,458,499	31.52	18.0	13.8
July	1,515,505	30.96	17.9	13.5
August	1,535,793	30.8	17.4	13.7
September	1,534,755	30.67	17.5	13.5

WORKING COSTS AND GRADE OF ORE PER TON MILLED, RAND MINES.

Mine.	Costs, Year Ending July, Sept. or Dec. 1907.	Costs Quarter, July or Sept. 1908.	Yield. 1907, Dwt.	Yield. 1908, Dwt.	Reduction in Costs.	Reduction in Yield, 1 dwt.=4.2s.
	s. d.	s. d.			s. d.	s. d.
Glen Deep	21	19 9	7.439	7.000	1 3	1 10
Geldenhuis Deep	19 8	18 11	7.085	6.712	9	1 7
Jumpers Deep	24 6	23 9	6.905	6.659	9	1
Nourse Mines	24	20 7	8.453	7.371	3 5	4 6
Rose Deep	18 8	16 4	6.563	6.266	2 4	1 3
Ferreira Deep	19 4	16 5	11.697	11.030	2 11	2 10
Crown Deep	19 3	14 11	9.226	8.240	4 4	4 2
Langlaagte Deep	23	18 1	7.062	6.350	4 11	3
Durban Roodepoort Deep	26 3	24 7	7.681	7.424	1 9	1 9

In order to illustrate the effect of large outputs in reducing costs, an accompanying table has been compiled from the returns for the month of August. The Randfontein mines are omitted:

REDUCTION IN GRADE, WITWATERSRAND MINES.

	Value per Ton.	Costs per Ton.	Dividend per Ton.
1897	39.7s	29.6s	10.1s
1898	41.3	28.0	13.3
1899	43.8	34.8	9.0
1903	39.8	28.8	11.0
1904	38.5	29.0	9.5
1905	35.8	27.2	8.6
1906	34.8	26.4	8.4
1907	34.0	25.0	9.0
1908*	31.8	22.6	9.2

*Estimated.

The seven largest mines are the Crown Deep, the Robinson, the Village Main Reef, the Knights Deep, the Robinson Deep, the Simmer & Jack, and the East Rand Proprietary, the latter a group of mines consolidated into one company.

Another table has been compiled from the statistics of the Rand Mines group to illustrate how reduced costs are obtained at the expense of grade. In five cases the reduction in costs is overbalanced by the reduction in yield. It should be mentioned that the Ferreira Deep operated 40 and the Langlaagte Deep 30 more stamps in 1908 than in 1907. While the net profit per ton is less in some cases, it must be remembered that the total available ore supplies of the mine are increased by the lowering of the grade. The figures are instructive and indicate that it is uneconomical to lower costs too far at the expense of grade.

EFFECT OF LARGE OUTPUTS IN REDUCING COSTS.

Companies Milling Tons per Month.	Number of Companies	Yield.	Costs.	Profits.
Under 10,000	10	33.4s.	23.4s.	10 0s.
10,000 to 20,000	13	29.6	20.0	9 6
20,000 to 30,000	13	28.8	17.0	11 8
30,000 to 40,000	10	31.0	17.0	14.0
40,000 and upward	7	32.6	14.8	17.8

The City Deep and Brakpan mines developments (*Aust. Min. Stand.*, Dec. 23, 1908) clearly demonstrate that the Rand may confidently anticipate the recovery of high values from great depths. In the City Deep the reef was intersected at a vertical depth of 2865 ft., and to date the average reef width disclosed is 22.7 in.; the average value is 1 oz. 1.7 dwt. per ton. At Brakpan the conglomerates were cut in the No. 1 shaft at a depth of 3890 ft., and in the No. 2 shaft at 3695 feet.

*Mining engineer, London, England.

Note—This is a part of the article reviewing mining conditions on the Transvaal, published in the Journal of Jan. 9, 1909; it was omitted from that issue on account of lack of space.

The Verde Mine, Arizona

By George W. Maynard*

Doctor Douglas' interesting and instructive article in the Journal of Feb. 20, 1909, on the early history of the Copper Queen, suggests that a statement about the beginnings of another great mine in Arizona may prove of interest.

In September, 1879, I went to Arizona to examine a number of mines and prospects which Gen. Jno. C. Fremont, at that time governor of Arizona, had brought to the attention of New York capitalists. The Southern Pacific railroad then had no connection with eastern roads at the south, so that to reach Arizona one had to travel via San Francisco through California to Yuma and then east to Tucson which, for many months, was the terminus.

My destination was Prescott, at that time capitol of the territory, the nearest railway point to which was Maricopa, about 150 miles away. The stage was a canvas-covered hack of the variety known as a "jerky." We pulled out at 8 o'clock at night. The one other passenger was a Wells-Fargo messenger who produced a rifle after crossing the Gila, the reason being that the stage had been held up there a few nights before. The town of Phoenix, now the capital, consisted of about half a dozen adobe houses and the "Palace Hotel" a combination of canvas and planks. In comparison with other western mining towns Prescott was really attractive with its spacious plaza, court house and a general air of neatness.

For about two months my time was taken up in visiting neighboring mining districts and in the examination of more or less developed properties and prospects.

General Fremont accompanied me in nearly all of my trips, which were made with exceptional comfort due to the kindness of General Wilcox, then in command of Fort Whipple, who loaned us a roomy army ambulance, a span of big mules and a driver. The daily intercourse with General Fremont enlivened by his accounts of his early explorations will always be treasured as the most delightful experience of my early western work.

The work in the field was followed on our frequent returns to Prescott during the long evenings by the brilliant conversation and Washington reminiscences of Mrs. Jesse Benton Fremont, the daughter of Senator Benton. Taken altogether that two months in Arizona was equivalent to a liberal education.

Makes Examination

On the completion of the work for my New York clients and as I was about leaving Prescott, I was asked by one of the Prescott merchants if I would go into the Black Hills about 30 miles north of Prescott and look at a copper prospect which he owned there. As the statement about the property appealed quite strongly to General Fremont we made an early start one morning, the General's son Frank accompanying us. We reached the foot of the mountain in the evening and camped that night. The following morning we took to the saddle and soon reached the summit of a ridge from which we had a view of the Verde valley made brilliant by the rising sun, an experience which can never be blotted from one's memory.

As all of my note books and copies of reports bearing upon my Arizona work at that time are buried in a store house I have to rely upon my memory for the following details of the examination. The outcrop and definition of the vein on the narrow plateau on the summit of the ridge was most impressive from a miners standpoint. The outcrop projected well above the surrounding surface, and was made up of malachite, azurite, chrysocolla and cuprite, a veritable flower garden, for a width of 15 ft. There had been but little surface stripping. For a short distance down the hillside the outcrop was readily traced but was finally lost sight of under a heavy growth of chaparral. The strike of the vein was apparently across a gulch but could not be definitely traced without tools for cutting down the undergrowth and breaking up the surface. About 100 ft. vertically below the outcrop an adit about 50 ft. in length had been driven 5 or 6 ft. into the vein at right angles to the strike. My impression is that it had not passed through the vein. In this crosscut there was considerable chalcopyrite and some chalcocite.

The outcrops and also the ore in the adit were sampled, in the latter case the copper sulphides being separately assayed. The assays showed no precious metals in the oxidized ores, but did give 10 oz. silver (with no gold) in the sulphides.

On my return to Prescott I informed the owner that he undoubtedly had the making of a good mine but that as it was a smelting proposition nothing could be done at present, for the reason that there was no fuel in the country and ore could not be shipped when the nearest railway was 180 miles distant. As the Atlantic & Pacific road, now the Santa Fe, was beginning to be talked about I advised him to hold on. To this he responded "I am hard up and if you can let me have $10,000 within the next 60 (?) days I will deed you a half interest in the mine."

On the strength of this proposition I sent a statement of my investigation to a party in New York, who with others was to pay me in about 90 days a considerable sum of money for some steel patents, asking for an advance of $10,000 on account for the purpose of securing the half interest in the mine.

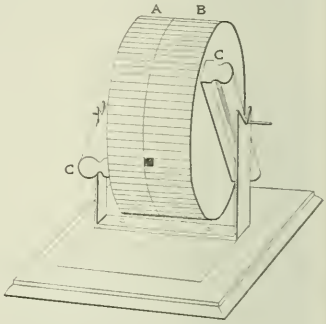
The telegraphic answer to my letter read; "Take my advice and have nothing to do with mines."

That mine is the "United Verde."

*Consulting mining engineer, 20 Nassau street, New York.

Multi-Cipher Device

James Trevor in the *Aust. Min. Stand.*, Nov. 18, 1908, describes a multi-cipher device devised by him and shown in an accompanying illustration. This device consists of two cylinders mounted loosely on an axle, but so arranged that they can be securely clamped together in any position. The axle rests in standards on a base board. In the illustration, *A* is the cylinder on which are the code words; *B* the one on which is the key to the code. *C* is a handle for aiding in turning the cylinders. In case one pair of cylinders is not enough other pairs of cylinders can be mounted on the same axle. A certain



MULTI-CIPHER DEVICE

phrase in the key is always selected as the one opposite which the keyword of the code is to be clamped. Each message is prefaced by a key word so that for each message the code is changed. This prevents easy deciphering of the code used, and the message can be read more easily than if a book has to be used.

The rock temperature in Bendigo mines, according to the report for 1907 of A. H. Merrin, chief mining inspector for Victoria, Australia, increases at the rate of 1 deg. F. for each 75 ft. below the zone of invariable temperature. At 4000 ft. the temperature due to the heat of the rocks is 110 deg. F. At this depth the temperature of the water issuing from the rocks is 114 deg. F. Under average underground conditions, when there is water in the downcast shaft, the actual temperature in the stopes will be somewhere between 75 deg. and 110 deg. F., depending upon the quantity of air entering the stope and the length of time the air is in contact with the rock before entering the stope.

Conserving Labor

Nothing could be more hopeful than the awakened interest in the preservation of our natural resources. We could not wish to discredit it; but it may be pertinent to ask, says *The Evening Post*, whether we understand what our real resources are, and whether we are not overlooking our most destructive forms of waste. Corresponding to the economist's three factors of production, there are three conspicuous forms of waste—waste labor, waste land, and waste capital. The greatest of these is waste labor, but it is the form of waste which is least understood and appreciated. It is the most important because it is the human factor which is being wasted, and the human factor has always and everywhere been the greatest factor in the production of wealth. Communities have grown rich in poor environments, and poor in rich environments, but no community ever grew rich while wasting its human energy; and it is doubtful if any community ever remained poor which utilized and conserved its labor power. Labor power, of course, includes mental as well as physical energy. That waste labor power is the form of waste least considered is shown by the fact that a great many people, perhaps a majority, not only do not deprecate it, but actually think it a good thing. A leisure class to consume the products of the workers is thought by many to be an economic necessity.

Of waste labor there are four principal kinds—the unemployed, the improperly employed, the imperfectly employed, and the voluntarily idle. Of these the least important is the unemployed, though it alone has received much attention. It is the least important because, first, it is normally and on the average the least efficient labor which remains unemployed; second, because the utilization of the labor power which is now going to waste at the upper end of the social scale will go a long way toward solving the problem of unemployment at the lower end of the scale.

By improperly employed labor is meant that which is engaged in acquiring rather than producing wealth. Enterprises whose sole purpose is to cause two dollars to emerge from the pockets of other men where one had emerged before, absorb a considerable fund of energy which ought to be concerned with blades of grass and similar things. It is unnecessary to mention the thief, the counterfeiter, the confidence man and the blackmailer. Their activities are already regarded as predatory rather than productive, and the law is doing what it can to stop them. From the economic point of view, however, there is no great difference between the counterfeiter and the adulterator of food and drugs, or the manufacturer of shoddy; between the confidence man and the promoter of overcapitalized corporations; or between the blackmailer and a certain type of advertising agent who persuades you to advertise with him, not because it will do you any good, but because it will save you from harm. A really productive enterprise carried on by purely productive methods increases the wealth in the hands of other people in proportion as it is successful; and in proportion as a man grows rich in such an enterprise by such methods, he makes the country richer instead of poorer. The law-giver who can turn all our labor power, mental and physical, into such channels, will make the country so productive that nothing short of a foreign invasion or a geological cataclysm could prevent us from becoming rich, even if our material resources were as meager as those of New England.

By imperfectly employed labor is meant that which is employed productively, but less productively than it might be. Wherever there is a man doing unskilled work who might, had he received the proper training, be doing skilled work, or doing skilled manual work who might be doing the more highly skilled and more needed work of managing and directing, there is a case of imperfectly employed labor. It is as great a waste of productive energy as it would be to have good garden land used for pasturing long-horned steers. Here, again, is a statesman's opportunity for enriching his nation, by providing the means for economizing to the greatest degree the labor power of the people. Much of it is now going to waste, in the sense that it has to be utilized in ways which are of little value, merely because of its over-supply, while other kinds of work are suffering because of the scarcity of competent men. An industry can expand only so far as its rarest factor will permit. The rarest factor is managing ability, and any policy, educational or moral, which will increase the supply of managing ability will enable industry to expand and to absorb greater numbers of the unemployed.

The voluntarily idle are of two classes —those who have retired on a well-earned competence, and those who live on wealth which they themselves have never earned. The first class does not trouble us much in America. The American business man's habit of continuing to work after having accumulated enough to provide for all his possible wants is singularly economical of human energy, provided, of course, that his is a productive or really useful business. The longer he remains active, the greater the fund of productive energy at work in the community and the richer the community will grow. It is, of course, unnecessary to say that no one is idle who is fully occupied with some useful work, even though he be not actually earning his living by it. Until recently, we have not been very much troubled with the second class, but our own prosperity is creating it and we need to look to the future. Here is another challenge to the constructive statesman. The loss of this kind of labor power is especially regrettable, because it is usually labor power of the very highest type which goes to waste in this form. It is the kind of power, which, if set to work, would increase the supply of the scarcest factor in the creation of wealth, both material and immaterial, and which would, therefore, strengthen society precisely where it is now weakest, and contribute most to our national prosperity.

The Arizona Copper Company, Ltd.

The annual statement for the year ended Sept. 30, 1908, of the Arizona Copper Company, Ltd., submitted to the stockholders in Edinburgh on Feb. 24, 1909, covers the operations of the Arizona Copper Company, Ltd., the Arizona Copper Company, of Arizona and the Arizona & New Mexico Railway Company. Profits for the year amounted to £288,138; and the surplus, after deducting preferred dividends, was £173,607. The balance brought forward from the previous year increased this surplus to £222,064 after carrying £90,000 to the reserve account. Out of the surplus the directors reccommend that $189,987 be paid in additional dividends.

The production of copper was 33,980,291 lb., which is greater than that of any previous year. The total ore mined amounted to 751,220 tons, 43.3 tons of ore being required for the production of one ton of copper. The first-class smelting ores yielded 6.64 per cent. copper while the concentrating ores gave 2.1 per cent.

Improvements included the installation of a new dust flue at the smelter and development work during the last half year amounted to 17,095 ft., exposing a large tonnage of low-grade ore and a fair amount of higher grade.

Some stocks of French coal companies sell at high prices. Thus a recent market report shows sales of Courrieres, par value 100 fr., at 2900 fr. per share; the dividend for last year being 80 fr. Douchy, par 200 fr., dividend 50 fr., brought 1055 fr.; Ostricourt, par 500 fr., dividend 50 fr. sold for 2375 fr.; Grand' Combe, par 250 fr., dividend 50 fr., sold for 1465 fr. The returns on the selling price at the rate of last year's dividends ranged from 2.1 to 4.7 per cent. Only expectations of a higher dividend rate would warrant some of the quotations.

Mine Labor and Accidents in the Transvaa

The number of laborers of all classes, skilled and unskilled, employed at mines and mills in the Transvaal at the close of 1908 was as follows:

Mines:	White.	Negro.	Chinese.	Total
Gold	19,605	164,826	12,275	196,706
Coal	426	9,048	.....	9,474
Diamonds	799	7,803	.....	8,602
Other	447	3,776	.....	4,223
Total	21,277	185,453	12,275	219,005

White labor was 9.7 per cent. of the total; Kafir, 84.7; Chinese, 15.3 per cent. In December there were 159 separate accidents reported, the casualties from which were as follows:

Number:	White.	Negro.	Chinese.	Total.
Killed	8	69	2	79
Injured	25	92	3	120
Total	33	161	5	199
Per 1000 employees.				
Killed	0.38	0.37	0.16	0.36
Injured	1.17	0.49	0.24	0.91
Total	1.55	0.86	0.42	1.27

During the year 1908, there were 777 persons killed and 1231 injured, a total of 2008 persons. Of the killed 65 were white men, 615 negroes and 97 Chinese; the respective proportions being 8.3 whites, 79.2 negroes and 12.5 per cent. Chinese.

Mr. Matthewson and the Smoke Case

By F. T. Havard*

In the conference of the counsel with Judge Hunt in the Anaconda smoke case, Mr. Matthewson described in detail and with much lucidity, the processes in use for recovering arsenic from the smeltery fumes and dealt with the advantages, and the more numerous disadvantages of the methods proposed for overcoming what the farmers style the "smoke nuisance." Mr. Matthewson said that the arsenic in the ores varied all the way from minimum quantities to 2½ per cent., usually occurring in but small quantities. He stated further, that 90 per cent. of the ore which come to the smelter is sent to the concentrator where 50 per cent. of the arsenic is removed and thrown on the dump. Of the arsenic which reaches the smeltery in the ore, some is dumped with the furnace slags, a part is recovered in refinery drosses, and the rest goes into the flue in the form of white fume, consisting principally of the oxides. He told how the arsenic is recovered from the fumes by redistillation and recovery, and advanced the statement that the method employed at Washoe is the most thorough known. In reply to a question from Mr. Kelley, the attorney of the Amalgamated, Mr. Matthewson said that there are only two other smelters in the United States which collect the arsenic from the fume, one being at Everett and one at Salt Lake.

In telling the court of the methods by which arsenic might be extracted, Mr. Matthewson classified the methods used as follows: *A*—Cooling processes: (1) water spray; (2) admission of air; (3) radiation; (4) freezing. *B*—Filtering processes: (1) bag house; (2) friction; (3) centrifugal gas cleaners. *C*—The Cottrell method. In commenting on the spraying method he emphasized the difficulty of disposing of the acid mud formed, and stated that a plant sufficient for the Washoe smeltery would cost $3,000,000. He disposed of the bag-house method by saying that a sufficiently capacious plant would cost $2,750,000, that the expense of its operation will amount to $1850 per day, with a recovery of arsenic to the value of $204, and that the life of the bags would be short. The installation of a radiation-cooling system would cost, in his estimation, $1,200,000, and would not be efficient. For the freezing system the pipes alone would cost $4,000,000, and the cost of operation would amount to $10,800 per day. The system, further, has not proved practicable. A plant using zinc oxide as a neutralizer would cost $3,000,000, and would require 500 tons of zinc ore daily. With regard to the Cottrell method, Mr. Matthewson said that its application was not practicable on a commercial scale, except under very peculiar conditions.

He concluded that if the friction system now used at Great Falls were successful, Anaconda would adopt it, although its installation should cost $2,000,000. Judge Hunt and Mr. Matthewson both stated that they had received many letters embodying schemes for collecting the arsenic, but in Mr. Mathewson's opinion, the men who had made the suggestions seldom realized the quantity of fume to be treated, and that consequently the ideas are of little value.

*Mining engineer, Helena, Mont.

Steel Production in 1908

The production of open-hearth steel in the United States in 1908, as collected and published by the American Iron and Steel Association, was as follows, in long tons, comparison being made with the returns for 1907:

	1907.	1908.	Changes.
Acid	1,270,421	696,304	D. 574,117
Basic	10,279,315	7,084,568	D. 3,194,747
Total	11,549,736	7,780,872	D. 3,768,864

The total decrease in 1908 was 32.6 per cent. Acid steel was 8.9 per cent. of the total, and basic 91.1, in 1908; the proportions in 1907 being 11 and 89 per cent., respectively. Included in the totals for 1608 are 311,777 tons of direct castings, of which 156,772 tons were acid and 155,005 tons basic steel. This quantity of direct castings was 434,748 tons less than in 1907

While the open-hearth production in 1908 was considerably smaller than in 1907, it was much larger than the production of bessemer-steel ingots and castings in 1908, the output of open-hearth steel in that year exceeding that of bessemer steel by 1,664,117 tons, or over 27 per cent. This is the first time that the production of open-hearth has exceeded that of bessemer steel.

The production by States for two years past was as follows:

States.	1907.	1908.
New England	239,797	158,417
N. Y. and N. J.	706,019	350,348
Pennsylvania	7,868,353	5,266,372
Ohio	819,642	525,171
Illinois	1,013,251	483,101
Other states	902,674	997,460
Total	11,549,736	7,780,872

Pennsylvania made over 67.2 per cent. of the total production of basic-steel ingots and castings in 1908, and over 71.8 per cent. of the total production of acid steel against over 66.4 per cent. of basic and over 82 per cent. of acid ingots and castings in 1907. Ohio, Illinois, Alabama, Colorado and New York, in the order named, were the next largest producers of open-hearth steel in 1908.

The open-hearth steel made in 1908, including both ingots and castings, was produced by 125 works in 21 States and the District of Columbia. In 1907 there were 137 works in 20 States and the District of Columbia, which made open-hearth steel. During 1908 there were 40 open-hearth steel works which did not make steel, as compared with 25 works in the preceding year.

Total Steel Production

The total steel production of the United States desregarding crucible steel, which has never exceeded 1 per cent. in any one year, has been as follows for 10 years past, in long tons:

	Bessemer Tons.	Bessemer Per Ct.	Open-hearth Tons.	Open-hearth Per Ct.	Total Tons.
1899.	7,586,354	72.0	2,947,316	28.0	10,533,679
1900.	6,684,770	66.3	3,398,135	33.7	10,082,900
1901.	8,713,302	65.2	4,656,309	34.8	13,369,611
1902.	9,138,363	61.6	5,687,729	38.4	14,826,092
1903.	8,592,829	59.6	5,829,911	40.4	14,482,740
1904.	7,859,140	57.1	5,908,166	42.9	13,767,306
1905.	10,941,375	55.0	8,971,376	45.0	19,912,751
1906.	12,275,830	52.8	10,980,413	47.2	23,256,243
1907.	11,667,549	50.2	11,549,736	49.8	23,217,385
1908.	6,116,755	44.0	7,780,872	56.0	13,897,627

The make of bessemer steel in 1908 was smaller than that of any other year given in the table. The production of open-hearth steel, on the other hand, though less than that of any given year since 1904, was greater than that of 1904, or any preceding year. The total steel output was less than that of any year since 1901, with the sole exception of 1904.

The ratio of the total steel to pig-iron production was 87.2 in 1908, against 90.1 in the preceding year.

During the first 11 months of 1908, an average of 8081 stamps were dropping on the Rand, and the average duty per 24 hours per stamp was 6.21 tons.

The Mineral Production of Canada in 1908

Total Mineral Production of Dominion in 1908 Valued at $87,323,849. Gain in Silver, Gold and Copper. Other Substantial Advances

BY JOHN McLEISH*

The following tables and comments give a full preliminary report on the mineral production of Canada in 1908. The figures of production given are, of necessity, subject to revision, since at this time, in many instances, producers of metallic ores have not themselves received complete returns from smelters. For these and other reasons estimates have to be made. It is hoped, however, that this preliminary statement may give a fair idea of the gross output of the mineral industry during the year. Acknowledgments are due to the various operators who have promptly furnished statements of their production, to the provincial mineralogist of British Columbia for a complete preliminary statement of mineral production in that Province, and to the other provincial mining bureaus for assistance rendered.

The value placed upon the mineral production of the Dominion since 1886, when complete reports were first prepared, has been as follows:

1886	$10,221,255	1898	$38,412,431
1887	10,321,331	1899	49,234,005
1888	12,518,894	1900	64,420,983
1889	14,013,113	1901	65,804,611
1890	16,763,353	1902	63,211,634
1891	18,976,616	1903	61,740,513
1892	16,623,415	1904	60,073,897
1893	20,035,082	1905	69,525,170
1894	19,931,158	1906	79,057,308
1895	20,505,917	1907	86,842,765
1896	22,474,256	1908	87,323,849
1897	28,485,023		

The total value in 1908 was, approximately, 8½ times that shown in 1886. The increase in 1908 over 1907 was 0.5 per cent.; over 1906, it was 10.4 per cent.

This preliminary review of the mineral production in Canada in 1908 shows that the industry has in the aggregate more than held its own despite the large decreases in the prices of metals. That this falling off in prices has been an important and serious question for the metal-mining industries, will be better realized when it is stated, that had the metals, copper, silver, lead and nickel, maintained as high average prices in 1908 as in 1907, their total production in Canada in 1908 would have been worth over $8,000,000 more to the producers than was actually the case.

The important feature of the mining industry during the year was undoubtedly the silver production, a total increase of over 72 per cent. being shown in the number of ounces produced. The metals, copper and gold, also show the important increases in quantity produced while iron, lead and nickel were produced in slightly smaller quantity than in 1907.

MINERAL PRODUCTION OF CANADA IN 1908.

Product.	Quantity.	Value.
METALLIC.		
Copper ..... Lb.	64,361,636	$ 8,500,885
Gold ..... Lb.	.....	9,559,274
Pig iron from Canadian ore ..... Tons.	99,420	1,664,302
Lead ..... Lb.	45,725,886	1,920,487
Nickel ..... Lb.	19,143,111	8,231,538
Cobalt ..... Lb.	1,853,286	112,253
Silver ..... Oz.	22,070,212	11,667,197
Total value, metallic.	....	$41,655,936
NON-METALLIC.		
Arsenic ..... Tons.	699	38,054
Asbestos ..... Tons.	65,534	2,547,507
Asbestic and asbestic sand ..... Tons.	25,239	25,829
Calcium carbide .. Tons.	6,864	417,150
Chromite ..... Tons.	7,225	82,008
Coal ..... Tons.	10,904,466	25,567,235
Corundum ..... Tons.	1,039	100,389
Feldspar ..... Tons.	7,877	21,099
Graphite ..... Tons.	251	5,565
Grindstones ..... Tons.	3,843	45,128
Gypsum ..... Tons.	340,964	575,701
Limestone for flux in iron furnace .... Tons.	418,661	289,705
Magnesite ..... Tons.	120	840
Mica ..... Tons.	.....	191,602
Mineral pigments—		
Barytes ..... Tons.	4,091	18,265
Ochres ..... Tons.	4,746	30,440
Mineral waters ... Tons.	.....	109,391
Natural gas ..... Tons.	.....	1,012,060
Petroleum ..... Bbl.	527,987	747,102
Phosphate (apatite) Tons.	1,596	14,794
Pyrites ..... Tons.	47,336	224,824
Quartz ..... Tons.	27,134	32,277
Salt ..... Tons.	79,975	378,798
Talc ..... Tons.	1,076	3,048
Tripolite ..... Tons.	30	195
Total value, non-metallic	.....	$32,479,006
STRUCTURAL MATERIAL AND CLAY PRODUCTS.		
Cement, natural .. Bbl.	1,044	815
Cement, Portland. Bbl.	2,665,289	3,709,063
Flagstones, ... No.	4,000	3,600
Sand and gravel (exports) ..... Tons.	298,954	161,387
Sewer pipe	..	514,042
Clay products, stone, lime, etc., est.		8,500,000
Total structural and clay products	.	$12,888,907
Estimated value of mineral products not reported	.	300,000
Total value, 1908....	.	$87,323,849

In the non-metallic class, decreases in gypsum and petroleum are more than counterbalanced by increases in coal, asbestos, natural gas, salt, etc. The portland-cement industry shows a small increase in sales and a large increase in quantity of cement made with large stocks on hand at the close of the year.

It should be noted that the valuation of the metals is based on New York prices, as reported by THE ENGINEERING AND MINING JOURNAL.

Some remarks are added on the details of production of the leading articles for the year.

GOLD

For the first time in nine years the gold output shows an increase over the previous year. The Yukon output in 1908 is estimated at about $3,600,000, as compared with $3,150,000 in 1907, while a considerably increased production is also shown in the province of British Columbia, derived chiefly from the Trail Creek ores, the placer workings having shown a smaller output. In Nova Scotia the output in 1907 was $282,686. Complete returns are not yet available for 1908, but the output was probably not over $225,000. Of the total gold output in 1908, over 44 per cent. was obtained from placer and hydraulic workings and 56 per cent. from sulphuret and quartz ores.

SILVER

The estimated silver production of Canada in 1908 was 22,070,212 oz., shipped as fine bars, silver bullion, and obtained in matte, ore, etc., as compared with 12,779,799 oz. in 1907, an increase of over 72 per cent. Owing, however, to the much lower price received in 1908, the total value shows an increase of only 40 per cent. Over 87 per cent. of the output was obtained from Ontario, and the increase is all to be credited to this province, since there was a slight falling off in the silver output of British Columbia.

The output from the Cobalt district in the province of Ontario again shows a very large increase over the previous year, nearly twice as much silver having been produced. Returns from 29 shipping mines show the ore and concentrates shipped, as approximately 25,497 tons, containing 19,296,430 oz. silver, as compared with 14,644 tons containing 9,982,363 oz. in 1907. Valued at the average price of refined silver for the year, the production in 1908 would be worth $10,200,865, and it represents an average return of 756 oz. of silver or $400 per ton of ore shipped as compared with an average return of 681 oz. of silver, or $445 per ton of ore shipped in 1907.

If the output of this district continues to increase at the present rate, Canada will in the immediate future, become one of the chief silver-producing countries of the world. In 1908, it held probably the third place and furnished about 12 per cent. of the world's output.

COPPER

Statistics of copper production in 1908 show a total output of 64,361,636 lb., an

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increase of over 14 per cent. over the production of 1907. There was an increase of over 900,000 lb. in the copper from the Sudbury mines, while preliminary statistics of production in British Columbia appear to show an important increase in production of over 7,000,000 lb. The total exports of copper in ore, matte and blister, were 25,568 tons.

Lead

All of the lead production shown in the general table, 45,725,886 lb., was obtained in the province of British Columbia. The production in 1907 was 47,738,703 lb., valued at $2,542,086; a decrease in quantity being shown of about 4 per cent. The total amount paid as bounty on lead production was, during the twelve months, $139,064. The exports of lead in ore, etc., during the year were 2256 tons, and of pig lead 6971 tons, or a total of 9227 tons.

Nickel

With the exception of the nickel contained in the ores shipped from the Cobalt district, the production of nickel in Canada is derived entirely from the well-known nickel-copper deposits of the Sudbury district. Previous to 1906 the output had been increasing steadily for a number of years. During the past three years, however, the production has not varied very greatly. About 815 tons less matte was shipped in 1908 than in 1907. The nickel contents were also somewhat lower in 1908, averaging about 45.1 per cent. as compared with 48.1 per cent. in 1907. On the other hand the copper contents were higher in 1908.

NICKEL PRODUCTION.

	1906.	1907.	1908.
Ore mined	343,814	351,916	409,551
Ore smelted	340,059	359,076	360,180
Bessemer matte produced	20,364	22,041	21,197
Bessemer matte shipped	20,310	22,025	21,210
Copper contents of matte shipped	5,265	6,996	7,503
Nickel contents of matte shipped	10,745	10,595	9,572
Spot value of matte shipped	$4,628,011	$3,289,382	$2,930,989
Wages paid	1,117,420	1,278,694	1,286,265
Men employed	1,417	1,660	1,690

NICKEL EXPORTS.

	1906.	1907.	1908.
To Great Britain	2,716,892	2,518,338	2,554,486
To United States	17,936,953	16,857,997	16,865,407
Total	20,653,845	19,376,335	19,419,893

Two companies are carrying on active operations: the Mond Nickel Company, at Victoria Mines, and the Canadian Copper Company, at Copper Cliff. The ore is first roasted and then smelted to a bessemer matte containing from 77 to 80 per cent. of the combined metals, copper and nickel, which is shipped to the United States and Great Britain for refining.

The accompanying table gives the results of the operations on the nickel-copper deposits of Ontario in 1906, 1907 and 1908, in short tons.

According to Customs returns exports of nickel in matte, etc., were, for twelve months ending Dec. 31, as shown in an accompanying table.

These figures do not include the nickel contents of the silver-cobalt ores from the Cobalt district, of which it is difficult to obtain satisfactory returns. The shippers of silver-cobalt ores receive little or no return for the nickel contents, although this metal forms an important constituent of the ore.

Iron and Steel

The total shipments of iron ore from mines in Canada in 1908 were 203,490 short tons, valued at the mine at $486,857 as compared with 312,496 tons valued at $666,941 in 1907. The greater part of this production was from the Helen mine, Michipicoten, delivered to Midland and Hamilton. During 1908 very little Canadian ore was exported.

Pig Iron—The total production of pig iron in Canada in 1908, from both Canadian and imported ores, according to direct returns from nine plants comprising 16 furnaces, was 630,835 short tons, valued at $8,111,194, as compared with 651,962 tons, valued at $9,125,226 in 1907. These figures do not include the output from the two electric furnace plants, making ferro-products, which are situated at Welland, Ont., and Buckingham, Quebec. Of the total during 1908, 6709 tons, valued at $171,383, were made with charcoal as fuel, and 624,126 tons, valued at $7,939,811, with coke.

The amount of Canadian ore, including mill cinder, etc., used was 219,266 tons, while the quantity of imported ore was 1,051,445 tons. The total amount of coke used during the year was 817,746 short tons valued at $1,770,320. The total amount of charcoal used was 1,121,900 bu., valued at $85,738. The quantity of limestone flux charged was 483,065 tons. The plant of the Atikokan Iron Company, Ltd., was out of commission throughout the year, while a number of others were operated for a part of the year only. The blast furnace at Londonderry was in blast for little over a month and the furnace of the Deseronto Iron Company, Ltd., for about two months.

Steel—The returns from eight companies making steel showed a total output as in the accompanying table.

STEEL PRODUCTION.

	1907. Tons.	1907. Value.	1908. Tons.	1908. Value.
Ingots—Open hearth (basic)	459,240	$9,157,703	443,442	$6,001,277
Bessemer (basic)	225,889	4,293,791	135,557	2,535,287
Castings—Open hearth (acid and basic)	20,602	2,031,380	9,051	617,126
Other steels	1,151	129,716	713	79,912
Total	706,982	$15,612,590	588,763	$9,233,602

A statement of the bounties paid on iron and steel during the calendar year, furnished by the Trade and Commerce Department, is also given.

The rates of bounty issued were the same in both years.

IRON AND STEEL BOUNTIES PAID.

	1907. Tons.	1907. Bounty.	1908. Tons.	1908. Bounty.
Pig from Canadian ore	95,915	$201,421	101,647	$213,458
Pig from imported ore	537,803	591,584	517,427	569,170
Total, pig iron	633,718	$793,005	619,074	$782,628
Steel ingots	666,590	1,099,873	556,289	917,877
Steel wire rods	68,738	412,417	49,630	297,779
Total bounty paid		$2,305,295		$1,998,284

Asbestos

Returns of shipments of asbestos from the eastern townships, province of Quebec, were received from 12 operating companies, which employed 2643 men in mine and mills and paid in wages $1,002,768. Several other companies were engaged in development work and preparing to make shipments during the coming year. The total shipments divided into crude and mill stock in 1907 and 1908 are given in the accompanying table.

Exports of asbestos from Canada were: 1906, 59864, value, $1,689,257; 1907, 56,753, $1,669,290; 1908, 61,210 tons, of $1,842,763 value.

Coal and Coke

Each of the coal-mining provinces except British Columbia, contributed an increased output to the coal production in Canada in 1908. The total shown includes colliery consumption and coal used in making coke. Of the total, Nova Scotia contributed over 59 per cent. Saskatchewan and Alberta over 19, and British Columbia 21 per cent. The production by provinces is given in the accompanying table, in short tons.

The total production of oven coke in 1908 was approximately 865,257 short tons, valued at $3,668,974, being an increase of about 3 per cent. over the quantity produced in 1907. The coke was made in the provinces of Nova Scotia, Alberta and British Colombia and entirely from Canadian coal. At the end of the year there

were in Nova Scotia about 659 ovens in operation and 173 idle; in Alberta and British Columbia on the same date 916 in operation and 528 idle, not including the ovens at Hosmer and Comox in British Columbia, from which no returns have yet been received.

Petroleum and Natural Gas

The production of crude petroleum is, as usual, practically all derived from the Ontario peninsula. Direct returns from the producers have not been obtained, but the production has been estimated on the basis of the bounty of 1½c. per gal. paid by the Dominion Government. The total bounty paid in 1908 was $277,193, representing a production of 527,987 bbl., compared with a bounty of $414,158 in 1907 representing 788,872 bbl. A decreased production of 33 per cent. is, therefore, shown.

Natural gas was produced in the counties of Welland, Haldimand, Norfolk, Kent, Essex and Bruce, in Ontario and at Medicine Hat, Alberta; the sales from the Ontario fields constituting over 95 per cent. of the total. The total receipts from gas sold in 1908 show an increase of about 24 per cent. over the receipts of 1907 and are now larger than at any time since the gas was first used.

Cement

Complete statistics of cement production in 1908 have been received from 23 operating plants. The total daily capacity of the 23 plants was about 27,500 bbl. as compared with an operating capacity of 14,300 bbl. in 1907. The operating plants were distributed as follows: One each in Nova Scotia, British Columbia and Manitoba, the latter manufacturing a natural portland, two in Alberta, three in Quebec province and 15 in Ontario. Of the 23 operating plants, 12 use marl and clay, 10 use limestone and clay, and one blast-furnace slag.

Detailed statistics of production in 1907 and 1908 are as follows:

	1907. Barrels.	1908. Barrels.
Portland cement sold	2,436,093	2,665,289
Portland cement manufactured	2,491,513	3,495,961
Stock on hand, Jan. 1	299,015	383,349
Stock on hand, Dec. 31	354,435	1,214,011
Value of cement sold	$3,777,328	$3,709,063
Wages paid	956,080	1,274,638
Men employed	1,786	3,029

The average price per barrel at the works in 1908 was $1.39 as compared with $1.55 in 1907. The imports of portland cement into Canada during the 12 months ending November, 1908, were 1,600,934 cwt. valued at $530,209. This is equivalent to 457,408 bbl. of 350 lb. at an average price per barrel of $1.16. The imports in 1907 were equivalent to 672,630 bbl. valued at $837,520, or an average $1.24½. The duty is 12½c. per 100 lb. There is very little cement exported from Canada, the consumption is, therefore, practically represented by the Canadian sales together with the imports.

An estimate of the Canadian consumption of portland cement for the last five years follows: 1904, total, 1,694,988 bbl., of which 784,930 bbl. were imported; 1905, 2,264,106, imported 917,558; 1906, total, 2,814,267; imported, 694,503; 1907, total, 3,108,720, imported 672,630; 1908, total, 3,122,697 bbl., of which 457,408 bbl. were imported.

COAL PRODUCTION IN CANADA.

Province.	1907. Tons.	1907. Value.	1908. Tons.	1908. Value.
Nova Scotia	6,354,133	$12,764,999	6,539,866	$13,138,124
New Brunswick	34,584	77,814	60,000	135,000
Saskatchewan	151,232	252,437	130,000	214,500
Alberta	1,591,579	3,836,286	1,845,000	4,899,611
British Columbia	2,364,898	7,390,306	2,329,600	7,280,000
Yukon	15,000	60,000	.....	.....
Total	10,511,426	$26,381,842	10,904,466	$25,567,235

Exports of Mineral Products

Exports of metals and minerals from Canada for the year are reported by the Customs Department as follows:

Arsenic	Lb.	1,913,732	$43,493
Asbestos	Tons.	61,210	1,842,763
Barytes	Cwt.	3,509	13,690
Chromite	Tons.	4,571	56,864
Coal	Tons.	1,729,833	4,661,377
Feldspar	Tons.	9,524	34,045
Gold	.....	.....	7,740,918
Gypsum	Tons.	280,091	324,574
Copper, fine in ore, etc.	Lb.	51,136,371	5,934,559
Lead in ore, etc.	Lb.	4,511,931	153,394
Lead, pig, etc.	Lb.	13,942,663	469,060
Nickel, in ore, etc.	Lb.	19,419,893	1,866,624
Silver, in ore, etc.	Oz.	20,884,451	12,403,482
Platinum, in ore concentrates, etc.	Oz.	43	937
Mica	Lb.	580,195	198,839
Mineral pigments	Lb.	249,635	4,850
Mineral water	Gal.	8,953	3,659
Oil, refined	Gal.	25	296
Ores, antimony	Tons.	149	5,647
Ores, iron	Tons.	4,334	72,260
Other ores	Tons.	13,910	509,779
Phosphate	Tons.	1	30
Plumbago	Cwt.	7,706	10,159
Pyrites	Tons.	17,283	96,600
Salts	Lb.	527,229	3,810
Sand and gravel	Tons.	298,954	161,387
Slate	Tons.	10,709	2,539
Stone, ornamental	Tons.	1,314	28,777
Stone, building	Tons.	4,009	14,034
Stone, for manufacture of grindstones	Tons.	661	5,991
Other products of the mine	.....	.....	176,007
Total value			$36,850,474

In addition there were manufactures exported to a total value of $2,940,379; the important items of value being $1,169,673 for manufactured steel; $399,785 for 194,546 lb. aluminum; $248,759 for 58,708 tons coke.

ASBESTOS PRODUCTION.

	1907. Tons	1907. Value.	1908. Tons.	1908. Value.
Crude	4,327	$830,633	3,346	$692,232
Mill stock	57,803	1,654,135	62,188	2,855,275
Total asbestos	62,130	$2,484,768	65,533	$2,547,507
Asbestic and asbestic sand	28,296	20,275	25,239	25,829
Total products	90,426	$2,505,043	90,772	$2,573,386

February Dividends

The accompanying table shows the dividends paid in February, 1909, by mining and industrial companies in the United States and by some foreign mining companies:

U. S. Mining Companies.	Location.	Amt. per Share.	Amount Paid.
Amal. Copper	Mont.	$0.50	$769,439
Bunker Hill Sull	Ida.	0.25	75,000
Camp Bird	Colo.	0.24	196,800
Colorado	Utah	0.08	80,000
Elkton Con., M. and M.	Colo.	0.01½	37,500
Homestake	S. Dak.	0.50	109,200
International Nickel, pfd.	N. Y.	1.50	133,689
Mohawk	Mich.	2.00	200,000
United Verde	Ariz.	0.75	225,000
Utah (*Fish Sp's*)	Utah	0.02	2,000
Total			$1,828,628

Foreign Mining Companies.	Location.	Amt. per Share.	Amount Paid.
Buffalo Mines, Ltd	Ont.	$0.01	$10,000
Cobalt Central	Ont.	0.02	95,230
Dolores	Mex.	0.15	60,000
Mines Co. of Am.	Mex.	0.02	40,000
Total			$205,230

U. S. Industrials.	Location.	Amt. per Share.	Amount Paid.
Cambria Steel	Penn.	$0.75	$675,000
Jeff. & Cl'f. C. & I., pfd.	Penn.	2.50	37,500
Phila. Gas, com.	Penn.	0.75	498,600
Total			$1,211,100

New Zealand Gold and Silver

Exports of gold and silver from New Zealand for the full year are reported by the Mines Department as follows:

	1907.	1908.	Changes
Gold, value	$9,867,118	$9,743,275	D. $123,843
Silver, ounces	1,562,603	1,731,336	I. 169,733

The gold bullion reported in 1908 was 506,381 oz. bullion, equivalent to 471,373 oz. fine gold.

West African Gold Mines

Gold production in West Africa—including the Gold Coast and Ashanti—in January was 24,844 oz. bullion in 1908, and 22,817 oz. in 1909; a decrease of 2024 oz. The bullion reported this year was equal to $442,804, or 21,810 oz. fine gold.

Colliery Notes

With reference to the observation of gas caps on safety lamps, the best authorities speak favorably of the use of a piece of blue glass in the foreground as a refinement that will enable the early detection of a blue gas cap on a small lighted oil wick.

Miners have a dislike for anything "new fangled," and consequently they view the advent of the rescue apparatus with feelings of distrust. When once they realize the true value of such apparatus, they will undoubtedly enter into the study of it whole-heartedly.

It is the habit of a gas to depart from the air currents and take up its abode in cavities along the airways. This is one reason why the reduction of pressure indicated by a fall in the barometer is dangerous; such an occurrence causes the pent-up gas in the cavities to expand in volume and mix with the air currents.

Henry Louis has called attention to the fact that our methods of testing for gas should be brought to a point of greater sensitiveness. The ability to see a cap is unequal among different men and consequently, the officials responsible for such testing should be required to undergo an examination. Colliery managers themselves may carry on such an examination by having a half dozen lamps burning in atmospheres of different kinds, and requiring the men to pass by one at a time and state what they can see. This test should be repeated at intervals, especially as the men grow older.

It is generally conceded that winding ropes constructed of steel wire are the best for colliery winding purposes. There is a divergence of opinion, however, as to whether the locked coil or the flattened strand ropes are best. Plough-steel locked coil ropes contain no hemp cores, consequently this class of rope is more rigid than the flattened strand variety. The latter class of rope possesses practically all the advantages of the former, and, furthermore, has no tendency to spin or kink. The flattened strand rope also exhibits less tendency to become brittle. Ropes of this construction are also easier to cap and to lubricate than locked coil ropes.

Warnings are of great benefit to colliery operators in enabling them to know when atmospheric conditions are dangerous. Henry Louis, before the Royal Commission on Mines in England, suggested that each colliery subscribe a small amount, say $2, to defray the expense of a center, from which warnings could be sent to adjacent collieries stating the likelihood of a great atmospheric depression approaching the district. The warnings should be sent as far in advance as possible, because the atmospheric conditions of mines differ so much. Many mines will indicate a change of the barometer before the barometer itself does, and others will answer much more slowly.

Basing his suggestion on the fact that a mixture of one-seventh of its volume of carbon dioxide to a mixture of firedamp at its most explosive point, will render the resulting atmosphere non-explosive, one mining engineer has proposed that a large furnace be erected near the mouth of each coal mine, and that sufficient carbon dioxide be generated to entirely fill the mine in a couple of hours, after which, all shots are to be fired. It is asserted by the same authority that this scheme will do away with the possibility of a dust explosion due to blow-out shots. The shots are to be fired by electricity, and after this has been accomplished, the fan is turned on full force so as to clear the mine of the gases that have been introduced. Mine operators will soon be dizzy trying to absorb the many ideas suggested to make their mines safe.

There is a certain amount of natural ventilation in all mines, and those with a temperature of more than 60 deg. at the working face probably contribute about 25 per cent. of the total volume of the ventilating current. It is always advisable to conduct the fresh air to the lowest point in the mine, and finish at the highest. Ascensional ventilation should be adopted so as to aid the fan wherever possible. One of the disadvantages of sprinkling in a mine is that the more vapor there is in the air the greater the strain on the work of the fan. Along this line it should be remembered that a waterfall in an upcast shaft greatly retards a ventilating current. Instances have been recorded where an accidental fall of water in an uncast shaft has been sufficiently detrimental to overcome the action of the fans and reverse the ventilation.

There has been much discussion of late as to the best standard of ventilation. The only practical method is to fix definitely the maximum percentage of marsh gas to be allowed in the return airway. Whenever the air contains a greater percentage of this gas than the amount prescribed, the ventilation should be considered foul. In dealing with ventilation in this way, the reason for fixing the standard, by prescribing a certain percentage of marsh gas, as the maximum permissible, is due to the fact that when a dangerous amount of carbon dioxide is present, the lamp would be extinguished before the gas would become dangerous to life. The greatest difficulty in fixing a certain standard of ventilation is the recognition that 1 per cent. of gas will create a condition of danger in a dusty mine, whereas 2 per cent. would not be any more dangerous in a mine free from dust. Any rules, therefore, will have to be modified in accordance with such conditions.

New devices and schemes for enabling the detection of small quantities of firedamp in a mine atmosphere, are being presented in rapid succession. One of the latest ideas advanced is to apply the microphone, by connecting this latter instrument in series with a telephone; when firedamp is present in the mine air, beats are sounded in the telephone located on the surface. The theory on which the scheme is based depends on the fact that if sound waves of two pipes of equal pitch impinge on microphones connected in series with a telephone, a clear note is heard, but if one of the pipes emits a slightly different note, there will be beats heard in the telephone. The practical arrangement is to have one pipe on the surface and the other underground; if firedamp is present in the mine, air of a different density will be blown into the underground pipe, which latter will emit a different note. The apparatus has already been tested in an atmosphere containing coal gas, and showed great sensitiveness. An admixture of but 0.1 per cent. firedamp gave three beats in twenty seconds, and an admixture of 1 per cent. gave 30 beats in twenty seconds.

Considerable care must be exercised when we attempt to dispose of gunpowder or dynamite. The *Engineer* suggests that the best way to destroy ordinary black gunpowder is to throw it into a stream under conditions that prevent any harm coming to human beings or animals through the dissolving of the saltpeter. If no suitable stream is available, the gunpowder may be poured out on the ground in a long thin line and ignited with a fuse at one end. To destroy dynamite cartridges, the paper wrappings should be carefully removed, the bare cartridges laid in a row with their ends in contact, and the first cartridge ignited with a fuse without a cap. Even with these precautions a simultaneous explosion of the entire mass may occur, so that it is wise to retire to a safe distance. The row of cartridges should be laid parallel with the wind and ignited at the leeward end, so that the flame will be driven away from the mass. Frozen dynamite should be handled with especial care, as its combustion is peculiarly liable to assume an explosive character. A small quantity of dynamite may be destroyed by throwing it, in very small bits, into an open fire, or the cartridges may be exploded one by one in the open air with fuses and caps. Dynamite should never be thrown into water, as the nitro-glycerine which it contains remains undissolved and capable of doing mischief. Other explosives which contain nitro-glycerine should be treated in the same way as dynamite. Ammonium nitrate explosives may be thrown in small fragments into an open fire, or, if they do not contain nitro-glycerine, may be destroyed by means of water. Explosive caps should be exploded singly with pieces of fuse.

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A Tariff on Zinc Ore?

Our advices from Washington indicate that the Ways and Means Committee is likely to recommend a tariff on zinc ore. It will be a very serious matter if such a tariff be established, and the committee should consider it carefully. In the first place let it discard the mass of memorials and statistics by which it has been overwhelmed from both sides. To a large extent they reflect only brief periods when commercial conditions, always fluctuating, were especially favorable to one side or the other, viz., miners or smelters. The matter of cost of production is so intricate that two experts of long experience in the business might discuss it for a month without coming to an agreement. A committee of laymen can expect no result other than confusion in dipping into the technics of such a business. Consequently it should confine itself to viewing the broad principles.

The average price for spelter at St. Louis during the last 10 years has been about 5.05c. per lb. Under existing conditions, aside from any tariff change, there is reason to anticipate a higher range in the years immediately to come, perhaps 5.25c. On the latter basis a price of $40 per ton for 60-per cent. ore at Joplin would leave but a narrow margin to the smelter. Yet, such a price for ore in the case of many operators at Joplin only meets the cost of production if all things be considered. Nevertheless, even so the mining of zinc ore is immensely profitable, inasmuch as the annual output of the Joplin district, about 250,000 tons, worth $10,000,000, pays a royalty of about $1,000,000 (in one form or another) to the owners of the land, who reap their profit while the operators may get none.

Now during the last decade there have been four years (of which three were successive) when spelter has averaged higher than 5.5c. per lb., and ore has fetched more than $40 per ton without leading to a material increase in the production of the Joplin district. The smelters have had to go elsewhere for the supply of raw material necessary to meet the requirements of domestic consumption, first to Colorado and then to Mexico. The ore resources of Leadville have waned as well as those of Joplin.

If a tariff be put upon zinc ore the price of spelter will be jacked up sufficiently to enable the smelters either to (*a*) obtain the necessary ore from Mexico and Canada at the increased cost, or (*b*) to obtain new supplies of ore from this country that normally cannot be produced profitably. There will be need for a careful adjustment of duties so as to keep out foreign spelter. If the latter be accomplished the only limit to the advance in price of spelter will be the point where consumption is restricted by users turning to cheaper substitutes.

Every cent that accrues to the pockets of the producers of zinc ore in the United States will come out of the pockets of American consumers. The smelters will pass on the advance to the galvanizers and brassmakers, and the latter to the users of the sheets and other manufactures. This phase of the question is self-evident. The miners want more money. Whence is it going to come? The middlemen—the smelters and the manufacturers of various degrees—may furnish it temporarily, but ultimately it must all be paid by the consumers.

Theoretically the smelter should not care what his ore costs (so long as he can sell the product at a proper profit), he being only a species of middleman. Practically he foresees that he will be driven among the rocks of shortage of ore supply, restricted consumption of spelter, and the competition of foreign smelters. These portend narrow profits, or none at all, and idle smelting capacity. All hope is to be abandoned of establishing an export trade in spelter or seeing the development of a smelting industry on the Atlantic coast. Just as the tariff on lead ore drove a smelting industry to Mexico, so will a tariff on zinc ore divert foreign ores to Europe.

As to the competition of European smelters we may form some idea from the plans of the iron-bound convention recently formed by them. This intends to control the price for spelter at London to a range of £20@23, or 4.35@5c. With the present duty of 1½c. per lb. on spelter the corresponding prices at which it could be entered at New York would be 6@6.65c. Practically, the condition that is threatening in the United States would be enjoyable to the European convention which would use America as a dumping ground, whenever necessary, irrespective of the price of 6c., the very purpose of the convention being to take care of surplus production. The source of that surplus production is Broken Hill, New

South Wales, where the ore is produced under conditions as to labor, etc., as costly as anywhere in the United States. The rise of Broken Hill as a zinc-producing district is due entirely to the efforts of engineers in solving one of the most baffling problems that metallurgy has known. One of the greatest triumphs in that district is owed to an American engineer.

The cost and profit in producing zinc depend fundamentally upon the grade of the ore yielded by the mines. The miners of Joplin, having exhausted to a large extent their richer ore, are now mining a lower grade than anywhere else in the world and have been able to do so only by the exercise of extraordinary ingenuity, but they suffer from an outrageous royalty system that hangs on their neck like the Old Man of the Sea. The States of the Rocky mountains have ore that is richer but of less docile character and are subject to higher freight charges because of their remoteness. Nor can it be said that they have approached their problems with the same persistence, intelligence and energy as has been done at Broken Hill.

It is, therefore, the problem of the Ways and Means Committee, and after it of Congress, to balance on the one hand the needs and demands of the miners of the United States; and on the other hand the rights of consumers, also American citizens, and the evident danger to the domestic smelting industry.

The British Columbia Copper Company

The report of this company for the fiscal year ended Nov. 30, 1908, shows that during seven months the mines shipped 319,527 tons of ore. At the smeltery three blast furnaces in six months handled 321,427 tons of ore, which yielded 5,767,355 lb. of copper, 13,597 oz. of gold and 58,204 oz. of silver.

The cost per ton of ore handled, including all charges from ore in place to sale of the metal products was $2.63 per ton; the cost of producing, refining and marketing per pound of fine copper, after crediting expenditure with value of gold and silver realized, was 9.996 cents.

It seems to us that this cost of $2.63 per ton of ore is probably the lowest on record. It is the more remarkable in view of the high cost of coke at Greenwood. On the other hand, a favorable factor is the self-fluxing character of the ore, the latter constituting practically 100 per cent. of the furnace charge. But however the conditions are regarded, the result reflects very high credit upon J. E. McAllister, general manager of the company, and especially manifests his success in effecting a coördination of the work of the different departments in such a way as to secure maximum efficiency all around. It is certainly extraordinary that it has been possible to mine and smelt a ton of ore for $2.63, including freight on the metallic products to market, and refining and selling of the same.

The Osceola Report

The report of the Osceola Consolidated Mining Company for 1908 records once more the phenomenally low cost of milling achieved at its property. In the treatment of 1,426,329 tons of ore in 1908 the cost was only 15.8c. per ton, compared to 17.47c. in the previous year. We believe that these figures are unsurpassed anywhere. The betterment of conditions in 1908, with respect to material and labor, both as to the reduced wage for the latter and at the same time its increased efficiency, is reflected in the cost of mining and milling, which in 1908 was $1.50 per ton of ore against $1.84 in 1907. Consequently, although the yield of refined copper per ton of ore in 1908 was slightly less than in 1907, the cost per pound of refined copper was only 10.53c. against 12.44c.

We have frequently had occasion during the last 20 years to criticize unfavorably the policy of Mr. Bigelow, the retiring president, in some respects, although we have always commended the efficiency of his management with respect to mining and milling. We think that proper recognition should be accorded to the valedictory of the present management, given in its last official report as follows:

"As this is the last report which will be issued by the present management, they wish to place before the stockholders a judicial decision certifying as to their economical management of the property and as to the adequacy of the price realized through their selling agents for the product of the company. In the findings of fact by Judge Knappen, in his opinion dismissing the bill against the Calumet & Hecla Mining Company, the court says: 'It is only just to the complainant (Albert S. Bigelow) to say that the charges made against his management of the Osceola Consolidated Mining Company to the effect that its product has not been economically manufactured and sold, and that it has not been made to bring the best prices, are shown to be without foundation.'"

Proposed Coal Mine Legislation

The budding agitation for reform in coal mining is beginning to blossom in the introduction of radical bills in several State legislatures. It is to be hoped that all of the measures finally enacted into laws will at least be based on common sense, even though they are not formulated by persons having an understanding of the coal industry and its problems.

In one State, legislation has been proposed that will prohibit the sale of fuel in which there is any foreign substance. Should this become a law, gas companies would have to furnish gas free from any air, and coal producers would be held liable if any of their product contained bone or slate.

It might be well to punish the tradesman who puts sand in his sugar or water in his milk, if he be not sufficiently punished by the loss of discriminating customers; however, the dealer who can sell pure fuel as the merchant sells pure food is a wizard who has certainly secured advanced knowledge of the science of the next century. Thousands of dollars have been spent by coal operators in removing bony matter from their coal, and they have then had no little difficulty in finding purchasers for their purified product.

There is so much coal legislation that is necessary, that the passage of ill-advised laws is to be deprecated. There has lately been a general cry for the conservation of our fuel resources; however, we shall not conserve our coal deposits nor the lives of our miners by adding any unnecessary burden to the industry. Let us have action that will permit the coal operator to inaugurate sane improvements rather than the making of laws that will force him to rob his acres and kill his men in order that his business may survive.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Mexican Zinc Ore

At this time when zinc-ore prices are depressed and there seems to be so much confusion as to the cause, any scrap of real information bearing upon the question is doubtless welcome.

With a view to getting at the facts in regard to the relation of Mexican importations to the downward trend of prices, I wrote to an old friend, a prominent engineer who is manager of a Mexican mining company in Chihuahua, asking him about the zinc resources of the Republic and received the following reply which may be of interest to the readers of the JOURNAL:

"The zinc industry is not in as flourishing condition in Mexico as you seem to think. * * * I know little of the occurrence of zinc outside of this state, but I believe this is the principal zinc producing state in Mexico.

"Zinc ores are found in the following camps: (1) Picachos, on the Kansas City, Mexico & Orient railroad, about 125 miles from the city of Chihuahua, where carbonate ores are mainly produced; sulphides occur but not on a commercial scale. (2) Santa Eulalia, about 16 miles from the city of Chihuahua, produces carbonate ore exclusively. (3) San Isidro, on the Chihuahua & Pacific railroad, about 140 miles from the city of Chihuahua, where sulphides alone are produced. At San Isidro the Sutton-Steele process of dry concentration is used with excellent results. (4) Almaloya, where carbonate and silicate ores are produced. (5) Parral and Santa Barbara produce sulphide ores only.

"The zinc orebodies are always found associated with silver-lead and in many cases the zinc is simply a by-product; although some mines, as at Picachos, are mined solely for zinc. It is claimed that there are, more or less exposed, in the state, 1,000,000 tons of ore, viz., Picachos, 50,000 tons; Santa Eulalia, 100,000; San Isidro, 200,000; Almoloya, 50,000; Parral and Santa Barbara, 600,000.

"The carbonate and silicate ores run from 32 to 45 per cent. zinc after being hand sorted. Crude sulphide ores run from 10 to 35 per cent. zinc. The sulphide ores present hard and complex milling difficulties. Formerly zinc was considered a detriment in the ore and such ores sold to the smelters were given a low zinc limit and charged for over about 5 per cent., losing thus the zinc and being penalized for its presence.

"The foregoing camps are producing almost all the ore that comes from this state, which for September and October was about 125 tons a day. Picacho ships carbonates, lead-free 45 per cent. zinc; San Isidro, sulphide concentrate, 45 per cent. zinc; Santa Eulalia, carbonate, lead-free, 35 per cent. zinc."

I simply give the foregoing as a statement of fact from which the reader can draw his own conclusions.

FRANK NICHOLSON.

Hazel Green, Wis., Feb. 16, 1909.

Assay of Gold in Copper Bullion

I was much interested in Doctor Hunt's description of the assay for gold in copper bullion by the sulphuric-acid method. I have been using this method for about two years, and have found the results to be very reliable as compared with those obtained by the "all-fire" method. In fact, it is my experience that the results are slightly in favor of the sulphuric-acid method.

However, I cannot agree with him as to the necessity for the use of cupric sulphate. It has been my method to use a solution of mercury nitrate or sulphate equivalent to 100 mg. of mercury, adding it directly to the copper borings, usually agitating it a little. Then add 80 c.c. of concentrated sulphuric acid, and place on a hot plate, boiling for three-quarters of an hour. Now cool and add about 400 c.c. of hot water, stirring it in gradually when all of the crystals will dissolve. Boil for 15 minutes; let settle and filter through a triple filter.

It has been my contention for some time past that the reason why the ordinary wet method gives low results is not because the gold goes into solution, but because of its very finely divided condition due to the violent reaction of the nitric acid, and that it is then carried through mechanically by the solution.

As a part proof of this theory, I have found that I can get results which compare favorably with the fire assay if I use a mercury salt. However, the results are not so uniform as in the case of the sulphuric-acid method.

The author of the mercury method always claimed that any sulphur present in the bullion will form a sulphide of mercury, and that this will take the place of lead acetate. It is also my experience that in low-grade bullion running from 10 to 50 oz., the silver is thrown down with the gold, and I could find no trace in the filtrate. Of course there may be some bullions that may require some modification, but I have not come across them.

It would interest me and perhaps others if Doctor Hunt would explain his theory for the use of permanganate in the filtrate before precipitating the silver. I have found no difficulty in getting all of the silver down by simply adding salt solution to the filtrate without any preliminary treatment, of course, taking the precaution to add enough to throw down any mercury that may have been dissolved. My work has included material running from 10 to 600 oz. in silver.

It is not my intention to criticize Doctor Hunt. I am rather in hopes of hearing from others, as the all-fire method is expensive and takes such a long time, and a method such as the sulphuric-acid method seems to me would be a blessing to the assayer.

F. B. FLINN.

Newark, N. J., March 2, 1909.

The Value of Good Management

One of the first questions asked of a promoter by a capitalist, or successful investor, after having satisfied himself regarding the merits of an industrial proposition, is "Who is going to manage this business?" The successful mining investor also asks the same question, and if everyone made sure of this important point before putting his money into a mining enterprise, there would be fewer failures than occur at present in what appeared to be "sure things."

It is surprising what chances people will take in mining investments without asking who is going to manage the property after it is bought, so that it can actually be made to pay the returns figured out on paper. More often than not, the engineer who has examined the property for purchase, if any engineer is employed at all, is not retained to carry out his own plans and recommendations, and the man who is placed in charge—usually some friend or relative of the buyers—carries out his own ideas, regardless of the engineer's previous advice, and so the entire enterprise often fails. The engineer's reputation generally suffers in the process also, although it may be no fault of his, as people are apt hastily to judge these failures from the results alone. There is an old saying that figures can-

not lie, but they are apt to be most misleading unless you know who made them, and who is going to make them work out in practice. No really successful mining man would think of investing his money in a proposition in regard to the management of which he knows nothing, no matter how well it shows up, unless he simply intends to hold it, as a piece of real estate, for a natural rise in value. Men with promising properties are constantly asking engineers to interest investors in their properties, without explaining at all who will manage them, but no engineer feels justified in complying with such a request.

This subject has been so impressed upon my attention lately in several instances, that I should like to set forth my views upon it. I am inclined to place a value of about 75 per cent. upon the management of a new mining proposition, and something like 25 per cent. upon the merits of the property itself. Of course, there are exceptions to this rule, as to most rules, notably in the case of a very rich property which pays a good return in spite of the management—where the mine is said to have made the reputation of the man without just cause—but even then a man having better executive ability and who knew his business thoroughly would undoubtedly have produced better results. In my experience such men are most difficult to find, and are worth all the money you pay them. Generally, I think it is the custom to give the manager, besides his salary, an interest in the property as an incentive to do his best. I also believe it is very rare nowadays that such a man attempts to temporarily impair the value of a property for stock-gambling purposes. The manager's chief desire is to build the property up and make it more valuable all the time.

In speaking of the management of a property, I have two positions particularly in mind. It does not always follow that a capable superintendent, who is competent to handle the miners and other men about the mine and to get the best work out them, is also equally able to pass upon the merits of a mining property or to plan out the proper work to be done. I believe these various vocations are special gifts from nature, and am backed up in my theory by knowing most excellent mine managers who have recommended very poor propositions to purchasers, honestly believing them good investments. It also follows that a good assayer or mill engineer, is not always equally as good in sizing up a mine. We are all specialists nowadays in our own field of work, and the results obtained from a harmonious combination of these different men is far ahead of what it used to be with only a general "handy man about the place." If, however, the examining engineer has executive ability, a loyal and efficient superintendent or mine manager to carry out his ideas, and the responsibility for the success of the mine placed upon his shoulders, then the owners have the best chance of winning out, and the men in charge deserve all the benefits they may get.

Not very long ago, a mine owner used the argument to me that his mine ought to be a good one because he had spent over $200,000 on it. However, in spite of this fact it was not. Another gentleman, who owned many large interests, all of which were uniformly successful, had invested heavily in a property years ago. It was a failure from the start, but still he had never been to see it himself, nor would he send an engineer to examine it and pass upon its value. Consequently, the mine has been shut down for years, and he keeps paying the taxes out of his pocket. These two cases were cited by the owners as results of bad management. In reality, they were not only results of bad management, but were primarily due to the lack of an examination by a competent engineer in the beginning. A poor mining property cannot be made to pay with the best management in the world, but a good one will pay in direct proportion to the management, and the better the management is the more confidence people will have in investing their money in it.

I am strongly in favor of placing a property in the hands of the engineer who examines it for the purchasers and of holding him responsible for the success of the investment. By this, I do not necessarily mean that he should live upon the ground, but rather that he should be retained as a consulting engineer, with his own superintendent or manager in charge, and should visit the mine occasionally to see that his plans are carried out. He should be given some interest in the property and should keep constantly in touch with the work as it progresses, making reports to the directors and fulfilling all the other functions of his position. The more properties this engineer can secure to handle in this way, the more valuable he becomes, as his experience in one place will help, not only him, but also the owners of the next mine.

A. P. ROGERS.

New York, Jan. 28, 1909.

The Steelton, Penn., *Reporter* says that a steel rail rolled by the Pennsylvania Steel Company, in 1876, for the Cumberland Valley Railroad was discovered the other day by James P. Gaffney, who was inspecting a lot of old rails sold by the railroad to a southern lumber company. The rail had been in use on the main line for 32 years and is still in serviceable condition. The date of manufacture is plainly stamped on the rail.

A Benefit Fund for Coal Miners Families

In view of the frequency of recurring accidents in the coal mines of this country and the recent movement to collect subscriptions for the benefit of those widowed and orphaned by certain of the more serious disasters, is not the time propitious for starting a "National Fund" to which every coal operator in this country—from Pennsylvania to the Pacific coast—should contribute monthly, or annually, a fixed sum per ton of product?

One mill per ton would seem to be within the means of the smallest operation. But such a fund, vested in and administered by a trust composed of three men of national reputation—appointed by the President of the United States—with the governors of the coal-producing States as an advisory commission would meet all requirements.

It would even seem that such a fund might be utilized to carry out important investigations looking to the development of safety appliances and improved methods on broader lines than those now being pursued by the Government.

In Pennsylvania a bill to tax coal operators with similar objects in view has been voted down on the theory that such a tax would ultimately fall upon the consumer; surely, a general contribution of 1 mill per ton would not be worth considering in such connection.

I hope that this idea may appeal to the readers of the JOURNAL sufficiently to excite discussion. If practical, it has great merit over any system of taxation. Is it practical? OPERATOR.

New York, Feb. 20, 1909.

The European Zinc Convention

The organization of this convention comprises three groups of smelters, viz., (*a*) the German, including the Dutch and some of the French and Belgian producers; (*b*) the Franco-Belgian; and (*c*) the British. Among the important producers only Giesche's Erben remains outside, that famous concern adhering to its historic policy of independence. The German groups have incorporated as the "Zinkhüttenverband," with a capital of 2,047,000 marks, of which Fritz Lob is chairman. Mr. Lob is director-general of the Hohenlohe interests; the organization of the convention is largely due to him. The spelter of the German group is to be sold by the Metallgesellschaft, Frankfurt am Main; Beer, Sondheimer & Co., of Frankfurt am Main; and Aron Hirsch & Sohn, of Halberstadt. These concerns themselves have large zinc-smelting interests. Production of all the groups will be regulated according to the plan that we have previously stated.

The Canadian Mining Institute

SPECIAL CORRESPONDENCE

The annual meeting of the Canadian Mining Institute opened in the Windsor Hotel, Montreal, Wendesday morning, March 3. At the opening session President W. G. Miller delivered a brief annual address. The institute, he said, was formed in 1898. It numbered then 63 members. Today there were 850. During the last ten years the institute had rendered valuable service to the mining industry in Canada. Several excursions had been organized by it, with the result that the mineral resources of Canada had been brought to the better acquaintance of mining engineers. Among the excursions organized, Mr. Miller mentioned that to British Columbia in 1899, that to the provinces of Quebec and Nova Scotia in 1900, which was organized with the American Institute of Mining Engineers, that to Cobalt in 1907, and finally the excursion of last year, which permitted the mining engineers to visit the mining lands of Canada from the Atlantic to the Pacific.

J. McLeish, of the Department of Mines, Ottawa, presented a report on the mineral production of Canada, a summary of which is given on another page. The reports of the officers and council were presented and approved, and other necessary business transacted.

The president's gold medal for the best student's paper presented at the last annual meeting, was awarded to H. H. Yuill, of McGill University.

J. Obalski, superintendent of mines for Quebec, presented a report in which he said the total mineral output for the province for 1908, valued at the mines, or at the nearest point of shipping, was $5,493,664. The mining industries employed 6324 men, whose wages for the year amounted to $2,094,357. The biggest item of production was asbestos, the output being valued at $2,551,596. Cement came next with $1,127,335.

TAXATION OF MINING LANDS

This subject was brought up at the afternoon session by a paper presented by E. L. Fraleck, of Cobalt. He pointed out the anomalies that existed, by which holders of land in unorganized parts were taxed, while land in organized regions escaped. He was strongly in favor of the 2c. tax, and thought there were even reasons for a higher tax, say of 5 or 25c. per acre. He spoke of the thousands of acres where the mineral rights had been bought by speculators, while the farmer who owned the land paid the taxes. In eastern Ontario there were places, owing to this anomaly, where it was practically impossible to obtain a title. The owners of the mining rights had disappeared. He said that the value of the minerals on the property was evidently the only consideration actuating the owner, and if the owner desired to hold that land idle, he certainly should have no objection, for the privilege of doing so, to paying the people of the country five cents an acre, especially when the public was spending a considerable amount of money each year in assisting him to put his rights to a profitable account.

R. W. Brock, director of the Geological Survey, declared that the greatest bar to development was idle lands, tied up through being held by speculators and the title obscured. He deprecated the frequent practice of the past, by which mineral rights had been given away with the surface rights.

The subject was discussed by a number of speakers, Colonel Hay, of Toronto, advocating the appointment of a commission to secure uniform tax laws.

THE ELECTRIC FURNACE

The evening session was held at McGill University, and was devoted to an illustrated lecture by Professor Stansfield on "The Electric Furnace, with special reference to the Electric Metallurgy of Steel." By the aid of limelight illustrations, the various types of furnace were depicted, and interest centered strongly in the experiments in the melting of metal, etc.

At the close of the lecture a visit was paid to the basement rooms, where electric furnaces were shown in actual operation.

THE STUDY OF ORE DEPOSITS

At the morning session on Thursday, March 4, S. F. Emmons, United States Geological Survey, sketched the history and development of the present knowledge regarding ore deposits. He traced this from his experience of 40 years in the United States, and showed the present strong tendency to find that orebodies are principally connected with igneous and volcanic activity. Mr. Emmons laid particular stress on the benefits to the mining industry in the United States which had been derived from the careful study of its mineral deposits by the geological survey.

Waldemar Lindgren, United States Geological Survey, Washington, reviewed the distribution of mineral deposits in the United States and showed that rocks of different ages were characterized by minerals of distinctly different character. He distinguished these periods, marked by predominance of certain metals, as metallogenetic epochs.

Dr. A. C. Lane, State geologist of Michigan, gave an address on "Mine Waters of Michigan," presenting the results of an analysis of the waters and the deductions to be drawn of the nature and origin of the iron and copper ores. He also discussed the influence of the grain of rock and its value in determining the presence of copper and other ores.

EXECUTIVE SESSION

The afternoon session was an executive session, devoted to the consideration of proposed amendments to the by-laws. These were thoroughly discussed, and most of them adopted.

After the session a party of the members under the guidance of Prof. F. D. Adams, visited the buildings, museums and laboratories of the various departments of engineering at McGill University. The completed new building was pronounced by the visitors to be the finest of its class in America.

In the evening there was a "smoker" largely attended by the members and much enjoyed.

ASBESTOS AND CHROME ORE

The morning session on Friday, March 5, was largely taken up by an elaborate paper by John A. Dresser, mining geologist, of McGill University, on "Mineral Deposits of the Serpentine Belt of Southern Quebec," chiefly asbestos and chrome ore. Other minerals dealt with were talc, copper, antimony and nickel. He closed by laying stress on the view that the serpentine belt was not merely of present importance, but of still greater prospective value.

THE CLOSING SESSION

At the afternoon session a number of papers were read, among them "Notes on the Chibogomou Region of Quebec," by Prof. E. Delieux, of Laval University, Quebec; "Timber Resources in Mining Districts," by Dr. B. E. Fernow, Toronto University; "The Effect of Fungi on Mine Timbers," by James M. Macoun, Geological Survey, Ottawa; and "Notes on the Occurrence of the Orebody at the City of Cobalt Mine," by Dr. Frank D. Adams, of McGill. Other speakers were Dr. J. F. Kemp, of Columbia University, New York; and Fritz Cirkel, of Montreal, who read a paper on "The Depth of Asbestos Deposits."

The remaining business and the committee reports were then disposed of. At the close of the meeting President W. G. Miller, of Toronto, who presided, congratulated the mining institute on the large attendance, and the enthusiasm which the convention had evoked.

The meeting was closed by the annual dinner in the evening, which was largely attended. Among the speakers besides President W. G. Miller were the Governor-General of Canada; Hon. Mr. Templeman, Dominion minister of mines; Hon. Frank Cochrane, minister of mines of Ontario; J. Obalski, superintendent of mines of Quebec; G. S. Lindsay and Mr. Goodeve, of British Columbia; Dr. James F. Kemp, of New York; J. E. Hardman, of Montreal; George R. Smith, of Thetford Mines, Quebec, and others.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Dr. R. A. F. Penrose, Jr., has returned from Europe.

S. E. Bretherton has moved his office to 311 Mills building, San Francisco.

William H. Cook has moved his office from Tucson, Ariz., to El Paso, Texas.

E. S. Moulton, of Central City, Colo., is making a business visit to Eastern cities.

Leonard Loehr, manager of the King Solomon mine, Sylvanite, N. M., is in New York.

L. H. Jones, of Asheville, N. C., has been appointed receiver of the Franklin Kaolin Company.

Jules H. Hirt is now in charge of the Dos Cabezos mines, near Casas Grandes, Chihuahua, Mexico.

The office of Charles L. Denison, with the Buffalo Mines, Ltd., and the Morris Run Mines, is now at 165 Broadway, New York.

Robert Huntley is now president of the Bonanza Belt Copper Company, of Johnson, Ariz., in place of R. Allyn Lewis, resigned.

H. C. Vancil, formerly of Joplin, Mo., has taken charge of the Joplin Mining, Milling and Tunnel Company at Georgetown, Colorado.

E. E. Carter has been inspecting the Payette dam in Boise county, Idaho, with the view of installing power for the Gold Hill mine at Quartzburg.

David L. Gregg, long manager at El Paso, Tex., for the Mine and Smelter Supply Company, of Denver, has resigned and removed to California.

Stanley C. Sears has been appointed general superintendent of the Benito Juarez Mines Company, with office at Salinas, San Luis Potosi, Mexico.

Harrison S. Morris has been chosen president of the Wharton Steel Company, in place of the late Joseph Wharton. Mr. Morris has been treasurer of the company.

George A. Packard has returned to Wakefield, Mass., from a three-months' trip, in which he visited parts of Montana, California, Nevada, Texas and Mexico.

Herbert C. Hoover, who has been delivering a course of lectures at Columbia, sailed for London on March 10. He expects to visit this country again about the end of the year.

Dr. J. E. Woodman, professor of Geology at Dalhousie University, Halifax, N. S., has been appointed professor of geology and curator of the geological museum at New York University.

Claude T. Rice, recently on the staff of the JOURNAL, has accepted a position at the Marmata mine on the Cauca river in Colombia. He sailed from New York March 6, on his way to South America.

Dr. Franz Meyer has resigned as director and treasurer of the Metallurgical Company of America and has returned to Germany to enter as partner in the firm of R. Wedekind & Co., at Uerdingen (Lower Rhine).

Millard Woodsome, treasurer of the Hoff Electrostatic Separator Company, is in Platteville, Wis., superintending some tests. He will return to Denver, Colo., shortly, where he will make his headquarters for some time.

Seward Babbitt, secretary and general manager of the Lash Steel Process Company and the Canadian Lash Steel Process Company, Ltd., has resigned his position with these companies and has returned to the International Steam Pump Company.

Henry M. Adkinson has undertaken the management of the Morning Star Mining Company for Boston clients who are operating near Ophir, Colo. Mr. Adkinson will continue as manager of the Gold Pioneer Mining Company at Telluride, Colorado.

Dr. Frank D. Adams, dean of the faculty of applied science of McGill University, Montreal, and Dr. Willet G. Miller, provincial geologist of Ontario, have been appointed honorary life members of the Institute of Mining and Metallurgy of Great Britain. Dr. J. B. Porter, of McGill University, and J. B. Tyrrell, of Toronto, have been elected to the council of the Institute.

William Morris Davis, professor of geology at Harvard University, who has been lecturing at the University of Berlin as exchange professor, is about to put in practice a plan unique in Germany. Accompanied by 60 of his geological students, he will make a tour through Sondershausen, the Wera Valley, Göttingen, and the Leine Valley for the purpose of giving practical illustration to the subject of his lectures.

Frederick H. Morley has returned to Denver from Mexico, where he was during the past two months. As field engineer for the Potter Palmer estate of Chicago, he was engaged during January on the examination of the Promontorio mine at Cusihuiriachic, Chihuahua, which was taken over by the Palmer estate on Jan. 15. During the remainder of his stay he investigated mining properties in the States of Jalisco and Oaxaca for the Chicago Exploration Company.

H. S. Snyder, recently vice-president, has been elected president of the Juragua Iron Company, with office at South Bethlehem, Penn. DeBerniere Whitaker, recently general superintendent of the company, has been elected vice-president and general manager, with headquarters at Santiago de Cuba. E. M. Holmes, recently assistant superintendent of the Spanish American Iron Company at Daiquiri, Cuba, has been appointed general superintendent of the Juragua Iron Company at Firmeza, Cuba.

Obituary

Dr. Gardner C. Wood, who died at Somers, Conn., March 7, aged 86 years, was for many years a student of geology, especially of the geology of the State. Some years ago he received considerable attention in connection with an alleged discovery of gold near his native place.

Societies and Technical Schools

Western Association of Technical Chemists and Metallurgists—The Chihuahua branch was organized at a meeting held Feb. 12. The following officers were chosen: Chairman, D. W. Shanks, La Plata mine; secretary, Leonard Worcester, Jr.; treasurer, George Griggs; member of board of control, J. H. Baron, Mexican Chemical Company.

Illinois Fuel Conference—A conference was to be held at the University of Illinois, at Urbana, Ill., March 11, 12 and 13, under direction of the United States Geological Survey, Technologic Branch; the Illinois Geological Survey and the College of Engineering of the University. The subjects to be considered included "Mine Explosions and Their Causes;" "Rescue Stations;" "Explosives;" "Coal Analysis;" "Smoke Suppression," and "Economy in the Use of Fuel." Examination of the fuel laboratories of the university, and of the mine explosion and rescue station recently established there were also on the program.

Mining Society of Nova Scotia—The seventeenth annual meeting was held at Halifax, March 3 and 4. The opening session was devoted to the president's address and the transaction of necessary business. Later Professor J. E. Woodman delivered an address on "Iron Mining in Nova Scotia," and a number of papers were read and discussed, among which were the following:

F. P. Ronnan—"A Practical Suggestion for Testing the Gold Mines of Nova Scotia."

E. Percy Brown—"How Can the Gold Mining Industry of Nova Scotia be Assisted."

E. Percy Brown—"Conservation of Our Forests in Relation to Gold Mining."

C. V. Brennen—"Some Mining Condidions in Nova Scotia."

H. B. Pickings—"Gold Production in Nova Scotia from 1889 to 1908, inclusive."

H. E. Coll—"Shaft Collar at No. 1 Allan Shaft."

John Johnston—"Submarine Coal Mining."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Toronto and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 6—The farmers in certain townships of Yuba county are protesting against the Government settling basin for débris established on the Yuba river south of the dredge at Hammonton. In the control of the river the engineers of the Federal Government decided on the construction of a series of restraining basins for the retention of coarser débris, the building of a series of training walls and a diversion canal connecting with a settling basin for the impounding of sand carried in suspension by the waters of the river. The protesting farmers assert that there is danger in the construction of such dams and basins because in flood seasons like the present, a mass of water may be suddenly released and overflow their properties. The settling basin is being built by the dredgers. These same people also protested against the proposition of the county supervisors to increase the number of pounds allowed to be hauled over the roads during the rainy seasons. At present the amount allowed is 3500 lb. and only last week a dozen teamsters were fined $50 each for hauling loads on county roads exceeding this amount. The Marysville merchants want the present ordinance changed in the interest of the dredge mining people because they have large quantities of heavy freight delivered from Marysville to Hammonton where the large dredges are in operation. Some of the pieces of machinery manufactured in the new shops at Marysville, and intended for the dredges at Hammonton weigh thousands of pounds and must be hauled intact by large teams. It was asserted that the poor roads prevailing dated from the advent of the dredge interests in the county. The community in that section has not prepared itself for the beginning of large enterprises such as the manufacture and operation of dredges. For many years, since the virtual prohibition of hydraulic mining, most of the people have been engaged in farming pursuits. Now come the dredging interests with a large manufacturing establishment at Marysville and numerous dredges at Hammonton. The old-fashioned ideas of hauling loads of hay, etc., over the roads must in time give way to more modern methods where it is necessary to provide roads capable of standing the weights of heavy machinery. To all this the farmers protest but the dredge men have decided to force the issue since they cannot work satisfactorily under present conditions. The roads must be rebuilt to suit present circumstances or these large enterprises will be greatly hampered.

The new rock-crushing plant of the Natomas Consolidated at Fair Oaks in the Folsom dredging field, now in course of construction will cost $150,000 and produce 1500 tons of crushed rock every 10 hours. The rock will be crushed to seven sizes, including small gravel for roofing purposes. This new plant, together with the old one already in operation at Dredge, in the same field, will enable the company to ship 65 cars of rock every working day. Storage capacity is arranged for 125,000 tons so that after each winter large quantities of rock will be available for road work. All this rock comes from the cobbles dug out in dredge operations on the auriferous gravel. Good macadam is also being made from cobbles dug up by the dredges at Oroville in Butte county. This by-product of gold dredging is one of the things not at first thought of in connection with this industry.

The mine owners of the State are much interested in a bill which makes any person who purchases gold bars, bullion, gold quartz, or gold bullion or mineral containing gold, keep a register of the transaction with the name and residence of the pledger or seller. He must also produce for inspection this register to any officer holding a warrant authorizing him to search for personal property, or on the order of a committing magistrate directing such office to inspect said register, or account of sales or purchases. This is in the interest of mine owners who are losing money through "high-grading."

No less a person than the secretary of the Associated Oil Company, the largest State organization engaged in the production of petroleum, is of the opinion that there is now an overproduction of oil in California. He thinks that the overproduction will be between 6,000,000 to 9,000,000 bbl. per year. While there were 47,500,000 bbl. of oil produced in California in 1908, 53,000,000 to 56,000,000 bbl. will be produced this year. In January, 1909, the production was 146,000 bbl. daily against 142,000 in January, 1908. At present there are 450 strings of tools running in the State producing 900 wells annually, which wells are naturally yielding much oil. The first of this year the Associated Oil Company issued a general order to cut down on its development work for the present. The home consumption of oil is increasing, but oil men must look to the Far East to help use up the vast amount now being produced in California. Japan is expected to be the principal foreign consumer.

Within a day of the time that the holders of the bond on the Oustomah gold mine at Nevada City intended to throw up the bond and quit, a clean-up at the mill proved that the ore was much richer than was expected, and 24 hours more time was asked for to make payment.

Salt Lake City

March 5—The International Smelting and Refining Company has three miles of grading completed and ties laid. The rails have arrived and the entire line will be finished by May 1. The railroads announce a reduction of $1 per ton on ores ranging between $20 and $60, and 50c. per ton on ores ranging between $70 and $100 from southern Nevada camps to the Salt Lake valley smelters. This reduction commences on April 3, and will particularly affect Goldfield and Tonopah.

Nearly 100 stocks are now listed on the exchange and most of them are active. The recent strike of the Iron Blossom was responsible for heavy trading in Tintic stocks. The Iron Blossom has begun the stoping of ore, and 100 tons of high-grade ore will be shipped to the Knight smelter daily.

The following properties, all of which are situated at American Fork and are controlled by Jesse Knight, have been listed upon the local exchange. Each company has a capital of 1,000,000 shares of 10c. par value. The ores carry lead, silver, gold and copper. The Mineral Flat, comprising 25 claims; the Miller Hill, 23 claims; and the Major Evans Con., 31 claims. There are now 17 Knight companies listed upon the Salt Lake exchange.

The Grasselli zinc plant at Park City is now treating 65 tons of zinc middlings per day. At the annual meeting of the Bullion-Beck Company, held March 1, the following officers were elected: George W. Heintz, president; J. F. Smith, vice-president and treasurer; P. F. Farnsworth, J. A. Cunningham, C. E. Allen, J. Fewson Smith, Jr., and Frederick Lyon, directors. This property is now controlled by the U. S. Smelting and Refining Company.

The Cactus mill at Newhouse was closed March 1. It had been the intention to keep one-half of the mill running while the other half was being remodeled, but on account of the low price of copper it was deemed best to suspend operations entirely

while the mill is being remodeled. This work should be completed about the middle of April.

Butte

March 4—The affairs of the North Butte Extension Development Company, successor to the North Butte Extension Mining Company, are still far from settled. J. A. Ryan, superintendent, has recently resigned as a result of orders from the East to suspend all operations. A. M. Andrews and R. J. Horner, of the board of directors, have also resigned, and there is still considerable dissension among the stockholders as to the details of the reorganization plan. It was the intention of the management to commence operations within a short time, and the surface plant was put in readiness for this purpose, but the difficulties encountered within the past few weeks have delayed resumption of work. It is stated that trouble has been experienced in getting the stockholders of the old company to pay the assessment necessary to exchange the old stock for the new, and that until there is a more generous response to the company's offer of exchange there will be no further work done on the properties.

The Government assay office at Helena has made public its report for the month of February showing that the amount of bullion received exceeded that received in February, 1908, by $32,821. The contributions from the several counties are as follows: Broadwater, $2569; Chouteau, $37,296; Deer Lodge, $3807; Fergus, $57,996; Granite, $194; Jefferson, $73; Lewis & Clark, $9160; Madison, $28,849; Missoula, $400; Silver Bow, $772.

Denver

March 6—At Leadville the Western Mining Company, working the Wolftone mine, which has one of the deepest shafts in the northern part of Carbonate hill, has secured the adjacent territory extending as far north as Big Evans gulch. This territory is now to be developed by a tunnel driven from some point near the bottom of the Wolftone shaft, which will pass from 300 to 500 ft. under the old workings in Small Hopes, Robert E. Lee, Tip Top and other bonanza mines. The purpose of the work is to develop the lower ore horizon of that section.

In the Cripple Creek district, the output for the past month was diminished by the bad weather. Operations at Stratton's Independence were retarded by the same causes, but now that spring has arrived, the mill has gone to work on the dump ores.

The Gilpin county camps of Central City and Black Hawk have not been materially affected by the severe weather. The Newhouse tunnel is being driven ahead with a small force, with no new developments of note to record as yet.

The high mines of the San Juan region are still in the grasp of winter, and in fact mining operations all over the State are quiescent from similar reasons.

Goldfield, Nevada

March 2—Production of the Goldfield mines for the week ending Feb. 27 was 6595 tons valued at $259,600. This does not include ore shipped to the Western Ore Purchasing Company.

The Nye and Ormsby county banks located at Reno, Carson City, Tonopah, Manhattan and Wonder closed their doors Feb. 23 and have gone into liquidation. The banks are entirely solvent and this action is due to the stringency of the money market, it being impossible to secure the necessary coin without sacrificing securities. The assests aggregate $1,600,000 with only $300,000 due its depositors, which insures every depositor being paid in full and that the stockholders will receive par for their stock, with a surplus left over.

In a decision rendered March 1 by the Supreme Court of Nevada, Thomas B. Rickey wins in the habeas corpus proceedings and all indictments against him and the bank directors fail. The court holds that under the State banking laws the receipt of funds by the teller could not be a receipt by the president unless an agency existed between them so the president could be regarded as principal. As an appeal to the U. S. Supreme Court is unlikely to be made, this means that Rickey and associates will go free after wrecking hundreds of homes in this State by their unsound financial exploitations.

At the Directors' meeting of the Florence Goldfield Mining Company held in Goldfield March 1 the entire board of directors was re-elected. It was decided not to pay a dividend at this time. This decision is explained by the fact that most of the leases heretofore existant, have expired and with them a large source of revenue has been cut off. No specified time is set for the resumption of dividends but they will be declared as soon as financial conditions warrant it.

Indianapolis

March 8—The order appointing William C. Niblack, of Chicago, receiver for the Deering Coal Company was brought to this city during the past week for entry in the United States Court. The managers of the company mines in Indiana say it has been evident for some time that big customers of the Deering mines were going elsewhere. The Illinois Steel Company transferred contracts for several thousand tons daily to other Indiana companies, notably the Vandalia Coal Company. Some of the orders went to companies in the Clinton field. Coincident with these transfers has been great activity in securing coal-land options in the Clinton field and also in the Vigo county field, which, too, is coincident with the recent incorporation of a company to build a short line from that particular field into Illinois by which coal may find outlet to the big steel plants on the lake near Chicago.

The Deering company was one of the first Western coal-mining companies to form a big merger and placed over 30 mines in this State under one management. The company owns about 17,000 acres of coal land in Indiana, and an effort will be made to keep the mines running under the supervision of a receiver to be named in Indiana. The March pay-roll will amount to $150,000. The Deering company was incorporated under the laws of Delaware in 1904. Its general offices are at 84 Van Buren street, Chicago. R. R. Hammond is president and J. B. Boynon secretary.

The Indiana Legislature adjourned March 8 after a 60-days' session. A number of bills affecting mines and miners were introduced, but only a few were enacted into law. The Foor bill providing for weekly payment of wages to coal miners, and the Higgins bill, making it lawful to use mine drills 3¼ in. in diameter and requiring the operators to sharpen them, were passed.

An appropriation of $7500 was made for the expense of the State Mine Inspection Department, and $8420 for the Department of Geology. Special efforts are to be made for the betterment of mining conditions and for the completion of coal-land surveys during the next two years.

Toronto

March 6—An order in council just adopted by the Canadian government extends the regulations for the disposal of quartz mining claims to lands within the limits of reserves established under the Dominion Forest Reserves act subject to the following restrictions: A crown grant will not be issued but the holder of a claim may obtain a 21-years' lease; no trees are to be cut without the permission of the Superintendent of Forestry; the lessee must keep clear of all inflammable material a space of at least 100 ft. from his works; engines must be fitted with spark arresters. The regulations in regard to coal-mining rights in the Northwest have been changed. Heretofore such rights could only be obtained by lease, the lessee paying in advance $1 per acre yearly. By the new regulation an applicant may obtain a two-years' lease of 2500 acres on payment of $100. This is designed to encourage prospecting for coal where no known surface indications exist. The money will be returned upon proof of actual prospecting work having been done, or will be applied on rental in case of subsequent lease.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

Cochise County

Swisshelm—Prospecting is being carried on in the Swisshelm mountains across the Sulphur Springs valley from the new camp of Courtland. The Swisshelm Development Company and the Heffern Mining Company are each sinking shafts. Gold-copper ores have been found in the shafts of both companies.

Graham County

Shannon Copper Company—Plans are being made to increase the output to about 2,000,000 lb. a month in order to reduce the cost of production.

Gila County

New York-Arizona Gold and Copper Company—Development work on the Louise claim has been rewarded by the disclosure of an 8-in. vein of gold-copper-silver ore at the 80-ft. level. A 15-h.p. gasolene hoist has been installed at the shaft, but work has been discontinued on account of water. Close to this shaft, the Thompson tunnel, which has been driven about 400 ft., opens up a 4-ft. vein of gold-bearing rock.

Navajo County

Silver Creek—A new company has been organized under the name of the Portal Mining Company to operate the Duffner property.

California

Amador County

Defender—Owing to the difficulty of obtaining fuel, this company has shut down for the present.

Zeila—Underground men have been laid off because of the immense flow of water at present.

Butte County

Wyandotte—The mill has been rebuilt, equipped with a new power plant and has commenced crushing ore from the mine of the company.

Mammoth Channel—At this property, Magalia, a new engine and hoist have been installed and the shaft is being enlarged. Funds are in hand to carry on the work of more effective prospecting of the channel.

Calaveras County

Black Metal—The new hoist has been completed, to be run by water power. The mine is being worked through an incline.

El Dorado County

Union—This mine, near El Dorado, now has 73 men on the pay roll and 20 stamps of the mill are running. Twenty more will soon start. Large quantities of sulphurets are being shipped. It is expected that the mine will be provided with 100 stamps during this summer.

Inyo County

Lost Burro—This group in Ubehebe district has been investigated by Los Angeles men with a view to purchase for $60,000. There are six claims in the group.

Monterey County

Chualar Cañon—A company is about to be organized to develop mines in Chualar cañon. Geo. V. Barlow and O. Hallet are the principal owners.

Cruikshank—It is reported that a rich strike has occurred in this old mine in Los Burros district. This was the first mine to be exploited in that district and at one time very high-grade ore was taken out. Labor is somewhat scarce in that section.

Nevada County

Lecompton and Norambagua—These two mines have been separately incorporated with the following directors: A. Gilbert, Santa Barbara, H. S. Abbott, Nevada City; H. K. Gilbert, Chicago; J. C. Anderson, New York; W. G. Griffith, Santa Barbara, Cal. The Lecompton is near Nevada City and the Norambagua near Grass Valley. They are both under bond to H. K. Gilbert, of Santa Barbara. The Norambagua is being worked and the Lecompton will soon be pumped out and developed.

Pittsburg-Gold Flat-Potosi—A new company, Mark B. Kerr, general manager, will retimber the Pittsburg shaft to the drain tunnel and the drain tunnel will be put in order. After a survey is made it will be determined whether to operate through the old shaft or sink a central shaft to develop the three properties under control of the company.

San Bernardino County

The camps on each side of the Ivanpah valley, which is crossed by the Salt Lake railroad between Cima and Goodsprings, are prosperous at present, numerous discoveries having been made. These are Kewahnee, Ivanpah, Clark, Goodsprings, Keystone, Lyons, Crescent, Vanderbilt, New York and Death Valley districts.

Shasta County

Shasta Gold Belt Mining Company—This organization owns mines six miles west of Redding and is doing considerable development work. Machinery is also being put up. A. L. Nichols is superintendent.

Conner—The group of mines owned by E. P. Conner & Sons on Salt creek, near Middle Creek station, has been bonded to New York men represented by M. T. Whitlock, of Kennett. There are both gold and copper claims on which work will be commenced shortly.

Sierra County

Gray Eagle—At this mine, Gold Point, W. L. Turner, superintendent, a number of improvements are being made and 10 more stamps will soon be added to the present 30-stamp mill.

Sierra Buttes Mining Company—The old No. 6 tunnel at Sierra City is being reopened and retimbered in order to mine ore which the English company is supposed to have left.

Alaska Mining Company—The station at the 500 level has been timbered and the work of sinking is being continued. The bottom of the old works has been reached.

Jersey—This group, between Omega and Kanaka creek, has been sold by C. C. Slattery and the new owner will at once extend the 1500-ft. tunnel to tap the channel.

Siskiyou County

Scott Bar—The company, which has been digging ditches for the past six months, is to build another three-mile ditch to tap Kelsey creek; and a four-mile ditch up into the cañon to tap Scott river. They are preparing to pipe the high channels near Scott Bar.

Trinity County

Trinity River Tunnel Company—The 1450-ft. tunnel through Horseshoe bend near Lewiston, lacks only about 100 ft. of completion, and will be finished shortly. The tunnel is expected to carry the entire flow of the river for nine months each year, during which the bed at Horseshoe bend may be mined.

West Point—This company, which has under bond the Leas & Nicholson group at Deadwood, adjoining the Brown Bear group, is running a lower tunnel to tap the vein.

TUOLUMNE COUNTY

New Albany—A strike of exceptionally rich ore has been made while stoping on the 300 level.

Karnac—This company has obtained possession of the Hancock quartz mine four miles west of Rawhide. The company has also an option on the Sarah Marble claims, owned by the Barnard Brothers.

United Mines Corporotion—This company has 100 men taking out ore from East lode properties. These are the Grizzly, New Albany, Lady Washington and Head Horse. Good ore is being taken from the New Albany.

Colorado

BOULDER COUNTY

Pittsburg & Gold Hill M. Company—W. R. Crockett, of Boulder, has faken the contract for the erection of a 15-stamp concentrating mill on the company's property at Rowena, and a half mile tramway is to be built to connect mine and mill.

Smoky Hill—A. Berger and associates, of Denver, have opened up good ores and are arranging for the installation of a compressor plant at Sugar Load mountain.

Black Swan—O. H. Brown & Co., Denver, have purchased the mill and will remodel it from a stamp mill to a modern cyanide plant for the purpose of handling custom ores as the product of the Sunshine mine near Salina.

CLEAR CREEK COUNTY

Geneva Extension, M. M. T. & C. Company—Eastern people have become interested in Peru district and E. K. Cass, of Georgetown, Colo., is in charge of operations.

Kennedy Mining Company—Boston capitalists are interested in subscribing a large sum of money for the development of the Centennial property near Georgetown.

Griffith—A new company is being formed with W. D. Hover, Georgetown, Colo., as manager. The company will erect an electro-chemical milling plant of fifty tons capacity for the treatment of its ores.

Philadelphia, M. & T. Company—Philadelphians are interested in the purchase of a group of claims at Kelso mountain, formerly owned by J. T. Hamill. Their office is at Georgetown, Colo.

Magnet—This group on Saxon mountain has been bonded by G. Laughlin, of Chicago, Ill., the bond calling for $80,000 of which a cash payment of $20,000 has been made.

GILPIN COUNTY

King Bee, G. M. Company—A good strike is reported on the Wellington No. 6 vein of this company, in lateral workings of the Newhouse tunnel and at a depth of more than 1700 ft. R. L. Martin, Quincy building, Denver, Colo., is manager.

Great Bonanza, G. M. & M. Company, Ltd.—British capital is interested and they have commenced developments on their Next President group of claims and are overhauling their Eagle amalgamating and concentrating mill at Black Hawk. C. C. Morgan, Central City, Colo., is manager and it is reported that the company will install the Elmore oil process.

Concrete Group—Edgar S. Moulton, of Central City, Colo., has purchased the mine from the Rocky Mountain National bank. Mr. Moulton has been operating it under lease since last June. Arrangements are being made for the deeper workings.

Sherman & Mocon, M. & M. Company—A good strike is reported in the main tunnel. F. L. Branham, Central City, Colo., is superintendent.

Hawn—Boulder people have purchased the property in Moon gulch and are preparing to develop it on a liberal scale. It is situated near the Smuggler.

Rocky Mountain Concentrator—Edgar S. Moulton, of Central City, will remodel the plant in Black Hawk, and will install new stamps, jigs and other machinery, increasing its capacity.

LAKE COUNTY—LEADVILLE

Bartlett Tunnel—Under the new management this property, Sugar Loaf district, will be extensively worked. While the tunnel was being driven several veins were cut, all showing ore, and it is the intention of the management to develop them thoroughly. The Bartlett vein will also be worked, and the tunnel driven ahead to catch the northern extension of the Dinero.

Iowa Gulch—Lessees have been at work during the winter on the Ella Beeler and Little Alice, also the Houston, and now have 200 tons of high grade ready to ship as soon as the roads are opened. The principal work has been done through a tunnel driven to the Houston and at this property rich gold ore was caught. The streak is small, but rich. Work has been done on the other claims and high-grade ore found. The three claims are on the same ore belt as the Lilian.

Margaret—In this mine, Granite, in the east drift at the 80-ft. level a few days ago a 3-in. vein of jasper was opened, with free gold. In addition to the rich streak there is a 2½-ft. vein of good milling ore.

Pyrennes—Lessees are driving a drift from the 1000-ft. level, Graham park, to connect with the R. A. M. When this is done extensive operations will be carried on in both properties. When the connection is made all of the hoisting will be done from the R. A. M. shaft.

Sunday Vein—Since the opening of this vein by the tunnel, the width being 12 ft. from wall to wall, the general opinion of mining men is that the vein will carry as far south as Empire gulch, and several will back this opinion up by driving tunnels on intervening ground. This work will be started early next month.

TELLER COUNTY—CRIPPLE CREEK

Callie—Work will soon be commenced in building a new ore house at this shaft. Some time ago some ore was found in the property, but at present no work is being done, as there is no way of disposing of the ore until the new ore house is built. The property belongs to the Stratton estate and is being worked under lease by the Callie Leasing Company, of which H. D. Thompson, of Cripple Creek, is the manager.

Victor—A considerable part of this property which is under lease to the Roscoe Leasing Company, is being worked under subleases. The property is situated on Bull hill and was one of the first shippers in the district. A large amount of ore has been shipped in the past and the company has paid more than its capitalization in dividends. Until recently for a number of years but little has been done on it. The property is owned by the Victor Gold Mining Company, of which D. H. Moffat, of Denver, has the control.

Illinois

Deering Coal Company—The United States Circuit Court at Chicago on March 4 appointed William C. Niblack receiver of the property upon application of creditors and stockholders. It is declared that the company is being pressed by creditors to whom it owes $1,000,000, and that it will be unable to meet the interest on its bonded debt ($5,000,000 first mortgage 5s, of which at last accounts $550,000 were in the treasury and $324,000 in sinking fund; also $50,000 Wilfred Coal Company first mortgage gold 5s). The company, it is alleged, has year contracts with the Illinois Steel Company, the American Steel and Wire Company, the American Bridge Company, and the American Tin Plate Company, to furnish annually from 900,000 to 2,000,000 tons of coal, but is unable to collect $215,000 due from these companies because of damage claims which the Dering company alleges to be without basis. The property includes a number of mines in Illinois and Indiana.

Kentucky

Bell-Jellico Coal Company—A controlling interest has been sold to A. S. Braznell, of

Pittsburg, and associates. The company owns the largest operating mines in the Jellico district.

Michigan

Copper

Arcadian—At the recent meeting of this company it was decided to sell its lands in Section 16 and also the main property to a new company which will soon be organized under the laws of Michigan, and which will in all probability take adjoining lands and begin operations on the northern extension of the Baltic lode.

Calumet & Hecla—This company continues exploratory work on the White Pine property in Ontonagon county. Trenching is going on with encouraging results.

Cliff—This company is carrying on diamond-drill operations close to the northern boundary of the Ojibway property, in view of opening the Kearsarge lode.

Michigan—A much better showing is being made at the A shaft, near the 17th level. The Calico lode is being opened by crosscuts. The shaft is on the hanging wall side about 75 ft. from the formation. Exploratory work has been started on some old workings lying in the eastern part of the property.

Copper Range—A much better grade of mineralization is being revealed in the lower workings of the Trimountain property at No. 4 shaft. Below the 13th level is an exceptional showing of good stamp and mass copper. At No. 2 shaft drifts on the 14th level are entering better ground.

Keweenaw—Sinking continues in the Medora shaft below the 16th level. At the 13th level a drift is being extended to the north to intercept the fissure vein that was exposed at the 11th level, and which promises to become an important factor in this company's development. Rock shipments aggregating about 110 tons daily are being made to the Phœnix mill.

Ojibway—At No. 1 shaft the crosscut from the 660-ft. level has entered the west bed of the Kearsarge lode and the mineralization exposed is even richer than opened at the level above. This bed is separated from the first, or east bed, by about 20 ft. of trap rock. At No. 2 shaft the crosscut from this same depth is in about 50 ft. on its way to cut the formation and has about 30 ft. more to go.

Superior—The 7th mill run put through the Atlantic mill yielded about 70 lb. of mineral to the ton of rock stamped, making about 50 lb. of ingot copper. This remarkable showing was made from the rock coming principally from the lower openings and a small portion from the stock pile.

Arcadian—Plans are being formulated for the organization of a new company to assume control of the Arcadian. The new company will be organized under Michigan laws and will have a capitalization of 150,000 shares, par value $25. Holders of Arcadian stock will be given share per share, but as the new company's stock will be assessible. Funds will be provided in this way for the development of the property. The sale of lands in section 16 to the New Baltic Exploration Company will give the company sufficient funds to resume operations without calling an immediate assessment. The Arcadian has a complete exploratory outfit and a shaft down about 200 ft. in close proximity to the trend of the formation recently opened at the New Baltic.

New Baltic Exploration—Trenching continues at this property and some very fine specimens of copper-bearing rock have been revealed, showing all the characteristics of the Baltic lode and it is believed by the management to be the northern extension of this formation.

Missouri

Joplin Zinc-lead District

Old Dominion—Six men were killed in a cave-in at the Buxton & Owens mine. The old Dominion has purchased 80 acres in Gordon hollow for $30,000.

Live Oak—The mill belonging to Husman Brothers, of Joplin, has been destroyed by fire.

Carnation—A rotary crusher is being installed to take the place of the regulation Blake crusher and rolls.

Lockport Mining Company—Short creek bottoms at Galena have been successfully drained and 16 lessees are already at work.

Montana

Butte District

Amalgamated—The Little Mina mine of the Parrot company is fast proving to be the big producer of that company. The shaft is nearly 1200 ft. deep. The principal development work is being done on the 600-, 800- and 1000-ft. levels. On the 1000-ft. level the vein south of the shaft has been opened up a distance of more than 700 ft. An auxiliary engine is being used for sinking the shaft, but plans are being made for the installation of a new hoisting engine, good for 2000 ft. The Parrot shaft is down 2000 ft., and work is being done on the 1200, 1400, 1600, 1700 and 1800 levels. On March 3, at the Diamond mine of the Anaconda company, a premature blast in the sump caused the death of four men working in the shaft. The shaft is now down 2500 ft., and sinking is still in progress.

Butte-Milwaukee—A deed has been recently filed for record conveying from the John Caplice Company to the Butte-Milwaukee Company an undivided three-fourths interest in the Bird quartz lode mining claim.

Butte-Knickerbocker—At the recent annual meeting of stockholders the following were elected directors for the ensuing year: George H. Roberts, of Boise, Idaho; F. L. Cobb and Edwin Higgins, of New York; B. F. White, of Dillon, Mont.; James Davidson, William Dyer, E. E. Kinerk, J. F. Saville, T. W. Bradley, J. M. Montgomery and George B. Conway, of Butte. Of these G. B. Conway was elected president; James Davidson, vice-president; B. F. White, treasurer; and William Dyer, secretary. The company's property is situated in the district immediately north of Butte.

East Butte—A vein carrying commercial ore has been recently encountered in the crosscut on the 900-ft. level south of the shaft. Drifting has been done for a distance of about 25 ft., and the management states that the vein shows a width of 7 ft. and an average assay of 9 per cent. copper and 20 oz. silver per ton.

Butte-Montana—A special meeting of stockholders has been called for March 20 to consider the plan to sell the company's property to the Butte-Alex Scott Company. Thomas A. Merritt, of Duluth, representing the Alex Scott Company, has submitted the plan that the old stockholders be given the opportunity of subscribing to the new company's stock on the basis of one share of the new for 10 shares of the old and a payment of $2.

Jefferson County

Comet Mine—This property has been closed down indefinitely. For the past six months the pumps have been kept in operation, but it has been several months since any development work has been done.

Missoula County

Iron Mountain Tunnel Company—This property, valuable principally as a silver-lead producer, is situated at Carter, Mont. A shaft has been sunk from the top of a mountain to a depth of 1700 ft. This connects with a tunnel one mile in length, driven in the side of the mountain. Work has recently been resumed and a new compressor and hoist are being installed.

Powell County

Butte & Elliston—The company's properties are six miles from Elliston. About 20 men are now employed. Two carloads of ore were shipped during the last 30 days to the Pan Handle Smelter in Idaho. The management states that the net smelter return on ore shipped was $900 per car. The ore carries gold, silver and lead.

Nevada

Churchill County—Fairview

Nevada Hills—The station recently cut on the 350-ft. level is in a high-grade ore,

the principal value being gold with some ruby silver. The orebody, as found on the 200-ft. level had a pitch to the south, and contained silver alone. It was intercepted by a quartz dike, and at the 300-ft. level the ore now occurs beneath the dike.

Nevada Hills—The strike recently made on the 350-ft. level of this property has improved much with development and the orebody shows a width of 6 ft. which assays from $30 to $40 per ton gold and silver in the proportion of 3 to 2.

CHURCHILL COUNTY—WONDER

Nevada Wonder—A ten-stamp mill is to be erected on this property. Francis L. Bosqui, the engineer who planned the system of ore treatment for the Goldfield Consolidated has made preliminary tests that warrant a satisfactory recovery from the ore.

Nevada Wonder—It is reported that the Nevada Wonder will erect a mill on its property, which report is strengthened by the fact that engineers have been making extensive surface surveys recently.

Wonder Vulture—The directors of this company have issued a circular letter to the stockholders asking for contributions amounting to ½c. per share to take care of a judgment and a number of small outstanding bills.

ESMERALDA COUNTY—GOLDFIELD

Phonolite Paymaster Mining Company—About 1000 feet of tunnel and shaft work has been done at a cost of $10 per foot. The miners have taken their pay in treasury stock at 25c. per share. The property is located near Phonolite, Nev.

Gold Bar—A good grade of ore is being taken out above the 200-ft. level; and also from the 300-ft. level. Development work is being carried on at the same time.

Consolidated Red Top Lease—A 4-ft. vein of ore has been opened up in the new stope above the 300-ft. level; the ore is farther south than in the old ore shoot, and toward the Red Top workings, which are being worked by the Consolidated Mines Company.

Black Eagle—The shaft, which is down 100 ft., will be pushed to the 150-ft level when laterals will be extended across the formation. The property is 8 miles northeast of Goldfield.

Kansas City Velvet Lease—Small shipments are being made from this property, the ore being extracted at a shallow depth. The main shaft is 300 ft. deep.

Goldfield Consolidated—At a meeting of the directors held in Washington, D. C., Feb. 25, a dividend of 30c. per share was declared, payable April 30 to stockholders of record March 31. This amounts to $1,080,000 and leaves over $1,000,000 in the treasury.

Little Florence—Ore of a low grade has been encountered on the 350- and 500 ft. levels of this property. The ore is identical in character with the high grade from other properties.

HUMBOLDT COUNTY—SEVEN TROUGHS

Reagan Lease—Development work shows better ore on the 300-ft. level.

A rich strike has been made in the north drift of the 300-ft. level where milling ore 3 ft. wide is showing with a narrow high-grade streak of shipping ore. The ore shoot is thought to be a continuation of the ore exposed in the 165-ft. level from which one carload sent to the smelter returned $1030 per ton.

NYE COUNTY—BULLFROG

Pioneer Lease—The crosscut on the 210-ft. level intercepted an orebody Feb. 21, and has penetrated the same 15 ft. without reaching the hanging wall. The ore has been sacked as broken down and stored in the mine pending the construction of larger ore bins. A shipment of two carloads was made Feb. 28.

Pioneer Extension—A contract has been let for 100 ft. of sinking; the shaft is to be double compartment 4x8 ft. in the clear.

National Bank—Settlements for the last shipment from the Logland lease, to the smelter at Needles, show three tons yielding $463 per ton, and 34½ tons $68 per ton.

Tramps—The main tunnel is now in 1400 ft. A hoist has been installed near the face and a winze sunk 100 ft., from the bottom of which a crosscut was run to cut the Tramp vein. This vein has now been penetrated and shows 12 ft. of milling ore.

NYE COUNTY—ROUND MOUNTAIN

Valley View—An impotrant ore discovery was recently made in the incline. The vein varies from one to five feet in thickness and assays $20 to $25 per ton. The vein is pure white quartz and is different from anything heretofore found in the district.

Jefferson Mining Company—James MacDonald has been engaged as manager. The old workings of the Kanrohat property will be thoroughly prospected before anynew development work is carried on.

NYE COUNTY—TONOPAH

Midway—Prospecting for new orebodies is being extensively carried on in the second, third, fourth and sixth levels, with stoping on the third and fourth levels.

Belmont—The most noteworthy feature shown by the past week's development is the increased size of the orebody exposed in the east drift from a winze sunk from the 1000-ft level, which now varies from six to seven feet, carrying a good grade of ore. Stoping is being carried up from the 1100-ft. level; in two places the backs being 20 ft. and 60 ft., with 125 ft between.

Tonopah Extension—General Manager Kirchen has just returned from attendance at the directors' meeting in New York City and states that a 30-stamp mill will be constructed within the next few months.

NYE COUNTY—HELENA

Broken Hills—Reports from this property indicate satisfactory results from development work. In the main workings the company has encountered a body of high-grade ore of the same character as that previously shipped; 2000 sacks are piled on the dumps and shipments are made at the rate of 15 tons per day, the ore running between $140 and $150 per ton.

New Mexico

GRANT COUNTY—SYLVANITE

Men from Cripple Creek, Colo., have obtained an option on three of the first claims staked in the camp, the Broken Jug, Golden Eagle, and Wake-up Charley. A cash consideration was paid for the option, which extends until March 1, and which gives the purchasing parties the privilege of buying a controlling interest, or nearly 60 per cent. of the stock in all three of the claims. The owners of the properties are, C. F., J. N. and E. J. Clark, who were the original locators, together with W. M. Carlin, Marvin Ish, Sol Camp and J. T. Goshen, holding altogether 700,000 shares of the stock, the other 300,000 remaining in the treasury. If the property is taken, work will be commenced at once upon a new shaft, probably near the line of the Broken Jug and Golden Eagle, and work prosecuted without any delay, modern machinery installed, and as many men put to work as can conveniently be handled.

SIERRA COUNTY

Monarch—The company is making extensive improvements in its plant. A large settling pond has been built, the water from which will be pumped back over the jigs and tables. The coarsest material is to be separated in jigs, while the slimes are treated on tables, the lead being saved by the first set and the zinc on the second, the contract being that the plant shall make a product having not to exceed 2 per cent. zinc in the lead concentrates and 1 per cent. lead in the zinc concentrates and not more than 10 per cent. of total loss in the tailings. The Galena Iron Works, of Galena, Ill., is remodeling the mill.

SOCORRO COUNTY

Tri-Bullion Smelting and Development Company—The mines are now producing and shipping smelting ore at the rate of about 100 tons a day, the ore being essentially zinc-bearing, but containing a small quantity of copper. The company intends to proceed with the construction of a smelting plant at Canon City, Colo., at an early date.

Oregon

Baker County

Intermountain Mining Company, Ltd.—W. L. Vinson, the former owner of the mine, has transferred the control to the new company, with headquarters in Baker City. The group of 16 mining claims is 18 miles southeast of Durkee, in Baker county. Tunnel No. 3 is now in the mountain about 600 ft., with a depth of 300 ft. below the apex. Tunnel No. 2, just above tunnel No. 3, cuts the orebody 100 ft. below the surface. This vein is from 3 to 6 ft. in width. A winze started down in tunnel No. 2 shows that the orebody is widening as depth is attained. There are several veins of ore on this group of claims, all showing pay ore on the surface. The ore is free milling and is easily saved on the plates. There is a 20-stamp mill on the property with a capacity of 60 to 75 tons per day. The company has water right sufficient to run 1000 stamps and owns 240 acres of good timber land, situated 4½ miles from the mine. The officers are M. S. Bond, president; Thomas Proffitt, vice-president; W. J. Patterson, secretary and treasurer; John H. Washburn, general superintendent.

The Irondyke—In the extreme eastern portion of Baker county there is some activity in the copper-mining industry. The Irondyke is owned by capitalists of Erie, Penn., and is managed by Frank E. Pearce, with headquarters at Homestead. One shaft is down about 700 ft. There are numerous tunnels, crosscuts, upraises and drifts amounting to about a mile of underground workings. The Irondyke is one of the best equipped copper mines in Oregon. The property is 60 miles from the railroad.

Peacock—Mr. Boggs, the manager and lessee, announces that as soon as the railroad is finished to Homestead, he will build an aërial tramway from the mine, across the river, to the O. R. & N. docks.

Sumpter District—The Columbia, Old Redboy, and the Imperial are operating with a full force of men. The Redboy is furnished with light and electric power from the recently installed Olive Lake Power Company.

Virtue Mine—This is an old mine and is under the management of J. K. Romig, of Baker City. It is operated by electric power, and is lighted throughout by electricity.

Uncle Dan—A few miles beyond the Virtue is the Uncle Dan mine, under the management of C. S. Blackmon, who is also the principal owner of the property. He is sinking the shaft down to the 300-ft. level. The mine is also operated and lighted by electricity.

Grant County

Standard Mine—The Susanville district is 60 miles west of Baker City; the Standard mine is operating in a small way, and has what is considered the only paying deposit of cobalt ore in the northwest.

Pennsylvania

Bituminous Coal

Monongahela River Consolidated—The results of operations for the first quarter of the fiscal year—Nov. 1-Jan. 31—are reported as follows:

	1908.	1909.	Changes.
Net earnings..	$ 680,254	$ 195,970	D. $ 484,284
Charges	478,323	384,191	D. 94,132
Surplus.....S.	$ 201,931	D.$ 188,221	.....

Charges this year were made up as follows: Depreciation fund on coal mined, $78,148; depreciation of equipment, $105,002; taxes and insurance, $78,751; interest, $122,290.

South Dakota

Custer County

Hartwell—President Hart, of Chicago, is directing the work in the main tunnel, now in 345 ft., and will soon start drifting on the ledge.

Saginaw—The mill is dropping ten stamps regularly and making good monthly cleanups. The vein where the main work is done averages 8 ft. thick.

Lawrence County

Eskimo—The Regan brothers, of Lead, report a good strike on their Yellow creek property. A vertical ledge has been opened up that appears to be permanent.

Homestake—Sinking has been resumed in the Ellison shaft at Lead. This shaft is down 1700 ft., being the deepest one in the district. At Nemo the company is commencing a small shaft on a copper ledge that has just been found.

Pennington County

Forest City—It is reported that the main ledge, which was lost in a fault some years ago, when the Clara Belle company operated the mine, has been found and is now being opened up at Oreville. It is 8 ft. wide.

Utah

Beaver County

The Frisco Consolidated Mining Company—This is a new company formed with a capital of 1,500,000 shares, par value $10 each. Malcolm, Green & Co., of Boston, have underwritten 17,000 shares at $2 per share; 25,000 shares will be placed in the treasury. The Frisco Contact Company receives 103,750 shares; the North Horn Silver Company, 1000 shares and $7000; the Glorious Company, 3240 shares and $2500, and the Good Hope Company, $2000. The consolidated company has 31 claims and the property is considered one of the best in the district. It is equipped with a good hoist, compressor and pumping machinery.

The Lady Bryan—C. T. Birchard, of Boston, has purchased five claims in the Star camp just south of the Hub. In former years the property produced rich ore.

The Leonora—The main tunnel is now in 155 ft. and shows some ore in the face. The property adjoins the Red Warrior.

Millard County

Millard Iron Mining Company—A quartz vein carrying gold and silver has been encountered in the shaft at a depth of 45 feet.

North Billy—Surface development has exposed gold-bearing rock.

Salt Lake County

Cardiff—Connection between the old and new workings and drain tunnel has been made. This will give a stoping back of 100 feet.

Tooele County

The Lion Hill—Good ore has been encountered at the bottom of a Winze sunk from the tunnel level. The vein is 7 ft. wide and contains from 8 to 10 per cent. lead, with silver and some gold.

Utah County

Dutchman Company—Four feet of lead carbonate ore has been cut about 100 ft. from the surface.

Canada

Alberta

The report of the Minister of Public Works for the Province of Alberta, recently submitted to the provincial legislature, states that in 1908 a total of 2,046,308 tons of coal was produced by 112 mines in the Province. The number of men employed was about 3500, and their wages ranged from $75 to $180 per month. Durin the year there were 62 coal-mine accidents, 11 of which were fatal.

As the existing agreement between the coal-mine operators and the men will shortly terminate, a joint meeting of representatives of the Operators' Association and the United Mine Workers of America has been called for the first week in March, to formulate a new agreement. For some time past reports have been in circulation to the effect that there will be a general cessation of work by the men until such time as they shall obtain more favorable terms, but this is denied by prominent officials of the local district who hold the view that "there is no likelihood of a shut-down, and that the adoption of such a course by either operators or men "would be suicidal."

South Alberta Irrigation Company—At Bow island this company has struck, at a depth of less than 2000 ft., a pressure of natural gas stated to be equal to about 7,000,000 cu.ft. per day. This flow is much greater than that met with earlier in the "Old Glory" well at Medicine Hat, where the flow is placed at about 4,500,000 cu.ft. per day.

West Canadian Collieries, Ltd.—During the latter part of February this company has been sending out from its Bellevue colliery 1200 to 1300 tons of coal per day, and on one day made its record output of 1350 tons. The company owns several collieries in the Blairmore-Frank district, and has its head quarters in the province at Blairmore. C. L. Rameau is general manager.

Scranton Coal Mining Company—This company has acquired the adjoining property, heretofore owned by the Central Mining Company. The combined holdings include 1500 acres of land. It is proposed to increase the output to 1000 tons of coal daily. S. Tanner, Spokane, Wash., is secretary and treasurer.

British Columbia—Rossland

Cabled advices from London state that the Le Roi No. 2, Ltd., which company has its headquarters in that city, has declared a dividend of 2s. per share, payable March 11. The authorized capital of this company is £600,000 in 120,000 shares of £5 each. Its output of shipping ore last year was about 30,000 tons averaging rather less than 1 oz. gold, 1 oz. silver per ton, and 1.6 per cent. copper. Its second-class ore, which is concentrated at the mines, runs about $3.50 per ton in all values. Paul S. Couldrey, of Rossland, is general manager.

British Columbia—Nelson

The president of the Associated Boards of Trade of Eastern British Columbia, in his report to the annual convention of delegates gave the following table showing the production of minerals and lumber in Southern Kootenay and Southern Yale during 1908:

Gold, 252,000 oz. at $20.67	$5,208,840
Silver, 2,988,000 oz. at 55c	1,643,400
Lead, 21,583 tons at $70	1,510,810
Zinc, 10,000 tons at $16	160,000
Coal, 582,000 tons at $3.50	2,037,000
Coke, 235,000 tons at $6	1,410,000
Total value	$17,557,025
Lumber and ties, 100,000,000 ft. at $15	1,500,000
Total	$19,057,025

Nova Scotia

Dominion Coal Company—The output for February amounted to 201,570 tons of coal against 282,000 for February, 1908. March 3 the mine at Dominion No. 6 was closed down, throwing 500 men out of employment. The shutdown is for an indefinite period, only sufficient men to attend to the pumps being retained.

Ontario

Globe Refining Company—Port Elmsley, Lanark county, Ont. This company, of which Rinaldo McConnell, Ottawa, is president, has undertaken the manufacture of plumbago and installed a plant.

Ontario-Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 27, were as follows: Crown Reserve, 296,900 lb.; Cobalt Central, 40,375; City of Cobalt, 60,000; La Rose, 259,050; Nipissing, 212,675; Right of Way, 122,490; Trethewey, 65,000; total, 1,056,490 pounds.

Cobalt Lake—The annual meeting was held at Ottawa Feb. 27. The financial statement presented showed working expenses $142,554, and proceeds including amounts due from smelter and value of ore on hand, $83,547. During the year 3272 ft. of work had been done, comprising 3138 ft. of drifting and crosscutting, and 134 ft. of sinking, in addition to 18,000 cu.ft. of stoping.

Crown Reserve—Rich ore is being taken out at the 135-ft. level, the lowest depth worked. Assays show silver contents of 8500 oz. to the ton.

Chambers-Ferland—Two strikes were made this week. One vein was found in No. 1 shaft slope, and the other at the 89-ft. level in No. 2 shaft.

Kerr Lake—Three new veins have been discovered at the 100- and 150-ft. levels, giving a total width of 35 in. of ore. The Lawson vein has been cut at the 200-ft. level where it yields 7 in. of rich ore.

La Rose—Drifting is being done at the 180-ft. level on the big vein in both directions from the raise made from the 100-ft. to the 200-ft. level, and rich ore is being taken out.

Nipissing—During February $75,000 of ore was taken out from sinking operations alone on the Fourth of July shaft, which is now down 165 ft. It will be put down to 200-ft. level before drifting is begun. The five veins found in the shaft at a depth of 125 ft. have united, forming 8 in. of ore. At the depth of 210 ft., vein 26 runs from 8 to 14 in. in width and the ore yields 4000 oz. of silver to the ton.

Right of Way—A quarterly dividend of 6 per cent. with a bonus of 9 per cent. has been declared payable April 1. A 6-in. vein carrying silver has been found at the 100-ft. level.

Ontario—Montreal River District

Otisse—A small vein encountered in the shaft at 43 ft. has steadily widened with depth and increased in silver contents. At 55 ft. it has developed into a strong vein with ore assaying 3000 oz. to the ton, the walls on each side also carrying silver making a shipping body 3½ to 4 ft. in width.

Mexico

Chihuahua

Cia Minera Londres—The lead-silver-zinc mine is nine miles from Guzman, on the Sierra Madre railway, and 79 miles from El Paso. Dr. Samuel Blair, of Albuquerque, N. Mex., is managing director and J. D. Hedding, general manager. The equipment includes 10x14 Ottumwa engine, 100-horsepower boiler, compressor and machine drills. The ore occurs in pockets along a lime-porphyry contact. Thirty-five Mexican miners are employed. Wages range from 85c. to $2 per day. Two machines are operated on the seventh level. On this level a new oreshoot has been found. The work is done by contract, the prevailing price being $6 per ft. Coal costs $8 per ton, laid down at the mine, and ore is hauled to the railway at $3. Excellent stone houses are furnished miners.

San Pedro—The Candelaria mine has installed a new pump, and is now shipping a small quantity of ore.

Cerros Colorados—The opening up of a large body of shipping-grade lead-silver ore at the Creel mine in the Cerros Colorados section to the east of Villa Ahumada is reported. Assays show 50 oz. silver and 50 per cent. lead. The property is under development by Mexico City men represented by Sr. Manuel Lujan, of Chihuahua.

San Toy—Daily shipments of more than 100 tons of 40-oz. silver ore are being made from the Juarez mine and production will be shortly resumed at the Galeana mine, doubling the present output. Donald B. Gillies, the manager of the company, as well as other Schwab mining interests in the United States and Mexico, is now spending most of his time at Chihuahua directing San Toy operations.

Guerrero

Balsas—Work is nearly completed on the 100-ton copper-smelting plant for the Maine & Nebraska Mining and Smelting Company. This work is in charge of Walter E. Koch, of El Paso.

Sonora

The Tigre Mine—The company is working 250 Mexicans, treating about 100 tons of ore a day and shipping about 300 tons of concentrates a month. Robert Musgrave is manager.

Sonora Copper Smelting Company—Shipments of ore are being made to the El Paso smelter. Over a mile of underground work has been completed. A. M. Conrad is manager. The main working tunnel is in 1300 ft., which gives a depth of 650 ft.

Harris Copper Company—A core drill is being used to prospect the La Caradad mine, Nacozari; other development is discontinued.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 10—The coal trade in the West shows some improvement, and in several quarters mines are reported running on longer time and with increased orders. At the principal centers an improvement is reported in the demand for steam coal.

A set-back to optimistic sentiment has been given by the receivership for the Deering Coal Company. This is one of the large combinations made at the hight of the prosperous period and heavily capitalized. It is uncertain what the result may be, but the company has evidently felt seriously the effects of the past year. The report of the Pittsburg Coal Company, just issued, shows that it has passed the worst year in its history but has been able to meet its obligations.

In the East the bituminous-coal trade continues quiet. The Seaboard trade shows some improvement, but rather slow, although producers are beginning to feel more hopeful.

In conference with representatives of some of the anthracite companies the miners' leaders have arranged for a meeting to be held on March 11 to consider the proposed new agreement. This will be only a preliminary meeting, however, and it is not at all likely that any definite results will be reached until later. The strike talk, however, is not quite so loud.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 27, short tons:

	1908.	1909.	Changes.
Anthracite	857,717	769,675	D. 88,042
Bituminous	5,246,482	5,519,214	I. 272,732
Coke	1,161,703	1,624,222	I. 462,519
Total	7,265,902	7,913,111	I. 647,209

The total increase this year to date was 8.9 per cent.

Coal and coke tonnage reported by the Pittsburg Coal Company for the year ended Dec. 31, short tons:

	1907.	1908.	Changes.
Pittsburg district	18,005,382	13,217,545	D.4,787,837
Hocking district	1,348,112	1,064,586	D. 283,526
Total coal	19,353,494	14,282,131	D.5,071,363
Coke	456,933	55,099	D. 401,834

The decrease in coal in 1908 was 26.2 per cent.; in coke, 87.9 per cent.

Coal shipments of the Monongahela River Consolidated Company for the three months of its fiscal year from Nov. 1 to Jan. 31, short tons:

	1908.	1909.	Changes.
River coal	1,523,765	910,929	D. 612,836
Rail coal	417,242	198,124	D. 219,118
Total	1,941,007	1,109,053	D. 831,954

The total decrease in shipments this year was 42.9 per cent.

Anthracite shipments in February were 4,576,004 tons, being 607,341 tons less than in January, and 72,248 tons less than in February, 1908. For the two months ended Feb. 28 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	1,933,434	1,982,656	I. 49,222
Lehigh Valley	1,703,680	1,642,908	D. 60,672
N. J. Central	1,324,302	1,204,980	D. 119,322
Lackawanna	1,573,001	1,357,001	D. 216,000
Del. & Hudson	1,071,627	1,037,869	D. 33,758
Pennsylvania	961,004	859,088	D. 101,916
Erie	1,107,954	1,214,583	I. 106,629
N. Y., Ont. & West.	447,193	460,264	I. 13,071
Total	10,122,095	9,759,349	D. 362,746

Three companies—the Philadelphia & Reading, the Erie, and the New York, Ontario & Western—report increases. The others show decreases, the largest being on the Delaware, Lackawanna & Western. The total decrease this year was 3.6 per cent.

New York

Anthracite

March 10—Business shows no change whatever. Demand has been about on the usual level and domestic sizes have moved very slowly. Steam sizes are a little more in demand and the supply is somewhat better, though it is still not excessive. Strike talk is now waiting for the results of the conference to be held this week.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal trade continues rather dull, and the closing of yearly contracts is proceeding very slowly. It does not seem to be easy to agree upon prices, unless producers are willing to work without profit. In current business the far East is sending a few more inquiries, but is not buying much. The Sound is a little more active and more inclined to take coal.

New York harbor is still rather dull. Buyers seem to be inclined to take coal only when they can get it cheap, while producers are rather holding back and are inclined to ship only on orders. Good grades of steam coal are still quoted at $2.40@2.50 f.o.b. harbor shipping point, with lower grades $2.20@2.30 per ton.

All-rail trade is improving a little and is much better than Coastwise business. Car supply is abundant and transportation is fully up to schedule, cars sometimes coming through a day or two before they are expected.

The Coastwise-vessel trade shows no improvement, and captains are almost tired of hunting for charters. Rates are unchanged, those quoted for large vessels from Philadelphia being: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Portsmouth, 80c.; Newburyport, 95c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

March 8—There is no improvement in the coal trade in Southern territory, and several mines are either shut down or running on slack time. All demands can be met and the production can be increased on very short notice.

Coke production is also at a low ebb. The demand amounts practically to nothing. The Tennessee company still has a large quantity of coke on hand for use when the iron production improves.

It has been some time since the coal and coke market in this section has been as quiet as it is now.

Chicago

March 9—A quiet but firm tone exists. The situation as regards demurrage is improving, forced sales being fewer and the quantity of coal coming to market being more nearly uniform from both eastern and western mines. With the probability of cold waves over, the tendency of retailers and consumers is to buy lightly and wholesalers will keep down their stocks correspondingly. Domestic coals still vary greatly with the weather; steam coals are holding steadily and are running to finer coals more largely.

Lump and egg from Illinois and Indiana mines sells in car lots at $1.75@2.50, run-of-mine $1.65@1.75 and slack $1.25@1.50. Smokeless is much firmer owing to restriction of shipments and forced sales are no longer the rule. Lump brings $3.15@3.45 for Pocahontas and New River and run-of-mine, same grade, $2.75@3.15; lower grade smokeless sells for $2.95@3.30 for lump, and $2.75@2.95 for run-of-mine. Brazil block is steady at $2.85.

Hocking Valley holds up to $3@3.15, with the supply held down closely to needs of the market. Youghiogheny is quiet at $3.15 for ¾-in. gas lump. Pittsburg No. 8 is in comparatively light demand at $2.65 @2.75.

The anthracite market has subsided into its usual quiet condition.

Cleveland

March 9—The coal market is dull for the present. Domestic coal has fallen off on account of the weather. Steam coal gains slowly. Prices are low. Negotiations are in progress over supplies for the Lake trade. Something depends upon the rate question, and shippers are waiting the decision of the Interstate Commission on the Pittsburg application for equalization of railroad rates.

Indianapolis

March 8—There has been a slight increase in the output of the coal mines during the past week. The Vincennes division of the Vandalia railroad brought out 50 carloads of coal a day for local shippers who ship it on to points north, some of it going to Chicago and other Lake points. A number of mines on this line have benefited by the transfer of large orders from the Deering Coal Company by the Steel Corporation, and this has taxed the road's facilities considerably. Operators say that the mines are now running from three to six days per week, with orders steadily increasing. It is not believed that the receivership of the Deering company's property will keep that company's mines closed. In some instances, notably in Sullivan county, the Milred and the Willfred, two of the best mines owned by the company, have received orders from the receiver to continue work.

Pittsburg

March 9—There has been no change. The large producers continue to quote on the basis of $1.15 for mine-run coal at mine on both spot and contract. Some small independents, however, are willing to sell at less and some spot sales have been made lately at close to $1 a ton. Large Lake coal shippers are still making contracts with Pittsburg producers for the coming season. The surplus coal of the Pittsburg-Buffalo Company will go to the Hanna interests, which are likely to be the heaviest shipper to the northwestern markets in the summer. The rivers are still navigable; yesterday two large tows went to the Cincinnati market and there is but little left for shipment this week. All the river mines are being operated at capacity, while the railroad mines are not going to more than one-third of capacity.

Connellsville Coke—The coke trade is stagnant and but few contracts for any grade are being made. Large producers continue to hold furnace coke at $1.75 for both spot and on contract, and foundry coke is being quoted at $2@2.25, according to delivery. The prospects at the present time are not regarded as good. The *Courier* gives the production in both fields at 268,852 tons. The shipments were 9630 cars as follows: To the Pittsburg district, 3341; to points west of Pittsburg, 5543; to points east of Connellsville, 746 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished for use of steamships, month of January, long tons:

	1908.	1909.	Changes.
Anthracite.....	160,465	165,092	I. 4,627
Bituminous	743,922	549,090	D. 194,832
Total coal.....	904,387	714,182	D. 190,205
Steamer coal....	519,970	427,743	D. 92,227
Total.....	1,424,357	1,141,925	D. 282,432
Coke..... ...	79,120	74,481	D. 4,639

Canada took this year 489,487 tons coal or nearly 70 per cent. of the total.

United States Coal Imports—Imports of coal and coke into the United States, month of January, long tons:

	1908.	1909.	Changes.
Anthracite.....	5,909	3,103	D. 2,806
Bituminous.....	149,117	99,109	D. 50,008
Total coal.....	155,026	102,212	D. 52,814
Coke.....	20,156	13,028	D. 7,128

Canada furnished this year 76,141 tons coal and nearly all the coke; Australia, 15,680 tons coal Imports are chiefly on the Pacific Coast.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 27: Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 10—The iron and steel markets are gradually adjusting themselves to the new conditions and some increase in business is manifest. The improvement is not rapid, but is going on slowly, as was to be expected under all the circumstances. In some quarters there is a disposition to attribute delay to tariff possibilities, but in others little attention is paid to this. It is manifest, however, that there is a more confident tone and an increasing disposition to place orders for some time ahead and to rely less on immediate purchases.

In the structural-steel market a good deal of business is being done and construction requirements are coming forward rather freely. Inquiries are numerous, though not all of them lead to immediate business. It looks now as though the summer will see a good deal of structural work. In bars a good business has been done and in plates there is also more demand.

The large New York Central order for steel rails has not so far been followed by others; but it is said that some important negotiations are in progress. Several orders for steel cars have been placed and others are expected, while railroad-bridge orders are coming in more freely.

In pig iron there has been a considerable volume of business and though it is mainly in small orders the total volume is increasing, while individual orders show a tendency to advance in quantity. Pig-iron prices are a little variable, and there is more or less shading when a desirable order is in question.

Nothing definite has yet been done about iron-ore prices for the season. The Lake interests are holding back but there is a growing impression that prices will not be materially changed.

The question of wages is still under discussion. The Phœnix Iron Company has ordered a general reduction of 10 per cent. and some smaller companies have taken the same action. At a meeting of the Eastern Pig Iron Association held this week it was resolved that a general reduction of 10 per cent. was necessary, but the carrying out of this was left to the members.

Pig Iron Production—The reports of the blast furnaces, as collected by the *Iron Age*, show that on March 1 there were 232 coke and anthracite stacks in blast, having a total weekly capacity of 421,000 tons. This is an increase of 6500 tons over Feb. 1 and of 19,000 tons over Jan. 1. Making allowance for the charcoal furnaces the production of pig iron was, approximately, 1,726,000 tons in February; for the two months ended Feb. 28 it was 3,547,000 tons.

Canadian Rail Contracts—The Dominion Steel Company has secured a contract for 40,000 tons of steel rails for the Grand Trunk Pacific, the price being $33.50 per ton, delivered at Prince Rupert. The company has also taken a contract for 15,000 tons of rails to go to Australia.

Birmingham

March 8—The Southern pig-iron market shows little improvement. One company announces the sale of quite a quantity of iron, something like 80,000 tons having been disposed of during the first two months of the year. Prices are a little weak. The shipments of pig iron from Southern territory continue steady. The make is holding up well Two furnaces which are under repair are re-

ported ready to start when the iron is needed. The Southern iron manufacturers will be able to meet all demands when the market improves. The cast-iron pipe companies in this section have recently been bidding on some big contracts and are assured of landing the business. These interests are already in possession of orders that will keep them busy for some time to come. The steel plant at Ensley is still practically in full operation.

The properties of the Southern Steel Company have been advertised for sale and the reorganized company, with W. H. Hassinger president, will in a short time be in possession and will take steps looking to operation.

Pig-iron quotations revolve around $12 to $12.50 per ton, No. 2 foundry.

Baltimore

March 9—Exports for the week included 405,336 lb. spelter, 574 lb. selenium, 2,616,700 lb. steel billets to Liverpool; 2512 tons steel rails and 1,247,810 lb. structural steel to Panama. Imports included 5850 tons iron ore from Cuba.

Chicago

March 9—Buying of pig iron is very light. Practically every melter of consequence is holding off until he sees how the market skies will clear under the clouds of tariff revision, lowered steel prices and recovery of confidence. Hardly a buyer is in the market for last-half iron; the business of today is done on short-order schedule. Sales are for deliveries within 30 to 90 days and for small amounts.

Prices are uncertain. The disposition of furnace agents is to grant concessions and $12 Birmingham undoubtedly represents certain contracts. This means $16.35 Chicago, against $16.50 for Northern iron, No. 2 being quoted in both cases.

Above these amounts 25 to 50c. is obtained on some sales. A prospect of the sale of a large amount of iron on six to nine months' delivery would bring out a low quotation.

An effort is being made by the Southern representatives to hold up prices to $13 Birmingham ($17.35 Chicago) on ordinary purchases. This apparently cannot stand in the face of present conditions.

Philadelphia

March 10—Nothing can be said concerning the pig-iron market that is encouraging either to sellers or buyers. Both forge and foundry continue extremely dull. The makers of pipe iron are encouraged with the belief that a great deal of pipe iron will be wanted within the next 60 days. The mills have been buying very little forge, and foundries are booking very little new business. It was expected that this week would bring out a large amount of business in basic iron, but a hitch has occurred somewhere, the details of which cannot be ascertained.

Steel Billets—Reductions which have been made verified the prediction which had been made all along. The base price of $23 at mill is believed to be the lowest probable level.

Plates—Plates have been very quiet for a week. The demand is for small lots for local requirements.

Structural Material—No large business will be done in structural material until the disturbing influences subside. Just what is disturbing the local market is unknown and the manufacturers have very little to say on the subject, except that the independent manufacturers are occupying a position of antagonism to the larger interests.

Scrap—The scrap market is very much disturbed. Very little material is being sold. The dealers are loaded up, considering the present condition of the market. Prices are merely nominal and buyers are looking for a further weakness.

Pittsburg

March 9—Business in the iron and steel trade has not improved materially. There is a hesitancy on the part of buyers to contract for their spring requirements until there is a more definite understanding as to the future. The market can, therefore, be regarded as a waiting one, but some business must be done regardless of prices as consumers must have material. The uncertainty as to the tariff is the main stumbling block in the way of a good buying movement at this time, and where it is possible to wait until this question is disposed of consumers have decided to do so.

The feature of the finished-steel market this week is the uncertainty regarding wire and wire products. There is fairly good information that before the end of the week the leading interest, the American Steel and Wire Company, will announce a stiff reduction in prices for the spring trade. Jobbers who have been accustomed to fill their warehouses early in March for the spring trade have delayed sending in their orders. Some business has been booked this week, but it has not been up to what actually will be required and there is no doubt but that a concession in the price will bring out a considerable tonnage.

There was some stir in Pittsburg last week when a report was circulated that billets had sold at $20 a ton at mill in Youngstown. This was positively denied by all billet makers in this and surrounding territory. It was admitted that at a meeting held here on Thursday, it had been decided to cut the price of both open-hearth and bessemer billets from $25, Pittsburg, to $23 and to eliminate the division of freight. Sheet bars and tinplate bars were cut from $27.50 to $25.50, Pittsburg, for delivery in Youngstown, Wheeling, McKeesport and Mingo Junction.

Pig Iron—There is scarcely any improvement. Actual sales do not exceed 1000 tons. Inquiries aggregate about 10,000 tons, but of these 6000 tons are for malleable bessemer and come from the East; it is probable the business will be placed in Buffalo territory as the freight rate from the Valley furnaces is heavier. The Westinghouse Air Brake Company is in the market for 1000 tons of bessemer iron. Prices are practically unchanged and are as follows: Standard bessemer, $15.50; malleable bessemer, basic and No. 2 foundry, $15; gray forge $14. It is understood basic can be shaded.

Steel—Merchant-steel bars are now 1.20c. and plates 1.40 cents.

Sheets—Independents are quoting $2 per ton higher than the minimum price supposed to have been announced by the leading interest. Their latest quotation, subject to change, is as follows: Black sheets, 2.30c. and galvanized sheets, 3.35c. for No. 28 gage.

Ferro-Manganese—Prices have dropped $1 a ton; quotations for prompt shipment are $43@43.50, Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the month of January are valued by the Bureau of Statistics of the Department of Commerce and Labor at $13,468,058 in 1908, and $10,329,388 in 1909; decrease, $3,138,670, or 23.3 per cent. Leading items of export, in long tons:

	1908.	1909.	Changes.	
Pig Iron	2,546	3,213	I.	667
Billets, ingots & blooms	5,317	9,506	I.	4,189
Bars	5,507	3,589	D.	1,918
Rails	16,285	13,187	D.	3,098
Sheets and plates	7,888	8,532	I.	644
Structural steel	11,017	6,453	D.	4,564
Wire	12,022	9,123	D.	2,899
Nails and spikes	3,686	3,579	D.	107
Pipe and fittings	6,075	9,166	I.	3,091

Decreases are shown in all the more important items this year.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States in January were valued at $2,076,766 in 1908, and $1,830,071 in 1909: decrease, $246,695, or 11.9 per cent. The leading articles of import were, in long tons:

	1908.	1909.	Changes.	
Pig iron	15,387	11,048	D.	4,339
Scrap	678	169	D.	509
Ingots, blooms, etc.	759	1,413	I.	6.4
Bars	4,066	2,318	D.	1,748
Wire-rods	1,163	1,022	D.	141
Tinplates	5,967	3,267	D.	1,800
Sheets and plates	353	208	D.	145

The only increase reported this year was in ingots and blooms.

Metal Market

New York, March 10—The markets still continue rather quiet, and no improvement is noted for the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1909..	$ 7,865,196	$ 3,412,583	Exp. $4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Year 1909..	7,865,196	3,412,583	Exp. 4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Silver:			
Jan. 1909..	4,542,254	3,660,052	Exp. 882,202
" 1908..	4,148,144	3,621,874	" 526,270
Year 1909..	4,542,254	3,660,052	" 882,202
" 1908..	4,148,144	3,621,874	" 526,270

Exports from the port of New York, week ended March 6: Gold, $3,278,100, chiefly to Argentina; silver, $1,017,974, chiefly to London. Imports: Gold, $709,148; silver, $70,254, both from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London continues unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American eagles. The Bank of England is absorbing most of the new supplies. In New York $2,500,000 in gold have been shipped to Argentina, and at the close of the week $3,000,000 are reported taken for shipment to London.

Platinum—Dealers' prices continue unchanged at $23.50@24.50 for refined platinum; $26 for hard metal and $19@21 for scrap. Business is improving a little, but is still rather quiet. Some change is expected soon.

SILVER AND STERLING EXCHANGE

Mar.	4	5	6	8	9	10
New York....	50⅛	50⅛	50¼	50⅛	50⅜	50⅜
London.....	23 1/16	23 1/16	23⅛	23⅛	23 9/16	23 7/16
Sterling Ex..	4.8770	4.8780	4.8810	4.8825	4.8820	4.8800

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—Some India bazar and China buying has carried the price up slightly, but there does not seem to be any special feature in the market.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
4	12 7/16 @13	12½ @12⅝	56¾	28¾	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
5	12 7/16 @13	12⅝ @12⅝	56	28⅝	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
6	12 7/16 @13	12⅝ @12⅝	....	28⅝	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
8	12¾ @13	12⅝ @12⅝	56⅝	28⅝	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½
9	12 7/16 @13	12⅝ @12⅝	56⅝	28⅝	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½
10	12¾ @13	12⅝ @12⅝	56¼	28⅝	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—In the week of March 4-10 there were some transactions of important size, chiefly for export. Domestic business was comparatively small. However, some of the large manufacturers appear to have been privately taken care of by certain producers. The price asked of domestic consumers is now 12⅝c., delivered 30 days, corresponding to about 12½., cash, New York, but sales for export have been made in large volume at a somewhat lower price. The buying power which was reported last week has lost its force. Domestic consumers seem for the time being to have satisfied their requirements, and European buyers can only be induced to take additional quantities by being offered concessions below the ruling quotations. The trade generally has been awaiting the figures of the Producers' Association, which were published on March 10, and show an increase in the visible supplies of about 29,000,000 pounds. The publication came too late to enable a judgment of the effect on the market prior to going to press. Meanwhile prices close dull and nominal at 12¾@13c. for Lake copper; 12⅜@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12¼@12½ cents.

The London standard market has fluctuated within narrow limits. Considering the uncertainty which is generally felt about the future of the market, it has taken the realization of speculative holdings relatively very well. The close is somewhat lower at £56 5s. for spot, £57 for three months.

Refined and manufactured sorts we quote: English tough, £61; best selected, £60@61; strong sheets, £72@74.

It is gossiped that the International Smelting and Refining Company holds an option on the Raritan copper refinery of the United Metals Selling Company.

Copper Producers' Association—The statement for March 1 shows stocks of marketable copper of all kinds on hand at all points in the United States, Feb. 1, were 144,130,045 lb.; production of marketable copper in the United States, from all domestic and foreign sources during February, 103,700,817 lb.; total supply, 147,830,862 lb. Deliveries of marketable copper for consumption and export during February, 74,546,614 lb.; stocks of marketable copper of all kinds on hand at all points in the United States, March 1, were 173,284,248 lb. The increase in stocks was 29,154,203 lb. during February.

Tin—The market in London as well as here has been rather dull throughout the week, but retained its firm undertone. Business done was on a small scale. The London close is cabled at £130 5s. for spot, £131 15s. for three months, while New York dealers quote the market at 28⅝ cents.

Lead—Business was somewhat more active, particularly early in the week. The cheap lots of Missouri lead which were floating about the market appear to have been absorbed and holders now are trying to get an advance. The market closes steady at 3.80@3.82½c. St. Louis, 3.95@3.97½c. New York.

The London lead market has been holding steady and closes unchanged at £13 7s. 6d. for Spanish lead, £13 10s. for English lead.

There is a certain amount of truth in the report cabled last week from Paris to the *Journal of Commerce* respecting a meeting of lead producers to consider the organization of a convention similar to that which has been effected among the producers of spelter, but the plans have not yet reached beyond a general discussion. The meeting was attended by representatives of certain American smelting interests. Insofar as American production and consumption of lead are concerned, we are, of course, quite independent of European conditions so long as a tariff is maintained, but the desilverizers in this country refine a great deal of Mexican lead in bond, which is exported to Europe, wherefore the interest of American refiners in the European market.

Spelter—The brass manufacturers are reported to have placed some orders, but business for galvanizing purposes has been of a retail character. Quotations are unchanged throughout the week at 4.72½@4.77½c. New York, 4.57½@4.62½c. St. Louis.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The London market is lower at £21 10s. for good ordinaries, £21 15s. for specials.

Other Metals

Antimony—The market is dull, and only a retail trade has been done. In the absence of business, quotations are nominal at 8@8¼c. for Cookson's; 7⅞c. for Hallett's; 7¾@7⅞c. for ordinary brands.

Aluminum—Quotations by the manufacturer here are unchanged at 24c. base for No. 1 ingots and 33@34c. base for sheets.

Quicksilver—A fair business has been done, but New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco is nominal at $45 for domestic orders and $43 for export. London price is £8 7s. 6d. per flask, with £8 6s. 3d. quoted by jobbers.

Cadmium—Currents quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States for the month of January are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	21,012	9,662	Exp. 11,350
Copper, 1908....	33,003	6,939	Exp. 26,064
Tin, long tons....	19	4,196	Imp. 4,177
Tin, 1908.....	33	1,155	Imp. 1,122
Lead, short tons.	7,466	9,966	Imp. 2,501
Lead, 1908.....	6,136	7,051	Imp. 915
Spelter, sh. tons.	364	283	Exp. 81
Spelter, 1908....	210	31	Exp. 179
Nickel, lb.....	695,576	853,630	Imp. 218,054
Nickel, 1908....	857,540	1,345,179	Imp. 487,361
Antimony, lb....	.....	584,147	Imp. 584,147
Antimony, 1908.	.....	709,245	Imp. 709,245
Platinum, oz.....	.....	12,466	Imp. 12,466
Platinum, 1908.	.....	3,312	Imp. 3,312
Quicksilver, lb...	7,553	.....	Exp. 7,553
Quicksilver, '08	11,730	.....	Exp. 11,730
Aluminum, value	$3,583	.....	Exp. $3,583
Aluminum, 1908	5,815	.....	Exp. 5,815
Ores, etc.:			
Zinc oxide, lb...	1,639,270	.....	Exp. 1,639,270
Zinc oxide, '08..	1,072,182	.....	Exp. 1,072,182
Zinc dross, lb....	1,698,663	.....	Exp. 1,698,663
Zinc dross, '08..	3,567,134	.....	Exp. 3,567,134
Zinc ores, lg. tons	.....	9,096	Imp. 9,096
Zinc ores, 1908.	4,048	2,445	Exp. 1,603
Antim'y ores, lb.	.....	1,491,128	Imp. 1,491,128
Ant. ores, 1908.	.....	118,945	Imp. 118,945

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 1588 tons calomine and 7508 tons other ores; against 1610 and 835 tons last year.

Zinc and Lead Ore Markets

Platteville, Wis., March 6—The base price paid for 60 per cent. zinc ore was $37.50 per ton. No premium reported. For 80 per cent. lead ore, $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 6

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green.....	411,600	.....	.....
Benton.....	331,200	.....	.....
Platteville.....	324,900	.....	209,400
Cuba City.....	304,983	.....	.....
Strawbridge.....	220,000	.....	.....
Livingston.....	210,000	.....	.....
Linden.....	163,270	.....	.....
Rewey.....	44,650	.....	.....
Total.....	2,013,603	.....	209,400
Year to Mar. 6.....	19,931,189	656,180	1,699,600

In addition to the above there was shipped to the American Zinc Ore Separating Company 170,170 lb., and to the Joplin Separator Works, 319,500 lb. zinc ore.

Joplin, Mo., March 6—The highest price paid for zinc sulphide ore was $40 per ton. As high as $38 base was paid for particularly choice ore, but the bulk of better grades sold on $37@37.50 base. The low base was $35 for slimes with $35.50@36.50 paid for ores of upward grade. Zinc silicate sold as high as $25, on a base of $18@19 per ton of 40 per cent. zinc. The average price, all grades, was $34.08 per ton.

Lead advanced toward the close of the week, as the metal market improved, selling at $51, which was paid for several bins. The bulk of shipments were on a base of $48@49 per ton of 80 per cent. lead. The average price, all grades, was $48.40 per ton.

The market appeared featureless on the surface, but a strong undercurrent was noted in zinc sulphides as the week progressed. This was occasioned by the receipt of a heavy shipping order by one of the purchasing agencies. A quiet canvass was made for the ore, and most of the 1000 tons was picked up at current prices without disturbing the market.

SHIPMENTS, WEEK ENDED MAR. 6

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,442,841	896,450	$ 83,932
Joplin.....	1,758,870	315,580	40,285
Duenweg.....	1,409,230	74,410	25,366
Galena.....	738,840	59,870	13,951
Prosperity.....	503,480	137,640	12,433
Oronogo.....	658,550	.....	11,260
Spurgeon.....	473,610	85,290	9,013
Granby	523,810	22,200	8,315
Miami.....	393,640	120,380	8,066
Alba-Neck.....	431,580	.....	7,984
Aurora.....	440,050	4,240	6,194
Badger.....	272,730	.....	4,909
Carthage.....	243,580	.....	4,505
Quapaw.....	219,730	.....	3,515
Shoalsburg-Saginaw..	192,050	28,280	2,791
Zincite.....	152,870	.....	2,751
Wentworth.....	176,870	.....	2,681
Carl Junction.....	65,720	.....	1,249
Cave Springs.....	61,100	.....	1,130
Sarcoxie.....	54,000	.....	667
Totals	12,213,150	1,746,340	$250,887

Ten weeks.....109,089,530 16,749,470 $2,399,566

Zinc value, the week, $208,202; 10 weeks, $1,972,450

Lead value, the week, 42,685; 10 weeks, 427,116

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	$37.60	$41.25	$35.66	$38.46	$46.88	$52.17
February....	36.53	36.94	34.92	34.37	49.72	50.50
March.....	36.19	.....	34.19	.....	49.90	.....
April	36.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.06	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September ..	37.63	.....	34.44	.....	54.69	.....
October.....	35.96	.....	33.28	.....	52.63	.....
November...	39.13	.....	35.02	.....	54.63	.....
December...	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 10—The general market is still quiet. Though a little business is being done, consumers still seem reluctant to buy far ahead.

Copper Sulphate—Business is on a moderate basis only. Prices quoted by dealers are $4.60 per 100 lb. for carload lots and $4.85 per 100 lb. for smaller parcels.

Arsenic—Business has not been large. Sales for the week amount to possibly 100 tons, at 3c. per lb. for white arsenic.

Nitrate of Soda—Indications in this article are better, and more business has been done, the result being a rather higher price for futures. Quotations are 2.15c. for both spot and future positions.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, month of January, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	969,404	E. 969,404
Bleach, lb.....	7,510,746	.....	I. 7,510,746
Potash salts, lb..	36,785,255	458,819	I. 36,326,436
Soda salts, lb....	834,932	29,600	I. 805,332
Acetate lime, lb.	.....	6,659,062	E. 6,659,062
Nit. of soda, tons	13,180	743	I. 12,437
Phosphates, tons	150	44,185	E. 44,035
Sulphur, tons....	3,036	5,817	E. 2,781
Pyrites, tons.....	42,687	.....	I. 42,687

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 20,011 long tons.

Mining Stocks

New York, March 10—The general stock markets during the past week have been irregular and rather inclined to weakness. There have been reductions in prices in a number of stocks, but some of these have recovered, while others have failed to feel the benefit of any reaction. The whole tone of the market is uncertain, and the fluctuations from day to day have had very little meaning.

In the Curb market the copper stocks have not been strong. Prices have not held their own, but have fallen whenever there was selling on any considerable scale. The market, however, has been inclined to dullness and the transactions, as a rule, have not been heavy. The Cobalt stocks have been rather stronger and more in demand than last week and have made a better showing than any other class. The Nevada gold stocks have been dull, and buying has not been at all active.

Boston, March 9—The stock market this week has had lots of ups and downs, but on the whole it has been not encouraging and rather inclined to weakness. The condition of the copper market, gold shipments to Europe and the temporary position of the banks have not tended to encourage speculation. Sales have been fair in amount, but buyers have been rather shy. Upon the whole it was a traders' market throughout.

Amalgamated was a strong feature, as usual, but has not held its own. It closes today at $67.50, which is $1.50 off from the highest of the day. The Boston specialties show no pronounced features. There was some activity in Parrot on reports that the lower drifts would soon reach the Anaconda vein. Nevertheless,

it sold off this evening to $29.75, after touching $30.50. Calumet & Arizona held around $101; Copper Range, after touching $77, lost $1; North Butte sold at $68.25, a loss of $1.25; East Butte at $14.50, a loss of 75c. today.

It is learned that the Bigelow interests received about $8,510,000 for their 125,000 shares of stock. The delivery was $2,700,000 cash, $5,810,000 in notes payable in from three to ten years. The many-times-postponed Osceola annual meeting for 1908 will be held March 11, just 10 minutes before the 1909 annual meeting.

Denver, Colo., March 6—The Denver Consolidated Stock Exchange was opened by a smoker March 2, at which the Governor of Colorado made the opening speech. The first call was held March 3. The officers in charge are determined that the most rigid rules shall be enforced in the listing of stocks, and in furnishing complete and authentic monthly reports. All kinds of stocks will be listed, but it will be of special importance to the mining industry of the State. The exchange officers and members have started with the intention of adhering to a high standard, and it is to be hoped that this will be maintained. The president is T. M. Howells, of Denver.

San Francisco, March 6—The oil companies listed on the California Stock and Oil Exchange in San Francisco paid $337,028 in dividends in February, making a total to date of $18,751,549 in dividends by those companies.

STOCK QUOTATIONS

NEW YORK	Mar. 10	BOSTON	Mar. 10
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.25	Adventure	7¾
Amalgamated	67⅝	Allouez	39
Anaconda	41	Am. Zinc	‡26
Balaklaia	‡2 1/16	Arcadian	4⅝
British Col. Cop.	7½	Arizona Com.	36½
Buffalo Mines	3	Atlantic	‡15
Butte Coalition	22¼	Boston Con.	12
Colonial Silver	¼	Calumet & Ariz.	100
Cum. Ely Mining	7⅞	Calumet & Hecla	630
Davis Daly	4⅞	Centennial	29½
Dominion Cop.	⅛	Con. Mercur	$.25
Douglas Copper	2¾	Copper Range	75⅞
El Rayo	2⅞	Daly-West	9½
Florence	3½	East Butte	14½
Foster Cobalt	.34	Franklin	13⅛
Furnace Creek	.11	Greene-Can.	9¼
Giroux	8⅝	Isle Royal	28¾
Gold Hill	⅜	La Salle	14⅞
Goldfield Con.	7 3/16	Mass	5
Granby	‡95	Michigan	‡10½
Greene Gold	¼	Mohawk	63
Greene G. & S	7	Nevada	18
Guanajuato	1¾	North Butte	68⅛
Guggen. Exp.	181	Old Colony	60
Hanapah	.15	Old Dominion	48
Kerr Lake	8¼	Osceola	129
McKinley Dar.	.90	Parrot	29⅞
Miami Copper	13⅛	Quincy	88
Micmac	1⅜	Rhode Island	‡4¾
Mines Co. of Am.	⅞	Santa Fe	2¼
Mitchell Mining	⅛	Shannon	14
Mont. Sho. C.	1⅞	Superior	43
Nev. Utah M. & S.	2 1/16	Superior & Pitts.	‡14⅛
Newhouse M. & S.	3⅜	Tamarack	281
Nipissing Mines	10½	Trinity	13
Old Hundred	⅜	United Cop., com.	12¼
Silver Queen	.64	U. S. Oil	‡29
Stewart	7/16	U. S. Smg. & Ref.	41⅛
Tennessee Cop'r.	3⅜	U.S. Sm. & Ro., pd.	44⅛
Tri-Bullion	1 1/16	Utah Con.	39⅛
Union Copper	1	Victoria	14⅞
Utah Apex	6⅛	Winona	6
Utah Copper	40⅛	Wolverine	147⅞
Yukon Gold	4⅞	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	37¾
Am. Smelt. & Ref.	81⅞
Am.Sm. & Ref., pf.	103⅜
Colo. Fuel & Iron	32
Federal M. & S., pf.	‡80⅛
National Lead	16
National Lead, pf.	‡107½
Pittsburg Coal	‡10¾
Republic I. & S.	19⅜
Republic I.& S., pf.	71½
Sloss-Sheffield	‡71½
Standard Oil	650¾
U. S. Steel	43¾
U. S. Steel, pf.	110⅛
Va. Car. Chem.	43⅛
BOSTON CURB	
Almeek	145
Black Mt.	2
Chemung	21½
Globe Con.	5
Hancock	12
Helvetia	3½
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	14⅛
Superior & Best	‡15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	Feb. 27	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	1.50	1.25
Cent. C. & C.	80.00	78.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.25	.17
St. Joe	12.00	11.00

LONDON	Mar. 10	
Name of Com.	Clg.	
Dolores	£1 10s	0d
Stratton'sInd.	0 2	9
Camp Bird	0 16	6
Esperanza	2 16	3
Temboy	0 18	9
El Oro	1 3	9
Oroville	0 10	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 3.
Furnished by Welr Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.33	St. Ives	.12
Best & Belcher	.36	Triangle	.02
Caledonia	.09	BULLFROG STOCKS	
Challar	.09	Gibraltar	.04
Comstock	.26	Homestake King	.04
Con. Cal. & Va.	.36	Mont. Shoshone C	1.62½
Crown Point	.35	Tramp Cons	.06
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.13	Bonnie Clare	.03
Hale & Norcross	.18	Lee Gold Grotto	...
Mexican	.69	Nevada Hills	1.12½
Ophir	1.20	Nevada Smelting	1.00
Overman	.14	Nevada Wonder	.85
Potosi	.10	Nevada-Utah	2.75
Savage	.16	Penn-Wyoming	.03
Sierra Nevada	.26	Pittsburgh S. Pk.	.70
Union	.25	Rawhide Coal	.49
Utah	.02	Round Mt. Sphinx	.05
Yellow Jacket	.37		
TONOPAH STOCKS			
Belmont	.78		
Extension	.68		
Golden Anchor	.01		
Jim Butler	.14		
MacNamara	.30		
Midway	.20		
Montana	.70		
North Star	.02		
Tono'h Mine of N.	6.62½		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.11		
Blue Bell	.03		
Booth	.16		
Columbia Mt.	.04		
Comb. Frac	1.00		
Con. Red Top	.07		
Cracker Jack	.02		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.04		
Goldfield Daisy	.63		
Great Bend	.17		
Jumbo Extension	.10		
Kendall	.05		
Lone Star	.04		
May Queen	.03		
Oro	.08		
Red Hill	.06		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS	Mar. 6
Name of Comp.	Clg.
Acacia	6¼
Black Bell	....
C. C. Con	3¾
Dante	25¾
Doctor Jack Pot	8
Elkton	71½
El Paso	50
Findlay	15
Gold Dollar	13
Gold Sovereign	3⅛
Isabella	25½
Index	....
Jennie Sample	8½
Jerry Johnson	6¼
Mary McKinney	36¾
Pharmacist	‡3¾
Portland	1.01
Un. Gold Mines	5
Vindicator	75
Work	7¼

Assessments

Company.	Delinq.	Sale.	Amt.
Atlantic, Ida	Feb. 20	Mar. 22	$0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
Caledonia, Nev	Mar. 16	Apr. 16	0.05
Challenge Con., Nev	Mar. 19	Apr. 9	0.05
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crater, Ida	Feb. 23	Mar. 27	0.001
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Lady Washington, Nev	Feb. 19	Mar. 12	0.06
Little Chief, Utah	Feb. 23	Mar. 16	0.01
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Overman, Nev	Feb. 18	Mar. 11	0.00
Reinbeer, Ida	Feb. 15	Mar. 18	0.10½
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.006
Utah Arizona, Ariz	Feb. 25	Mar. 18	0.001
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23 834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.725	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	12.949	13.098	13.295	58.786	57.868
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.389	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.9[illegible]	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.466	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.567	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.800	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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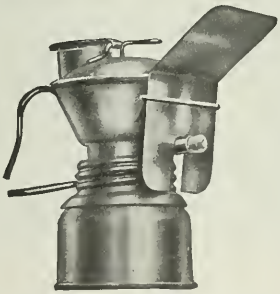
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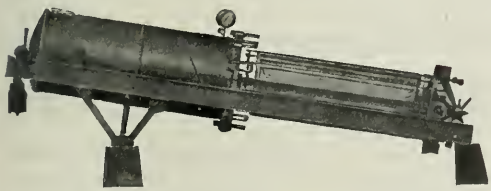

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The Great Falls Coalfield in Montana

Amalgamated Copper Company Is One of the Largest Coal Producers in the Northwest. Tail-rope Haulage Pulls 3500 Tons in 10 Hours

BY A. T. SHURICK*

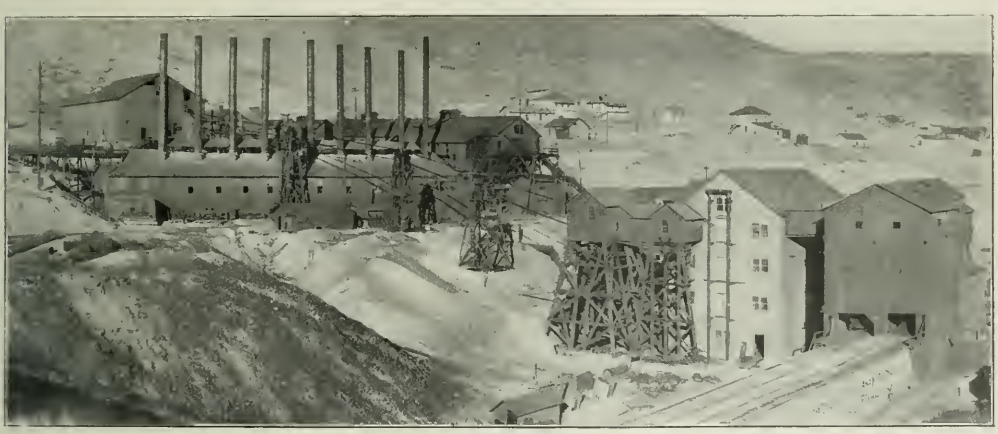
The Great Falls coalfield, from a commercial viewpoint, occupies a position probably unrivaled among the western coal operations and even with the high ash content of its coal, it ranks as the largest producer in Montana.

The area of workable coal included in this field is roughly about 230 square miles, its general dimensions being about 30 miles long by 8 miles wide. The term "workable coal" as here used is a misnomer, and signifies only its economic value from a consideration of the surface cover; in much of this area the coal will be found too thin to permit of its development as a practical coal-mining proposition, in the present era at least.

On the United States Geological Survey map, showing the coalfields of the United States, the Great Falls field lies in the western portion of the Judith Basin region on the extreme western border of the Northern Great Plains province. It is here classified as a bituminous coal, being one of the only two fields in Montana so classified.

The geology as a whole is simple, the measures being practically horizontal and no faults or displacements of any magnitude have yet been discovered. The principal coal horizon occurs about 60 ft. above the base of the Kootenai (Lower Cretaceous), which formation is here about 475 ft. thick, and is composed of alternating shales and heavy sandstones. Massive sandstones predominate near the bottom adjoining the coal horizon, and in some instances forming ideal roof and bottom conditions.

Probably an average haul for the entire field to Great Falls would be 18 miles, and to Butte 180 miles. It represents clearly the most Northwestern coalfield of any magnitude in the United States, and will doubtless continue to be the predominating coal district from Great Falls to the coast.



SURFACE PLANT AT THE BELT MINE SHOWING TIPPLE AND WASHERY BUILDING

Past and Present Operations

The first authoritative examination of this field, of which there is any record, was made by members of the Transcontinental Survey in 1879. It was later reported on by Newberry acting for the Great Northern Railway, and again in 1891 by Weed of the United States Geological Survey, who submitted a very comprehensive report.

The westernmost portion of the field, or what is known locally as the Smith River district, has probably the thickest seams in the entire field; prospects in this vicinity show 18 ft. of coal with the usual interstratified bands of slate and bone. The district has no shipping facilities and consequently no extensive development has been done.

The Sand-Coulee district, lying about the center of the field was the first heavy producer, and at present has the largest output. Three important operations predominate; the Cottonwood Coal Company, the Nelson Coal Company, and the Gerber Coal Company, with a more than usual strong following of smaller operations, ranging from prospects to the largest operation practicable without steam equipment.

The Cottonwood Coal Company (a subsidary of the Great Northern Railway) is the pioneer of the entire field and by far the largest operator in this particular district. They began active operations at Sand-Coulee in 1888 on the completion of the railroad, and produced about 300,000 tons in that year. Later, they changed their principal base of operations to Stockett, about five miles around from Sand-Coulee, where they have a complete equipment, including a washing plant unique in the history of the western coal industry. (See "A Bituminous Coal Breaker," Trans. Am. Inst. of Min. Eng'rs. Vol. 35 Stockett.)

The first work done in the Belt Valley

*Engineer, coal properties, Amalgamated Copper Company, Washoe, Montana.

district was in 1877 and from then until the advent of the railroad, in 1889, from 500 to 1000 tons per annum was freighted across to Fort Benton, which was then the head of navigation on the Missouri river, and much of the fuel was used to coal the steamers down the river.

In 1891 the Anaconda Copper Mining Company secured a lease on the Belt mine and succeeded in shipping sufficient coal to Butte to seriously threaten Wyoming operators who controlled this market, and brought about a much needed adjustment of prices. This was continued until 1894 when they bought the property outright and immediately started developing for a large output.

The Anaconda Copper Mining Company's Belt Mine

The Belt mine, which is probably the largest coal mine with a single opening in the Northwest, is selected for detailed description:

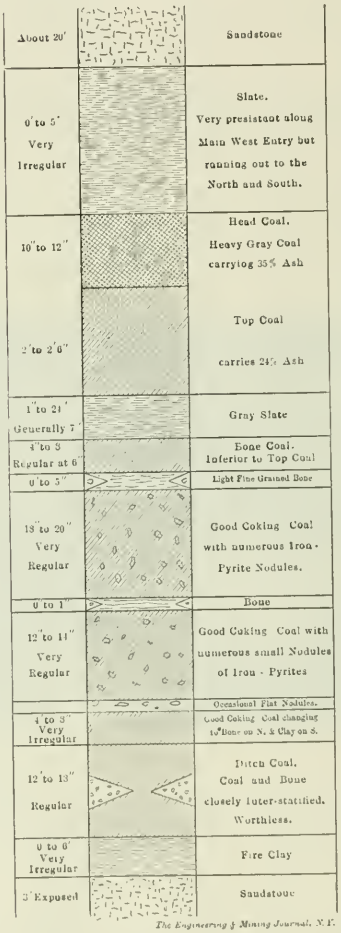
At the time of the acquirement of this property by the Anaconda Copper Mining Company, it was the only producing coal property directly controlled by that company, and the result was that exceedingly heavy output demands were made upon it. Much credit is due the coal-department officials in meeting these demands, as they were probably unprecedented, even among the modern plants of that day in Pennsylvania and West Virginia.

Owing to the comparatively extreme irregularity in dips, both in pitch and direction, it has been necessary to adopt a more or less flexible system of working. The Main West entry, which is the main haulage-way was driven in 3300 ft. when an area of low coal, which came in with a pronounced upthrow in the bottom, was developed by the north entries; the Main West entries were then turned paralleling the line of the fault, and are now in 7600 ft. in this direction making the total distance from the mine mouth a trifle over two miles. In on this new course 1600 ft., a "hill" of such magnitude was encountered, that, for haulage purposes, it was found necessary to develop around it. The entries were turned on their original course again for 1500 ft., and then back at a rather sharp angle toward the Main West for 1800 ft., this being the present inside point of the main haulage. This haulage-way, including a short outside haul, is 7000 ft. long and 48 car trips, of 2¼ tons to the car, are pulled by the tail-rope system.

The track is laid with 30-lb. rails, both main and tail ropes are 1 in. in diameter, and the trip attains a speed of a little over 8 miles per hour. The maximum grade is 3 per cent. and is against the loads; 3500 tons of coal have been pulled in 10 hours on this haulage-way, before it was extended to its present length, and if the rock had been included it would probably have been close to 4000 tons. Partings 550 ft. long are required as sidings on which to make up the trips, and there are at present two such partings, one at the 16th entry draining the territory from there into the face, and the other at the 12th entry to pull pillar coal from the south side.

Engine-Planes are Used

The secondary haulage is accomplished



A DETAILED SECTION OF THE COAL SEAM AT THE BELT MINE

on the engine-plane system, with horses acting as auxiliaries in making up the trips. These engines, of which there are 8 in use, are duplex- using compressed air and ranging from 6x8 to 8x10 in., and use from ¾-in. to ⅞-in. wire rope. They are located in the more elevated portions of the mine so the loads run by gravity to the partings on the Main West, and the empties the same to smaller partings near the working face; from this latter point the empties are delivered to the working places by horses and the loads are made up into from 8 to 12 car trips. Eighteen horses are used on this work.

The System of Mining

The general system of mining is simple, the main haulage centering on the Main West entry and cross entries being driven to the North and South with perpendicular distances of usually 500 ft. between them. All entries are driven on the usual double-entry system, with a 25-ft. pillar, and crosscuts about every 100 ft. Fig. 2 shows a portion of the inside workings typical of the mine as a whole. The contours, showing the topography of the bottom of the coal, exhibit clearly the irregularities of dip.

Rooms are turned every 50 ft. off those cross entries on both sides, and where the topography permits, are driven at right angles to the entry. It is essential that the rooms be driven slightly on the raise in order to be self draining, the mine being very wet; in some instances, however, where it has been necessary to go to the dip for short distances, the "Finlander Pump" (a tub set up near the roof with a trough leading to the room mouth) has given satisfactory results.

The most desirable room-and-pillar dimensions have been found to be a 30-ft. room with a 20-ft. pillar; a 30-ft. room with a 10-ft. pillar was attempted in one portion of the mine but resulted in a large and rather expensive squeeze. Where roof conditions are the best, a 50-ft. room and a 30-ft. pillar are used, the room being laid with two tracks one up each rib.

Mining is done entirely by the puncher machine; the company has about 30 of the Ingersoll-Sergeant Type G 2 machines, of which about 20 are in use at the present time. The machines work under severe conditions, the mining being hard and the seam thoroughly impregnated with exceedingly hard nodules of iron-pyrites. Eighteen picks are required per machine, per eight-hour shift, and the average work done by a machine is a cut 45 ft. long and 4 ft. 6 in. deep.

Miners' Wages

Machine runners are paid 11c. per ton, helpers 9c. and loaders 43½c., it being the duty of the latter to shoot the coal and keep the timber and track up in his place. Inside wages run from $3.25 to $4.00 for eight hours at the working face.

The mine is generally self draining, although in some of the lower portions small compressed-air pumps are required.

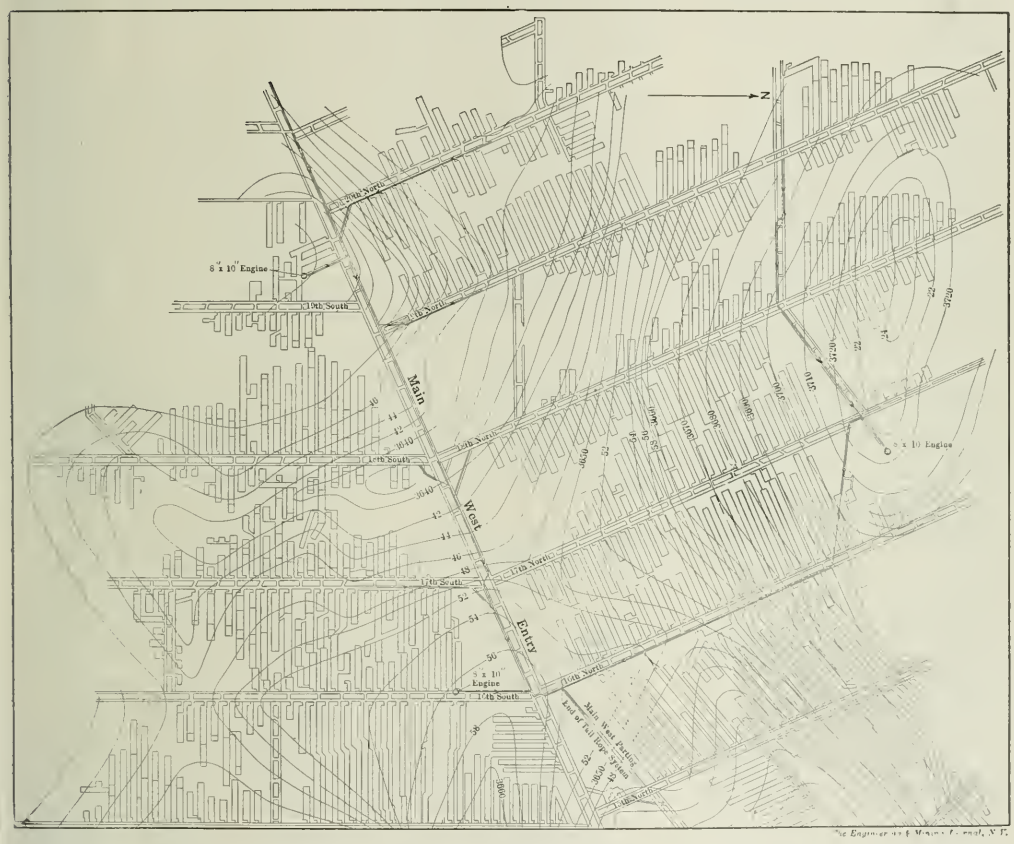
The ventilation is simple, the air being forced in through all working places to an up-cast shaft near the extreme inside workings, having a motive column of about 350 ft. The fan is of the Guibal type, 20 ft. in diameter, and driven by

a 12x16-in. engine direct connected. The mine has never been known to show any firedamp, which together with its exceeding wetness, and its generally good roof, places it among the safest mines in the west.

The Coal

An accompanying drawing shows a section of the seam as it has been developed in this mine, showing clearly the maximum thickness of the coal-bearing strata which has been encountered, and the minimum which it has been found economical to work, together with the individual peculiarities common to each of the strata, such as its total change of character and uniformity.

This section forms an interesting exhibit of the persistent irregularities common to the western coals; it would be possible to compile many different sections from the one here shown, and the geologist would be puzzled to correlate them, were their stratagraphic positions unknown. A rough average analysis would be 51 per cent. carbon, 27 per cent. volatile, 18 per cent. ash and 3 per cent. sulphur. The foregoing analysis shows the one serious trouble of the field, the high ash content, for which the top coal is directly responsible. The bottom bench of coking coal was at one time mined separately and produced a coke that was equal to the Connellsville coke both in composition and physical structure. The ash content, in the coal, however, by the very thorough treatment outlined below, is reduced to 6.5 per cent.



MAP OF THE BELT MINE SHOWING ENGINE PLANE HAULAGE SYSTEM AND TOPOGRAPHY OF SEAM. ARROWS SHOW DIRECTION OF HAUL

The Surface Plant

The difficult treatment of the coal, made essential by the high ash content, and the large amount of power required in mining and hauling the coal inside, necessitates a rather elaborate surface equipment. The boiler plant is equipped throughout with the Tuttle Manufacturing and Supply Company boilers, there being ten 60 in. by 16 ft. and seven 54 in. by 16 ft. The boilers are located in batteries of two, there being one stack for each battery. A feature in connection with the boiler house, the importance of which is probably not generally appreciated among coal men, is the practice of carrying the weight of the large stacks on the roof trusses. In this case the boiler house is built of steel throughout, but a queen truss (which is generally the limit of the average mine carpenter) built up of 8x10 in. timbers, will readily carry any ordinary load of this character on spans up to 38 feet.

Power Plant

Compressed air is furnished by a Corliss Cross compound condensing air compressor 24x48x24¼ in. on the high pressure side, and 44x48x24¼ in. on the low. A smaller compressor, 24x30x24¼ in. acts as an auxiliary to the large one. Power is furnished the washer by means of a 300-h.p. rope-transmission system consisting of a 24x48 corliss engine driving a

20-ft. diameter wheel from which five 2-in. diameter manilla ropes run to the washer 235 ft. distant.

The electric-light equipment, furnishing about 1100 lamps from 16 c.-p. to 32 c.-p. for the works and the town, consists of a 12x12x20x12-in. Westinghouse compound high-speed engine driving a Westinghouse single-phase 1100-volt 50-ampere dynamo.

The haulage engine operating the tail-rope system consists of two 15x18-in. cylinders driving directly a 6-in. shaft, which in turn gears back to two drums in the proportion of about 1 to 6. The two drums are 5 ft. 6 in. in diameter with 6-ft. faces and are so connected up that they may be thrown in and out of gear separately.

The machine shop is equipped with a lathe having a 26-in. swing and a 11-ft base, a milling machine with a 42-in. base, a drill press with a 36-in. swing and a 6-in. pipe cutter all run by a 6x8-in. vertical engine. The blacksmith shop has five forges and an 800-lb. steam hammer.

The tipple is equipped with three Phillips dumps, one for coking coal and two to handle the run-of-mine, and owing to the large size of the trips, two stationary engines are used to handle the cars on the tipple. One engine, a 6x8-in. single cylinder vertical "dummy" pulls the loads down to the tipple by means of an ingenious endless-rope system using 1½-in. manilla rope. The other engine is the usual duplex mine haulage engine with 6x8-in. cylinders, and pulls the empties back up into the mine. A 30-in. circular saw driven by a 6x8-in. vertical engine is conveniently located to where the empty trip stands, and props are thus readily sawed to the required length and loaded.

The Washing Plant

The washery has two board divisions, one handling the coking coal and the other the non-coking. The greater part of the equipment was made at the company's foundry and machine shops in Anaconda.

The non-coking coal on being dumped at the tipple passes down through two 24x30-in. crushers, one reducing to 4-in. and the other to a 2-in. size. The crushed coal passes into a Dodge conveyer which carries it to storage bins in the washer. This conveyer works on a 10-deg. pitch against the "loads," is 150 ft. long, and has a capacity of 800 tons in eight hours.

From the storage bin, which holds 700 tons, the coal is elevated and distributed to three Jeffrey-Robinson washers each having a theoretical capacity of 400 tons and an actual working capacity of about 350 tons. The clean coal from the washers is elevated into the washed coal drainage bins having a capacity of 800 tons, whence it is loaded into railroad cars and shipped for steam coal. The refuse is again elevated and fed by means of a screw conveyer and a sluice box into two jigs each having a capacity of 20 tons in eight hours; these two jigs recover about 20 tons of sulphur nodules which are shipped to Great Falls and used at the smelters. The coking coal, on being dumped at the tipple, feeds into a conveyer similar to the non-coking coal, but with only 600 tons capacity, whence it is delivered to the coking-coal division of the washer.

The method of treating the coking coal is so complex that a description of the equipment only will be attempted here. The first floor consists of five tanks which act as temporary repositories for the refuse and different sizes of coal pending their elevation for retreatment or final disposal. On the second as well as on the third floors, there are 10 jigs, all of the Luhrig type. The second floor has a crusher and the third floor a crusher and screen, the latter sizing to over ½ in. and under ⅜ in. The fourth floor has two 6x4-ft. screens and one 8x10-ft.; the latter having a capacity of 400 tons in eight hours and sizing the coal to over 1½ in., 1 in., ⅜ in. and under ⅜ inch.

The elevating equipment consists of eleven elevators having a range of work from the first to the fourth floor. The building itself is of brick and steel throughout. One hundred coke ovens of the usual beehive type, 12 ft. in diameter, extend out from the washed coking-coal drainage bin, the coal being delivered to the ovens by means of a six-ton larry pulled by a horse.

Electrolytic Determination of Nickel

By V. P. Davis*

Dr. August Schumann, of Eisleben, has just published some results of analyses and experiments (*Zeits. f. angew. Chemie*, Dec. 18, 1908—2579) carried out under his personal supervision in which he confirms the inaccuracy of Professor Classen's method for the quantitative determination of nickel by electrolyzing the double oxalate. Some new methods are detailed which Doctor Schumann considers entirely trustworthy. The work is yet unfinished, therefore full details of manipulation are lacking, except in the analysis of pure nickel salts; but certain facts seem to be definitely established.

The metal must "plate" on the cathode; that is, deposit in coherent form, not as "sponge" or "moss." Negative metals, such as copper, antimony and arsenic must be absent. The presence of iron, manganese and aluminum is permissible only in small amounts. Chlorides and nitrates, when properly dealt with, give perfectly reliable results, contrary to the present generally accepted opinion. The best results are in every case obtained with a strongly ammoniacal electrolyte. The addition of soda pyrophosphate as recommended by Brand is an unnecessary complication, results with and without its use proving identical.

Weston's boric-acid method is applicable only when using a platinum dish or wire gauze as cathode. With a conical or cylindrical cathode the nickel deposited spongy and could not be weighed. Treadwell's recommendation, consisting in the addition of a small quantity of sulphuric or hydrochloric acid, to the electrolyte, is criticized as untrustworthy. Results by this method failed to check within allowable limits.

The obvious disadvantages of a strongly ammoniacial electrolyte have been met in part by the substitution of ammonium carbonate; though final report is yet to be had in this connection. An improvement in the cathode is the use of a piece of platinum wire gauze in place of the customary dish or cylinder. The gauze presents the advantage of lower first cost on account of its light weight, ease in cleaning, and the fact that it unfailingly deposits bright coherent metal. Faultless results are obtained with a low-current density and the addition of a certain amount of ammonium sulphate to increase the conductivity of the electrolyte. Following is a description of the analysis of nickel-ammonium sulphate: Electrolyte, 150 c.c. (including 40 c.c. ammonia); separation of electrodes, 1 c.m.; voltage, 6.14; temperature, 60 deg. F.; amperes, 0.37; time, 4 hours; Ni present, 0.1828 grams; Ni found, 0.1828 grams.

*31 Union Square, New York City.

Osceola Mining Company

This company reports for 1908, with comparison to two previous years, as follows:

	1908.	1907.	1906.
Cop. sld., lb.	19,815,046	11,080,210	18,588,451
Price, cents...	13.39	18.17	18.89
Unsold cop. .	1,435,748	3,054,543	..
Gross earn...	$2,914,544	$2,481,306	$3,646,811
Oper. exp...	2,091,824	1,674,178	1,868,140
Gross prof..	$822,720	$807,128	$1,788,671
Construction..	145,615	84,373	155,482
Net profit..	$677,105	$722,755	$1,623,189
Dividends	576,900	673,050	1,153,800
Surplus	100,205	49,705	469,389
Prev. surp	1,386,869	1,337,164	867,775
Total surp	$1,487,074	$1,386,869	$1,337,164

Mining statistics for the year compare as follows:

	1908.	1907.	1906.
Tons rock std	1,241,400	811,603	1,016,240
Lb. min. ob...	26,912,944	18,607,747	24,227,281
Fine cop., lb.	21,250,794	14,134,753	18,588,451
Cost per lb. at mine	8.74c	10.59c	8.73c
Cost per lb., smelt., frt., other chgs.	1.10c	1.25c	1.32c
Tl. cost per lb., refined	10.53c	12.44c	10.89c

The deepest vertical shafts on the Rand are the Cinderella Deep, which is 4200 ft. deep and the Jupiter, 4230 ft. deep.

Placer Gold Mining in Interior Alaska

The Fairbanks, Tanana and Koyukuk Districts Offer a Promising Field for Prospecting, Lack of Transportation Being the Chief Obstacle

EXCERPTS FROM A PRIVATE LETTER

Placer mining in its different forms is the principal industry of all interior Alaska. The production of gold in the Territory for 1906 was $18,600,000; and for 1907, $16,400,000, the decrease being due to labor troubles and the lack of labor. Half of the total amount produced in 1907 came from the Fairbanks district, but gold is being produced from the gravels in many places throughout Alaska. The number of places producing gold is increasing annually and I think will continue to do so for a long time to come. The staking of large areas by power of attorney has deterred prospecting a great deal, particularly in sections near producing camps. There are hundreds of square miles of territory, however, that has been neither prospected nor staked.

General Conditions in Alaska

Poor transportation is the greatest obstacle to mining in the interior. Means of conveyance are controlled by one or two companies, practically to the exclusion of all others. Projected and partially built railroads from the vicinity of Valdez, on the coast, into the copper districts in southern Alaska will, when completed, no doubt be a great help to the Tanana valley and a large area in that vicinity. Were it not for the high price of equipment much ground which is now valueless would be productive. Such favorable conditions will no doubt be brought about in a few years. The Koyukuk country, on the headwater of the Koyukuk river, in which very rich discoveries have been made lately, gives promise of being a large producer in the near future. The Koyukuk river lies north of and flows in a course almost parallel to the Yukon river into which it empties about 600 miles from the mouth.

Good reports come from the Valdez Creek country, about 200 miles southwest of Fairbanks and about the same distance from Valdez. It empties into the Susitna river, which in turn empties into Cooks Inlet. It is a very inaccessible district and supplies are expensive. There are some very rich gravels on the rimrock and on benches in a few places, but on the creeks the prospectors have not reached bedrock on account of the water. There is no machinery in the district. Miners are bothered with large boulders in places I understand. The gold is coarse; $1,000 was paid for a single nugget found in this district.

There is a great deal of coal as well as copper in many parts of interior Alaska as well as on the coast. Prospecting is handicapped somewhat by conditions, by frozen gravel and by the fact that the country is generally covered with a growth of moss or tundra. This accounts largely, in my opinion, for the lack of quartz discoveries in the interior.

The total population of the interior of Alaska will hardly exceed 5000, and the small number actually prospecting, under conditions which make prospecting laborious and slow, indicates how much of Alaska still remains to be prospected. The drilling machines are working, mostly, for an interest in the ground they prospect. The interest usually given is one-half, and the number of holes drilled from 6 to 12 on claims of 20 acres, or about this proportion.

There have been some new discoveries of good pay ground lately on Engineer and Lower Goldstream creeks, also on Little Eldorado creek, both near Fairbanks. A few days ago I saw a pile of ten gold bars in the window of the bank in Fairbanks. They were the result of sluicing operations during the winter months.

It takes about 25 or 30 days for mail to travel from Fairbanks to the United States in winter *via* stage; there are two stages a week from Fairbanks to Valdez. In summer it takes a little longer *via* steamboat, to Dawson and White Horse. No outside mail comes in *via* Nome or St. Michaels.

Methods of Mining

The methods and costs of mining vary with conditions and locality. The methods in the region about Fairbanks where most of the gravel is from 50 to 300 ft. deep to bedrock are: Sinking shaft to bedrock, drifting along the course of the pay gravel and driving crosscuts from main drift to both limits of the deposit. The pay gravel is extracted by breasting out the crosscuts beginning at the farther limits of the drifts and working toward the shaft. The pay gravel is hoisted with as little waste as possible, and is sluiced for the recovery of the gold. The main drifts are usually carried about 200 ft. each way from the shaft and timbered. The crosscuts are seldom timbered, for in most cases the gravel is solidly frozen and usually permits of breasting without the use of timber, the work being carried on in two or more of the crosscuts as desired. Work in this case means thawing the gravel, usually by steam, and extracting by pick and shovel. While extracting the gravel in the breast on one side of the drift, thawing is in progress on the other side. The steam point generally used for thawing is a piece of round hollow soft steel about 8 ft. long with a blunt hollow point of tool steel for piercing the ground, and a solid head of tool steel made strong enough to drive with a hammer. Steam is admitted through a pipe fitted laterally to the head. Hot water is, however, more frequently used for driving the points into the gravel and the thawing completed by means of steam. This has been found to be more rapid and satisfactory as a rule. The points are placed about 2½ ft. apart and require from 1 to 2 boiler capacity per point. In most places the points are left in the ground from 15 to 24 hours each thawing from 3 to 5 cu.yd. or more.

In many cases where a larger amount of ground is blocked out the points are left in the ground 10 or 12 hours and then withdrawn to be used elsewhere, the ground being allowed to "sweat" as they term it, thawing continuing for several hours after the points have been withdrawn, owing to the heat radiated from the thawed gravel.

Hot water hydraulicking by means of pulsometer or pumps of other types has been successfully used in some places and I think could be advantageously employed more generally.

After thawing, the gravel is removed by pick and shovel and carried by wheelbarrows or cars to the shaft, whence it is hoisted to the surface by buckets, generally attached to an automatic carrier or traveler which permits the dumping of the gravel directly into the sluice boxes, located 100 ft. or more from the collar of the shaft. In winter the gravel is conveyed to a dump under which sluice boxes have been placed, and is passed through the boxes in the spring when snow and ice begin thawing and water is available. Winter work is therefore somewhat more expensive. Gravel must average more than $2 per cu.yd. of ground worked in order to pay a profit in drift mining. Wages are $5 and board for miners, $7 for engineers and mechanics, and $10 for foremen.

Other Methods

Open-cut mining is carried on in a few places where the gravel is shallow. The ground is stripped either by sluicing or

with scrapers operated with steam or horsepower. Sometimes the gravel is thawed by steam, occasionally by exposure to the sun, and frequently by running water over it, when water is available. In the latter case bedrock drains are usually constructed and some means of elevating tailings employed. The usual method for handling the gravel after it is thawed is either by shoveling into wheelbarrows carrying it to the bucket in which it is conveyed and dumped into sluice boxes, or by moving it directly to sluice boxes with scrapers. In the latter case a common plow is generally used for loosening the gravel.

Gravel deeper than about 20 ft. can usually be worked more cheaply by drifting than by open-cut methods, especially if the gold is concentrated at or near bedrock, which is the rule in the parts of the district that I have been over.

The best clean-up I personally know of, last year. was on Discovery claim, Cleary creek. The amount of gold recovered from the gravel in three days by ten men was a little more than $22,000. I have heard of larger clean-ups and presume that the reports are true.

The methods generally in use could be improved, and costs could be materially reduced by the use of proper equipment. One reason why better equipment is not employed is because most of the ground is worked by leasers, or "laymen" as they are termed here, the amount of ground in each lease being small, from 100 to 500 ft. along the claim and, of course, extending to both side lines. The leasers in most cases are men with small capital; consequently they use only such equipment as is necessary. If they do find pay the amount of ground under lease is so small that expensive equipment is not justified. The locators of ground naturally destre a large number of leasers, for then the ground is prospected more quickly and the gold, if any, is recovered in less time.

A method of extracting gravel with some kind of mechanical device for digging and loading, instead of with pick and shovel, which is the universal practice, would, I believe, very materially reduce present costs. The average output per man with pick, shovel and wheelbarrow is about 9 cu.yd. delivered to the bucket at the shaft for a 10-hour shift. The Park automatic loader and conveyer, manufactured by the Railway Materials Company, Chicago, it is claimed, handles from 1 to 3 cu.yd. per minute. I saw one in operation at the Gunnison tunnel in Colorado and it certainly handled muck very rapidly. These machines do not require a track, and I think would be easily adapted for the work described. The lack of any kind of undercurrent or mercury in connection with the sluice boxes also tends to reduce the amount of gold recovered. The methods here described will, I think, apply in general throughout Alaska.

The cost of thawing ground, generally, is about 30 or 40c. per cu.yd. Some dredges claim to be handling thawed gravel for 10c., but I am inclined to think it will be nearer 20c. for general practice, except under favorable conditions, judging from what I have seen.

Dredging

With regard to dredging, the practice is much the same as in the United States; the costs, however, must be twice as high. Frozen gravel is the greatest obstacle in dredging. The short working seasons also hinders the work. But in spite of these unsatisfactory conditions, I believe there is a big field and many encouraging opportunities for dredging in Alaska. The many rivers and sloughs traverse thousands of miles of territory a large portion of which is known to be gold bearing. The numerous bars in the beds of the streams are never frozen and could be easily dredged if the quantity of gold justified the expenditure. In very few instances have they been prospected, and then as a rule only by the crude appliances of the average prospector, and not with a view to dredging.

Last summer I panned some of the bars near here and seldom failed to get colors although the gravel panned was taken from the surface to a depth of about 12 in. and from immediately beside the river when the water was low. In coming down the Yukon I noticed in a few places, sluice boxes or rockers on a few of the high bars. Prospecting for this character of dredging ground could best be carried on in the winter.

Prospecting with Machine Drills

Any type of drilling machine, such as the Keystone, Star, Dempster, Cyclone, Empire, or even a spring-pole drill operated by hand would be adaptable for this kind of work. Dempster drills could be set up on the ice which covers the rivers in winter and the work could thus be carried on much more rapidly and to better advantage than from a scow. They may be moved from place to place quickly. There are a few of these drills here in use for prospecting the gravels. They do not require any casing when drilling in solidly frozen ground.

The greater part of the overburden is a very fine sand, and in this the drills make as high as 75 ft. in a day of 10 hours. In the gravel it ranges from 5 to 20 ft. per day. Work is carried on all winter These machines complete weigh 2 or 3 tons and are cumbersome to move for the country is generally covered with "nigger heads" (hillocks or big bunches of grass) and is practically impassable for any kind of vehicle. For inaccessible country except where roads are built, the Empire drill is best and cheapest; also for prospecting gravels not more than 100 ft. deep. The heavier sizes weigh about 1600 lb. and the lighter ones (for gravels up to 50 ft. deep), about 1000 lb. They can be taken apart and made into packs of 75 lb. The machine can be operated by hand or by horse or steam power. The others named cannot be operated except by steam, or gasolene.

The Spring-pole Drill

I have not seen or heard of the use of a spring-pole drill in Alaska although drills of this kind are frequently used in the United States. The spring-pole drill consists of a piece of drill steel, usually about 2½ or 3 in. in diameter of bit weighing about 150 lb. and fastened by means of a rope to the end of a pole which sustains the weight. One man, by pulling down on the rope, allows the bit to strike the ground, thus gradually cutting and disintegrating it so that it can be taken out by means of a sand pump.

An outfit of this kind does not weigh more than 350 lb. and can be operated to advantage to a depth of 50 ft. if not deeper. Such a machine would be invaluable to the prospector here providing he had a fair knowledge of drilling with any of the power machines named. It would permit of his prospecting ground where living water is encountered, which is impossible with the equipment of the ordinary prospector in Alaska. Living water has been encountered in some parts of practically every camp that I have heard of in Alaska. Such gravels, the conditions being favorable, could be dredged at good profit.

Investigations along this line will I believe result in the installation and operation of many dredges throughout interior Alaska. The type and size of the dredges to be employed will be governed by conditions. A small dredge with an estimated capacity of 500 cu.yd. per 24 hours was constructed at Fairbanks last fall at a cost of about $6000. The machinery was made by the Byron Jackson Company, of San Francisco, and consists essentially of a digging wheel which discharges through bottomless buckets into a 6-in. suction pipe connected with a centrifugal pump mounted on a barge at water level. Gasolene power is used for operating it; the requirement being 16 h.p. It was in operation for a day or so and it is claimed, worked satisfactorily.

A knowledge and the careful consideration of existing conditions is essential to the successful construction and operation of dredges in Alaska. This has been thoroughly demonstrated by the many unsuccessful installations on Seward peninsula. There are dredges now operating successfully and at a profit on Seward peninsula, however, and the successful ones are not all of the same type either. I have heard of dredging ground in the Forty Mile district southeast of Fairbanks upon which some dredges are operating. I understand there is also good

ground for dredging northeast of Fairbanks, in the Birch Creek district near Circle on the Yukon. Mr. Barnette, a banker and mining operator of Fairbanks, has invested rather heavily in the Birch Creek district this fall and winter and has a drill of the Keystone type prospecting ground with a view to dredging. One hears of ground in almost any of the districts that may possibly be suitable for dredging.

Winter Prospecting

In Alaska the greatest amount of prospecting is done in the winter. A large proportion of the prospectors work in the mines in the summer and prospect in the winter. They travel over the frozen streams in winter with sleds. In the summer poling boats are used, long boats of the canoe type, pushed along by means of a pole. In going down stream nothing is needed except an oar, with which to guide the boat.

Ice begins breaking up about the first or middle of May, and in a few days after the ice begins to break up the rivers are clear. Summer advances rapidly after the ice goes out. Mush ice begins to run in the rivers about Oct. 15 or 25, and in a week or two the rivers are frozen over. There are usually no frosts until about the first or the middle of September. Many vegetables are raised in Alaska. Potatoes raised in the territory sold for 10c. per lb. last fall. Tomatoes, celery, carrots, turnips, etc., were also on the market.

Prospecting by Means of Shafts

Sometimes the thawing of the ground is accomplished by means of a wood fire, or with rocks heated and thrown down the shaft and covered with moss. When this method is employed several holes are usually thawed simultaneously. The method is very slow, from a few inches to as much as a foot in depth being thawed in a day. The more common device is the steam point, the usual prospector's outfit consisting of a small boiler weighing about 250 lb. and costing about $250. A couple of points with ½-in. pipe and a short length of steam hose, picks, shovels, etc., complete the equipment. Hoisting is usually done by hand. The complete outfit, including provisions for a season, can usually be loaded in a poling boat and handled by two men.

In winter prospectors frequently use dog teams if game is plentiful in the districts to be prospected. Otherwise they are too expensive to keep. As a rule it is not necessary to timber prospect shafts. When water is encountered, work is usually abandoned even though the prospect is fairly good, which is frequently the case.

The common method in Alaska for estimating values is by the quantity per pan, from five to seven pans being reckoned as a cubic foot.

Placer claims are usually staked 660x 1320 ft. except in association claims which consists of 160 acres.

Regarding the prospecting of wet gravels, I have seen but one drilling machine equipped with casing which is necessary in order to drill ground of this character, and this machine was owned by Mr. Barnette and was on the way to the Birch Creek district for the purpose of prospecting shallow dredging ground. Drilling machines in the neighborhood of Fairbanks abandon the hole when they strike thawed gravel, for the loose ground caves in, and attempts to drill without casing nearly always results in the loss of a string of tools, which are very expensive and hard to replace. The hole drilled by most machines is 6 in. in diameter, although 4 in. is sometimes used.

An outfit, including a season's provisions and a spring-pole drill which can be operated by one man, will cost in the neighborhood of $1500. One thousand dollars a year would about cover expenses. A larger allowance would permit of visiting a greater number of districts traveling by regular passenger boats operated by the transportation companies, and this might be best if securing property by bond and option were considered of the first importance.

Experiences in the Koyukuk District

Since beginning this letter I have had an interview with a man who has just arrived from the Koyukuk district. He had been in that section three or four years and brought out $3000 or $4000 in gold dust. He said the best find so far made is on Olson's claim, Nolan creek, at a depth of 140 ft. and on bedrock. Three men took out $125,000 above expenses in about three months, one pan taken from in front of a ridge in bedrock being worth $1500. Two claims above this on the same creek $65,000 was taken out in the season, but the gold came mostly from gravel to a depth of 12 or 15 ft. from surface. He does not think they reached bedrock at all.

In one place in which he worked on Emma creek, eight miles above Nolan creek, they drifted in on good pay gravel until they struck a hard cemented conglomerate which they could not work although they used some powder. He said they could see some gold in the conglomerate. He also stated that they sometimes found in the sluice boxes gold entirely covered with a white crust or coating, probably carbonate of lime. He stated that bedrock was sometimes limestone, but more generally a schist.

The gulches were frequently narrow and steep. They worked on lease in one place where they shoveled gravel as deep as 3 ft. below water, never reaching bedrock except in a few places; the gravel produced good pay. There is very little machinery of any kind in the district, the transportation companies claiming that they could not get shipments in during the fall. He stated that wet ground on one or two creeks that he had panned prospected well, but that the gravel was probably deep and would be expensive to pump; it might be dredged, but he knew nothing of dredging methods.

There were no drilling machines of any type in the country. The number of men in the district was about 200. To anyone with little money he would recommend the country as a good prospecting field. He said that he got $18.20 per oz. for his gold at the bank after paying a 2½-per cent. fee for exchange or purchase, which is charged by all banks in Fairbanks, when purchasing gold dust. The Olson strike, was described in the Seattle papers in July, 1908, on the arrival of an Episcopal minister from the Koyukuk. The gold from this district is coarse.

Opportunities in the Interior of Alaska

To those who will work and have a knowledge of how to do so intelligently and who are not afraid of some hardships, Alaska offers many inducements, one in particular being the prospecting of wet gravels. This, I believe, can readily be done with drills of almost any type. A determination of the gold content and depth and a rough estimate of the flow of water would indicate whether the ground could be worked profitably by dredging or otherwise.

The cost of a machine drill is about $2500, and an equipment of this kind is expensive to operate and move except for very short distances, as for instance from one hole to another on a 20-acre claim. Engineers' wages are $7 per day and board, and of helpers, $5 a day and board. Wood and water must usually be hauled and this requires the services of another man and sometimes a horse for a portion of the time. With a spring-pole drill there would be no additional expense above those necessary with present methods. Of course a spring-pole drill will not drill nearly so fast as a machine but it requires much less time to move, set up and take down. A spring pole can usually be cut where the hole is to be drilled. Wet gravels can be prospected if casing is used, as readily as with machines.

In making concrete mortar-block (C. E. Parsons, *Bull. No. 50* I. M. and M.) the concrete should be well tamped as well as thoroughly mixed, and if possible all the cement should be put in place in one day. Generally the proportion of cement is increased near the top of the block.

In Austrian mines, according to the *New Zealand Mines Record*, underground rescue chambers are provided. These are made to hold 50 men, and besides having pure oxygen piped into them, are stocked with provisions, first-aid supplies and rescue apparatus.

The Mines and Mills of Tonopah, Nevada

The Gold-Silver Mines Have Been Handicapped by Lack of Transportation; Cyanide Mills Now Treat the Low-Grade Ores

BY G. E. WOLCOTT*

In the last few years the Tonopah mining district has been rapidly taking a place of importance among the silver-producing camps of the United States. Recent strikes in the camp promise a steady and probably increased production. The principal producing properties of the district are, in the order of tonnage produced, as follows: The Tonopah Mining Company, the Montana-Tonopah Mining Company, the Tonopah-Belmont Mining and Development Company, the MacNamara Mining Company, the Midway Company and the Tonopah Extension. The Jim Butler, West End and North Star mines have been rather intermittent producers. The approximate total monthly production is at present about 25,000 tons with an estimated value of more than $500,000.

Until within the last few years only ore of a comparatively high grade could be mined at a profit, but with the completion of the milling plants at Millers of the Belmont and Tonopah companies and that of the Montana-Tonopah at Tonopah ore of much lower grade can be worked. The town of Millers is situated on gently sloping ground 11 miles from the mining center. Water is obtained in ample quantities for milling purposes at a depth of about 35 ft. and is pumped to the mills from plants situated a short distance below them.

TONOPAH FROM BROUGHER HILL

Methods of Mining

None of the Tonopah mines has been troubled with water, although the deeper shafts have reached a depth of 1200 ft. and more. The Mizpah shaft of the Tonopah Mining Company is at present being sunk to a greater depth than has hitherto been reached.

Overhead stoping is the rule, the machines mostly in use being of the air-hammer type, which have here almost entirely replaced piston machines for overhead work. Piston machines, 2½ in., are mostly used for drifting and sinking. The ore consists chiefly of quartz carrying only a small percentage of sulphides, with the silver mostly in the form of proustite and pyrargyrite. The proportion of silver to gold is about 100 to 1 by weight or 5 to 2 in value. A part of the ore requires very little sorting, and some is milled without any sorting at all; the proportion of waste rock in the ore is usually comparatively small. Veins vary in width from a few inches to as much as 30 ft. or more, and are usually only slightly inclined from the vertical.

The Tonopah Extension is the only mine which is shipping any amount of ore to outside points. The ore as milled has

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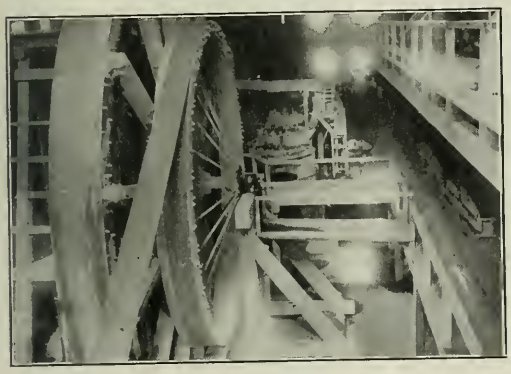
an average grade of from $20 to $25. All of the principal producers of the camp are situated in the saddle between Oddie and Brougher hills and upon the sides of these hills.

MILLING

The mills of the district include the Belmont mill, having 60 stamps; the Desert mill of the Tonopah company, 100 stamps, and the Montana-Tonopah with 40 stamps. These three mills are treating in the aggregate about 24,200 tons per month, the tonnage being divided as follows: The Desert mill, 1350; Belmont, 6000; Montana-Tonopah, 4700. Assuming an average grade of $22 and an extraction of 90 per cent., this gives a yearly production of $5,749,200.

The Montana-Tonopah mill has recently been described. This plant is situated at the company's mine on a side-hill site, and less power is required for elevating purposes than at either of the other two mills. The plant is well constructed throughout and has been treating ore at an average cost of less than $4 per ton.

The Belmont mill was first constructed to use Huntington mills following the stamps; but at present these are not in use, the entire crushing being done by stamps. The batteries crush through a 35-mesh screen and run in units of 20 stamps, driven by 50-h.p. electric motors. The stamps are arranged so that 10 stamps can be started at a time. The same arrangement is used at the Desert mill. The flow sheet of this mill is much more complicated than that of the Belmont or the Montana-Tonopah mills. The essential difference between this mill and the Belmont is that stage grinding is employed by the use of Huntington



SAND WHEEL, DESERT MILL

LEACHING TANKS, DESERT MILL

MINE AND MILL, MONTANA-TONOPAH COMPANY

DESERT MILL, MILLERS, NEVADA

BELMONT MILL, MILLERS

ZINC BOXES AND CIRCULATION TANKS, DESERT MILL

mills following the stamps. The stamps crush to 10 and 12 mesh, and the Huntingtons to 30 mesh. The middlings from the Wilfley tables are also reground in a Huntington mill. With the exception of this feature the practice is essentially the same as at the Belmont plant.

At the Belmont mill the crushing is done in a solution containing 45 lb. cyanide per ton. In the sand-leaching tanks 300 lb. additional cyanide is used for 140 tons of ore, and in the slime-agitation tanks, 300 lb. for 80 tons of ore. The total cyanide consumption is 3.2 lb. per ton. To prevent the reprecipitation of silver in the form of sulphide, ¾ lb. lead acetate is added for each ton of ore; at the Desert mill 1 lb. is used for three tons of ore in the sand tanks, and 1 lb. for each ton in the slime tanks. The sands are first collected in dewatering tanks, where they are drained by means of a suction pump and then transferred by belt conveyers to the leaching tanks.

The treatment in the leaching tanks occupies 14 days. At the Desert mill a Blaisdell excavator is used for emptying tanks, while hand labor is employed at the Belmont. In each case the tanks are emptied by center-discharge gates upon belt conveyers.

Slime Treatment

The slimes are agitated by mechanical agitators for a period of 72 hours, steam and compressed air being admitted at the bottom of the tanks for heating and oxidizing. It is aimed to heat the pulp to about 90 deg. and steam is generated especially for this purpose. A lowering of temperature results in decreased extraction. Sands and slimes are produced in the proportion of 55 to 45.

From the slime-storage tank the slimes go to two Butters filter tanks containing 60 leaves each, the filters being 5x10 ft. The original filters had a filtering medium consisting of cocoa matting inside heavy filtering cloth. These proved unsatisfactory because of the clogging of the matting by lime, and are being replaced by homemade filters using the original frames. Instead of cocoa matting, wooden strips, ½ in. square and placed 2 in. apart, are used. These give better satisfaction than the original leaves and give a greater filtering capacity.

The treatment in the filter vats takes a little more than three hours. Slimes are introduced for about 1¼ hours; the pulp is then pumped back to the storage tanks, the cake being held on the leaves; and weak cyanide solution is drawn through about one hour. The time taken in charging, discharging, etc., brings the total up to more than three hours. The filters are given a treatment in dilute hydrochloric acid every 15 days, separate tanks being provided for the treatment. The filters are also tested to detect and repair any leaks that may develop.

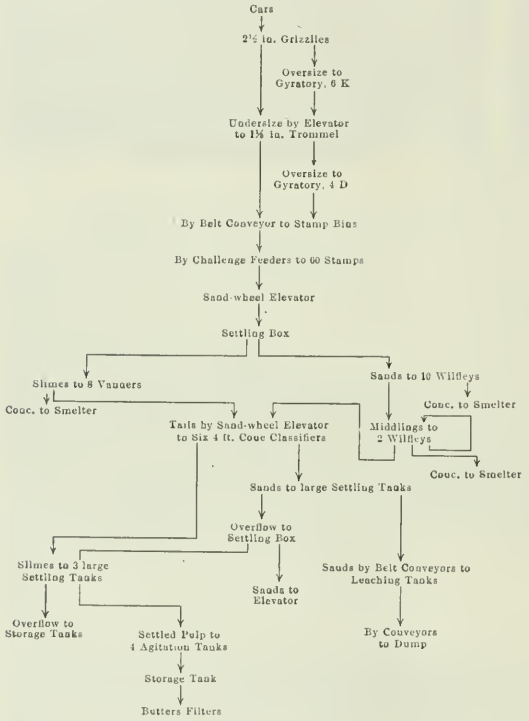
Precipitation at both the Belmont and the Desert mills is by zinc shavings cut at the plant. The zinc precipitates are dried and melted direct, without any preliminary acid treatment. At the Montana-Tonopah mill precipitation is by means of zinc dust, the precipitates being sent to the smelter.

Concentration and Costs

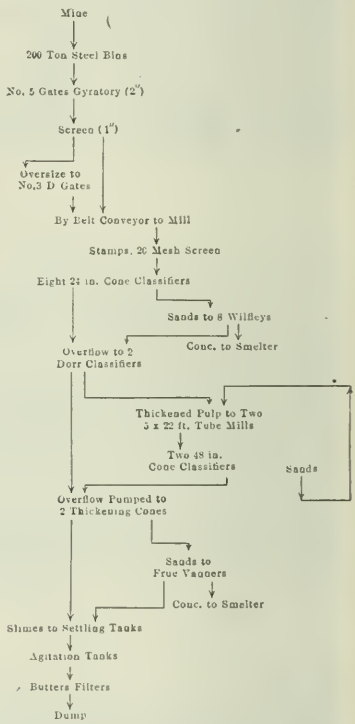
In the concentrating department one ton of concentrates is obtained from 100 tons of ore, the concentrates carrying an average of 600 to 700 oz. silver and about 8 oz. gold. No attempt is made at any of the mills to treat their own concentrates, although some experimental work has been done with this end in view.

At all three of the mills a bullion recovery of approximately 90 per cent. of both silver and gold is claimed.

At the Belmont mill the cost of treatment for the year 1907 was given as $7.825 per ton. While authoritative figures could not be obtained at the time of my visit, this figure is generally supposed to be higher than the actual cost. The Belmont and Desert mills at first generated their own power by steam at a rather excessive cost. This has since been greatly lowered by the use of power



FLOW SHEET, BELMONT MILL



FLOW SHEET, MONTANA-TONOPAH MILL

generated near Bishop, Cal., and supplied at the mills at a rate of from $11 to $12 per horsepower-month.

At the Belmont mill the crushing is in one operation with subsequent separation of sands and slimes; at the Desert mill stage grinding, with Huntington mills following stamps and separation of sands and slimes, is used, while at the Montana-Tonopah entire sliming of the product with the use of tube mills is practiced. It would be interesting to compare the milling costs in the three cases, but at present sufficient data are not available.

Short Talks on Mining Law—XIII

By A. H. Ricketts*

A patent for land claimed and located for valuable deposits may be obtained by any person authorized by law to locate a mining claim and who may have complied with the terms of the mining act. That act provides what steps are necessary, and the Land Department may be said to regulate the proceedings for, and to finally determine the right to the patent.

The Land Department (including in that term the secretary of the interior, the commissioner of the General Land Office and their subordinate officers) constitutes a special tribunal, vested with judicial power to hear and determine the claims of all parties to the public lands which it is authorized to dispose of, and also the power to make conveyance of the government to the parties it declares are entitled to it.

The manner for obtaining a patent for either a lode or placer claim, whether for a single claim or for a number of contiguous lode or placer claims, that is, those which touch sides, lie alongside of, are adjacent or adjoin, with or without a mill site included therein, or for a mill site only, is substantially similar, except that all lode claims and mill sites must be officially surveyed for patent; and that coal lands can be entered only after survey and by legal subdivisions under special regulations. But one entry of coal or saline lands and possibly of a mill site by any person, association of persons, or a corporation, is allowed by law. Placer claims which have not been located according to the rectangular subdivisions of the public surveys must be officially surveyed. Claims which constitute one or more contiguous 10-acre lots of a 40-acre tract, may be subdivided into squares with lines at right angles with the lines of such surveys, and can be appropriately described as, say, the northeast quarter of the northeast quarter of the northeast quarter of a certain section, range and meridian, are not subject to such survey. If the claim be all placer ground, that fact must be stated in the application for patent and be corroborated by the affidavit of other persons. If of mixed placers and lodes, it should be so set out, with a description of all known lodes situated within the boundaries of the placer claim. Known veins or lodes included within such area must, if claimed by the applicant, be specifically applied for, or his right thereto will be waived. Where an official survey of a placer claim is made, the Land Department requires the deputy making the survey, to file a verified, corroborated report, containing such data as, for example, the proximity of the claim, the centers of trade or residence, the amount of vegetation, the *locus* and size of streams, etc. Such report must be made a part of the application for patent, or as oddly expressed in the rules of that department, be "included in the oath of the applicant."

Applications for Patent—the Survey

The initial step in an application for either a lode or a mill site, or both combined, is the filing with the United States surveyor general of the district in which the same may be situated, of a written application, requesting an official survey of the claim by a deputy United States mineral surveyor, nominated therein by the applicant, who has no interest in the claim and whose charges must be paid for by the latter. The courts are not in accord as to whether the deputy is the agent of the applicant or not. Contemporaneously with the application there should be filed therewith a copy of the location notice certified by the officer in charge of the records where the same is recorded, or a statement showing sufficient reasons for its absence. Also a certificate of deposit, issued by the proper United States subtreasurer for the amount which may be required by the surveyor general in the preparation of the plat and field notes of the survey in his office. Thereupon such deputy receives an order of survey from such officer. The survey should be actual, and should be made in conformity to the rules of the Land Department, of which the surveyor-general's office is an integral part. When making the survey the end lines of the location may be straightened within the boundary lines of the claim. Errors in the survey occurring through the carelessness or negligence of the deputy, must be corrected by him at his own expense. His failure to comply with instructions from the department to do so within a specified time is ground for his suspension or removal from office.

The deputy is required to transmit to the Surveyor General his field-notes, a preliminary plat of the survey, indorsed with his approval, together with a statement of the value of the labor done or improvements made upon the claim, or if done upon one of a group of contiguous claims, that the work so done or the improvements made tend to the development of all the claims within the group and equals in the aggregate the statutory expenditure of $500 upon each of them. These data are retained in the office of the surveyor general, who, if the same are correct, approves thereof and causes copies of the same to be made in his office and sends to the applicant copies of the plat for posting upon the property, and also for filing in the local land office, together with the field-notes, as a part of the application for patent. This officer also sends a copy of the plat to the general land office at Washington and another copy to the local land office. It is usual for him to certify upon the plat that the statutory amount necessary to obtain a patent has been expended upon the claim (not upon the mill site). But this is not essential as such an expenditure may be made after survey and before the expiration of the period of newspaper publication and the certificate filed thereafter. This certificate of expenditure may be attacked in the land department before patent issues. Otherwise, it is conclusive of the facts stated therein. The equivalent of this certificate is an affidavit, where the application is for a placer claim which is not subject to official survey, made by two or more disinterested witnesses that not less than $500 has been expended by the applicant or his grantors upon the claim, located by legal subdivision.

The next step in the proceeding is for the applicant to post a copy of the plat in a conspicuous place upon the claim and also one upon the mill site, if the application includes such, together with a notice of intention to apply for a patent. Both must be posted in such a way that they can be readily examined by any person desiring to do so. This posting must be done in the presence of two credible witnesses, who must make affidavit of such posting. This affidavit, which should state the date and place of posting, and contain a copy of the notice posted must be filed with, or before, the application for patent is filed.

Proceedings in the Local Land Office

What may be termed the "application papers," and which should be filed say, contemporaneously in the proper land office, consist of the following documents:

1. The said affidavit of posting the plat and notice upon the claim.

2. An application under oath of the claimant, or his attorney in fact or agent thereunto duly authorized, which should show, as clearly as possible, the facts constituting compliance with the requirements of the law, the origin of possession and the basis of the claim for the patent. If the application is for saline lands there must be incorporated in the application a statement that the applicant has never, either as an individual or as a member of an association, located, applied for, entered or held any other saline lands. If the party applying for patent does so as a trustee, he must fully disclose the nature

*Member of the San Francisco Bar.

of the trust, the names of his trustors, and furnish satisfactory proof of the citizenship of himself and of them.

3. Evidence of the citizenship of the applicant, which, if a natural person, should be given by his affidavit; if an association of persons, by the affidavit of each of them or of an authorized agent or attorney in fact made upon his information, or upon his information and belief; or if a corporation, by a certified copy of its articles of incorporation.

4. A duly authenticated copy of the authority of the attorney in fact or agent to apply for the patent, which in case of an individual or association may be by letter of attorney, or if the claimant be a corporation, by a copy of the resolution appointing him for that purpose, taken from the minutes of the meeting of the directors of the corporation, at which he was appointed, and certified to as correct by its secretary, under the seal of the corporation.

5. A copy of said plat and field-notes given by the surveyor general to the claimant.

6. A duly certified copy of the location notice and an abstract of title of the property complete to the time of filing the application, certified by the custodian of the records, or by a duly authorized searcher of records, or an abstract maker, who must certify that no conveyances affecting the title of the claim appear of record, other than these set forth in the abstract. The abstract may be in the usual form of such a document. That is to say, instruments usually abbreviated in such a work, may be abbreviated therein.

Other Requirements

In the event that the records may have been destroyed, an affidavit by the claimant, supported by the affidavit of any other person cognizant of the facts relative to the location, occupancy, possession, etc., should be filed with the application. When an applicant bases his right to a patent upon the statute of limitations, he is not required to file any evidence of location, copies of conveyances, or abstracts of title, as in other cases; but he is required to furnish a duly certified copy of the statute of limitations affecting mining claims in the State or Territory within which the claim may be situated, together with his affidavit, giving a clear and succinct narration of the facts as to the origin of his title, and likewise as to the continuance of his possession of the ground covered by his application; the area of his claim, the nature and extent of the mining that has been done thereon, whether there has been any opposition to his possession or litigation with regard to his claim, and if so, when the same ceased; whether such cessation was caused by compromise or by judicial decree, and any additional fact within the claimant's knowledge having a direct bearing upon his possession, and *bona fides*, which he may desire to submit in support of his claim. Thereafter the proceedings are the same as in other cases, excepting that the statement of facts as to the origin of the title of the applicant must be corroborated by the affidavit of one or more disinterested persons.

If the locators are the applicants for patent, they should state in their application, if such be the fact, that they have disposed of no interest in the claim.

Transfers made after the filing of the application will not be considered, but patent will issue in the name of the applicant, except when he is defeated in an adverse suit, or the protest of a co-owner may be sustained; but where the applicant is known to be dead prior to the submission of the final proofs and payment for the land, the register's duplicate receipt will issue in the name of the applicant's heirs and patent issued in conformity thereto.

Generally, all affidavits required in these proceedings may be verified before any officer authorized to administer oaths within the land district wherein the claim may be situated, as, for instance, a notary public within the county for which he is appointed, whether such county is wholly or partly without such district. In coal-land applications each application, declaratory statement and affidavit must be verified before the register or receiver in the land district wherein the lands involved are situated. All affidavits made outside the proper land district are insufficient and proceedings based thereon are void and patent cannot be obtained thereon. The exceptions to the rule are, that where the applicant resides or the adverse claimant resides, or at any time being beyond the limits of the district wherein the claim is situated, he may make any oath or affidavit required for proof of citizenship or to the adverse claim before the clerk of any court of record, or before any notary public of such State or Territory.

7. An agreement of the publisher to hold the applicant for patent alone responsible for charges of publication of notice.

8. A notice for publication and one for posting in the local land office, embracing all the data given in the notice posted upon the claim and indicating the *locus* of the claim by giving the connecting line, as shown on the field notes and plat between a corner of the claim and a United States mineral monument or corner of the public survey. Also stating the boundary of the claim by courses and distances, and the names of the bounding claims, if any. If this notice is declared insufficient by the land department, the application is defective, and the proceedings from that point must be commenced anew.

Where the application embraces a mill site there must also be filed an affidavit of two or more persons capable from acquaintance with the land to testify understandingly of its non-mineral character.

If no reason appears to the local land officers for rejecting the application the register orders publication of notice of such application for 60 days in a newspaper published nearest to the claim. The time for filing an adverse claim is not enlarged by the fact of excessive newspaper publication, nor by stipulation between the parties. During the period of publication, the plat and notice must remain posted on the claim, and during the same period the register must keep a copy of the notice posted in the land office.

If the application should be rejected by the local land officers, they must give their reasons therefor, and allow the applicant 30 days for an appeal to the commissioner of the General Land Office at Washington, from whom an appeal lies to the secretary of the interior.

If no adverse claim is filed, the applicant, after the said period of newspaper publication, or after the adverse claim is determined if one be filed, must within a reasonable time thereafter file the following additional papers:

9. Affidavit of the publisher that the said notice was published for the statutory period.

10. Affidavit of the claimant, that both the said plat and notice remained conspicuously posted upon the claim during the period of such publication.

11. Affidavit of the claimant showing what fees and charges were paid to the register and receiver, to the deputy for the survey of the claim for publication of the notice, and for the land embraced in the claim.

12. Written application for purchase from the Government of the property, accompanied by a sum equal to $5 an acre, and each fractional part thereof, for a lode claim and mill site, or for a known lode within a placer claim and $2.50 for each acre and each fractional part thereof embraced within a placer claim.

Thereupon the receiver of the land office issues a "duplicate receipt" to the applicant therefor. This instrument is sometimes called "final receipt," or "certificate of purchase." After its issuance further annual expenditure on the claim is not required, unless such receipt may have been procured by fraud.

When Proceedings are Suspended

The patent proceedings may possibly be interrupted by the filing of an adverse claim or a protest. The difference between an adverse claim, which is provided for by the mining act, and a protest, which is provided for by the rules of the Land Department, is that the first named must be filed within the 60-days' period of newspaper publication by one, or the heirs of one having a direct interest, or some right in the land, or some part of it, adverse to the applicant, and must be followed by an action commenced in a court of competent jurisdiction within 30 days thereafter; whereas a protest may be filed at any time before the actual

issuance of the patent by a person who appears as a friend of the Government in the proceedings, or in aid of the establishment of his equitable right in the premises. The grounds of a protest may be the non-citizenship of the applicant, or some fraud, lack of good faith, or failure on his part, in regard to any of the essential requisites to entitle him to a patent; or that the protestant is a claimant of a present interest and is surreptitiously excluded by the applicant from the application for patent. In the latter case, if suit is brought, the Land Department delays the issuance of patent until the courts have determined the rights of the respective parties, although there is nothing in the law requiring it to do so, and ordinarily proceedings on a protest are confined to the Land Department without right of appeal in the absence of a present interest.

By the terms of the mining act, the filing of the adverse claim suspends all proceedings in the Land Department, except the publication and posting of the plat and notice upon the claim and the filing of proof of each thereof, until the adverse claim is finally determined by the court, or is adjusted between the parties thereto, or the same is waived.

Waiver may be evidenced by a failure to commence suit within the statutory time, or by filing in the records of the court a statement or stipulation of the plaintiff that he abandons his case, or waives his claims, or by an instrument, signed by him and duly authenticated, stating that he has sold his interest to the other party, or by his failure to appear at the trial. Where an adverse claim has been filed, but no suit commenced against the applicant for patent within the statutory period, a certificate to that effect by the clerk of the State court having jurisdiction in the case, and also by the clerk of the Circuit Court of the United States for the district in which the claim is situated, are required by the Land Department. If suit has been commenced upon the adverse claim, a relinquishment, or other evidence of abandonment of the adverse claim will not be accepted by the Land Department, but the case must be terminated and proof thereof furnished by a certificate of the clerk of the court, to that effect, or by a certified copy of the judgment roll.

The applicant for patent waives his right thereto by failing to prosecute his application to completion by filing the necessary proofs and making payment for the land within a reasonable time after the expiration of the period of publication of notice of the application, or after the termination of the adverse proceedings.

The Adverse Claim

An adverse claim is limited to the determination of surface conflicts arising from independent conflicting locations of the same ground by adverse mineral claimants, or between a mineral claimant and the owner of a mill site, or possibly where the same land may be claimed under different laws, as for example, the owner of a town lot may adverse an application for a mining claim. It does not extend to controversies between co-owners claiming under the same location or title.

An adverse right is lost if not made the subject of an adverse claim, and the latter is nullified if not followed by suit commenced and prosecuted with due diligence. An adverse right cannot be the subject of a protest or *vice versa*.

The courts have specifically found that the following holders of rights in a mining claim are not compelled to file an adverse claim to protect their respective rights: Co-owners, easement-holders, lien-holders, a mining claimant as against an application for a town-site patent, the owner of a known lode against an application for a placer patent not including such lode therein, a senior patentee, and in some cases a tunnel claimant.

The adverse claim must be upon oath of the adverse claimant, or his or its duly authorized agent or attorney in fact, cognizant of the facts stated. It must show the nature, boundaries and extent of the adverse claim and be followed by suit brought within the statutory period and prosecuted to final judgment unless otherwise disposed of.

The nature, boundaries and extent of the adverse claims are shown by the filing in the local land office of the following papers:

1. A plat showing the adverse claimant's entire claim, its relative situation or position with the one against which he claims and the extent of the conflict, except that when both claims are claimed by legal subdivisions, no survey or plat is necessary. If not so held it is preferable to have such plat made from an actual survey by a deputy mineral surveyor and its correctness officially certified thereon by him, but this is not essential, nor does the matter have to pass through the surveyor general's office.

2. An affidavit fully setting forth the nature and extent of the interference or conflict and whether the party claims as a purchaser for a valuable consideration or as a locator. If the transaction was a verbal one, the circumstances attending the purchase, the date thereof, and the amount paid are to be stated. This should be corroborated by the affidavit of one or more witnesses, if any were presented at the time.

3. A duly certified copy of the location notice from the office of the proper county recorder.

4. A duly certified copy of the conveyance to the adverse claimant, or an abstract of title, as in the case of an application for patent.

5. If the "adverse" is filed by an agent or attorney in fact proof of his authority, as in the case of an application for patent.

Upon the filing of these documents and the payment of the requisite fee, the officers of the local land office give notice of such filing to both parties and that it is necessary for the adverse claimant to bring suit thereon within 30 days after such filing, to determine the right of possession to the land in dispute.

The adverse suit may result in a judgment for none of the parties thereto, or in a judgment in favor of the plaintiff or of the defendant, or there may be as many different judgments affecting different parts of the claim as there are successful parties to the litigation.

To complete the patent proceedings the successful party to the litigation is required to file in the local land office a duly certified copy of the judgment roll, except that where such suit has been dismissed a certificate of the clerk of the court to that effect or a certified copy of the order of dismissal will be sufficient, together with the proofs required where no adverse claim has been filed. In case he be an adverse claimant, he must also file therein:

1. A certificate of the surveyor general that the requisite amount of labor has been done or improvements made and the description required in other cases.

2. A written application to purchase, and payment as set forth in No. 12 hereof.

Whereupon, a "duplicate receipt," or certificate of purchase is issued, provided the local land officers are satisfied that the proper proofs have been filed, in which event the whole proceedings and the judgment roll are certified by the register to the commissioner of the General Land Office, and patent issues to the claimant for the claim as applied for, or for such portions thereof as the applicant or the adverse claimant shall appear from the judgment of the court to possess rightfully. That is, patent issues to the respective parties, according to their respective rights, provided, that the officers of the General Land Office are satisfied that patent should issue at all, as the judgment of the court is conclusive only between the parties as to the right of possession and not as between them or any of them and the Government in the matter of the passage of the fee-simple title. Hence, the Land Department may require an amendment of the application or of some one or more of the papers comprising the same, or order a hearing in the local land office to determine the character of the land or order a segregation survey therof; or possibly it may cancel the certificate of purchase, and perhaps upon proper proceedings had, declare the land restored to the public domain. A subsisting "duplicate receipt," is equivalent as far as third parties are concerned. It is free from collateral attack.

Reclaiming the Inclined Hoistway at Mine 21

By Guy C. Stoltz*

Mine 21 at Mineville, N. Y., a magnetite property of the Port Henry Iron Ore Company, was at first (1846) worked on the outcrop by the room and pillar method the ore being hoisted on a double-track 57-deg. incline trestled throughout and following in general the dip of the footwall. As the workings became deeper, the management, in order to secure the of extraction from the open pit was, however, offset by the annual expense incurred in handling the large volume of water, precipitated in the pit in the form of rain and snow.

After the larger pillars had been mined out, the pit method was abandoned, sinking was resumed and the mine was again worked on levels, room and pillar fashion, and a roof of ore was left to protect the workings from any possible slides from the faces of the open pit.

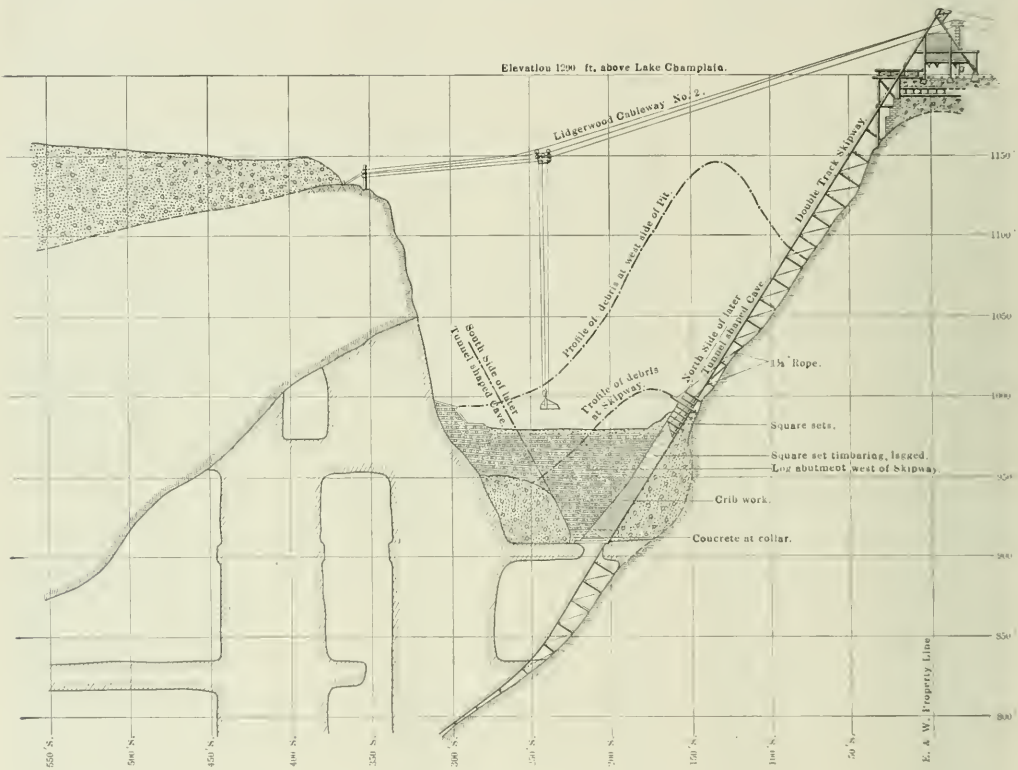
Falls from the Sides of the Pit

Soon water and atmospheric agencies began to act upon the gneissic footwall, was resumed water had risen in the lower workings 200 feet.

Portions of the workings were still accessible through break-throughs at other points on the outcrop farther up on the strike. An examination under the collar of the shaft in the pit floor, showed that slabs from the hanging wall had covered the opening and had blocked any further slide of débris into the newer workings. The rock filling at the collar had been reinforced by ice which had formed from the percolating surface water.

Method of Reclaiming Hoistway

In the early spring Superintendent



SECTION, MINE 21, SHOWING RECLAIMED SKIPWAY

approximately 35 per cent. of the deposit left in pillars and floors, decided to shoot down the roof and overlying burden of sand and boulders. This was done and an open pit was formed, extending out from the hoistway in a broad fan shape, to points where the burden, because of the dip, became too deep to shoot down and rehandle economically. This involved some very cheap mining. The ore and rock was hoisted by the double-track incline, and two Lidgerwood cableways. The low cost

and upon the pillars which were supporting a very scamy hanging wall, overlaid with drift and boulders. In February, 1905, one of the pillars gave away and one side of the pit fell about 300 ft. vertically, wiping out a long stretch of the trestled hoistway and covering the ore floor to a depth of 100 ft. with loose material and rock. The discharge pipe from a triple-expansion Worthington pump operating at the main sump 500 ft. below the surface had been swept away and the workings began to fill with water. Before pumping

Clonan and I made preparations to reclaim the hoistway. The sides of the open pit were trimmed, the fallen stuff was partly leveled and sinking was begun to provide a shaft through the earth and rock. The 100 ft. of obstruction was of a very sandy nature piled up in the shape of a cone and during the period of sinking was in a constant state of movement.

Long shaft bearers, four in all, were laid and anchored in place by four 1⅛-in. cables, hung at the corners and made fast to iron plugs back on the footwall.

*Mining engineer, Mineville, N. Y.

As sinking advanced on the 57-deg. angle, breast boards of varying lengths were used on the hanging-wall side. They were held in place by props resting against the material on the footwall side of the shaft. The wall plate was first introduced, the set interval lagged with 3-in. plank, and whenever possible the breast boards were removed. The footwall plate was next placed and finally the end pieces and divider. Very frequently the hanging plate would move back, and to place the last three sticks, it would be necessary to jack the wall plates. Shaft sets of square-set pattern were used and introduced at 2½-ft. intervals providing two compartments, 6x7 ft. inside measurement.

The weight of the earth on the hanging-wall side snapped many of the 1⅛-in. hanging irons first used; they were replaced by 1¼-in. iron, and great care was taken to have them cooled properly at the hook. Frequently, to hold back the drift, it was necessary to drive piling, but the presence of so many large boulders in the fallen material made this a slow method of procedure. Necessarily some block holing had to be done during the course of sinking, in which case crude logs were piled over the rock and also spiked to the timbers.

As the weight on the bearer cables increased, because of the timbering and also because the drift was in a state of movement, constantly pulling on the timbers, it was necessary to use more cables to keep the shaft sets near the true alinement. They were clamped at the hanging-wall corners around the wall plates and end pieces and drawn taut to other iron plugs on the footwall. As sinking progressed tracks were laid and by using lap-slides the skip cars were lowered to the bottom of the shaft, and the loose material was hoisted to the surface.

At a depth of 50 ft. the slabs, that blocked the collar 50 ft. below the last set of square-set timbering, gave away, and the bottom of the shaft fell out. It gave sufficient warning, so that the men in the shaft had time to climb some distance up the shaft timbers. The cave formed with funnel-shaped sides. Steeply sloping faces with large slabs from the hanging wall, boulders in the drift projecting from the sides, made the task of laying bearers at the bottom of the cave anything but desirable. The 50 ft. of timbering was still held fairly well in line by the cables.

Building up Cribwork

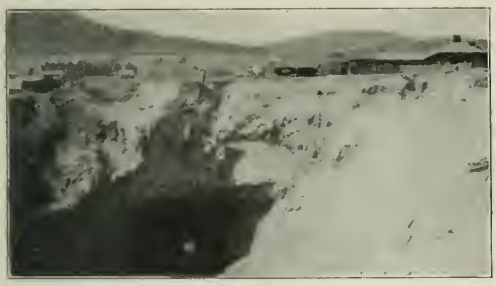
The next work was to trim the sides, to make it safe for men to work below. Again as little trimming as possible was done, for the material all fell to the bottom of the mine and had to be rehandled and hoisted to the surface. Men working with ropes around their waists, each attended by two men higher up who could pull them up in case of a fall from the sides, placed the first set of timbers on the collar.

Crib work of 10x12-in. yellow pine sticks was started up on the angle of 57 deg. to meet the 50 ft. of overhanging square sets. The sticks were thoroughly drift spiked and further strengthened by concrete walls built on three sides of the collar and to a hight of 15 ft. from the ore floor. After the crib work had been built to the proper hight, and had been securely tied to the overhanging square sets, track stringers were laid and timber was lowered from the surface to rebuild the trestled track below the shaft collar.

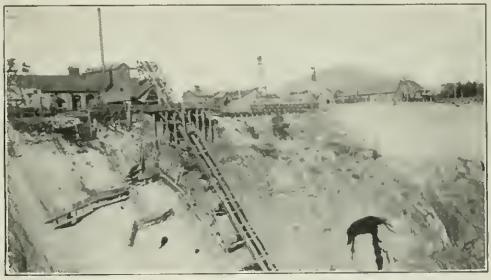
Log Abutment to Protect Timbered Hoistway

To protect the exposed timbered hoistway from any other falls, logs were lowered by the cableways and an abutment was built close to the timbered shaft, and on the west side of the open pit. Stretching across the bottom of the pit and for a hight of almost 100 ft. these logs were placed log-cabin crib fashion and filled with the fallen earth and rock until a level floor of sufficient area was made to catch any later falls and to prevent the material from rolling over and upon the timbered skipway.

Sinking through the fallen ground was a very tedious piece of work, and consequently no remarkable headway could be made. Two 10-hour shifts advanced on an average of 2 ft. per day. After the material from the three sides and bottom of the shaft had fallen through the collar, and crib work was begun, by working only in daylight a shift would advance 5 ft. in the 10 hours.



WEST SIDE OF PIT, AFTER THE FALL



MINE 21, OPEN PIT AND HOISTWAY

Gasolene Traction Drill

Drilling machines operated by gasolene power have been manufactured for a number of years, but only recently have these machines been so arranged that they could be moved from place to place by their own power. As these machines have to be moved over all sorts of roads it is essential that the power should be so mounted that the tortional strains shall not fall upon the moving parts. Certain features of automobile construction are being adopted, such as replacing the old friction drive by cluches controlling the forward and backward movements, the gears for each being always in mesh.

When set up ready to drill the road-driving clutch is thrown to neutral position, and the engine is connected to the drilling part proper with a belt and drilling commenced. A machine of this type made by the Cyclone Drill Company, of Orrville, Ohio, has the front axle stationary, the wheels swinging in knuckles. Other features of this company's latest type machine are: A positive clutch for the spudder crank; a specially designed clutch to start or stop drilling without shutting off the engine; control of the engine speed by a worm gear that increases or decreases the tension of the governor spring; magneto and battery system of ignition, two spark plugs being used.

Rhodesian Mines

Gold production in Rhodesia in January is reported at 48,621 oz. fine, a decrease of 3016 oz. from December. By values the production for the month was $970,316 in 1908, and $996,041 in 1909; an increase of $25,725 this year.

Other production reported for January was 20,172 oz. silver, 9 tons copper, 69 tons lead and 628 tons chrome ore. The coal output from the Wankie mines was 11,725 tons.

Behavior of Calcium Sulphate at Elevated Temperatures with Some Fluxes*

By H. O. Hofman and W. Mostowitsch.

Hydrous calcium sulphate loses its combined water at about 900 deg. C. Anhydrous calcium sulphate heated at atmospheric pressure in pure dry air remains unchanged up to 1200 deg. C. At 1200 deg. it begins to be dissociated, with the separation of sulphur dioxide and oxygen, as at this temperature sulphur trioxide cannot exist as such. The rate and degree of dissociation vary with the time and the temperature. Calcium sulphate fuses at about 1360 deg. C. and is more or less decomposed; the resulting product is a mixture of calcium oxide and sulphate; the proportions of the components vary with the time and temperature of the preliminary heating. Silica decomposes calcium sulphate at an elevated temperature; the decomposition begins at 1000 deg. C. and is finished at 1250 deg.; the product contains only calcium oxide and silica; the reactions taking place may be expressed by

$$CaSO_4 + SiO_2 = CaSiO_3 + SO_2 + O$$

$$2\ CaSO_4 + SiO_2 = Ca_2SiO_3 + 2\ SO_2 + O, \text{ etc.}$$

The examination of the product leads to the conclusion that the formation-temperature of calcium silicate lies below its melting-temperature.

Pure ferric oxide heated at atmospheric pressure in pure dry air is not dissociated at 1500 deg. C. Pure ferric oxide begins to decompose calcium sulphate at 1100 deg. C.; the decomposition is finished at 1250 deg.; ferric oxide requires on the whole higher temperatures to decompose calcium sulphate than does silica, but the decomposition proceeds at a more rapid rate. The process taking place may be expressed by the reaction

$$CaSO_4 + F_2O_3 = CaO.\ F_2O_3 + SO_2 + O.$$

The calcium ferrite formed fuses at 1250 deg. C.; it has, however, the property of dissolving calcium sulphate and of decomposing it, which indicates the existence of ferrites other than given by the formula.

Pure lead oxide has no decomposing effect upon calcium sulphate.

The Carmichael-Bradford Process

The gypsum added to the charge of raw sulphide lead-ore, characteristic for this mode of blast-roasting, is decomposed mainly by silica and ferric oxide; the sulphur dioxide resulting from the dissociation of sulphur trioxide set free enriches the gases.

Gypsum has no decomposing effect upon galena.

The lead sulphide of the charges is oxidized by the oxygen of the air blown into it; the sulphur trioxide dissociated into sulphur dioxide and oxygen at the temperature of decomposition of calcium sulphate cannot have any oxidizing effect in hot parts of the charge; in the upper cooler region of the converting pot there is a possibility of some sulphur trioxide being formed from sulphur dioxide and oxygen with the assistance of a catalyzing effect of the charge, but even here the newly formed sulphur trioxide can hardly have any oxidizing effect, as the equations

$$SO_3 = SO_2 + O - 22{,}600 \text{ cal.}$$

$$PbS + 3\ O\ (air) = PbO + SO_2 + 104{,}000 \text{ cal.}$$

point toward the strongly exothermic direct oxidation by means of the excess of free oxygen present in the gases.

The decomposition of calcium sulphate with the simultaneous dissociation of sulphur trioxide,

$$CaSO_4 = CaO + SO_3 - 95{,}000 \text{ calories.}$$

$$SO_3 = SO_2 + O - 22{,}600 \text{ calories.}$$

$$- 118{,}200 \text{ calories,}$$

represents two strongly endothermic reactions which must be favorable to the roasting of galena, as they counteract any tendency to local overheating and consequent fusion of the charge.

Further, the sulphur dioxide set free has a loosening effect upon the charge and thus acts favorably upon the process. From the thermal considerations it appears that in blast-roasting galena, calcium sulphate has a more favorable effect upon the result than calcium carbonate, which, according to

$$CaCO_3 = CaO + CO_2 - 45{,}150 \text{ cal.},$$

absorbs less heat.

Ordinary Oxidizing-Roast.

In the ordinary oxidizing-roasting of ores the temperature is usually not raised to above 900 deg. or 1000 deg. C. As gypsum is not decomposed at this temperature, its presence can but have the effect of increasing the percentage of sulphur in the roasted charge.

Oxidizing-Roast of Calcareous Blende

In the oxidizing-roasting of calcareous blende the calcium carbonate is converted into calcium sulphate; and the latter, not being decomposed at the temperature of from 1200 to 1250 deg. C. attained in the operation, might be expected to increase the sulphur content beyond the degree it actually does were it not for the presence of small amounts of silica in the gangue and of isomorphous iron sulphide in the blende converted into ferric oxide, both of which favor the decomposition of calcium sulphate, and are thereby helpful in the diminution of the sulphur content.

Reduction of Roasted Calcareous Blende

On the other hand, the presence of large amounts of isomorphous iron sulphide in blende, as in many marmatites, has a harmful effect upon the reduction of roasted calcareous blende on account of the low temperature (1250 deg. C.) at which calcium ferrite fuses. The reduction of zinc oxide in practice is carried on at a temperature of 1300 deg. C.; the fused calcium ferrite, which is very fluid, will penetrate the charge, hinder reduction, and make rich residues; further, it will have a corrosive effect upon the retort material.

Knudsen Process for Pyritic Smelting

In this process, it will be remembered, copper-bearing pyrite is smelted in a converter lined with dolomite. Practical experience has shown that the more basic—i.e., the richer in iron—the slag, the more quickly will the lining be slagged, while slags with a reasonably high percentage of silica do not corrode the lining as rapidly. The reason for this peculiar fact now finds its explanation in the formation of readily fusible calcium ferrate. The experiment given on page 68 has shown that magnesium ferrite does not form at a temperature as high as 1500 deg. C.; hence, the richer in magnesia the dolomite, the more resistant will it prove to slagging.

Basic Steel Processes

The facts stated in the preceding paragraph regarding the ease with which calcium oxide is slagged by ferric oxide, and the difficulty of forming a magnesium ferrite, are important as regards the lining of basic-steel furnaces. Here it has also been found in practice that magnesia resists the corrosive effect of an irony slag much better than does lime.

Role of Ferruginous Slags in Non-Ferrous Smelting

The fluxing effect that basic slag rich in iron from copper- or nickel-refining furnaces has upon the blast-furnace-charge of acid ores, may be explained in part by the fusibility and fluidity of calcium ferrite. This oxide slag readily dissolves the less-fusible component parts of the charge, and helps to form at the desired temperature a slag of the required fluidity. The general principle of slag-formation by solution has been proved experimentally in a different way by Doelter,[1] who found, in observing slag-formation under the microscope, that the process was one of solution, in which the mineral having the lower melting point, after fusing, dissolved the one having the higher.

*From *Bulletin*, A. I. M. E., January, 1909.

[1] "Physikalisch-Chemische Mineralogie," Barth, Leipsic, p. 127 (1905).

The Mining Industry in Queensland

The Chief Product of the Mines near Chillagoe Is a Copper-Lead-Silver Ore Averaging 8 Per Cent. Copper and 17 Per Cent. Lead

BY GERARD W. WILLIAMS*

The state of Queensland is one of the largest and least known of Australian colonies. It extends from the 29th to the 11th parallel and is bounded on the western side by the 138th meridian, the greater part of the state, therefore, lying within the tropic of Capricorn. The mines may be conveniently grouped as follows: The Northern fields comprising the Herberton tinfields, the copper country that extends for a radius of about a hundred miles around Chillagoe, and the goldfields of the extreme north; the Northwestern district comprising what is generally known as the Cloncurry field, the most important mineral here being copper; the Charters-Towers goldfields, the copper-gold district of which Mt. Morgan is the natural center; and the goldfields of Gympie. The various fields will be considered in this order.

The town of Chillagoe is situated 140 miles by rail from the port of Cairns. Along the coast and roughly parallel to it runs a range of the mountains varying in hight from 2000 to 5000 ft. This belt of country, some 40 miles wide, is well timbered and of proved fertility but beyond the landward slopes of the range the country passes into rolling plains sparsely timbered with small eucalyptus and covered with indifferent grass. Geologically the country consists mostly of highly altered sedimentary rocks overlying granites. Newer intrusive rocks penetrate both the granites and the sedimentary series which are of Silurian age. Chillagoe itself is situated at the junction of the granite and the slates with the Permo-Carboniferous limestones which outcrop in bold craggy scarps sculptured into fantastic shapes.

The Copper Mines

The chief mines in this district are, the Ruddigore, Zillmanton and Mungana mines, in the neighborhood of the town, the O. K. about 60 miles northwesterly and the Einasleigh 120 miles south.

As these mines all present different geological features a brief description will be given of each.

The Ruddigore—This mine, the property of the Chillagoe Railways and Mines (Ltd.), is situated 2½ miles by rail from the smelteries at Chillagoe. It is a low-grade copper mine. The orebody appears to consist of a stockwork of chalcopyrite in a quartz porphyry; the surrounding rock is granite. As exposed by an open cut, now 100 ft. in depth, the main shoot is 270 ft. long and 40 ft. wide with an average copper content of 2.75 per cent. At present this ore is hand picked up to 4 per cent. and shipped to the smelteries. The lode is nearly vertical, the hanging wall being clearly shown, but on the footwall side there is no defined wall and the values pass out into the granite country. From bore holes the lode has been shown to extend to 250 ft. in depth. The present mining manager for the Chillagoe mines, J. Rhodda, is engaged in sinking a shaft in the western country rock with a view to opening up the lode at 125, 225 and 325 ft. respectively. Till this is done it is naturally impossible to estimate the real value of the mine.

At the *Zillmanton*, which is situated about two miles from the smelteries, the orebody occurs as a contact lode between granite and limestone. The mine is interesting from a geological point of view in that it is intermediate in character between the pure chalcopyrite granite orebody of the Ruddigore and the limestone deposits of copper-lead-silver-zinc ore at Mungana. The limestone is entirely converted into massive calcite and on the side of the orebody there is a layer of varying thickness of soft ferruginous clay. This clay renders mining extremely difficult for from its nature it makes a dangerous hanging wall and moreover it forms an impervious layer which dams back the water in the limestone. In places this clay becomes so thin that the water breaks through making the mine liable to flood. The whole limestone country is extremely wet. In developing the bottom level (350 ft.) the main level was carried in the solid granite and exploratory crosscuts and false drives run out into the orebody. At the time of my visit the workings were flooded.

The Mungana mines—These mines, of which the Lady Jane and the Girofla are the most important, are the property of the Mungana Mines (Ltd.), a subsidiary company of the Chillagoe Rails and Mines (Ltd.). They lie in a wide ore belt that runs in an east-west direction through the massive Permo-Carboniferous encrinoidal limestone. The ore channel is proved for about three miles and numerous mines have been opened up on it. In one place a dike of granite crosses the orebody, converting the limestone on the contact to garnet rock. The limits of the ore are in some instances marked by the occurrence of crystalline schists. The orebodies consist of more or less persistent caverns in the limestone which have been filled with mineral. The Lady Jane has been opened up to 426 ft. in the mine shaft, but the lowest level is 320 ft. Work on the 420 has been delayed owing to influx of water from a water course in the limestone, tapped in sinking.

The deposit takes the form of an almost vertical chasm in the limestone. In section it resembles an open fan and at the 320 level measures 260 ft. in greatest length by 60 ft. across the center. At the 210 level the deposit was 60 ft. longer and 10 ft. wider. The actual outline, however is irregular and varies considerably from one level to another. The nature of the ore too varies widely. On the same sill floor it is possible to pass from a straight copper ore assaying 30 per cent. metal in black sulphide through an intermediate sulphide ore containing black copper, galena, blende and anglesite, to a straight silver-lead ore. Lots of copper ore assaying 51 per cent. metal have been shipped. Black sulphides exist on the 320 level and in a winze sunk to 69 ft. below that level, thus indicating the essentially secondary nature of the deposit. The average shipping grade of copper-lead-silver ore is 6 per cent. copper, 21 per cent. lead, and 20 to 25 oz. of silver. The "copper" ore varies from 10 to 20 per cent. copper, 4 to 14 per cent. lead with from 4 to 50 oz. silver. As will be shown later this latter ore is treated only for its copper and silver.

The orebody does not stand well in mining and in consequence is timbered with square sets which are kept well mullocked up. The sets are constructed of round timber, the manner of cutting being shown in Fig. 1. An interesting phenomenon was observed in the stope over the 320 level. The stopes were up on the fifth set at the time when without warning the timbers began to take weight badly. Despite all strengthening it was found advisable to cease work and every effort was made to keep the drive open. Legs and caps were smashed in almost as soon as placed in position and at one time it appeared certain that the level must be lost. The No. 4 winze was sunk from the 210 level but when down to 54 ft. it was necessary to cease work owing to the intense heat. A blower was started but before work was resumed the heated air in the cavity *X*, shown in Fig. 2, was accidentally tapped through the winze No. 1 and escaped along the 210-ft. level driving out all men from the stopes above for several days.

*Consulting engineer, Stock Exchange Club, Melbourne.

On examination the following conclusion was arrived at: At some time the ground at *X* fell and in falling sealed the outlet of the fissure into the old No. 1 winze, which had previously acted as a a vent; as oxidation proceeded the temperature and pressure of the inclosed air increased, and the broken ground acted as a great piston forcing down all the stope and drive sets with irresistible pressure. Some idea of the pressure may be gained from the fact that when the gas escaped from the No. 1 winze the floor of the new No. 4 winze fell into the cavity. The floor was only 14 in. in thickness but together with the broken ore lying on it, it had been held up against the winze by the caisson pressure inside.

At the Girofla the nature of the ore deposit is similar but there are two shoots at the surface which unite at the 410-ft. level. This mine is lower grade in depth than the Lady Jane, the ore on the 510 level averaging 2.2 per cent. copper, 20 per cent. lead and 6 to 12 oz. silver. From this mine large quantities of "flux sulphide" are mined and sent to the smelteries at Chillagoe, ten miles distant. This flux contains 1.5 per cent. copper, 12 per cent. lead and 6.5 oz. silver.

The carbonate levels of all the Mungana mines have yielded rich carbonate and oxide ores. The whole ore channel contains mineral deposits many of which have already been located and it is quite certain that exploratory work with the diamond drill will result in the opening up of other deposits. As to the permanence in depth of these cave deposits it is difficult to speak with certainty. The fissures or caves in which the minerals are deposited may extend downward for a considerable distance, but the presence of zinc renders it highly probable that in the primary zone the copper will be replaced by that metal. The Chillagoe company controls several other mines along the granite-limestone belt but none of these were working at the time of my visit. They are only profitable when copper stands at a high price.

The Chillagoe Lead and Copper Smelteries

The smelteries of the Chillagoe Rails and Mines Company, are situated at Chillagoe, 149 miles by rail from Cairns. As indicated in the foregoing description of the mines supplying ores to the smelteries highly complex ores have to be treated. For working purposes all ores received are classified as lead or copper ores according as they are treated in the lead or the copper-blast furnaces. The accompanying table shows the chemical composition of the ores at present being treated.

From time to time small parcels of high-grade copper ore are treated.

Lead Smelting

The ores treated in the lead smeltery are the Lady Jane and Girofla sulphide and oxide ores (excepting the "flux sulphides") together with purchased ore from the Consols mine. The Lady Jane and Girofla ores are mixed in the proportion of 2 to 1 and crushed through a No. 5 Gates crusher, the product passes to a 36x30-in. Krupp roll and from this through another similar roll which delivers to the boot of an elevator. Half of this crushed ore is fed to two large Edwards roasters. The latter measure 89x16 ft. over all, the inside hearth measuring 83x14 ft. The hearth has a fall of 5 deg. (¾ in. per ft.). There are two rows of 20 rabbles, the arms are 3 ft. 6 in. long with five "feet" to each arm. The rabbles are driven from two 3-in. shafts which run the length of the roaster. The roof of the roaster is 1 ft. 5½ in. in the center arching down to 10 in. at the sides. The fireboxes are three in number, one at the end and two placed in the middle. Opposite to each rabble is a port, 9x10 in. The rabbles revolve at the rate of 1 r.p.m. (the last four travel somewhat faster) and discharge to a cross tunnel from which the roasted ore is removed by a push conveyer. Each roaster treats from 30 to 50 tons per day according to the degree of desulphurization required. The size and sulphur content of the partly roasted material is as follows, the second figure representing percentage of roasted ore, and the third figure, the per cent. of sulphur it contains: On ½ in., 15, 14.1; on ¼ in., 12.3, 12; on ⅛ in., 7.5, 11.4; on 20 mesh, 22, 10.9; through 20 mesh, 43, 6.3. The loss in weight is about 15 per cent.

The roast is wetted and after mixing with unroasted sulphide ore and some limestone is charged to the Huntington-Heberlein converters, of which there are 12 with kettles of 10-ton capacity each. Each pot or kettle averages 2.5 blows per day with air at 20 oz. The company is under agreement not to publish details of the working of this plant although it is not easy to see what danger to the patentees would lie in such publication. From the converters the blown charge is dumped direct onto the floor beneath. The kettles swing over and after the charge falls out they swing back again for the new charge which is run in from hoppers connected with the feed bins above. The fines, which average 70 per cent. and consist largely of unsintered sulphides, are mixed with sulphide ores and reblown. At the time of my visit, work on these kettles had been greatly improved and, as a result of certain changes in the sulphur content of the charge, the fines had been materially reduced. The sintered charge has approximately the following composition: Silver 12 oz. per ton; copper, 4 per cent.; lead, 20; silica, 15; ferrous oxide, 27; lime (CaO), 1.2; zinc oxide, 15; sulphur, 4.5. From the floor beneath the Huntington-Heberlein plant the lumps of sinter are spalled up and railed to the smeltery floor.

The lead furnace has a rectangular water jacket, 40x160 in. at the tuyeres. From the top of the crucible to the feed

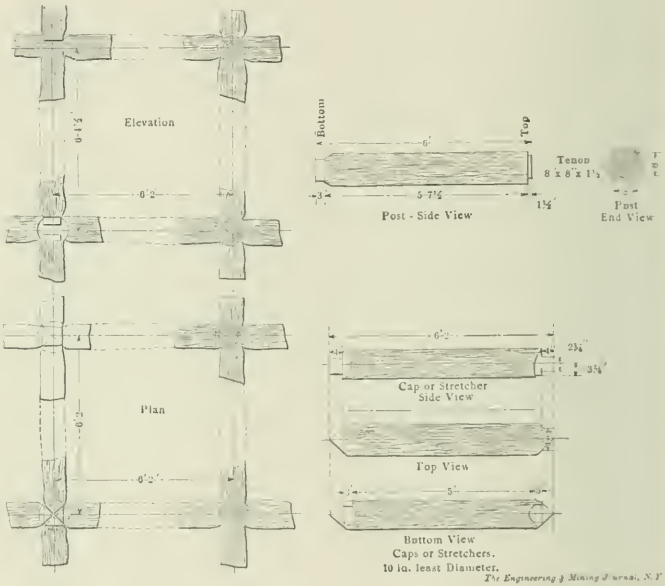


FIG. 1. METHOD OF FRAMING ROUND TIMBERS

floor is 18 ft. 6 in. and the water jacket extends 8 ft. above the tuyeres. The jacket measures (inside) 5 ft. 8 in. by 14 ft. 10 in., is straight sided and built of 5/8-in. mild steel. There are nine tuyeres 4 in. in diameter to each side. The furnace charge is approximately:

H-H product	3200 lb.
Oxidized Girofla	600 "
Limestone	400 "
Lead slag	700 "
Copper slag	400 "
Dirty lead mattes	400 "
Lead dross	300 "

It is made up in three heaps on the charging floor and a barrow load of coke equal to 13.5 per cent. added to each heap. Sixty-three charges go through per day (24 hours).

From the furnace the following products are obtained: (1) Lead bullion, 17 tons, 60 to 65 oz. silver per ton; (2) dross from the lead well, 8 tons; this is returned to the furnace; (3) matte, 20 to 25 tons; this matte averages: lead, 19 per cent.; copper, 23; sulphur, 20; ferrous oxide, 25; zinc oxide, 10 and silver 16 oz. It is tapped into cooling launders of cast iron from which it is broken out and sent to the copper furnace. (4) Slag. This averages: Silica, 25 per cent.; iron (FeO), 35; lime (CaO), 12; zinc (ZnO), 16.5; lead, 2.0; copper, 0.55; sulphur, 3.0; silver, 0.5 oz. per ton.

The lead bullion contains less than 0.25 per cent. copper. The recovery of lead varies from 85 to 89 per cent. of the "available" lead. The "available" lead is the percentage of lead less the percentage of copper, i.e., on an ore containing 26 per cent. lead and 4 per cent. copper the available lead would be 22 per cent. Recent experiments on blowing up the lead-copper matte direct, have been encouraging and this is looked upon as a possibility for the future.

Copper Smelting

The copper furnace measures 160x40 in. at the tuyeres, the water jacket extending up 7 ft. 9 in. The feed floor is 18 ft. above the level of the tymp. There are sixteen 3-in. tuyeres arranged in two rows of eight each on the longer sides of the furnace. The tymp measures 3 ft. 4 in. by 18 by 6 in., and is constructed of 5/16-in. copper.

The average day's run for the past three months has been: Ruddigore ore, 40 tons; Queenslander ore, 30; Lady Jane oxidized and carbonate, 15; lead matte from lead furnace, 20; Girofla flux sulphide, 15; limestone, 30; high-grade mattes (40 per cent. copper), 9; lead slags from lead furnace, 20; coke, 6 per cent. on the charge. From the smelteries the daily returns averaged 24 tons of matte containing 50 per cent. copper, 13 lead, 4 zinc, 16 sulphur and 16 iron (FeO). An average slag composition has been: silica (SiO_2), 37 per cent.; zinc (ZnO), 4; alumina (Al_2O_3), 9; iron (FeO), 26; lime (CaO), 19; lead, 3; copper, 0.4 and silver, 0.4 oz. per ton.

The converters are two in number but the present air supply is only sufficient to keep one blowing at a time. When freshly lined their capacity is about 1½ tons which is increased to 6 tons on the fifth "blow." Generally speaking each lining treats 11 tons of copper. The following notes, taken from the time slate illustrate the time required for converting: "Charged with 2 tons matte, blowing for 45 min., slagged off. Slag very viscous and has to be rabbled. Two tons of matte added, blowing for 20 min., and another half ton of slag skimmed off. After a further blow of 6 min. the converter slagged, and the metal, 2.1 tons of 99-per cent. blister, poured into molds." The blister assayed 100 oz. silver per ton. The gold content was inappreciable.

During blowing a large portion of the copper scorifies out into the slag, the action being very similar to that which takes place in an ordinary scorifier during the treatment of copper lead. The converter slags have the following composition: Silica, 22.5 per cent.; ferrous oxide, 34.5; zinc oxide, 13.6; alumina, 5; copper, 8.5; lead, 20; sulphur, trace.

The quartz used in the converter lining contains 92 per cent. silica. Eight parts of it are mixed with four of binder composed of red clay obtained locally and two of old liners. The lining is tamped with small pneumatic hammers. The dust is returned to the converters and the slags are stored and smelted periodically in the lead furnace with a charge of the following proportions: Converter slags, 88 tons per day; H-H product, 25; Girofla lead sulphide, 34; limestone, 20; lead dross, 6; coke, 14 per cent. on charge.

The production per day averages: (1) Lead bullion, 11 tons; (2) Copper matte; lead, 26; copper, 35 per cent., goes to the copper furnace; (3) Slag. The composition of the slag is: Silica, 25 per cent.; ferrous oxide, 37; lime (CaO),

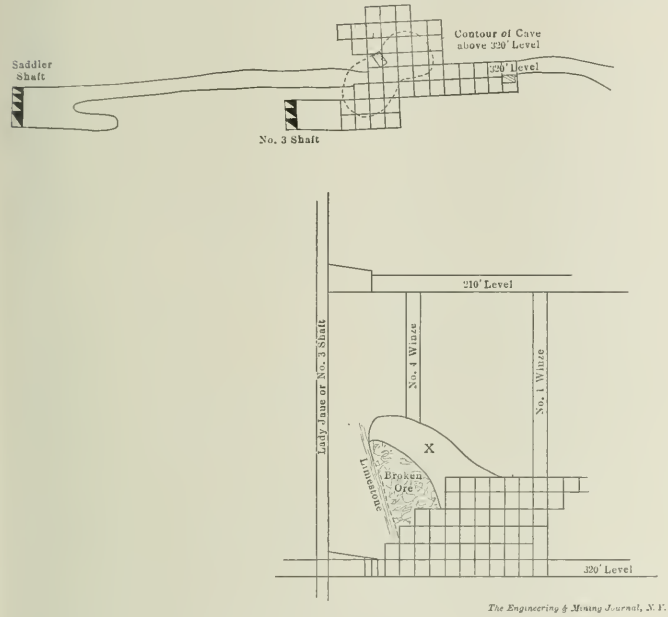


FIG. 2. LADY JANE SHAFT AND PORTION OF WORKINGS SHOWING CAVE

COMPOSITION OF ORES TREATED AT CHILLAGOE SMELTERY.

Name.	Silver. (Oz.)	Lead.	ZnO.	Copper.	FeO.	Silica.	Sulphur.	Alumina.
Lady Jane sulphide	11.5	20.0%	18.0%	4.0%	22.0%	12.5%	23.0%	
Girofla sulphide	5.7	17.5%	9.0%	2.0%	32.0%	9.0%	20.0%	
Ruddigore	1.0			4.0%	9.0%	60.0%	4.0%	13.0%
Consols (purchased)	23.5	30.5%	19.2%	0.25%	19.3%	6.0%	23.5%	
Girofla oxidized	14.3	16.7%	1.8%	8.4%	26.0%	22.4%	3.0%	
Girofla flux sulphide	6.2	7.5%	7.0%	1.0%	37.5%	12.0%	19.2%	
Mungana oxidized	11.0	13.0%	1.0%	10.0%	20.0%	27.5%	2.0%	
Queenslander	4.0		6.0%	4.0%	28.0%	18.0%	22.0%	6.0%

13.5; zinc oxide, 12.5; lead, 3; copper, 0.5.

The running of this charge has a most beneficial effect upon the furnace, all zinc accretions upon the sides and bottom of the crucible are cut out and the whole furnace is washed out clean. Previously these converter slags were returned to the copper furnace but the process had to be discontinued as the slags ran up high in copper.

The lead furnace was blown in on the first of January, '08, and was running well at the end of September. The copper furnace started a few weeks later and has run continually except for a few days' stop caused by lead and "mush" getting into the well. This furnace is running below its true capacity for it is necessary to run it side by side with the lead furnace in order to treat the mattes. The supply of straight copper ore is somewhat limited at present. Another lead furnace has been blown in and work is proceeding on a new one for copper.

The difficulty of copper smelting on these complex ores lies in the fact that if the coke is allowed to increase lead bullion is reduced and this collecting in the well chokes up the furnace. Practically no lead is recovered from the copper furnace, the bulk being volatilized and the rest going into the slag. A small quantity goes into the matte and is mostly blown out in the converters. Smelting practice at this plant is still in a transitional stage but immense improvements have been effected in little over a year's time since the present manager, J. Horsburg, took charge. Hampered by expensive freight, costly and not too efficient labor, and a badly laid out plant, the work done by the smelters is more than creditable, and marks a new and entirely successful departure in Australian metallurgy. As time goes on and the operations of the Chillagoe Mines and Railway extend, these smelteries will become of immense importance not only to the company but to North Queensland as a whole. The entire district traversed by the Chillagoe railways is mineral bearing but in most cases the ores are extremely refractory.

THE O. K. COPPER MINES, LTD.

The leases owned by the O. K. company are situated 50 miles north of Mungana, the terminus of the Cairns-Chillagoe line. The intervening road is bad, even for North Queensland. For three months of the year, during the rains, the roads are almost useless and the dry creeks of summer, over which they run, become raging torrents. In the immediate vicinity of the mine the country rock consists of quartzites and shales, the latter of Silurian age, which have been subjected to considerable dynamic metamorphism and as a result it is difficult to state definitely what was the original nature of much of the rock. Petrologically the "country" varies from a highly silicious, massive greenish rock containing a small amount of hornblende to a rock composed of granules of aluminum silicate with secondary quartz and calcite. The schistose nature of the rock in the immediate neighborhood of the lodes is essentially secondary, induced by pressure and side movements. In some respects the rock is not unlike the amphibolites which compose the lode-bearing rocks of Kalgoorlie (West Australia). No rocks which can be definitely referred to an igneous origin are found in the mine.

As is the case with most of the mines in the Chillagoe district the surface gozzans are well leached and have proved of little value. Patches of carbonate and silicate of copper were found but they proved of comparatively small extent. The black sulphides come in at water level (55 ft.). The mine has been opened up to a depth of 200 ft., but there are indications that this level will be the last to yield payable ore. Therefore, this mine is of interest chiefly from a metallurgical point of view. With the addition of limestone the ore is practically self-smelting, basic and silicious ores occurring in approximately equal quantity. The composition of the ore is as follows, the first figure being for basic and the figures in parentheses for silicious ore: Silica (SiO_2), 5 to 20 per cent., (40 to 70 per cent.); iron (FeO), 29 to 50; (7 to 18); alumina (Al_2O_3), 0 to 2; (1); lime (CaO), 0 to 5; (1); copper, 2 to 8; (8 to 20). Only a very small proportion of the ore is oxidized; the rest is sulphide ore.

The furnace measures 72x36 in. at the tuyeres and is 11 ft. to the feed floor. It is fitted with a crucible for inside settlement and the slag and matte are tapped intermittently.

The average daily charge is made up of 35 tons basic ore, 35 silicious ore, 16 limestone and 14 of converted slags, flue dust, etc. The smelting is semipyritic, 5 per cent. of coke being used. Flue dust is heaped up in the open and after weathering for a few months it is made up in a Huntington mill with 25 per cent. of kaolin ore. The mass is made into briquets by hand and after drying these are fed to the furnace. The slag runs about 40 per cent. of silica and 32 of ferrous oxide. The metal recovery is given as 90 per cent. Attached to the smelting furnace is a converter, which runs only two shifts a day, matte produced on night shift being returned to the furnace on day shift. The matte averages 48 per cent. copper.

All stores have to be brought 50 miles by road, 10 traction engines being used for this purpose. Mining costs $4 per ton (2240 lb.), smelting $6 and converting $20 per ton of metal. With average ores, (8.5 per cent. copper), blister of 99 per cent. is produced at the mine for $205 per ton or delivered on the wharf at Cairns for $230 per ton. Labor costs $2.50@3 per shift of eight hours, and it is not too efficient.

To date the company has smelted 57,000 tons of ore for a return of 6360 tons of copper. The mine is now treating 8.5 per cent. of ore of which there is an estimated reserve of 30,000 tons. On another lease about a half mile away a rich shoot of black sulphide ore is being opened up.

The mine is only a small one but it has had a distinctly successful career having paid half a million dollars in dividends end erected a plant to the value of $240,000 on an original capital of $15,000. The working limit, with copper at $350 per ton appears to be 6.5 per cent. ore so that there is but a poor outlook when the primary ore is reached. As in most mines in this district zinc occurs in the ore. Despite its small size the mine is of interest as an example of the small scale smelting which is carried on in mines remote from railways and ports.

Australasian Gold Returns

Gold output in Western Australia in February was 123,116 oz. fine. For the two months ended Feb. 28 it was 281,315 oz. in 1908, and 255,383 oz.—or $5,278,767—in 1909: a decrease of 25,932 oz. this year.

In February New South Wales reports 28,222 oz. gold. For the two months ended Feb. 28 the total was 45,340 oz. in 1908, and 48,107 oz.—or $994,373—in 1909; an increase of 2767 oz. this year.

New Zealand gold production in February was 33,443 oz. bullion in 1908, and 41,265 oz. in 1909; an increase of 7822 oz. The bullion reported this year was equal to $794,461, or 38,581 oz. fine gold. Silver reported was 133,387 oz. in 1908, and 154,258 oz. in 1909; an increase of 20,871 oz. this year.

The growth in size of Lake ore carriers is illustrated by a statement showing the average cargo of vessels loaded at the Duluth, Missabe & Northern ore docks in Duluth for a series of years, in long tons:

1895	1,809	1906	6,973
1900	3,783	1907	7,516
1905	6,037	1908	8,325

The average cargo of 1908 was more than four and one-half times that of 1895—and was handled in a shorter time.

The Associated Oil Company is building a pipe line from the Sherman oilfield in California to the port of Redondo in Los Angeles county. Wharves are also being built at that place. The Mitsui company is preparing to put on a regular line of tank steamers to carry oil from Redondo to Japanese ports.

Mining Enterprises in France

SPECIAL CORRESPONDENCE

The mining interests owned by French capital are of two kinds. Sometimes these enterprises are due entirely to foreign initiative with controlling companies constituted under foreign laws; sometimes they are due only to French initiative and capital and are controlled by French companies. The former plan owes its popularity to the success of the Transvaal gold mines in 1895. The French public at that time became familiar with the shares of the English companies, some of which sold practically all their stock in France. Although some French financial groups tried to take a direct interest in these companies their efforts came too late and met with little success. Of the two banks organized at that time to deal in the gold mines, the Banque de l'Afrique du Sud and the Compagnie Française de Mines d'Or et de l'Afrique du Sud, only the latter continues business at this time. However, the principal Rand trusts have still their own offices in Paris.

Gold mines take a considerable place in French investments and have an important market on the Paris Bourse. French capital is also largely interested in diamond mines. A large amount of De Beers stock—if not the largest part of it—is held by French capitalists. The Jagersfontein and the Premier Diamond have also a great number of French shareholders.

The mining shares in which French capitalists and speculators take the most interest are those of the Rio Tinto, whose prices are closely influenced by the American market, particularly by Wall Street. Besides the Rio Tinto we find very large investments in English companies, such as Cape Copper, Tharsis, Golden Horseshoe, Lagunas and Lautaro nitrates; in Belgian companies such as Asturienne des Mines, Vieille Montagne and many collieries; in German companies such as Harpener, Zincs de Silésie; in Italian companies, such as Montecatini; in Russian companies, such as Naphthes de Bakou; in Austrian companies such as Alpines, and in Turkish companies such as Balia-Karaïdin, Héraclea colliery, etc.

Aside from these financial interests in foreign companies there are a number of mining enterprises in which both management and capital are in French hands. The older of these companies were organized to work the French mines, especially the coal seams of the north and center of the country. As these mines are in rich industrial districts the promotors easily raised the money necessary for their large business. The French collieries, owing to their exceptionally good management, their sound financial organization and the regularity of their dividends, command prices for their stocks which yield an interest of 3 to 4 per cent. only.

France, having comparatively few mines, has not been contented with its own enterprises or with the financing of foreign companies. The law of 1893, which allowed mining companies, only "civil" up to that time, to adopt the commercial form of the "sociétés anonymes" (joint stock companies limited), gave a great impulse to the development of the mining enterprises in the colonies and abroad, but especially in Algeria and Tunis. The leaders in this line were some of the large financial groups, commonly called the "Haute Banque."

Among them the most progressive and successful one is the Banque Mirabaud. It started under the name of Société d'Etudes et d'Entreprises, an important bureau for the investigation of mining enterprises. Owing to the large means available and to care in the selection of mining experts, this bureau studies every proposal with a care that has almost excluded failure. The Banque Mirabaud controls entirely the Boleo in Mexico, the Phosphates de Gafsa in Tunis, the Penarroya in Spain, the Mokta-el-Hadid in Algeria, the Bor in Servia. It is largely interested in the Epinac colliery in France, in the Sels Gemmes et Houilles de la Russie Méridionale, in the Ouasta Mesloula (Algeria) in the Vieille-Montagne Zinc in Belgium. It holds also many interests jointly with Rothschild Brothers, not only in Boleo, Penarroya, in the doubtful enterprise of Inguaran in Mexico, but also in undertakings special to the latter group and above all in the Nickel Company, which, by its connections with the International Nickel Company, controls the European market for nickel. Its mines are in New Caledonia and its smelting works are in England, France and Germany.

Next to the Mirabaud and Rothschild groups, the importance of which extends far beyond their mining enterprises, there exist a number of secondary groups of more recent date. We may instance:

1. The Bonnardel group, with interests in the Platinum Syndicate and the new gold-mining companies of French Guiana.
2. The Max Lyon-Achille Adam group with Catemou in Chile, Tuco-Cheira in Peru, and above all in Algeria and Tunis with Djebel-Ressas and Fedj-Assène.
3. The Vassal group with the Sosnowice colliery in Russia.
4. The Leonino group, chiefly interested in the French gold mines.
5. The Urruty group—representative of the Metalgesellschaft—dealing chiefly with Algerian and Tunisian mines such as Guelma, Safsaf and Kanguet.
6. The Bondeli group, with mines in the same countries, such as Djendli, and Djebel-Ressas; also connected with the Max Lyon group, and having unofficial help from the Credit Lyonnais.
7. The Rodocanachi group with Bou-Thaleb and French Laurium.

There are also different groups at Lyons and Paris with interests in Russian collieries and in gold mines in Madagascar, French Guiana and French West Africa.

The great banking institutions have often been criticized for their systematic indifference to industrial enterprises. This is not quite justified as some of them are directly or indirectly interested in mining companies. Among them may be instanced the Société Generale in Ekaterinowka and Routchenko, Russia; the Compagnie Française des Mines d'Or et de l'Afrique du Sud; the Omnium d'Algerie Tunisie; the Credit Industriel et Commercial in the Bethune colliery in France, the Czeladz Platinum in Russia, and the Omnium d'Algérie-Tunisie. The Comptoir National d'Escompte de Paris is interested in the Compagnie Française des Mines du Laurium, in Greece.

To complete this general note we must mention the considerable interests of the great iron works in the iron mines of Lorraine and Algeria.

Many important foreign firms, such as the Metallgesellschaft of Frankfurt and Müller, of Rotterdam, have representatives in Paris and take a part in the mining business of France. We may add that the principal foreign manufacturers of mining machinery such as Fraser & Chalmers, Ltd., Krupp, Humboldt, Gröppel, Bleichert and Koppel, have in Paris branches or agencies carrying on a large business with the mining companies.

The number and importance of French mining enterprises has increased considerably in the last few years, principally during 1905-1906, when the majority of the new undertakings were connected with mines. It has been frequently noticed that at the time of financial crises, French investors feel inclined to buy only bonds and mortgage securities, while during prosperous times capital is willingly applied to industrial undertakings and principally to mining.

At present signs of a revival are obvious. A number of new mining ventures are being planned, some of which are ready and only awaiting a favorable time for soliciting capital and adding a few names to the already long list of French mining enterprises.

The French bronze coins of 5 and 10 centimes are to be withdrawn from circulation (*Min. Journ.*, Feb. 6, 1909) and replaced by aluminum coins 3 and 7 grammes lighter in weight. The standard of the aluminum must not be less than 990/1000, which is the same as that of commercially pure aluminum. There are to be coined 348,750,000 ten-centime pieces and 562,500,000 five-centime. It has been pointed out that pure aluminum is too soft for this use, and experiments are being made to solve this problem.

The Mammoth-Grand Central Case

SPECIAL CORRESPONDENCE

The Federal Supreme Court has just handed down a decision in the case of the Mammoth Mining Company against the Grand Central Mining Company, the latter being a Utah and Colorado corporation. This was a suit begun by the Grand Central Mining Company to recover for the removal of ores from beneath the surface of its Silveropolis mining claim and for an injunction. The defendant, the Mammoth Mining Company, filed a counterclaim, setting up that it was the owner of certain mining claims which were said to be senior to all other claims concerned, and that the vein or lode from which the ore in question was taken has a part of its apex within the Mammoth Mining Company's original holding which, if true, would entitle the Mammoth company to the ore. The case was originally decided by the Supreme Court of Utah in an elaborate opinion, and it was then appealed to the United States Supreme Court on the ground that the decision rested on a definition of a lode or vein which the plaintiff in error contests, and which, therefore, turned on the construction of Revised Statutes, Sec. 2322. The Federal Supreme Court dismisses the writ of error largely upon the same ground that was taken by the Utah court. It lays great stress on the fact that the Mammoth company could not locate the hanging or footwall of the supposed vein, the presumption being that the ore belongs to the owner of the claim under which it is found. The mines in question are found in a lime belt, which covers about two square miles, and is the great producing area of the Tintic district. In some places the limestone beds are upturned, large areas tilted upon edge, the beds dipping vertically, while in other places they dip at lower angles and in special areas the dips are quite uniform; and again it seems, though not frequently, anticlinals exist. This limestone is surrounded on all sides except the north by igneous rocks. The sedimentary rocks are broken up and fractured—evidently the result of igneous intrusion. The limestone carries some iron in the different forms of iron oxide, also some manganese, and in places the limestone is crushed, crumbled and brecciated. The view is taken that under such circumstances a vein cannot be said to exist merely because the rock is crushed, shattered, or even fissured, and that what will constitute one must depend somewhat on the nature of the country in which it is alleged to be found. It is recognized that a true vein may be barren in places, but the decision of the Utah Supreme Court is accepted to the effect that to allow the Mammoth company's claim would amount practically to declaring the whole limestone area to be one vein, thousands of feet wide. The Federal Supreme Court, however, while noting that the Supreme Court of Utah expressed the opinion that there is a difference between a lode sufficient to validate a location and an apex giving extralateral rights, remarks that this question is not necessary to a decision in this case, and that it will not, therefore, express any opinion on that matter at the present time.

The National Conservation Commission

SPECIAL CORRESPONDENCE

It has been unofficially made known that at the recent meeting of the Joint Conservation Committee, which met last week in Washington in executive session, it was determined that the work of the committee could no longer go on under Federal control and at Federal expense. This committee is the organization resulting from the National Conservation Conference which met in Washington early last winter, and, on disbanding, left behind it resolutions favoring the establishment of a national committee under the control of the Federal Government to coördinate the efforts of the States and of private organizations in the interest of conservation. The committee was to consist of six members of State conservation commissions and three members of the national conservation commission, all of whom were to be designated by Chief Forester Pinchot, who was to act as chairman. Upon reaching Washington it was found by the members that the action of Congress in attaching to the sundry civil appropriation bill a rider prohibiting the use of funds of the National Government for the support or expenses of any board or commission not authorized by legislative enactment would prevent the expenditure of Federal moneys in connection with conservation. The work of the committee will, however, by no means be abandoned. There are at present about 37 State conservation commissions and about 50 committees of national organizations of private individuals, all needing leadership and aid. The committee intends to supply these, and it will rely for funds upon private contributions. Of the latter an adequate supply is understood to be in sight. At the recent meeting in Washington, a good deal of time was spent in considering this situation, but full attention was also paid to the large number of letters and suggestions received from the various State commissions and private organizations. A digest of these suggestions is being prepared and will probably be made known within a short time. No definite time has been fixed for the next meeting of the committee, but it is expected to occur soon.

The Bureau of Mines Bill

SPECIAL CORRESPONDENCE

After various efforts to get the bill to establish a bureau of mines before the Senate for discussion and a vote, it was finally brought up during the evening session of March 3, but a vote was prevented by a filibuster. Had a division actually occurred, probably the bill would have passed. The defeat of the measure was due to the success of opponents in preventing it from being taken up until the session was close to its end, when the time of the Senate could easily be occupied by anyone who wished to prevent the adoption of a given proposal. With greater energy and adroitness it would have been entirely practicable to have brought the subject to an issue much earlier. The final test, however, showed the location of the opposition as well as its character much more accurately than at any time heretofore. Those who were chiefly instrumental against the bill were Senators Clay, of Georgia; Teller, of Colorado; Clapp, of Minnesota, and Stone, of Missouri. With the concealed assent and support of a number of other senators this group was entirely adequate to accomplish the object in mind—the postponement of the bill to which they were antagonistic.

OBJECTIONS TO THE BILL

The principal objection to the bill, as developed in the course of discussion, was the unwillingness of the Senate to increase the number of Government bureaus and departments now in existence. Thus Senator Clapp voiced the apparently prevailing opinion, saying: "The bill is simply designed to establish another bureau for the government of this country and the government of Congress. Sooner or later Congress has got to take the stand that Congress will determine first and for all time in a session what the appropriations will be."

This view seemed to be supported by others on the ground that the marked success the Geological Survey has already had in enlarging its appropriations would be repeated in the case of a bureau of mines, were one to be created. The fear of interference with the "reserved powers" of the States also figured to some extent, Senator Carter stating that: "We have in the respective States certain laws relating to the inspection of mines. * * * The Federal inspectors of mines might prescribe one rule with reference to the safety of mines whereas the State law might prescribe another rule. How could the mining operator in the State of Montana, working a gold mine or a copper mine, determine when he was within his rights and complying with the law, should the law of the United States provide that an inspector appointed by the President, or by the bureau of mines, should insist

upon a rule fixed by Congress, whereas the State law provided for another rule of action entirely? I think the senator in charge of this bill should state clearly and distinctly the right, as he understands it, under our system of government for a Federal officer to enter a State to prescribe the method of conducting a mining operation in that State."

Senator Carter further remarked that the Federal Government had properly regulated and provided for inspection of coal mines in the Territories, and he thought that it might now with propriety make a similar provision for the inspection of quartz mines in the Territories. It could go no further.

Senator Teller plainly placed his opposition on the ground that the bureau would be of no real service. In the course of a long speech he said: "My objection to the bill is twofold: First, that it will be a great waste of money, an expenditure without return, and that it will be an absolute interference with the mining operations of this country, particularly with the mining of precious metals. * * * There is not in any section of the world men engaged in that industry who know any more about it than the miners of Colorado, Montana, Idaho, California and Utah. We do not need the fostering hand of the Government. We do not need any man to come from Washington out there to tell us how to develop our mines or, in the words of the bill, how to promote and develop the mining industries of the United States to make diligent investigations of the methods of mining, the safety of miners. Everybody who has lived in a mining country knows how to do that. If they did not know, my experience is that they could not get any relief from a bureau established here in Washington."

Although Senator Newlands interposed to assure Mr. Teller that numerous conventions of mining experts in the West had united in asking for the bill, the speaker only answered by the general charge that such conventions were not representative, and hence could not be trusted to interpret popular feeling.

It is intended to introduce the bill again at the next session of Congress and to make an effort to secure its early passage.

Tariff Revision Notes

SPECIAL CORRESPONDENCE

The manufacturers of ferro-alloys have suggested to the Ways and Means Committee a new draft of language which they wish to have inserted in the paragraph of the new tariff corresponding to paragraph 183 of the present tariff. The proposed language is also approved by General Appraiser Fischer, who has had particularly under his supervision the various questions concerning the importation of ferro-alloys. The proposed wording is as follows:

Paragraph 122. Strike out the word "ferrosilicon."

Paragraph 183. Insert the following words: "Chromium or chromium metal, tungsten, molybdenum, titanium, silicon, tantalum, ferrosilicon, ferrochrome or ferrochromium, ferrotungsten, ferromolybdenum, ferrotitanium, ferrovanadium, ferrotantalum, ferrophosphorus, ferroboron, and all other metals and alloys, all the foregoing crude or refined but unwrought, whether capable of being wrought or not, and whether produced in electric furnace or blast furnace or by chemical or other process, not otherwise specially provided for in this act,——ad valorem."

TOOL STEEL

In a detailed brief submitted to the Ways and Means Committee the Columbia Tool Steel Company, of Chicago Heights, Ill., demands that a duty be placed on all foreign tool steels sufficiently high to protect the American maker against unfair competition by inferior grades, and also to protect the buyer and direct his attention to the superior quality of American-made tool steels. The demand is made apropos of a brief filed some time ago by several firms in Boston in which reference is made to the fact that European steels can be duplicated or excelled in this country by half a dozen tool-steel makers selling at a lower price. The Columbia Tool Steel Company then says: "If it were possible for all tool steel entering the United States to be classified according to its quality as shown by analysis, there would be no need of a protective tariff. The traditions built up prior to the manufacture of tool steel in America still have such a strong hold among certain classes, that when a standard European make of steel fails to give results the workman invariably will take the blame on himself for not giving it the proper handling, whereas if a failure occurs with American steel it is always the steel that is at fault. . . . . This would be manifestly impossible, in addition to which the tool-steel consumer has no facilities for making chemical analysis."

BISMUTH ORES

A new tariff treatment of bismuth has been proposed to the Ways and Means Committee by the Monsanto Chemical Company, of St. Louis, Mo., which recommends that in connection with the duties on lead there shall be a change in the wording intended to meet the conditions of production of bismuth. The change proposed is as follows: "Lead bullion or base bullion containing 95 per centum lead or less—per pound on the lead contained therein. *Provided*, that in levying and collecting the duty on lead, duty shall also be levied and collected on any other dutiable material contained therein. *Provided*, that in no bullion containing bismuth shall such bismuth be dutiable unless such bismuth is equal to or exceeds 75 per centum of said bullion."

It is argued that should the revised wording be employed it "will have the effect of building up a new industry in this country at the expense of a foreign monopoly, which at the present time exists."

The Tennessee Merger

SPECIAL CORRESPONDENCE

The confidential report of the majority of the Senate Judiciary Committee relative to the question whether President Roosevelt was authorized to permit the merger between the United States Steel Corporation and the Tennessee Coal, Iron and Railroad Company has now become public. It shows that a majority of the committee who censured the President, based a considerable part of their argument upon the alleged fact that he allowed a monopoly to come into existence, and that this monopoly consisted in large part of a control of iron-ore deposits. The majority report says: "Another important factor entering into the potential capacity of the Tennessee company is the proximity of the iron ore, coal and limestone holdings to each other and to the plants, and the consequent saving of transportation charges." Referring then to the report of the National Conservation Commission, the majority report quotes the following: "The known supply of high-grade iron ores in the United States approximates 3,840,000,000 tons, which at the present increasing rate of consumption cannot be expected to last beyond the middle of the present century." The majority continue as follows: "If, then, the United States Steel Corporation now owns and controls 2,400,000,000 tons of high-grade iron ore, as has been estimated, it has 62½ per cent. of the total supply of the country. If this corporation acquired 700,000,000 tons of iron ore with the Tennessee company, it added to its then estimated holdings of 44 per cent. of the iron-ore supply 18½ per cent., giving it as stated control of 62½ per cent. of the iron-ore supply of the United States. The purchase of this 700,000,000 tons of iron ore from the Tennessee company, increasing the Steel Corporation's holdings of ore more than 40 per cent., created that future monopoly in ore and commanding position in trade to which Judge Gary testified before the Ways and Means Committee. The Steel Corporation, it is admitted, now practically controls the ultimate iron-ore supply of the United States."

Pulp for concentration on blanket and canvas tables is diluted to 7 water to 1 ore at the Giant mine, Rhodesia (*Journ.*, Chem., Met. and Min. Soc. of South Africa, Nov., 1908), in order to obtain maximum efficiency.

Lake Superior Iron Ore

Shipments of iron ore by rail from the Lake Superior region in 1908 have now been reported in full. They were 587,893 tons—against 975,959 in 1907—and make the total for the year 26,044,987 tons, or 38.5 per cent. less than in 1907. The all-rail shipments are chiefly from the Mesabi range to the Zenith furnace at Duluth, from the Newport and Hemlock mines to Mayville, from the Illinois and Mayville mines in Wisconsin to Chicago and Mayville and from some of the Cleveland Cliffs company's Marquette range mines to the charcoal furnaces of Michigan.

The shipments, as apportioned by ranges, were as follows, in long tons:

Range:	1907 Tons.	1907 PerCt.	1908 Tons.	1908 PerCt.
Marquette	4,388,073	10.4	2,414,632	9.3
Menominee	4,964,728	11.8	2,679,156	10.3
Gogebic	3,637,102	8.6	2,699,856	10.4
Vermillion	1,685,267	4.0	841,544	3.2
Mesabi	27,495,708	65.0	17,257,350	66.3
Baraboo	95,790	0.2	122,449	0.5
Total	42,266,668	100.0	26,014,987	100.0

The shipments do not include those from the Michipicoten range in Canada, which were 148,000 tons in 1908, all from the Helen mine.

On the old ranges the Gogebic shows a smaller proportional decrease than the others. The Vermillion range had the largest proportional decrease, which was chiefly due to the abandonment of the Chandler mine, which was the chief producer up to two years ago.

The larger productions on the Marquette range were 438,379 tons from the Cleveland Cliffs and 278,366 from the Hartford; on the Menominee, 391,620 tons from the Chapin, and 365,361 from the Pewabic. On the Gogebic the leading producers were the Norrie, with 773,243 and the Newport with 579,390 tons. The Vermillion had only one great shipper in 1908, the Pioneer, with 477,506 tons. The Mesabi leaders were the Hull-Rust, 2,026,683; the Burt, 1,460,998; the Fayal, 1,439,879; the Adams, 765,592; the Virginia, 661,329; and the Mahoning, 611,592 tons.

The Oliver Iron Mining Company—the mining department of the Steel Corporation—in 1908 shipped a total of 14,123,957 tons, or 54.3 per cent. of the total. Only a small part of this came from the Hill lands, though a good deal of development and exploration work was done there.

Notwithstanding the dull year, shipments were made from six new mines—one on the Marquette, two on the Menominee, and those on the Mesabi range. Shipments are also reported from four old mines, which had been closed for several years previously—two on the Menominee and one each on the Marquette and the Mesabi.

Records of the shipments of Lake Superior ore have been kept from the first, and it is possible to give a statement of the total production up to the end of 1908. The figures are as follows:

Range:	Year Opened.	Total Ore.	Per Ct.
Marquette	1859	87,660,506	21.6
Menominee	1877	66,320,369	16.3
Gogebic	1884	56,807,198	14.0
Vermillion	1884	27,626,970	6.8
Mesabi	1892	167,492,908	41.2
Baraboo	1892	797,868	0.2
Total		406,705,819	100.0

The Baraboo range in Wisconsin is included, although it does not adjoin any of the other ranges, because there is some evidence of its geological connection with the Gogebic deposits. The date for the first shipments from this range has been set back to 1892, owing to the inclusion this year of the Mayville mine, which had not previously been reported.

In all there were 162 shipping mines in 1908, of which 25 were on the Marquette range; 34 on the Menominee; 18 on the Gogebic; 6 on the Vermillion; 77 on the Mesabi; and 2 on the Baraboo range. In 1907 shipments were made from 179 mines.

Hydraulic Mining in California

Special Correspondence

The great quantity of water which has fallen this year in California has favored the hydraulic miners. This particular branch of the gold-mining industry is now most active in the counties of Siskiyou and Trinity, on the northwestern coast of the State. In those sections, as well as in the counties of Humboldt and Del Norte, there is no restriction on hydraulic mining as there are no navigable rivers and most of the larger tributary streams empty into the Klamath river which carries the drainage into the Pacific ocean. These northern counties, however, are not as well equipped with general ditch systems as the more central mining counties of the State. In Nevada, Placer and other central hydraulic mining sections, extensive ditch and reservoir systems were devised and built before there were any restrictions laid upon hydraulic mining, and these systems still exist. In Siskiyou and Trinity, however, each mine has to provide its own water supply and there are few public ditches from which water may be purchased. In these counties there are large bodies of auriferous gravel which have never been mined for this reason. The ground is of little value without a water supply and considerable capital is usually necessary to furnish this. There are few very large hydraulic enterprises in those regions though there are numbers of small ones, each with its individual water supply. However, the largest hydraulic mine in the world—the La Grange near Weaverville—is operating in Trinity county.

Hydraulic mining in California is now receiving the attention of both the national Congress and the State Legislature. In Congress Mr. Englebright has introduced a bill, an abstract of which has been given in the Journal. Its real purpose is to permit miners to let hydraulic débris pass into mountain gulches or streams, provided they remove an equal amount from any place designated by the engineers of the California Débris Commission and pay for said removal. That is, if a miner some hundreds of miles from a navigable stream, lets any tailings get into a stream, he is privileged, if he pays for it, to remove an equal amount from some part of the stream or tributary where it is navigable. In this way he might continue to mine and yet not add any volume to the débris already in the river. The Anti-Débris Association is opposed to this and has resolved to send telegrams to Washington urging the defeat of the bill. In the State Legislature, Caminetti has a bill which creates an advisory board to the State Department of Engineering, composed of men who have interest and experience in gravel-mining matters. The River Commission people already have such an advisory board. The board is to be given powers only to advise with, and make recommendations to, the State engineer and the California Débris Commission, on matters pertaining to hydraulic mining. The California Miners' Association has sent a special committee to Sacramento to urge the passage of the bill, and the Anti Débris Association has sent a similar committee to try and defeat the measure.

Canadian Iron Production

The total production of pig iron in Canada has been heretofore reported. The detailed figures, as collected by the American Iron and Steel Association are as follows, in long tons:

	1907.	1908.	Changes.
Foundry and forge	84,979	114,951	I. 29,972
Bessemer iron	164,910	112,811	D. 42,099
Basic iron	341,257	335,410	D. 5,847
Total	581,146	663,172	D. 17,974

The total decrease was 3.1 per cent. Basic iron was made in 1908 by four companies owning nine furnaces and bessemer pig by two companies owning three furnaces. The basic and bessemer iron was all made with coke. Canada has not made spiegeleisen or ferromanganese since 1899.

On Dec. 31, 1908, Canada had 16 completed furnaces, of which 10 were in blast and six were idle. One of the idle furnaces was being rebuilt. Of the total 13 usually use coke for fuel and three use charcoal. In addition one coke furnace was projected and two coke furnaces upon which work was suspended some time ago were partly erected.

During the first half of 1908 the total number of furnaces in Canada actually in blast for the whole or a part of the period was 14, of which 11 used coke and three charcoal. During the last half of the year the total number of active furnaces was 11, of which nine used coke and two charcoal.

Comparative Tests of Run-of-Mine and Briquetted Coal

After a series of tests in burning run-of-mine and briquetted coal on a locomotive and on a torpedo boat, Mr. Goss, the engineer who conducted the tests, gives the results as follows:

(1) The briquets made on the Government's machines have well withstood exposure to the weather and have suffered but little deterioration from handling. (2) In all classes of service involved by the experiments, the use of briquets in the place of natural coal appears to have increased the evaporative efficiency of the boilers tested. (3) The smoke produced has in no test been more dense with the briquets than with coal; on the contrary, in most tests the smoke density is said to have been less when briquets were used. (4) The use of briquets increases the facility with which an even fire over the whole area of the grate may be maintained. (5) In locomotive service the substitution of briquets for coal has resulted in a marked increase in efficiency, in an increase of boiler capacity, and in a decrease in the production of smoke. It has been especially noted that careful firing of briquets at terminals is effective in diminishing the amount of smoke produced. (6) In torpedo-boat service the substitution of briquets for coal improves the evaporative efficiency of the boiler. It does not appear to have affected favorably or otherwise the amount of smoke produced. The briquets used in this series of tests were of a form requiring considerable bunker capacity for their storage, but as the form of the briquet is a detail entirely within control, this objection need not apply to the use of the briquets in actual service.

Locomotive Tests

Many low-volatile coals, such as those mined in the vicinity of Johnstown, Cambria county, Penn., are semi-smokeless and therefore very desirable for use in locomotives at or near terminals; nevertheless, on account of their low evaporative efficiency, they have not been found altogether satisfactory when used as locomotive fuel. Their tendency to disintegrate rapidly on the grate during combustion causes large quantities of cinders and sparks of high calorific value to be discharged. These cinders accumulate in the smoke box of the locomotive, obstruct the draft on the fires, and reduce the capacity of the boiler. The investigation here reported, therefore, was undertaken to determine in what measure, if any, the process of briquetting will serve as a remedy for these defects and to discover the effect of the process on efficiency and capacity.

The coal selected for the tests was taken from a mine working the Lower Kittanning coal bed near Lloydell, Cambria county, Penn., on the South Fork branch of the Pennsylvania railroad. Its characteristics as a locomotive fuel were therefore well known. The Lloydell coal is a friable, low-volatile bituminous coal, and the carloads selected for the tests consisted of run-of-mine. The coal was exposed to the weather for 30 days on the way to the St. Louis testing plant, before being briquetted. It showed but little change due to this exposure except a decided increase in moisture, which, however, was eliminated in the briquetting process.

The binding material in all the briquets was water-gas pitch. This material was furnished at the briquetting plant of the United States Geological Survey, in St. Louis, at $9 per ton, or 0.45c. per pound. The least amount of binding material that would make perfect briquets was found to be 5 per cent. of the weight of the coal. The cost of the binder in one ton of the 5-per cent. briquets was therefore 45 cents.

The cost of briquetting, including all charges, is estimated to be about $1 per ton of briquets; that is, the briquetting added approximately $1 per ton to the cost of the coal. The briquets were made, however, in an experimental plant, and the price is for this reason probably not so low as if they had been made on a much larger scale. After the coal was made up into briquets it was returned to the locomotive testing plant at Altoona, Penn., for the tests.

To observe the effect on briquets of exposure to the weather, a number of the round and square briquets were placed on the roof of the testing plant. After four months of exposure for the round and three months for the square briquets, no change whatever from their original condition was noticed. They appeared to be entirely impervious to moisture and were still firm and hard.

The briquets were little affected by handling. They were loaded at St. Louis in open gondola cars and shipped to Altoona, where they were unloaded by hand and stacked. They were handled a third time in taking them to the firing platform of the test locomotive. After these three handlings they were still in good condition, very few were broken, and the amount of dust and small particles was practically negligible.

The results of the tests justify the following conclusions: (a) The evaporation per pound of fuel is greater for the briquetted Lloydell coal than for the same coal in its natural state. This advantage is maintained at all rates of evaporation. (b) The capacity of the boiler is considerably increased by the use of briquetted coal. (c) Briquetting appears to have little effect in reducing the quantity of cinders and sparks; the calorific value of these, however, is not as high in the briquetted as in the natural fuel. (d) The density of the smoke with the briquetted coal is much less than with the natural coal. (e) The percentage of binder in the briquet has little influence on smoke density. (f) The percentage of binder in the briquet has little influence on smoke density. (f) The percentage of binder for the range tested appears to have little or no influence on the evaporative efficiency. (g) The expense of briquetting under the conditions of the experiments adds about $1 per ton to the price of the fuel, an amount which does not seem to be warranted by the resulting increase in evaporative efficiency. (h) With careful firing, the briquets can be used at terminals with a considerable decrease in smoke. (i) The briquets appear to withstand exposure to the weather, and suffer little deterioration from handling.

Briquets made from Arkansas semi-anthracite, two qualities of Indian Territory slack, Indian Territory screenings, Missouri slack, Indiana Brazil block slack, coke breeze, and a mixture of coke breeze and washed Illinois coal were tested, and comparisons were drawn either with the same coal that was used in the briquet or with coal similar to it. In nearly every test the results reported show that the coal when burned in the form of briquets gives a higher evaporative efficiency than when burned in the natural state. For example, Indian Territory screenings give a boiler efficiency of 59 per cent., whereas briquets made from the same coal give an efficiency of 65 to 67 per cent. Decrease in smoke density, the elimination of objectionable clinkers, and an apparent decrease in the quantity of cinders and sparks are named as the chief reasons for this increased efficiency.

Australian Iron Bounties

The Australian Parliament at its latest session passed a bill for "the encouragement of manufactures," and regulations prepared under this act have been issued by the government. A bounty of 12s.—$2.88—per ton will be paid on pig iron made from Australian ore, the quantity to be 1000 tons or over; and the same amount on bar iron puddled from Australian pig, at least 250 tons in quantity; and on steel made from Australian iron, not less than 100 tons to be considered. Bounties of 10 per cent. on value—which apparently means current price—are to be paid for iron or steel sheets or plates, minimum 100 tons; steel or iron wire or wire netting, minimum 50 tons; iron or steel pipes and tubes, minimum 50 tons. All are to be made from Australian iron. The year for bounties is to begin May 1, and the total amount to be paid is limited to £180,000 in five years.

During the first 11 months of 1908, an average of 8981 stamps were dropping on the Rand, and the average duty per 24 hours per stamp was 6.21 tons.

Colliery Notes

To get maximum efficiency from your ventilation, split your air as near the fan as possible.

Pumps should be set as close to the sump or water supply as practicable, so that there is no danger of drowning the pump in case of an accident.

One mine foreman states that a good mixture of mortar for stoppings is made by taking one part of cement to about seven parts of fine coal dust.

When searching for an unexploded charge in material blown down, great care should be taken that the detonator be not struck with a pick or other tool.

When any quantity of coal at the face is supposed to contain a portion of an unexploded charge, and the explosive is not recoverable, the coal should be securely packed in the goaf.

The principal difficulty in the utilization of peat under boilers appears to be the frequency with which it is necessary to fire. This disadvantage is caused by the lightness of the material and also on account of its rapid combustion.

The mine foreman who persists in his assertion that it is better to always curse his men in order that the maximum effort may be obtained, is making the mistake of his life. Those miners who only answer to rough handling are exceptions, and any organization will prosper better without them.

If a general examination were held and all coal-mine managers and superintendents were asked to tell what they know concerning the laws that regulate coal mining in their respective States, it would be surprising what little time would be required by some of these officials in telling all they know.

The fireboss who makes his rounds at 3 a.m., aided only by the light of a dim safety lamp, has no easy task; for this reason, he should insist on the miners keeping their places safe and clear. When miners do not keep their places in a condition that permits easy travel, the fireboss should stop them from working until they clean up.

Any loose rock or dangerous top in a working place should be taken down immediately after it is discovered. Nothing is more important than that the miner should make his place safe, and when orders are given to pull down dangerous roof, or to put props under it, the miner who disobeys or delays should be punished.

It is stated on good authority that an economical plant ought to make peat fuel at 60c. per ton. This result is accomplished by first draining the water from the bog, and then using a dredge which can take up an entire section of peat, 12 to 14 ft. in depth, at one time. Recent tests have proved that a good quality of peat has a calorific value of 10,082 B.t.u. per pound.

As long as the cost of coal remains low, and freight charges moderate, the most promising field for the economic exploit of our vast peat lands lies mainly in the gasification of peat, and the utilization of its by-products, rather than the manufacture of briquets. In conjunction with such a plant, the making of peat mull and peat straw, are industries that may meet with success if conditions are favorable.

Since the miner's certificate is so easily obtained, would it not be a wise safety precaution for the mine foreman or an assistant to go with a new man who is about to start as a miner, and see how he goes about preparing his shots and putting his place in order. It would be a difficult matter for any man, not versed in the art of mining, to hide his incompetency from an experienced foreman. Should the applicant be found incapable, the mine foreman should either employ him as a laborer or refuse his services altogether.

Up to the present time, the many mechanical and electrical arrangements which have been designed to dry peat cheaply, have all proved commercial failures. The only economical drying agents so far discovered, are the wind and sun. Could some scheme be devised whereby peat could be produced as a fine powder for dust firing, the field of this fuel would rapidly attain importance. There are only four works in Europe that manufacture solid peat briquets, and not one of these establishments has proved a great commercial success.

Mine managers should investigate carefully before they employ foremen or superintendents who have a reputation for producing the so-called "cheap ton" of coal. Many of these men, who are so much sought after, have a habit of reducing expenses by mining all the easily available coal, without devoting time or attention to future economic and systematic development. Such men remain with one company but a short time, and usually make it a point to change about the time the output starts to decrease and the cost begins to increase.

In the year 1650, at a colliery in North Wales, the general plan was to employ a man to enter the mine and fire the gas before the miners went to work. This man, who was called a "fireman," was dressed heavily, with his outer clothes thoroughly soaked in water. He carried a cane on which a naked lamp was fixed; when a doubtful or dangerous place in the mine was reached, he would lay down on the floor, or in a ditch, and then raise his candle to the roof and fire the gas. The historian states further that the fireman was seldom hurt. If the plan followed in 1650 were to be adopted at some of our gaseous mines today, it is probable there would be a great scarcity of firemen

If we assume the average depth of all the peat bogs in the world to be 7 ft., then for this depth, every square mile would yield $7 \times 112{,}000 = 784{,}000$ tons (2000 lb.) of air-dried peat, and the estimated 200,000 square miles of bogs represent 156,800,000,000 tons of stored fuel. Considering that the heating value of the peat will average 4000 cal. per kg., or 7200 B.t.u. per lb., this is equivalent to 94,080,000,000 tons of coal of 12,000 B.t.u. per lb., or less than 4 per cent. of the estimated coal resources of the United States. Basing our figures on the present consumption of coal and lignite, without considering a future increase, our peat deposits would last about 75 years. The peat bogs in the United States would be exhausted in about 35 years if utilized as the sole supply of solid fuel.

The question of tamping shot holes in mines has recently been subjected to considerable discussion by coal engineers. The experiments of an English investigator show that owing to its inertia and friction on the side of the hole, tamping offers greater resistance to the escape of gases than generally supposed. This same authority has found that in a 1-in. diameter hole, 2 oz. or 4 oz. of powder would not blow out more than 7 in. of clay tamping, and that when the blast breaks out its burden, such tamping is often found intact in the hole. For high explosives, the 12 or 18 in. of tamping often used is unnecessary, as a few inches would often be sufficient. Many experienced shot-firers claim that in general, it is sufficient to use a tamping of water, or that a few inches of clay or paper pushed tightly home is all that is required. It will be interesting to hear what other authorities have to say on this subject.

The Pennsylvania law requires that all men who propose to become miners in the anthracite mines, shall first serve two years as a miner's laborer, previous to their appearance before the miners' examining board to obtain a certificate, which credential is necessary to their employment as miners. The intention of this law is often frustrated by the deception practiced by foreign miners. When a foreign laborer has been employed at some of our mines for two or three months, it often occurs to him that if he could only secure a certificate, he could mine coal as well as the man he is working for. The general plan followed is to have one of his friends of the same nationality, appear before the miners' examining board, and after giving the name of the laborer who desires the certificate, the more experienced miner answers the dozen or more questions propounded, pays his $1.50 to the board, takes his certificate and sells the paper to his friend for the price agreed upon. Is it any wonder that mine accidents which so frequently occur, are often due to the ignorance of the miner himself?

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Illustrated.

The Situation in Copper

The statistics reported by the Copper Producers' Association last week for the month of February are not properly comparable on their face, with those for January because January was a long month and February a short one. Consequently, it is necessary to reduce to a daily basis. Upon such a basis it appears that the production in January averaged 3,617,265 lb. per day; in February, 3,703,600 lb. per day. This was a rather large increase; if maintained for a year it would amount to nearly 30,000,000 pounds.

The exports in January were 42,985,600 lb.; in February, 31,104,640 lb. Deducting these figures from the deliveries reported by the Association, it appears that American consumers in January took 47,376,821 lb., and in February, 43,441,974 lb. Computing the figures according to the working days in each month, the deliveries to domestic consumers in January averaged 1,822,185 lb., and in February 1,888,781 lb. So far as they go, these figures are encouraging, but they carry the metal only up to the gates of the manufacturers, and we do not know the situation inside of the latter. If we may assume that consumption is actually going on at the rate indicated for January and February, it must be recognized that there is a substantial improvement over the average for the whole of 1908, and that it is to Europe chiefly to which we must look for the great increase in demand to absorb the accumulating stock.

It was not to be supposed that production in February should exhibit a diminishing rate, inasmuch as the refineries were still working upon crude copper produced by the smelteries previous to Jan. 1. During February there was some curtailment by the miners who are unable to produce profitably on a 12½-cent basis, but even so it is doubtful whether their restriction is not more than offset by the increased production of Ely and other places that can produce profitably at a much lower figure. In this connection it is worth while to explain what is meant by cost of production. Sometimes the meaning is "direct operating cost." More conservatively, the meaning is the difference between gross proceeds and dividends to stockholders, which include all expenses for development, new construction, etc. Even so, the ultimate cost is an amount sufficiently large to reimburse the investment of capital. The allowance that should be made on the last account is difficult to determine for a variety of reasons. Moreover, in the curtailment of production there is a running expense on account of overhead charges which may make it cheaper to forego temporarily capital-return than to cease production entirely. Formerly, these conditions used not to be so carefully considered, but nowadays the talk that copper is cheap at about 12c. manifests not so much increased cost of production as compared with 10 years ago as it does the idea lurking in many minds that the capital invested in the production must receive an adequate return; in other words there is a better understanding of economics.

As to the outlook for copper in the immediate future, it is doubtful if the large sales that were made about March 1 help matters materially. Part of them were for speculative account, which does not assist at all; another part, representing the transactions with manufacturers, may not any more than make good the contracts that expired in February. It is quite obvious that there must be either a natural curtailment of production, or an increase in demand from home and abroad. Probably both those things will come into play and the market will naturally seek the level where demand and supply will balance.

Blast Roasting

Ever since the introduction of the Huntington-Heberlein, Savelsberg and Carmichael-Bradford processes there has been discussion as to the reason why they are so efficient in desulphurizing galena. Several years ago it was thought that lime played a chemical part in these processes, and ourselves leaning toward that belief we applied to them the generic name of "lime roasting." Later experience cast a great deal of doubt upon the chemical agency of lime, the function of the latter appearing to be to act as a diluent of the charge, and Prof. L. S. Austin introduced the name "pot-roasting" because the processes were then commonly performed in pots. Still later it developed that they could be done with other means, and A. S. Dwight used the term "blast-roasting." This will doubtless survive.

This progress in nomenclature marks the development in ideas as to these processes. Their results being so remarkable

in respect to rapidity and completeness of desulphurization and minimization of loss of lead and silver that it appeared to be necessary to attribute them to some undescribed chemical reaction. However, evidence gradually accumulated to show that there was nothing but an intensification of the ordinary reaction between sulphides and atmospheric oxygen, just as the combustion of coal on a grate is hastened by an under-grate blast, or indeed, the combustion of zinc sulphide (as in Bartlett kilns and the Greenawalt porous-hearth reverberatory). Indeed, we find the closest analogy in the blast furnace for smelting, which under certain conditions possesses a great oxidation-factor. Yet, the well known fact that the Carmichael-Bradford process, using gypsum, yields more sulphur dioxide than can be credited to the ore, has caused suspicion to remain that perhaps after all there is some reaction between lime, or lime sulphate, and the sulphides. So far as we were aware, calcium sulphate was not decomposed at the temperature believed to be attained in this process.

Prof. H. O. Hofman and W. Mostowitsch, in a paper in the *Bulletin* of the American Institute of Mining Engineers for January, 1909, report the results of an experimental investigation that clear up all doubts as to this matter. They have found that calcium sulphate begins to be decomposed at 1200 deg. C., but the dissociation is not complete until a much higher temperature is attained. However, silica begins to decompose $CaSO_4$ at 1000 deg. and the reaction is complete at 1250; while ferric oxide begins to decompose $CaSO_4$ at 1100 deg. and the decomposition is complete at 1250 deg., the product being calcium ferrite. The formation temperatures of calcium silicate and calcium ferrite are lower than their melting temperatures. Gypsum has no decomposing effect upon galena.

It is now established that in these processes the galena is oxidized by oxygen alone, but while the temperature in the ordinary oxidizing roast is but 900 to 1000 deg., in the blast roast it must be 1000 to 1250 deg. It has for a long time been recognized that the temperature of the latter roast is higher than would be implied by the low volatilization of lead, and it has been pointed out that the thermal action is localized as in the well-running blast furnace. However, although the older theories as to the formation of calcium plumbate, or other compounds, in these processes have had to be discarded, the results of Hofman and Mostowitsch support the notion that there was some chemical action other than mere atmospheric oxidation. Inasmuch as gypsum is not decomposed at 1000 deg., the temperature of ordinary roasting, its presence can but have the effect of increasing the percentage of sulphur in the roasted charge. But at slightly higher temperature two important reactions occur, although lead or zinc play no part in either, whereby desulphurization is completed.

Metallurgists owe a great deal to investigations of this character, such as are being carried on in the laboratories of the Massachusetts Institute of Technology, Columbia University, and other institutions. They are beginning to reduce our knowledge to the precise basis of physical and pyrometric measurements and are rapidly furnishing data upon which new practices will be based. This is a line of work upon which the colleges should more and more concentrate their attention.

Steel Making in the United States

The production of steel ingots and castings in the United States in 1908 was less by a little over 40 per cent. than that of 1907, the decline having been rather greater than that in pig iron. The make of steel in 1908 was the smallest reported since 1901, with the sole exception of 1904, when the total was only 130,321 tons less than last year. The total make in 1908 was 13,897,627 tons, of which only 6,116,755 tons were bessemer, or converter steel, 7,780,872 tons being made in the open-hearth furnace.

Aside from the great decrease, the notable feature in the year's production was that the falling off in bessemer output was proportionally much greater than in open-hearth, the result being that for the first time the latter formed the larger part of the steel made. The proportion of converter steel to the total in 1908 was 44 per cent., which compares with 50.2 in 1907, and with 72 per cent. 10 years ago. Moreover, the smallest loss was in the basic open-hearth process, so that last year acid steel was only 49 per cent. of the total and basic 51; the proportions in 1907 having been 55.7 and 44.3, while in 1898 they were 82.3 and 17.7 per cent. Divided according to the process used, the production of steel for 11 years past has been as follows, in long tons:

	Bessemer.		Acid Open-hearth.		Basic Open-hearth.	
	Tons.	Per Ct.	Tons.	Per Ct.	Tons.	Per Ct.
1898.	6,609,017	74.8	660,880	7.5	1,569,412	17.7
1899.	7,586,354	72.0	866,890	8.2	2,080,426	19.8
1900.	6,684,770	66.3	853,044	8.5	2,545,091	25.2
1901.	8,713,302	65.2	1,037,316	7.8	3,618,993	27.0
1902.	9,138,363	61.6	1,191,196	8.0	4,496,533	30.4
1903.	8,592,829	59.6	1,094,998	7.6	4,734,913	32.8
1904.	7,859,140	57.1	801,799	5.8	5,106,937	37.1
1905.	10,941,375	55 0	1,155,648	5.8	7,815,728	39.2
1906.	12,275,830	52.8	1,321,653	5 7	9,658,760	41.5
1907.	11,667,549	50.2	1,269,773	6.5	10,279,315	44.3
1908.	6,116,755	44.0	696,301	5.0	7,084,568	51.0

Basic bessemer steel was never made in this country on a large scale, and has not been made at all since 1897. All the bessemer metal in the years given above was acid steel. In this table the small quantity of crucible and special steels, which has never reached 1 per cent. of the total, is disregarded. This production of crucible steel in 1907 was 145,309 tons; for 1908 it has not yet been reported, but probably did not exceed 110,000 tons. This would make the total output of steel for the year just over 14,000,000 tons.

The year 1909 may be expected to show a substantial increase over 1908, though there is now no probability—hardly even a possibility—that it will attain the high level of 1907. It is safe, however, to predict that there will be no great change in the proportions of the different classes of steel.

The preponderance of the open-hearth process may be expected to continue permanently, since it is based on the actual substitution of one process for the other, and not on any temporary condition. Thus, for instance, the steel made in the great new works at Gary will all come from open-hearth furnaces; and such furnaces have lately replaced an important group of converters in the Carnegie works at Pittsburg. The bessemer converter has had an important part in industrial history, but it is gradually giving way to its later rival.

THAT CONCESSIONS IN price do really stimulate consumption is illustrated by the recent experience of the American Radiator Company, which in 1908 realized the largest profit in its history. In their annual report the directors state that the lower selling prices established, because of reduction in cost of raw materials, induced a great number of people to purchase products for introduction in old buildings, and business from that source was largely increased.

The Anthracite Position

At the conference held in Philadelphia, March 11, there were present representatives of all the anthracite companies, headed by George F. Baer, president of the Philadelphia & Reading, and the United Mine Workers' committee, headed by President Lewis. The operators rejected all of the miners' demands. They also made a definite counter proposition to renew the present agreement for a term of three years, as in 1906. This means that the United Mine Workers must sign such an agreement before the existing agreement expires, on March 31, or take action upon the question of suspending work in all the collieries of the anthracite region. An official statement given out by Mr. Baer is as follows: "A committee of seven representatives of the Anthracite Mine Workers and a committee of seven representatives of the anthracite operators held a joint meeting to discuss the mine workers' demands. These demands are the same that were drafted in Scranton last October.

"The operators declined to accede to the demands. The chief reason offered for the rejection was that any increase in the cost of production would necessitate an advance in the price of coal, and that such an advance was impracticable. The operators said that the wages in the anthracite mining industry were already at a high level and could not be increased.

"The announcement of the operators' position was followed by a free discussion of the various demands, each side stating its views fully in regard thereto. The operators declared their unwillingness to reopen the eight-hour-day question and other questions passed upon by the Anthracite Strike Commission of 1902. They also declared themselves opposed to the mine workers' proposition for a one-year agreement.

"They declined to recognize the United Mine Workers of America, chiefly on the ground that it was controlled by bituminous mine workers. They said they met Mr. Lewis and his committee as representatives of the anthracite mine workers and not as officers of the union. The operators called upon the report of the Strike Commission to support their refusal to deal with the United Mine Workers.

"At the end of the discussion the operators made the definite proposition to renew the present agreement for a term of three years."

A second conference held on March 12 had the same result, and the committees adjourned with the understanding that another conference would be held after President Lewis, of the United Mine Workers, and his committee had presented the operators' proposition to continue the existing agreement for another term of three years to a convention of the mine workers.

Accordingly a convention of representatives of the miners in the three districts in the anthracite region has been called, to meet at Scranton, Penn., on March 23. All further conferences are adjourned until after this meeting.

It will be seen that the differences are wide. The operators declare that they are entirely uncertain as to the result, but they are determined not to give way, and not to surrender the open-shop principle, which has been the rule for three years. So far as trade is concerned, the season is approaching when domestic demand is light, and there are heavy stocks on hand, which will supply the trade for some time. Stocks of steam sizes are small, and a suspension would throw a large part of this trade to bituminous coal. Upon the whole, the conditions favor the operators, and they have on their side the support of the public, which cannot see the reason of the miners' demands, and is in no humor to submit to increased prices for coal.

The New Tariff as Proposed

The bill brought in by the Ways and Means Committee on March 17 makes the following changes:

Item.	Present.	Proposed.
Asphaltum, crude	free	$3.00 per ton.
Fluorspar, crude	10%	0.50 per ton.
Fluorspar, refined	20%	1.75 per ton.
Boric acid	5c. per lb.	2c. per lb.
Borax	5c. per lb.	2c. per lb.
Bauxite, refined	0.6c. per lb.	0.5 c. per lb.
Ammonium sulphate	0.3c. per lb.	free
Alum	0.5c. per lb.	0.25c. per lb.
Soda ash	¾c. per lb.	0.25c. per lb.
Sodium nitrate	2½c. per lb.	2c. per lb.
Salt cake	$1.25 per ton.	$1.00 per ton.
Sulphur, refined	8.00 per ton.	6.00 per ton.
Gypsum, crude	0.50 per ton.	0.40 per ton.
Gypsum, calcined	2.25 per ton.	1.75 per ton.
Iron ore	0.40 per ton.	free
Pig iron	4.00 per ton.	$2.50 per ton.
Bar iron	0.6c. per lb.	0.4c. per lb.
Steel rails	5/16c. per lb.	7/16c. per lb.
Aluminum	8c. per lb.	7c. per lb.
Lead in ore	1½c. per lb.	1c. per lb.
Lead bullion	2⅛c. per lb.	1½c. per lb.
Monazite sand	6c. per lb.	4c. per lb.
Spelter	1½c. per lb.	1c. per lb.
Sheet zinc	2c. per lb.	1¼c. per lb.
Zinc in ore	free	1c. per lb.

Refrigeration Applied to Mining

The application of mechanical refrigeration to mining operations, shaft sinking, etc., has been practiced (*Mining Science*, Dec. 10, 1908) in Europe for the last 25 years. In America, however, although well known, it has been little practiced, compressed-air methods being more favored. For instance, in 1906 there were about 56 shafts sunk in other countries by this method, while in America there was only one.

The field for this system of operation is much the same as that of the compressed-air method, i.e., working through quicksand or strata of gravel impregnated with water. Each system, of course, has its special advantages and adaptabilities. For instance, the compressed-air method is superior for laying foundations under water by the caisson system, or for penetrating impregnated strata where rapidly flowing water is encountered which would tend to carry away partially frozen material. On the other hand the refrigeration method is better adapted for working to depths where compressed air may not be efficiently used on account of the injurious effect of the pressure upon workmen. With high pressures used in working to considerable depths frequent changes of shifts are necessary and much time is lost. In such cases the ventilation is liable to be unsatisfactory, leakage enters as a large factor of loss and the danger of a serious blow-out must always be faced.

In Europe the refrigeration method is mostly used in sinking in coal, iron and salt mines. In salt mining it is least efficient owing to the fact that the water impregnated with brine necessitates exceedingly low temperatures to produce freezing.

Methods of Working

The methods of operation practiced are modifications of the Poetsch system. In one system employed small holes are sunk around the periphery of a circle to inclose the proposed shaft. In each of these holes two pipes are lowered. The larger is closed at the bottom and into this the shorter one, open at the bottom, is lowered. The original lining of the holes is then drawn, the pipes connected, the outer to the brine or ammonia supply and the inner to the exhaust. Freezing of the surrounding material is then effected and the shaft is carried down within the inclosed circle. Afterward steam or hot brine is turned in the pipes to thaw out the ground and to facilitate their removal. The great disadvantage of this system is that, as with a diamond drill, the pipes sometimes depart from the desired direction entering the proposed course of the shaft.

Another development of this same system is in many cases more desirable. Shorter lengths of pipe are used connected by flexible joints with a central receiving head divided into two chambers, one the supply connected with the outer pipes, the other the exhaust connected with the inner pipes. The refrigerating material in circulating through the system freezes the surrounding ground. The core is excavated, lining inserted between the tubes and the lining completed while the tubes are again sunk to their full length. The points of variance between this and the first case are in the fact that the work progresses in stages and that a removable receiving head is used; thus shorter lengths of pipe are required and the danger of their deflection is reduced.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

A Novel Stadia Rod

Mr. Granbery's article in the JOURNAL of Feb. 27, 1909, on stadia measurements recalls some work I did in the '70s, using stadia measurements in running several thousand miles of lines to make a topographical map of several hundred square miles. My rod was made in 7-ft. lengths, jointed, feet marked in black, and tenths painted alternately red and white, the rod being 3x¾ in. I forget who told me to use looking-glasses, but I had pieces of looking-glass cut 0.1 ft. long and inserted them in the rod in the 0.9-ft. mark, the number being painted above the foot mark. With an intelligent rodman any distance for which the rod was long enough could be measured without trouble.

A "kink" I worked out proved a great time-saver in the field, and with care was just as accurate as the vertical-angle calculation for difference in elevation. It was as follows: After reading the distance on the rod and recording the vertical angle, bring the telescope level, note with the eye a piece of dirt, branch, or any object that the middle cross-hair cuts, bring the lower cross-hair up to this object, note by eye the point where the upper cross-hair cuts, screw up the telescope until the lower cross-hair cuts this new point, continue this until the upper cross-hair cuts the rod, note the reading on the rod of the upper cross-hair, then the difference of elevation is the stadia reading multiplied by the number of times the telescope has been moved up less the reading of the top cross-hair.

Thus, suppose stadia reading is 7 ft. = 700 ft. distance, that the telescope has been moved up eight times and then the top cross-hair cuts the rod at 4 ft., then

$$7 \times 8 - 4 = 52 \text{ ft.} =$$

hight of bottom of rod above instrument. If the rod is lower than the instrument, bring telescope level, work down until bottom cross-hair cuts rod and add this reading. Thus, distance as before, but lower cross-hair cuts rod at 16-ft. mark; then

$$7 \times 8 + 16 = 72 \text{ ft.} =$$

hight of bottom of rod below instrument.

In plotting topography in the field this will be found much the quickest way to get the difference in elevation, and it is also a check on the vertical angles. There are times, of course, when it cannot be used, as when the level line cuts above the sky line, or when a grain field is cut by the cross-hairs. With good points to look at I found it to check up on the vertical-angle readings and only calculated vertical angles at night or on rainy days to check up the work. The only way to take topography with stadia is to plot the contours in the field; everything that saves time helps.

Another pointer for the beginner is: In taking vertical angles, sight at any convenient foot mark on the rod, record the vertical angle and under it put the foot mark with the prefix + or —, depending upon whether the rod is lower or higher than the instrument; thus, vertical + 5 deg. — 3 ft., or — 10 deg. + 6 ft.; the 5-deg. angle was taken to the 3-ft. mark and the 10-deg. to the 6-ft. mark on the rod; these feet to be added or subtracted from the calculated elevation.

Two good men in clear country should easily run 10 miles a day of stadia lines and put in the topography. A good rodman, however, is essential. I think Mr. Granberry's rod would be improved by inserting looking-glass at every foot mark. I do not see the necessity for the fine markings; tenths of a foot, I think, are are all that are required except for quite short sights.

R. H. SANDERS.

Philadelphia, Penn., March 10, 1909.

Diamond Mine in Pike County, Arkansas

The letter appearing in the JOURNAL of Feb. 13, 1909, under the above heading and written by Dr. John C. Branner, from Stanford University, Cal., in criticism of my article on an "Arkansas Diamond Mine," which appeared in the JOURNAL of Jan. 16, 1909, seems to require an answer from me.

Taking Doctor Branner's criticisms in the order in which they are written, it appears that the fundamental trouble with my article lies in the unfortunate statement that Doctor Branner scouted the idea of the igneous mass containing diamonds. This, Doctor Branner admits to be true in his letter, but explains that he did so deliberately to keep people of Arkansas from going crazy.

The fact that I attributed Doctor Branner's skepticism (for in the absence of his letter of explanation it can be taken as nothing else) to a wrong reason, which Doctor Branner corrects by the true quotation from his own report, seems to me to refute his accusation of my having repeated most of his geology, for had I done so, I certainly would have made no mistakes and would certainly have given him full credit for same, as was done in the case of other authorities quoted in the article.

I first visited the Arkansas diamond field in June, 1908, for the purpose of making a report on same. While in Little Rock, the president of the Arkansas Diamond Company showed to me a copy of the report of the Arkansas Geological Survey containing Doctor Branner's and Doctor Brackett's reports and descriptions of the igneous area. I read these reports through hurriedly and glanced at the appended map, this being the only time I had seen the report or, to my knowledge, the map, until after the publication of Doctor Branner's letter.

As full geological reports had already been made by competent geologists in the employ of the Arkansas Diamond Company and others, and I had been employed to report on the engineering and economic possibilities of the field, the geological features were not of as much interest to me at that time as they might otherwise have been.

In regard to the geological portion of my article, the only part of it that was not written from my own personal field observations is the paragraph relating to the inclosing or country rock of the igneous area. This information was pieced together from several different reports and articles on the region, and it would have been difficult to give credit to any one of them, and was, therefore, published as general information. These reports may have been partly or wholly based on Doctor Branner's report.

As to the map in question, Doctor Branner certainly has justification for his claim. This map was given to me by the Arkansas Diamond Company with the information that it had been made by persons in their employ, which is absolutely correct, except that no mention was made of the fact that the volcanic outline, as determined by Doctor Branner, together with Doctor Branner's geological key, had been traced on the map to show the relative position of the area as determined by Doctor Branner and as determined by their survey. This fact I was not aware of until after the publication of Doctor Branner's letter, when I procured as soon as possible a copy of Doctor Branner's report and map and checked up both carefully. I am very sorry that the map was published without due acknowledgment

to Doctor Branner and hope that he will accept my apology for having done so.

In regard to my footnote relative to not finding diamonds in the *true matrix* in South America, I will leave that question to specialists in geology to fight out among themselves. A similar footnote or reference will be found, I believe, in *The Mineral Industry* for 1907. A discussion on this subject would prove interesting.

In conclusion, I beg to assure Doctor Branner that I had no such childish intent—appearances from his viewpoint to the contrary—to elect him "IT," nor do I pose as the "one gallus" man who first realized the possibilities.

JOHN T. FULLER.

Murfreesboro, Ark., March 1, 1909.

Firing Shots from the Electrical Power Service

D. Harrington's interesting account in the JOURNAL of the system of firing shots by electricity at the Utah Fuel Company's collieries, reminds me of the experiments that were carried out in the United Kingdom in the early days of electric lighting. In those days the electrical pressures did not exceed 110 volts and many things could be done with impunity that would not be practicable in these days, when pressures of 3000 volts are employed underground in collieries.

At the collieries where the system was carried out, an iron wire was connected to the end of one of the electric-light cables, and was carried into the workings, upon earthenware insulators. To fire a shot, one of the fuse wires was connected to this iron wire, and the other wire was pushed into the shot hole. In those days there was usually sufficient "earth" or "ground," as it is so much more expressively called in America, to complete the circuit through the fuse, when a switch, placed in any convenient position, and inserted in the iron wire, was closed. In addition to this, at one of the collieries, at least, where shot firing from the electric-lighting service was carried out, the electric engine-plane signals were also worked from the lighting service.

So far as I know, no serious accidents took place, but in Yorkshire, where it was tried, there were complaints of serious shocks being received from the rails, at some distance from the shot holes. In the collieries where the signals were worked from the electric-lighting service, it was very common to see flashes of light, similar to those one sees between the wheels of a tram car and the rails, at different parts of the engine-plane roads, produced by broken signal wires making contact with the rails, and then being pulled out of contact.

The arrangement described by Mr. Harrington avoids a large number of difficulties inherent to any method of firing shots, or working signals from the power service. The precaution of disconnecting the shot-firing service from the generator, at all times except at the instant of firing, is exceptionally good. It insures, if the regulation is carried out, that the shot firing service itself cannot give shocks as long as its insulation is perfect. The provision also, of switches controlling the different branches, and still more, locking the switch cases, so that they cannot be interfered with, is of great value.

There is one danger, however, remaining, and that is the possibility of the shot-firing service cables making contact either directly with the power-service cables, or with some other metal which is in contact with the power-service cables, and transmitting the killing pressure to some other innocent body of metal, nearer the face. This difficulty should be largely overcome, and apparently from Mr. Harrington's report of the absence of accidents, has been entirely overcome, by the careful system of inspection which has been adopted.

There is another point that I think should be mentioned. Already, even in main roads, there is difficulty in finding room for the cables necessary for distributing the power current, so as to insure them against accident. I am afraid that it would be still more difficult in the majority of cases, to find room for the shot-firing service cables, though it appears to me that the arrangement, if carried out, would be a very good one.

SYDNEY F. WALKER.

Bath, England, Feb. 20, 1909.

Tariff Notes

SPECIAL CORRESPONDENCE

A large number of additional briefs dealing with the duties on minerals and metals to be fixed in the forthcoming tariff bill have been filed with the House Ways and Means Committee. Among these are a lengthy argument from the Cleveland-Cliffs Iron Company, Cleveland, Ohio, submitting data regarding the cost of iron-ore production. According to this statement, the costs at points of delivery are as follows: At Lake Erie ports, $3.06; Mahoning and Shenango valley points, $3.71; Pittsburg and vicinity, $4.11; western Pennsylvania points other than above, $4.31; points east of the Alleghenies, $4.56. From these figures the inference is drawn that any reduction in the tariff on iron ore should be made with extreme conservatism.

IRON AND STEEL

Briefs filed by pig-iron interests in Pennsylvania and Virginia are to the effect that any reduction in the tariff on pig iron will be disastrous, one concern—the Thomas Iron Company, of Easton, Penn.—asserting that any serious change will eventually compel all manufacturers of merchant pig iron in the East to go into liquidation.

James Lord, president of the American Iron and Steel Refining Company, has submitted estimates of the cost of manufacturing refined bar iron. The cost of material is placed at $23.75, and the cost of conversion—including labor, taxes, insurance, depreciation and replacement—at $9.35, or, in all, $33.10 per ton.

Powell Stackhouse, president of the Cambria Steel Company, submits a statement showing the cost of steel rails to his company. This is $14.92 per ton for all purchased materials, supplies, ores, transportation, etc.; $9.42 for labor in mining and manufacturing; administrative and selling expenses of about 56c. per ton; or in all, $24.90 per ton.

LEAD

In a lengthy argument before the Ways and Means Committee, Vice-President Brush, of the American Smelting and Refining Company has undertaken to rebut the contentions of manufacturers of lead articles and others who are dissatisfied with the existing trade situation. Mr. Brush urges the retention of the duty of 1½c. per lb. on lead in ore, giving a protection of $30 per ton. He argues that, were there to be a cut in the tariff, the effect would be to discourage not only lead mining in the Rocky mountain region, but all other mining as well. The precious metals, he points out, cannot be recovered from the refractory ores of the Rocky mountains except as lead is used as a base to collect the precious metals in the process of smelting. In this process there must be at least 10 per cent. of lead in the furnace charge. Thus, according to this argument the whole business of the Rocky mountain region would suffer from such a change in tariff duties as is referred to. Mr. Brush further sets forth that the present price of 4c. per lb. for lead is not exorbitant, as is charged by critics, inasmuch as the cost of production in this country, not taking into account the depreciation of the mine, is approximately 3½c. As regards the alleged bad treatment of the mining interests by the smelters, it is set forth that the contracts with the miners agree to pay the latter the market price for their lead, silver and copper the day that it is shipped. Hence, it is argued, the claim that the smelting company profits by manipulating the price of raw material must be without foundation. It is denied that there is general community of the lead interests through joint directorates or common ownership of stock as has been charged.

The great lowering in costs that has been lately so conspicuous on the Rand, South Africa, has been due mainly to improved efficiency in the labor.

New Publications

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PHYSIKALISCHE CHEMIE DER METALLE. By Rudolf Schenck. Pp. 193, illustrated. 7x10½ in.; paper, 7 marks. Halle, a. S., 1909: Wilhelm Knapp.

YEAR-BOOK OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, 1909. Pp. 350. 6x9¼ in.; cloth. New York, 1909: Published by the Institute.

ARTIFICIAL WATERWAYS AND COMMERCIAL DEVELOPMENT. By A. Barton Hepburn. Pp. 115. 5x8 in.; cloth, $1. New York, 1909: The Macmillan Company.

COMMISSION D'ENQUETE SUR LAS DUREE DU TRAVAIL DANS LES MINES DE HOUILLE. Rapport Final. Pp. 33. 8½x11 in.; paper. Bruxelles, 1908: Goemaere.

THE PORTLAND CEMENT INDUSTRY FROM A FINANCIAL STANDPOINT. By Edwin C. Eckel. Pp. 93; illustrated. 6x9¼ in.; cloth, $2. New York, 1908: Moody's Magazine.

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THE GEOLOGY AND MINERAL RESOURCES OF NEW BRUNSWICK. By R. W. Ells. Canada Department of Mines, Geological Survey Branch. Pp. 135; illustrated. 7x10 in.; paper. Ottawa, 1907: Printed by S. E. Dawson.

ROAD MATERIALS OF SOUTHERN AND EASTERN MAINE. By Henry Leighton and Edson S. Bastin. U. S. Department of Agriculture, Bull. No. 33; pp. 56; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

THE GEOLOGY OF THE PERSIAN GULF AND THE ADJOINING PORTIONS OF PERSIA AND ARABIA. By C. E. Pilgrim. Memoirs of the Geological Survey of India, Volume XXXIV, Part 4. Pp. 177; illustrated. 7x10½-in.; paper, 5s. 4d. Calcutta, 1908: Geological Survey of India.

TEXT-BOOK OF PETROLOGY. Fifth Edition, Revised. By F. H. Hatch. Pp. 404; illustrated. 5x7½ in.; cloth, $2.80 New York, 1909: The Macmillan Company; London, Swan Sonnenschein & Co., Ltd.

Contents: The physical characters of the igneous rocks. The constituent minerals of the igneous rocks. The classification of the igneous rocks. The distribution of the igneous rocks as illustrated by the British Isles.

MINERAL RESOURCES OF THE UNITED STATES, CALENDAR YEAR, 1907. Part I, Metallic Products. Part II, Nonmetallic Products. Pp. 743 + 897; illustrated. 6x9 in.; cloth. Washington, 1908: Government Printing Office.

This book is more clumsy than heretofore for having been divided into two volumes. This is done in accordance with an act of Congress. Why Congress should have made such a prescription, or bothered itself about the matter, is beyond comprehension. However, the ways and reasonings of Congress are "things that no fellow can find out," as Lord Dundreary used to say.

The book and the investigation of which it is the result cost the people of the United States about $75,000. If it were not that the U. S. Geological Survey is able to stretch its organic law to cover almost everything under the sun, we should ask the director to explain under what guise of legality the public funds are spent on reports as to the mineral resources of foreign countries and diverse other matters.

MAGNETIC DEPOSITS OF THE CORNWALL TYPE IN PENNSYLVANIA. By Arthur C. Spencer. U. S. Geological Survey, Bull. No. 359. Pp. 102; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

This is a record of recent work in an old district, the object of which was chiefly to ascertain new facts bearing on the origin of the ore deposits. The results, so far as this object is concerned, were rather disappointing, but the author has been enabled to give a good description of an interesting group of mines. The orebodies occur in masses at different points on a rather wide belt extending from the Delaware river west and south across Pennsylvania to the Maryland line. The ores are generally magnetite, with enough pyrite to make roasting necessary. The largest and best known orebody is at Cornwall; it has been worked over 100 years, and is stilll exploited on a large scale. Smaller bodies have been, and are still worked at Boyertown, Joanna, Fritztown, Warwick and Dillsburg, all having nearly the same character.

INDUSTRIE DES METAUX SECONDAIRES ET DES TERRES RARES. By Paul Nicolardot. Pp. 435; illustrated. 4¾x7 in.; cloth, 5 francs. Paris, 1908: Octave Doin.

The plan of this little book is to take up each of the secondary metals having industrial applications, and to give for each its discovery, distribution, preparation, properties, alloys, extraction, detection and estimation, products and use in the industries. The book contains an introduction dealing with the preparation of alloys of the secondary metals by the alumino-thermic process and in the electric furnace, and the preparation of filaments for incandescent lamps. The metals are then treated in the following order: tungsten, molybdenum, vanadium, titánium, uranium, zirconium, yttrium, thorium, cerium, osmium, columbium and tantalum. Following is the appended matter, consisting of a list of the minerals referred to in the work, a bibliographic index, an index to the authors and subjects treated, and a systematic table of the contents.

The work contains considerable valuable information, such as could only be obtained by a search through recent chemical literature, and, for this reason, is to be recommended to the commercial or practical man. However, some important omissions are noted. The processes of Gin are not mentioned, and beryllium, the oxide of which is used extensively in the gas mantle industry, is omitted, as well as iridium. The historical discussions, although not presenting other than well-known facts, are commendable. Contrary to the custom of most continental chemists, Nicolardot properly refers to the element discovered by Hatchett as columbium.

Several minor typographical errors, fortunately unimportant, are noted. The arrangement of the references in an "index bibliographique," and not at the bottom of each page as they occur, is productive of some confusion and loss of time; but the comprehensive, yet condensed text, written in scholarly manner by an authority in mineral chemistry and metallurgy, renders the work so valuable that one forgets these lesser faults.

The National Conservation Conference

SPECIAL CORRESPONDENCE

March 5, the joint conservation committee provided for by the National Conservation Conference, which met some time ago, convened in Washington and began work in executive session. The committee as appointed by Chairman Pinchot includes (in addition to Mr. Pinchot himself) six members of State conservation commissions and three members of the National Conservation Commission. Representing the State commissions were J H Teal, Portland, Ore.; Paris Gibson, Great Falls, Mont.; W. K. Kavanaugh, St. Louis, Mo.; Frank Rane, Boston, Mass.; O. J. Salisbury, Salt Lake City, Utah, and W. H. Milton, Marianna, Fla. The National commission is represented by Senator Knute Nelson, Alexandria, Minn.; Newton C. Blanchard, Shreveport, La., and George C. Pardee, Oakland, Cal.

To this committee reports were transmitted giving the details of the work accomplished by the State commissions and other organizations of similar character. The committee began by attempting to condense these reports and to draw from them practical suggestions as to what can be done in the way of coöperation between the conservation movements in the several States. The final recommendations will be transmitted by the conference to the several governors and the President, and these officers will be urged to do what they can to secure united action of all organizations concerned with the conservation of natural resources.

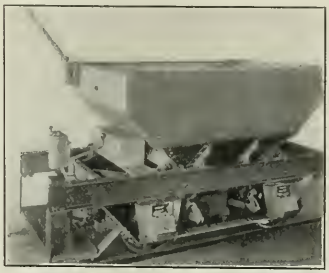
Among other documents which are before the committee for its use are those growing out of the resolution adopted by the conservation conference upon the suggestion of Powell Evans, of Pennsylvania, who presented a resolution providing that members of the national organizations in attendance upon the meeting be invited to offer their advice as to how the movement could be made practical.

A Bottom-Delivery, Electric, Charging Car

The accompanying illustration shows a type of car in use in a number of the largest smelters and concentrators, known as the Atlas center-dump, swinging-door design. The door swings outward and is operated by the lever adjacent to the operator on the platform. The sides and ends are steep so that the material will not adhere, thus giving a clean delivery at all times.

The wheels are made of special material to withstand the hardest work, and are ground to insure maximum adhesion. The bearings are dust proof and packed with waste. The brakes are of the standard street-car, inclosed ratchet handle type.

The electrical apparatus consists of a Westinghouse No. 64 motor, with type R controller, inclosed resistance, circuit breaker and cut-out switch, and reversible spring-type trolley. The cut-out switch is operated from the platform, and when the operator leaves the platform the current is cut off. This is for safety and avoids accidents, particularly as these cars are operated under very close clearance conditions. The wiring is specially incased in water-tight conduits to protect against the gritty material, which sometimes wears



ATLAS BOTTOM-DELIVERY, ELECTRIC, CHARGING CAR

the insulation. The cars have a capacity of 5 tons and run on a 36-in. track. The over-all length is 11 ft., the width 5 ft., and the hight from top of rail to top of car 5 ft. 6 inches.

The cars are manufactured by the Atlas Car and Manufacturing Company, Cleveland, Ohio, and the electrical equipment by the Westinghouse Electric and Manufacturing Company, Pittsburg, Penn. They are now in use at such smelters as those of the Garfield Smelting Company, Garfield, Utah; Michigan Smelting Company, Houghton, Mich., and the Anaconda Copper Mining Company, Anaconda, Montana.

Geological Survey Appropriations

SPECIAL CORRESPONDENCE

In the session of Congress which closed March 4, appropriations for the Geological Survey turned out more favorably than was expected at one point in the progress of the bills. The general current allowances have, of course, been maintained, but certain special changes have occurred, as follows:

1. A reduction of $150,000 in the fuel-testing appropriations of the Survey. This cuts the amount from $250,000, the sum set aside last year, to $100,000 for the coming year. Inasmuch, however, as it was expected that this appropriation would last only for one year on any basis, the allowance of $100,000 is regarded as an addition to, rather than a deduction from, the original appropriation.

2. An increase in the appropriation for topographic surveys to $350,000. This has stood at $300.000 during the past two years, but was $350,000 during 1906 and 1907. The increase for the coming year is thus $50,000.

3. An omission of the $10,000 heretofore granted for palaeontological investigations.

4. A transfer of the palaeontological work to the division of geological surveys. The latter appropriation is, however, increased by $25,000, raising it to $225,000 instead of $200,000, the figure for the past four years. Thus a net increase of $15,000 has occurred on palaeontology and geologic surveys taken together.

5. An increase of $10,000 in the appropriation for the investigation of the mineral resources of Alaska making this $90,000 instead of $80,000, the figure for the past five years.

6. An addition of $2500 to the annual rent allowances for the Survey. This permits an enlargement in the annex, which will be sufficient to allow the transfer of photographic laboratory of the Survey. This change is believed to be in the interest of more efficient safeguards against fire. At the same time it is held to furnish another argument in favor of the construction of a new building, inasmuch as every addition to the annual rent bill increases the economy to be realized by a new building. As to the building itself some progress has been made, although no favorable action was taken by Congress as a whole. The most that was accomplished was to get a favorable report from the House Committee on Public Buildings and Grounds. With another session's work the more hopeful friends of the Survey think that the desired provision can be pushed through Congress. In the course of the agitation in behalf of the bill its supporters received far more pledges of assistance than at any time in the past.

Correction

On page 399 of the JOURNAL of Feb. 20, 1909, in the 17th line from the bottom of column 2, the sentence reading: "The great plan in the argument of long life," etc., should read as follows: "The great flaw in the argument of long life."

The iron-ore properties in the State of Minnesota were assessed in 1908 at a total of $176,340,749, or about 20 per cent. of the total real-estate valuation. The taxes paid on the iron lands amounted to about 15½c. per ton of iron ore produced in 1907. On the smaller production of 1908 they were nearly 25c. per ton.

The Calcium Nitrate Industry in Norway

Sam Eyde, in a recent lecture, described the status of the "saltpeter" industry at Notodden, in Telemarken, Norway. He traced the undertaking from its conception, and, throughout the experimental stages, to its present maturity under the auspices of the Badische Anilin und Sodafabrik, whose rival method, together with capital requirements by the Norwegian promoters, necessitated an assimilation of interests. The Birkeland-Eyde nitrate industry at Notodden is epoch-making, in that it is the pioneer of its kind; from beginning to end it has been planned and carried out by Norwegians. Owing to breakdowns at the power station and factory, an average use of 13,000 kw. only was obtained in 1908, whereas the normal should have been 22,000 kw. In the last six months, allowing for occasional shortages of water, the average was 19,500 kw., with a revenue of about 1,500,000 kroner, and a cost of 970,000 kroner, which for the six months gives a net profit of 530,000 kroner. In experimental operations 1,000,000 kroner has been expended. The total capital in connection with the Notodden and Svölgfos construction was 11,000,000 kroner. The revenues will be further increased as soon as arrangements for the special production of ammonia nitrate and lime saltpeter, as well as the better regulation of the watersheds, are completed. Herr Eyde anticipates that with the further damming of the auxiliary falls, which would occupy 10 years, at a cost of 150,000,000 kroner, the yearly output of Norwegian nitrate would amount to 300,000 tons. Chile at present produces 1,800,000 tons annually—say, in 10 years' time (1920), 2,500,000 tons. As Norway's production in 1920 will have reached about 300,000 tons, to the value of 45,000,000 kroner yearly, it will only amount to about 12 per cent. of Chile's output in the same period. Chilean nitrate has to undergo a chemical process before it reaches the consumer, and climatic and labor drawbacks will in a high degree tend to prevent prices falling to a level that would threaten the Norwegian industry. Experiments with the practical use of Norway saltpeter have been carried out by authorities on agriculture in Norway, Sweden, Denmark, Germany, France, England and Scotland, Austria, Hungary and Italy, and results bear out the favorable opinion expressed by specialists on the first appearance of the fertilizer, viz., Norway saltpeter is equally as good as that from Chile; and in soil poor in lime it is even better.

The three companies connected with the Notodden-Rjukanfos power and nitrate production are: the Norwegian Power Company, capital 16,000,000 kroner; the Norwegian Saltpeter Works, capital 18,000,000 kroner; and the so-called Norwegian Transport Company, capital 3,000,000 kroner, which was formed to connect Rjukanfos, Notodden and Skien by rail and water.

Technical details of the Birkeland-Eyde process now in operation at Notodden, and that of the Badische furnace method are not generally available, nor will it be known which of the two processes will be adopted for the Rjukanfos construction until the Badische process has been installed and tried in a factory now being built at Notodden.

Tomboy Gold Mines, Ltd.

Special Correspondence

This English company operates a gold mine at Telluride, Colo. The report for the year ended June 30, 1908, records a profit of £87,115 on the last 12 months' working. Owing to the development of large bodies of comparatively low-grade ore in the lower levels, a policy was adopted of reducing the grade so as to yield profits of £5000 per month instead of £8000 per month. This policy aims at lengthening the productive life of the mine and maintaining a uniform rate of production in the future. The ore reserves at the close of the company's financial year were estimated at 410,000 tons.

Work has been carried on mainly on the Argentine group of claims, the Tomboy group having been operated by leasers whose output netted the company in royalties the sum of $2153. The milling operations resulted in the crushing of 104,091 dry tons of ore from which bullion to the value of $657,561 and concentrates worth $341,459 were recovered. These amounts, together with $13,482 received for boarding house, rents, royalties, etc., gave a total revenue of $1,012,502. The expenditure on mining and development was $340,553, or $3.27 per ton; on milling, $134,742, or $1.29 per ton, and on general expenditure account, $58,910, or 57c. per ton. The total expenditure was $534,205, or $5.13 per ton, leaving a surplus of $478,296 on working account.

The manager, D. A. Herron, reports an interesting improvement in the treatment of middlings derived from the concentration of the ore in the mill. These middlings had formerly been a waste product. The new plant consists of classifiers, Wilfley tables, a roasting furnace and magnetic plant; and a separation of the iron, zinc and copper contents of the ore, with which some gold is associated, is effected. Zinc and iron concentrates of a marketable value are now produced. The plant was put into operation on Jan. 1 last. Experience has shown that the plant is capable of improvement and certain defects in the original design are to be remedied. The labor situation is reported to be now quite satisfactory.

The issued capital of the company is £300,000. For the year 1906-7 the dividend was 37½ per cent., and for 1907-8, 30 per cent. For the ensuing year it is proposed to hold in abeyance the development of the mine below the 2100-ft. level and to confine operations to the development of the orebodies indicated in a general way by the 1750- and 2100-ft. levels.

Mining in the Yukon Territory

Special Correspondence

The report of the "Mining and Metallurgical Industries of Canada, 1907-8," states that the number of placer mines operated in the Yukon Territory on June 2, 1908, was approximately 7184. The Placer Mining act requires work to be done on each claim to the value of $200 each year, but claims may be grouped so that expenditure on one or more claims shall be considered as covering all claims included in the group, and all the claims enumerated have been worked either separately or as one of a group. The number of quartz-mining claims in good standing in the Territory is approximately 1054. In the southern section extensive operations in copper and gold mining are being carried on. At Whitehorse a number of copper mines are in operation, and considerable quantities of ore being shipped. At Conrad considerable development in gold-quartz mining has been done with good results. There are 13 hydraulic mining locations in existence, comprising a total frontage of 38½ miles, which are all being operated in some degree. There are 58 dredging leases, comprising 304 miles of the submerged beds of rivers. These leases are confined to the Yukon, Forty Mile, Klondike, Stewart and Hootalinqua rivers. There were 12 large dredges in operation, nearly all having an indicated capacity of about 3000 cu.yd. per day, and it was anticipated that before the end of the season several others would be installed.

The only means by which the department can compute the production of gold in the Yukon is upon the amount on which royalty has been paid. The provision for the payment of a royalty came into force Sept. 11, 1897, and the records since that date show a total production of $82,983,636. The maximum production was reached in 1902-3 with an output of $12,113,015, each subsequent year showing a falling off, as will be seen by the following figures: 1903-4, $10,790,663; 1904-5, $8,222,053; 1905-6, $6,540,007; 1906-7, $3,304,791; 1907-8, $2,820,161.

Two coal mines were in operation. The Tantalus, about 215 miles above Dawson produced last year over 7000 tons and the Sourdough, about 50 miles below Dawson, produced over 5000 tons. The coals retails at from $15 to $18 per ton.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A mail car containing a number of copies of THE ENGINEERING AND MINING JOURNAL of Feb. 27 was destroyed by fire in Illinois. Subscribers who have failed to receive that issue may obtain it by sending a postal card to this office. Our number of extra copies being small, subscribers will confer upon us a favor by making applications promptly.

Paul R. Forbes has returned to Mexico.

Allen H. Rogers has returned from Chile.

E. P. Mathewson, of Anaconda, Mont., has been visiting New York.

Richard A. Parker, Denver, Colo., visited New York and Boston last week.

S. H. Brockunier has returned to Wheeling, W. Va., from Alaska.

L. C. Church, of Joplin, Mo., has examined zinc-lead deposits at Alva, Oklahoma.

J. R. Finlay leaves New York this week for a trip to the Pacific coast, where he expects to be for about a month.

Henry C. Beeler, recently State geologist of Wyoming, has opened an office at Denver, Colo., as mining engineer.

F. C. Roberts has resigned his position as manager of the Ventanas mine in Durango, Mexico, and will return to San Francisco.

William C. Seddon, of Baltimore, has been chosen chairman of the executive committee of the Alabama Consolidated Coal and Iron Company.

W. E. Miller, of Glasgow, Scotland, secretary of the Arizona Copper Company, Ltd., is inspecting the company's mines and works at Clifton and Morenci, Arizona.

Douglas Muir has resigned his position as superintendent of the mill and cyanide plant of El Conde Mining Company at Tepehuanes, Durango, Mexico, to take effect May 1 next.

Thomas Cox, formerly at Ely, Nev., and for some time past at Cerro de Pasco, Peru, expects to return to this country about June, and will open an office in San Francisco.

James L. Bruce, late engineer and assistant superintendent of the Grace Zinc Company, has been appointed general superintendent of the Continental Zinc Company at Joplin, Missouri.

F. A. Jordan has resigned his position as general superintendent of the Continental Zinc Company at Joplin, Mo., to take charge of an iron mine in the Moose Mountain district in western Ontario.

Robert Hawxhurst, Jr., remains in Chile as general manager of the Poderosa Mining Company, Ltd., of London, which has recently acquired the properties of the Compañia Minera Poderosa de Collahuasi, Chile.

J. R. Dallas has resigned his position as engineer for the Leetonia Mining Company at Hibbing, Minn., to accept a position as manager for the Wheeling Gold Range Mining Company, at Sodaville, Esmeralda county, Nevada.

James Taylor has been appointed mine inspector for the sixth Illinois district, with office at Springfield. He succeeds Thomas Hannah, resigned. Mr. Taylor was formerly in Illinois, but for some years past has been managing a mine in Alberta, Canada.

C. A. Pringle, recently in Mexico, has been appointed manager of the Tintic Mining and Development Company's properties in the Bingham district, Utah. These include the Yampa smelter. He succeeds C. W. Saxman, resigned. J. C. Dick, general superintendent has also resigned.

George T. Oliver, just chosen United States Senator from Pennsylvania, was, until recently, engaged in the steel business. He was first vice-president and afterward president of the Oliver Wire Company until that company disposed of its plants in 1899. In 1889 he became president of the Hainsworth Steel Company and retained that position until its merger with the Oliver & Snyder Steel Company in 1897, of which he was president, until he disposed of his interest in the concern a few years ago.

Obituary

John Stevenson, superintendent of the Dunlap-Connellsville Coke Company, died at Hecla, Penn., March 6, aged 55 years. He had been employed in the Connellsville region for many years.

William McCully McKelvy died at Pittsburg, Feb. 28, aged 70 years. He was born in Pittsburg. He was president of the Alpha Portland Cement Company, a director of the Lockhart Iron and Steel Company, and of the Pittsburg Foundry Company.

James Robertson, Coatesville, Penn., died March 4, aged 48 years. He was superintendent of the open-hearth steel department of the Lukens Iron and Steel Company. He was a native of Glasgow, Scotland, came to this country about 24 years ago, and since then has been prominent in open-hearth steel practice, being connected with the above-named company since 1901.

John E. Carr, who died at Leavenworth, Kan., March 4, aged 69 years, was born in England and brought up as a mining engineer. He came to this country nearly 42 years ago. In 1872 he took charge of a coal mine near Leavenworth, and was actively engaged in opening and managing coal mines in Kansas until his retirement a few years ago. He was the first man to put coal mining in Kansas on a paying basis.

George Everest, a miner, died recently at the age of 80 years, near Igo, in Shasta county, Cal., where he first went at the end of 1848. He had never since that time been outside of what is now Shasta county, and had continued mining operations all that period, never having followed any other occupation. While a record to the contrary would have been satisfactory, it is necessary to note that he died a poor man.

Societies and Technical Schools

Montana Society of Engineers—At the monthly meeting in Butte, Feb. 13, Victor C. Heikes, of the United States Geological Survey, with headquarters at Salt Lake, Utah, gave an interesting talk about the statistical labors of the Survey under his charge, within the district comprising Arizona, Idaho, Montana and Utah.

Canadian Cement and Concrete Association—The first annual convention and exhibition of this association was held in Toronto March 1-6. About 60 manufacturers were represented at the exhibition, which was opened by Hon. Doctor Reaume, Ontario minister of public works, who said that the provincial government had taken a leading part in introducing the use of concrete for bridges, dams, etc., and recommending it to municipal bodies. The convention proper met on March 2 and was largely attended. The opening address of President Peter Gillespie, Toronto, presented a comprehensive review of the growth of the portland-cement industry in America. He urged the adoption of a standard form of specification for city contracts, and recommended the establishment of a government laboratory for the testing of materials. Dean Galbraith, of the faculty of engineering, Toronto University, said that with cement it was now possible to economize the wood used in building and conserve the forests. A large number of papers were read and addresses given. Among those who addressed the convention were A. W. Campbell, deputy minister of public works, Toronto; Emile G. Perrolt, Philadelphia; Prof. E. Brown, McGill University, Montreal; J. E. Moore, Chicago; J. Augustine Smith, South Bend, Ind., and Charles D. Watson, Cleveland. Officers were elected as follows: President, Prof. Peter Gillespie, Toronto; vice-president, Gustave Kahn, Toronto; councillors, T. L. Dakes, Owen Sound, Ont.; Kennedy Stinson, Montreal; C. A. Lingham, C. Caniff, J. G. Murphy, D. Raymond and C. H. Thompson, Toronto.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Toronto and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 12—While the State of California is producing nearly 50,000,000 bbl. of petroleum annually, it seems rather odd that some oil should also be imported. During the fall months of last year 4,694,000 gal. of light oils, or tops, came into this port under the name of naphtha, from Singapore. It originated on the island of Sumatra. An export duty of 6 per cent. was imposed, and this country, to counteract that, imposes a 6-per cent. import duty. The light oil is used in the refineries on San Francisco bay in making illuminating oils, being added in suitable proportions during the process of manufacture of lighting oil from California petroleum. The California oils are mostly heavy ones, with asphalt base, and light oils are rather scarce.

The State Anti-Débris Association has received a surprise in having Yuba county cut off further money contributions. This association has been maintained by the counties of Yuba, Sutter and Sacramento, the supervisors of which contribute a monthly allowance. Yuba has been paying $225 per month but at the last meeting of the board of supervisors it was decided to discontinue these payments for the future.

The mayor of Sacramento has announced that he will shortly call a convention to see what steps may be necessary to control or to stop dredge mining. Some of the newspapers are now calling on the engineers of the California Débris Commission to come forward with the necessary information about this industry. As it happens, however, this commission has nothing whatever to do with dredge mining, and has not studied its details. How the people at the proposed mass meeting are to get at facts when men interested in the subject, and having knowledge of it, are not invited to attend, remains to be seen. The dredge men have little fear of this since they can have exact facts brought out in court should litigation ensue.

The bill drawn by Senator Caminetti to appoint an advisory board of the department of engineering which might permit the building of impounding dams at hydraulic mines without going to the present expense of applying to the California Débris Commission, has been so amended that no final action can be taken without reporting to the legislature. It is also provided in the amendments that the courts have power to review the proceedings. With these amendments the bill has passed the Senate and gone to the Assembly. The proposed law was intended to simplify matters for small hydraulic mines.

Salt Lake City

March 12—The United States Supreme Court has, for want of jurisdiction, dismissed the suit of the Mammoth Mining Company *vs.* The Grand Central Mining Company, which is generally construed as a victory for the latter company. The case which involved the question of apex, has been fought over nine years. A judgment of approximately $170,000 stands against the Mammoth company.

For the week ending March 5, 184 cars of ore were shipped from the Tintic district. The following mines shipped in 20-ton cars: Colorado, 39 cars; Black Jack, 1; Beck Tunnel, 9; Brooklyn, 8; Dragon Iron, 34; Iron Blossom, 3; Swansea Consolidated, 1. The following mines shipped in 50-ton cars: Ajax, 9 cars; Horn Silver, 3; Silver Shield, 4; Bullion Beck, 2; Centennial Eureka, 46; Eureka Hill, 3; Mammoth, 1; May Day, 4; May Day concentrates, 1; Ridge & Valley, 2; Sioux Consolidated, 14.

Butte

March 10—Plans formulated some time ago for raising $85,000 for the purpose of meeting option payments and paying off indebtedness of the Pilot-Butte Copper Company are meeting with an indifferent response from the stockholders. W. P. Jahn, president of the company, has recently issued another letter requesting response to the former appeal for subscriptions and calling attention to the loss which will be incurred in the event of failure to take up the option on the Pilot claim. He states that unless a payment of $35,000 is made on the option from N. J. Beilenberg the company will lose the quarter interst represented by the option, on which several substantial payments have already been made.

In the action of Alonzo W. Evans against the Lake Shore Gold Mining Company, in which plaintiff secured a default judgment for $10,123 some time ago, a satisfaction of judgment was filed by Evans a few days ago. Evans also filed a motion to set aside the judgment against the company, stating that his attorney had entered the judgment without his knowledge at a time when he, the plaintiff, was negotiating a compromise. Evans' attorney is now resisting the cancellation of the judgment on the ground that he has a lien upon the same for the payment of his fee amounting to $2263.

The Western Mining and Supply Company, of Butte, has brought suit against the North Butte Extension Copper Mining Company and the North Butte Extension Development Company for a sum slightly under $1000 alleged to be due as rental for a pump used by the latter companies. An attachment has been levied upon the Black Crow, Overman, Occidental, Free Trade, Third Sphinx and Michigander quartz lode claims and the Clipper and Assay mill sites.

Denver

March 13—It does not seem likely that our State legislature will pass any laws this session looking toward the regulation of the smelters, and fortunately so, for it would appear better for these matters to be regulated by competition than by legislative compulsion.

A despatch from Salt Lake City today states that the Utah Mine Operators' Association has called for a conference to be held in that city March 25 by representatives from the principal lead camps of Utah, Nevada, Idaho and Colorado, the object being to devise means of protecting the lead-mining industry from the action of those who seek to reduce the tariff during the present session of Congress.

Goldfield, Nevada

March 9—The ore treated and shipped from Goldfield for the week ending March 6 was as follows: Nevada Goldfield Reduction Company, 685 tons averaging $40 per ton; 50 tons from Pioneer at $90 per ton; Consolidated and Combination mills, 4500 tons, estimated value $40 per ton; Goldfield-Florence, 800 tons averaging $20 per ton, and 225 tons shipped through Western Ore Purchasing Company the value of which is not made public.

Tonopah shipments: Tonopah Mining, 3150 tons; Belmont, 920 tons; Montana-Tonopah, 760 tons; Jim Butler, 300 tons; MacNamara, 235 tons; West End, 100 tons, and Midway, 100 tons. Total estimated value of $135,000.

C. A. Gehrman, superintendent of the Florence-Goldfield, last week tendered his resignation, which was accepted. George Wingfield was elected president of the Goldfield Mining Stock Exchange March 3, to succeed H. T. Bragdon, who resigned on account of ill health. Mr. Wingfield's election was made at a meeting of the

board of directors after receiving a communication from him at Washington, stating that he would accept the position.

Senator Payne's bill providing for an exhibit and appropriation for the session of the Mining Congress to be held at Goldfield this fall, passed the Senate March 3, and has gone to the House. The law creates a commission of three who shall collect mineral exhibits from the various parts of the State and carries an appropriation of $5000.

Indianapolis

March 15—The 20th annual convention of United Mine Workers of Indiana held a five-days' session at Terre Haute last week. Government ownership of coal mines as a solution of the problem of caring for disabled and worn-out miners was a proposition advanced by a number of delegates.

W. J. Woods, president of the Indiana Railroad Commission, addressed the convention, pointing out what the commission is doing to protect the lives of men employed about the railroad switches leading to the mines and elsewhere.

The convention emphasized the sentiment of breaking away from the old political parties and having labor demand that its own members represent it in public office. The miners are greatly disappointed over the rejection by the last legislature of bills introduced by labor interest.

W. H. Blatchley, State geologist, is in a quandary over the appointment of a State mine inspector. Under the new law 13 applicants took the first examination for appointment as State mine inspector and deputies and not one made the required grade of 85 per cent. Three of the number made grades of 80 per cent. The written examination covered questions relating to chemistry as applied to coal mining, mine engineering, and practical coal mining.

Among the applicants who failed to make the required grade were the present State mine inspector and his deputies, but Mr. Blatchley says the item of experience has not been sufficiently considered, and he believes when this is done a number of the applicants will have grades sufficient to comply with the law. Mr. Blatchley has submitted the matter to the attorney-general for an opinion.

Toronto

March 12—A return presented to the House of Commons at Ottawa, shows the approximate area of coal-mining lands in Saskatchewan to be 10,648 acres and in Alberta 373,691 acres. From payments for coal lands since Jan. 1, 1906, the government had received in Saskatchewan $22,786; in Alberta $1,116,413, and from coal royalties $22,300 in Saskatchewan and $23,514 in Alberta.

The situation in the Gowganda mining district during the early spring is likely to be serious, as between the breaking up of the winter roads and the opening of navigation some weeks must elapse, during which the new camp will be practically isolated. It is estimated that there are now upward of 10,000 people in the district, who unless extraordinary measures are taken to provide for them, may suffer for want of food. Every endeavor is being made to keep the line of communication open as long as possible and an immense quantity of freight is going into the country. The expense of freight is enormous, a rate of $50 per ton being charged from Charlton to Gowganda. Teams are hired at $15 per day.

The Canadian Pacific Railway has officially announced that, as soon as the frost breaks, a canoe freight route will be opened to Gowganda from a point on the line 35 miles west of Sudbury. As there are long stretches of lake navigation along this route, on which launches can be used, they will have, in addition to canoes, a number of launches for the heavier freight, putting horses on the portages to secure quick transhipment. The route is by way of Duncan lake, Shining Tree lake, Wapoose river and Montreal river.

Johannesburg

Feb. 25—Asbestos, of the chrysotile variety, occurs in many parts of South Africa, and the deposits of importance being opened up at present are situated in the Carolina district of eastern Transvaal, and the Victoria district, Rhodesia. The asbestos exported from Cape Colony is a fibrous amphibole. The Carolina company, controlled by one of the Rand's big houses, has issued a report showing that 281 tons of asbestos, mostly hand-cobbed, were produced during the last fiscal year. The profit of £20 may appear insignificant enough, but it compares favorably with the margin between revenue and expenditure declared by the majority of pioneer concerns floated in the outside districts during recent years. The crude produced is of good quality and 60 per cent. of it shows fibers over 1 in. long. Mining costs are naturally high, as the vein of productive serpentine averages only 2 ft. in thickness.

Yet another development record has been established. At the Van Dyk, in the East Rand, 323 ft. were driven in 62 shifts, with two 3½-in. Ingersoll-Sergeant machines. The ground, though deep, must have been especially favorable. Only 12 holes per round were required and each round, accounting for 5.21 ft. of average progress, required 44.3 lb. of blasting gelatine. It may be mentioned that the Brakpan company, which has done exceptionally speedy work in vertical and incline shaft sinking, is in the vicinity, and it would appear that the East Rand basin will, as a whole, be found cheaper to develop than other parts of the field.

The year 1908 has been anything but a prosperous one in the South African diamond mines, yet the fascinations of the work hold a large community of adventurers to the alluvial of the Orange River Colony, Griqualand West and the Transvaal. The relieving feature of the year's record has been provided by the new Harrismith diggings in the Orange River Colony. Mayer's Prospect has been proved rich and from a block 600 by 240 ft. in extent stones to the value of £30,000 are reported to have been won.

Paris, France

March 6—The study of the Lorraine coalfield has brought new facts to light. Borings undertaken at Gironcourt, near Mirecourt, have shown coal seams at a depth of 700 and 823 m. The first is 70 cm. thick, the second 60. Trias and Permian were only 270 m. thick at that spot, instead of 1020 m., as found by previous boring at Mont sur Meurthe. The belief is that it is the upper coal formation that has been struck. The coal producers in the north of France are striving to keep up the price of coal. The companies are divided into two groups; those that have joined the Douai Consortium and those that have not. The Consortium has lost ground in the East where German and Belgian coals are sold, but has succeeded so far in keeping up higher prices than the outsiders.

Official statistics of coal production for the departments of Nord and Pas-de-Calais show that the year 1908 holds the record, the coal mined being over 25,000,000 tons, against 24,000,000 in 1907. This result is remarkable since 1908 has been a poor year for the metallurgical industry. The output of both coalfields 10 years ago—in 1899—was 20,000,000 tons only. The advent of Belgian workmen is one of the chief factors in this increase. They bring in a reinforcement eagerly welcomed in France where the question of labor is often a hard one.

The Société des Gisements d'Or de St. Elie (French Guiana) made a profit of only 175,737 fr. in 1907-08. The company works its alluvial deposits of St. Elie and Dieu Merci on the leasing system, mines paying a royalty. In all, 244 kg. of gold have been saved, by the lessees. The Société des Mines de Zinc d'Ain Arko (Algeria) has just made its first report. On a capital of 1,500,000 fr. the profits amounted to 1,283,197 fr. This company proposes to pay 50 per cent. per share of 100 fr., having already repaid 25 fr. per share last year, and hopes to repay the balance of its capital at the close of the new year. It also expects to bring the output up from 12,000 to 15,000 tons. The concentrating mill built for dealing with calamine ores, which were not previously treated was put into commission in December last.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

BIBB COUNTY

At Centerville, recently, two of the men charged with firing into a train carrying non-union miners and guards at Blockton, during the strike last August, were tried and convicted. Mileto Papovitch was convicted of murder in the second degree and sentenced to three years at hard labor. Boris Dabovitch was convicted of murder in the first degree and sentenced to imprisonment for life. Both were defended by counsel employed by the United Mine Workers.

JEFFERSON COUNTY

The Alabama Consolidated Coal and Iron Company has filed a second mortgage on its properties to the amount of $5,000,000. Part of the money will be used in redeeming some of the outstanding bonds and part in improvements. The company is said to have sold a large quantity of iron recently.

The annual meeting of the Sloss-Sheffield Steel and Iron Company was held in Jersey City during the past week. Despite the fact that there was a great depression on last year, a surplus was reported. The same officers and board of directors were reëlected.

Alaska

Haines Mining and Milling Company—A Nissen stamp mill has been purchased for the mine back of Valdez. The officers report the possession of several ledges, the average value of which is about $30 per ton.

Mother Lode—George E. Baldwin has been appointed superintendent. He was formerly with the Guggenheim interests in charge of the Bonanza mines.

Arizona

GILA COUNTY

Inspiration Mining Company—Stockholders voted to amend the articles of incorporation, changing the name of the company to the Majestic Copper Company.

Cordova Copper—Henry B. Hovland, Hoval A. Smith and associates have arranged for the merger of the Eureka group of claims and the properties now owned and under bond by the Globe Consolidated Copper Company. The new company will have a capitalization of 300,000 shares, par value $10. One hundred thousand shares full paid Cordova copper stock will be issued for the 100,000 shares outstanding full paid Globe Consolidated Copper Company stock. There will be issued 125,000 shares, $2 first call and $8 per share remaining due, subject to the call of the board of directors. Part of this stock will be exchanged for outstanding Globe Consolidated stock, and 70,000 shares unissued and under option will remain in the treasury. M. E. McCarthy will have charge of the property.

GRAHAM COUNTY

Graham County—March 5, 1909, the legislature of Arizona passed a bill which provides that Graham county shall be divided into two counties and that the new county, Greenlee, which contains most of the mines of the district, shall bear all of the bonded indebtedness of the present Graham county, amounting to about $146,000. The new county is named for Mace Greenlee, the first prospector to explore the district. The southern half of the county will still be known as Graham county. The division takes effect Aug. 30, 1910.

Arizona Copper—Plans are being made to install an electric fire-alarm system at Clifton and Morenci. The production of copper for the month of February was 1273 tons.

Standard—A contract was recently closed with the Detroit Copper Mining Company whereby shipments of ore may be sent from Metcalf to Clifton *via* the Longfellow incline. The Arizona Copper Company will haul the ore from the incline to the smelter.

MARICOPA COUNTY

Vulture—Ten stamps of the old 80-stamp mill have been repaired and are now working on ore that is taken out in development work. Forty-five men are employed.

Arkansas

JOHNSON COUNTY

Little Rock Packet Company—This company, recently incorporated with a capital stock of $200,000 by W. M. Kavanaugh and associates, has closed a contract with W. H. West, of Coal Hill, Ark., for the lease of 1000 acres of coal land in the Coal Hill district. The lease is for 10 years, and contains an option by which the company may purchase the property. There is at present a mine in operation, producing from 400 to 500 tons of coal per day, and it is the intention of the lessee to continue developments.

California

AMADOR COUNTY

Argonaut—A complete change of management has been effected. J. W. Lilienthal is now president; B. F. Taylor, vice-president; E. V. Zumbiel, secretary; R. S. Rainford, superintendent. Rapid development is now expected to take place.

Central Eureka—The work being done in reopening the shaft is within 400 ft. of the bottom and it is intended to sink much deeper.

Kennedy—At this extensive property, Jackson, a fine orebody has been found on the 3150-ft. level. Some of the rock being taken out is exceptionally rich, and the average values are as good as those when the mine was first discovered.

CALAVERAS COUNTY

Easzy Bird and Peek Ranch—The people who have been bargaining for these mines have made first payment, and the deal has been closed.

Maine—At this old mine, West Point, a new shaft is being sunk by B. D. Porteous and D. O. Oliver.

INYO COUNTY

Estelle—This company is driving a tunnel near Keeler to cut a vein of silver-lead-copper ore. It will be 8000 ft. long and some 500 ft. have been driven. Machine drills are advancing the work at the rate of 10 ft. per day.

Lane—Reynolds & Peterson, of Darwin, are hoisting ore from the old workings of this mine.

Lost Burro—The first payment has been made. The operators will ship the high-grade ore while the mill is being built. Work will commence at once. The mine is in the Ubehebe district.

MARIPOSA COUNTY

Enterprise—At this property, near Hornitos, 12 men are at work taking out good ore, and the mill is kept at work steadily. New machinery is soon to be installed. F. H. McCall is manager.

SIERRA COUNTY

Snowden Hill—The new bedrock tunnel is being driven rapidly ahead and an upraise for the gravel will soon be made. The mine is owned by the American Mining and Development Company, and was one time known as the Jerry Watts placer. The property is seven miles from Camptonville.

Colorado

Lake County—Leadville

Vinnie—Another pocket of rich ore was recently taken from this property on Breece hill. The mine is worked from the Yak tunnel and the company has this month declared a dividend of 1 per cent., equivalent to $5000.

Butte—During the week a two-foot gold-bearing vein was encountered in the tunnel.

Buckeye—This section lies to the northeast of Leadville and the little work that has been done on the surface shows that the formation is the same as that of Breece hill. Indications are promising.

Dinero—The present drawback to the successful working of the orebody opened last September in the tunnel is the water that accumulated in the old workings when the property was idle. This is being obviated by the driving of three upraises. At present the company is shipping about four cars of ore per week and the smelter returns show 50 oz. silver per ton.

Bartlett Tunnel—Preparations are now under way to drive this tunnel in Sugar Loaf district several hundred feet farther into the hill. A body of ore running high in silver has been opened in one of the drifts. The new company that took hold of the property recently is known as the George Nash Mining Company.

Cleveland—The shaft is now 785 ft. deep, leaving 40 ft. still to be sunk to complete the contract of 200 feet.

San Juan County

Silver Lake—The electrical machinery at the mill has been completely overhauled and the mill will be started as soon as the crushing rolls are erected. There is a large quantity of ore in the bins.

Indiana

Sullivan County

A decree of foreclosure in favor of the First Trust and Savings Bank of Chicago has been entered against the Southern Indiana and Indiana Southern Coal companies. The mortgage indebtedness against the Indiana Southern Coal Company is $1,500,000, and that against the Southern Indiana Coal Company is $1,842,000. All of the properties of the two companies, including mines and lands in this and adjoining counties, are subject to the sale.

Warrick County

A 6-ft. vein of coal has been discovered two miles southwest of Booneville. The vein is about 50 ft. below the surface and roof conditions good. The farm of 225 acres underlaid with this coal belongs to Henry Korf, of Evansville. This is one of the richest finds made in this part of the State for some time. The length of the vein is unknown, but it is believed to extend over considerable territory.

Michigan

Copper

Quincy—The Pontiac or No. 9 shaft is down below the 300-ft. level and shows good copper-bearing rock. The land tributary to this shaft is being prospected by drifts from No. 8 shaft which are now within 800 ft. of the new shaft. The framework for a shaft house is on the ground.

Franklin—Sinking continues at No. 3 shaft on the Pewabic lode below the 700-ft. level. This lode is well mineralized at the drifts from the 22d and 23d levels of No. 1 shaft. All work on the Conglomerate lode is being centered in mining the previously blocked-out ore. It will take about a year to clean this all up.

Lake—Sinking continues at a depth of over 500 ft., and drifting is under way on the 410-ft. level. It is necessary to extend the workings to ascertain the value of the property.

Ojibway—The west bed of the Kearsarge lode opened at the 650-ft. level of No. 1 shaft is showing up well. At No. 2 shaft the crosscut from this same depth is nearing the lode and should encounter it about the same time that the shaft reaches the 800-ft. level.

Calumet & Hecla—The second portion of the regrinding mill will soon be ready to go into regular commission. Results that have been obtained from the first quarter of this mill are satisfactory.

Island Copper—This company has been recently organized under the laws of Michigan and will carry on operations in Houghton and Keweenaw counties, but principally on Isle Royal island. The company is capitalized at $1,000,000 with 40,000 shares of $25 par value, with offices at Houghton and Duluth.

Centennial—The annual meeting of stockholders will be held at Boston, Mass., April 6, 1909.

Missouri

Zinc-Lead District

Monticello—This company has incorporated with a capital stock of $100,000 to operate the Monticello mine at Prosperity. F. A. Brown, R. K. Pitkin, the manager, and Byron Bourne, all of Joplin, are the stockholders.

Myrick—This mill, southwest of Joplin has been destroyed by fire.

Montana

Butte District

Coalition—A station is being cut on the so-called 1700 level of the Tramway mine, which is in reality, about 1820 ft. below the surface. Production through this shaft averages between 600 and 650 tons daily, chiefly of ore mined from the Minnie Healy ground. The 1300-, 1400-, 1500- and 1600-ft. levels are being worked, the greater production coming from the 1400- and 1500-ft. levels. An electric tramway carries the ore from the shaft to the ore bins, a distance of about 200 ft. The Rarus mine is producing about 850 tons daily.

Deer Lodge County

Southern Cross—Shipments of ore have recently been resumed. Twenty men are employed. With the advent of more favorable weather the stamp mill on the property will be put in operation.

Oro Fino—Anderson & Boscum have a lease on this claim, situated near Georgetown, and have shipped five cars of ore since the first of the year. The gold-bearing ledge is being worked through a tunnel.

Fergus County

Barnes-King—About 120 men are employed. During the past 12 months the mine has been operating with a net profit of from $1000 to $5000 per month. The management states that during February the bullion produced amounted to $25,000 and the operating expenses to about $15,000.

The annual meeting of the stockholders was held at Kendall, Mont., March 3. The following directors were elected: John Gillie. C. W. Goodale, Donald Campbell, L. O. Evans and Phil. C. Goodwin, all of Butte; W. H. A. Fischer, New York City; John L. Bright and Wilfred Johnson, of Lewiston, Mont.

Granite County

Senate Group—An order of court has recently been made approving the sale of the property, situated in the Moose Lake district, to George M. Bourquin, of Butte. The sale was made by the executor of the estate of Ernest Cranmer.

Jefferson County

Corbin Copper Company—The management states that in the three tunnels on the Anna, Rosalie and Dewey claims, an average of 12 ft. advance is being made daily. About 50 men are employed.

Boston & Corbin—The shaft has reached the 700-ft. mark and is being enlarged from two to three compartments. A crosscut from this level will tap the vein 200 ft. below the present workings.

Roymond Mining Company—The property is situated three miles east of Clancy and carries gold and silver. The management states that they plan to resume operations early in the spring.

Lewis and Clark County

Souvenir Gold—At a meeting of stockholders held last week the proposition of J. H. Simpson for a reorganization of the company was accepted. The present

company is capitalized at $300,000 with 1,200,000 shares of the par value of 25c. each. The proposed company will have the same capitalization, but with 300,000 shares of the par value of $1.

Nevada

Churchill County—Jessup

Rochelle Mine—A strike is reported on this property, owned by Messrs. Rice and Bailey. The vein, which is two feet wide, shows free gold. A shaft has been started and a hoist will be installed.

Eureka Mine—Messrs. Ratcliffe, Mack and Loose, owners of this group have a shaft down 130 ft. from which a drift has encountered ore. The ore is being sacked for shipment and a power hoist is to be installed.

Esmeralda County—Goldfield

Goldfield Consolidated—A strike of large proportion is reported on the 600-ft. level of the Mohawk. The vein is said to have a width of 40 feet.

Combination Fraction—The output was slightly over $40,000 for the month of February. The mine is in good shape with a number of available stopes.

Esmeralda County—Atlanta

Fairview-Cherokee Lease—An 18-ft. ledge of quartz has been opened on the 500-ft. level. The ore is not of a shipping grade, but it is improving as drifting goes on.

Esmeralda County—Hornsilver

Orleans Mine—Small shipments continue regularly. The new, vertical, working shaft recently started, disclosed an ore shoot 10 ft. wide at the 65-ft. level, from which ore is now being taken. A gasolene hoist will be installed at once.

Hornsilver Mining Company—H. B. Taylor, of the Goldfield Engineers' Lease and Geo. B. Holleran will resume operations. The old hoist will be moved to the shaft on the Cable Lease, which will be sunk to the 300-ft. level before any laterals are run.

Esmeralda County—Rawhide

Coalition Estate—There are now 40 leases in operation on this property. Ten are making regular shipments. Nineteen hoists are in operation and large bodies of milling and shipping ore are being developed.

Lander County—Hill Top

Hill Top Mine—This property is about 20 miles southeast of Battle mountain. The first shipment consisted of two tons of selected ore that netted over $2 a pound after deducting all expenses. The district is not yet three months old and already has several properties shipping. A controlling interest in the Hill Top was recently sold to P. J. Queely, a coal operator of Rock Springs, Wyo., for $110,000.

Lincoln County

Pioneer Oil—Operations are at Indian Springs, about 20 miles from Las Vegas, Nevada. A drilling outfit costing $6000 has been purchased and will be placed in service at once.

Nevada Oil—This is a new corporation, with a capital stock of $100,000. The company owns 24,000 acres of oil land near Indian Springs. The officers are: Frank Oliver, president; F. A. Lucy, vice-president and treasurer; A. J. Sommers, secretary; Ira McFarland, general manager. Headquarters will be maintained at Goldfield.

Nye County—Tonopah

Montana-Tonopah—The new refinery was completed last week and the first run was made March 3. The product representing a 15 day's cleanup was 21 bars of bullion weighing 90 lb. each. During the week 790 tons of rock were crushed, 235 tons of which came from the MacNamara. An unusually large amount of development work was performed during the week.

Jim Butler—S. H. Brady, formerly of the Belmont, was appointed superintendent of the property and took charge March 1, filling the vacancy made by the resignation of Alex Johnson. It is reported that extensive development work will be carried on from both the Stone Cabin and Wandering Boy shafts.

Storey County—Virginia City

Sutro Tunnel—The fire of two months ago resulted in great damage to the tunnel. A heavy cave has taken place destroying the stave pipe which was at that time being installed, thus seriously retarding the flow of water. The flume underneath the track, instead of being cleaned out by the greater pressure of water has become clogged and 50 men are now working six-hour shifts in the endeavor to remedy matters. At the time of the fire, the water was held below the 2450-ft. level, but now the 2400-ft. level is flooded and the water is still rising. An effort is being made to prevent its rise to the 2350-ft. level where there are a number of expensive pumps, hoists and other machinery.

New Mexico

Grant County

Monte Cristo—Returns from the first shipment of ore from the Pearl mine at Sylvanite yield $320 per ton. The Monte Cristo is a new company, the officers of which are: H. J. Bowles, president; H. W. Baylor, vice-president; D. W. Barnhill, secretary and treasurer; all of Uvalde, Texas.

Mogollon Gold and Copper—A reorganization has been effected. The new officers are Frederick M. Seward, Goshen, N. Y., president; W. B. Royce, Middletown, N. Y., vice-president; Frank P. Jones, Silver City, secretary and treasurer.

Grant County Telephone—This company has just completed its line to the Mogollon, connecting with all points of importance between that district and Silver City.

Oklahoma

Pittsburg County

On Feb. 23 there was an explosion in mine No. 8 of the Rock Island Coal Company by which nine men were hurt. Later H. C. Booth, general manager; Robert Pickett, superintendent, and James Curran, pit-boss, were arrested and held for trial on complaint of Peter Hanraty, district mine inspector. He charged that the men were allowed to go to work there and to fire their own shots which, he says, was a clear violation of the law.

Oregon

Josephine County

Oriole Gold Mining Company—This company, capitalized at $1,000,000, has just been organized; the home office is at Salem. The president is B. F. Rowland; vice-president and general manager, J. C. Mattison; secretary, O. S. Blanchard; treasurer, G. W. Donnell.

Lane County

West Coast—A gold brick worth $5000 was shipped to San Francisco as part of the February clean up. Ten men are now steadily employed in the mines; the future looks bright and prosperous. More men will soon be put to work blocking out ore in the tunnels.

The present company is the reorganization effected when the Oregon Securities Company failed. Mr. Ryan is superintendent.

St. Peters Creek—A. P. Churchill, owner, near Bohemia, has discovered an ore vein that pans well in gold. The property is only a prospect. The ledge is about 4 ft. wide. Its extent has not yet been ascertained.

Martin Creek—S. H. Burghardt, manager, reports some fine ore in the tunnels. Work has been in progress all winter, and it is reported that a plant will be installed in the early summer.

Combination—Good progress is being made with the development work, and as soon as the roads are better so as to make freighting possible they will build a concentrator. Some very rich silver ore has been found lately.

Golden Rule—Good work is being done on this property near Bohemia, and the company is now applying for a patent to its mining claims. It has made ar-

rangements for the capital needed to install a complete mining plant, concentrator and sawmill.

Pennsylvania

Anthracite Coal

Philadelphia & Reading Coal and Iron Company—The statement for January and the seven months of the fiscal year from July 1 to Jan. 31 is as follows:

	January.	Seven Mos.
Earnings	$3,072,526	$20,305,654
Expenses	2,959,817	19,130,351
Net earnings	$ 112,709	$ 1,175,303

For the seven months there were decreases of $3,838,845 in earnings; of $3,011,298 in expenses; and of $827,547 in net earnings.

Bituminous Coal

J. V. Thompson, representing Pittsburg parties, has bought a tract of 5485 acres of coal land near Waynesburg, in Greene county. It is said that the land is to be developed soon.

South Dakota

Custer County

The mica mine of the Westinghouse Electric Company at Custer has temporarily suspended operations.

Lawrence County

Gold Eagle—A two-compartment shaft is being sunk on its main orebody. The shaft starts from the end of a 360-ft. tunnel and the contract is let for 500 ft. Crosscutting will begin at the 100-ft. level.

Golden Girl—Development work is shortly to be started. A number of prospect shafts will be sunk upon the exposed ledge in order to determine the best location for a permanent shaft.

Gold Dollar—This company expects to build a 100-ton cyanide mill, commencing work this spring. The property has been well developed.

Homestake—Preliminary work has commenced upon the 1700-h.p. hydroelectric plant at Spearfish creek. At least two years will be required for its completion.

Utah

Beaver County

Mammoth—A drift from the 60-ft. shaft shows a 4-ft. ledge on a lime-granite contact. The ore carries lead, gold and silver.

Salt Lake County

Dalton & Lark—The machinery is being overhauled and repaired and the pipe line over the hill will be placed in the Mascotte tunnel. It will probably be a month before the mine is in shape for active development.

Yampa—The smelter produced 5,500,000 lb. of copper during 1908. The plant is now producing about 1,000,000 lb. of copper per month at an estimated cost of about 8c. per pound.

San Pete County

Golden Reef—When the shaft reaches a depth of 250 ft., a crosscut is to be run to explore the vein encountered above.

Virginia

Washington County

Virginia Iron, Coal and Coke Company—Material for relining and otherwise repairing the blast furnace at Bristol has been received. The repair work will cost $75,000.

Washington

Kittitas County

Skookum Copper—The Government has granted this company, operating in the Cle Elum district, permission to cut all timber required in constructing 16 miles of wagon road to the mine, and its new 250-ton concentrating plant. Work is progressing rapidly.

Snohomish County

Wayside—This mine, near Granite Falls, under the management of Receiver Ned Hawkins, has encountered an orebody in the seventh level by a crosscut 12 ft. from the bottom of the shaft. The exposure shows 2 ft. of good ore. At the present time the deepest working is 500 ft. below sea level.

West Virginia

Braxton County

Cosmopolitan Coal and Coke Company—A controlling interest in this company has been sold to S. P. Boyd, representing Pittsburg parties. It is reported that the transfer is in the interest of the Steel Corporation. The company owns 11,600 acres of land in Braxton county, running over into Marshall county. It has a mine and coke plant at Gilmer.

Wisconsin

Zinc-lead District

Highland—Jack and bone were struck at a depth of 37 ft. on the Whalen farm, two miles southeast of the village; the ore occurs in a disseminated vein and is a continuation of the Burrichter range. A deposit of white bone is being developed on the Manning property two miles west of Highland. In prospecting on the Tormey lot of the famous Crooked End, the Highland Mining Company struck 2 ft. of bone. This company is also prospecting on the Whalen 80, north of the village. Both of the company's mills have been idle for two months, but the smaller plant will start running next week. The Franklin has opened up a rich deposit of bone on the Leuke tract; the company has over 600 tons of this ore in surface dump and will begin milling as soon as the weather settles.

Platteville—The Wisconsin Zinc Company will construct a mill on the Mitchell Hollow some time this spring; the ore has been crosscut 50 ft., the main sheet measuring 8 to 12 in. thick. The Gogebic, just west of the Kohinoor blende, will be opened up by shaft. The Homestead has completed its roasting plant. Over 500 tons of green concentrates are accumulated in the bin. Shipments from Platteville have been light the last three weeks, on account of bad roads. A few companies are holding for better prices, among them the Wisconsin Zinc Company, which alone has 1000 tons of green concentrates in bin.

Rewey—Mifflin—The shaft on the Ellsworth land reached the top of the pitch at 82 ft., showing lead and jack in sheet form. The Big Tom has completed shaft-sinking at 115 ft. and is following a 4-in. sheet of jack and lead toward drill holes which indicated a heavier deposit. The 50-ton mill on the Squirrel has been completed; the mine has a 14-in. sheet of jack. The Union Zinc Company has connected its new shaft and mill by 300 ft. of tram and will resume work in mine and mill. The mines in this camp which are producing regularly include the Coker, Sunrise, Senator, Gruno, Peni, Peacock and Slack; 50 per cent. of the production goes to the separating plants at Platteville and Galena.

Canada

Alberta

The population within a radius of 15 miles of Frank, in southwest Alberta, is estimated at between 9000 and 10,000. Farther north, within a similar radius of Bankhead, there is a population estimated at about 5000. In both districts coal mining is the chief industry, and its development in recent years has brought in the larger part of the population.

The joint meeting of representatives of the Coal Mine Operators Association of western Alberta and eastern British Columbia, and the United Mine Workers of America, recently opened at Macleod to formulate a new agreement to take the place of that to expire on March 31, has been adjourned until March 16, to allow F. H. Sherman, president of the local district of the mine workers to take an active part in the provincial election campaign now in progress.

British Columbia

Official figures, compiled from returns received, show that the correct production of coal and coke in 1908 was practically as stated in the estimate published in the Journal of Jan. 30. The revised figures show the production of coal to have been

1,678,000 long tons and of coke 247,400 tons.

The quantity of ore produced in the Boundary and Kootenay districts during the months of January and February was: Boundary district, 258,000 tons; East Kootenay, 17,000; West Kootenay—Ainsworth & Slocan, 16,500; Nelson, 9500; Rossland, 32,000; total 333,000 tons. This includes copper, gold and silver-lead ores.

Crows Nest Pass Coal Company—At the annual meeting held in Toronto March 12, sweeping changes were made in the directorate. G. G. S. Lindsey, president and managing director; Hon. Robert Jaffray, vice-president; E. R. Wood and Sir Henry Pellatt all declined reëlection. The new board of directors consists of Elias Rogers, Toronto; Colonel Clough, New York; J. P. Graves, Spokane, Wash.; W. F. Robertson, Granby, B. C.; E. C. Whitney and H. B. McGiverin, Ottawa, and R. N. Young, Toronto. Mr. Young is secretary. It is understood that Sir Henry Pellatt has sold his large block of stock in the company to James J. Hill, so that the control now rests with the Great Northern Railway and the Granby Copper companies.

British Columbia—Vancouver Island

Two new coaling ports are to be established on the east coast of Vancouver island—one at Boat harbor, about six miles north of Oyster harbor, which is the shipping port of the Wellington Colliery Company's Extension mines, and the other at Hardy bay, in the northern part of the island. The South Wellington Coal Mines, Ltd., George Wilkinson, Nanaimo, superintendent, has opened a coal mine near Nanaimo, and is installing a tipple of 1000 tons daily capacity, constructing a tramway seven miles to Boat harbor, and erecting bunkers and loading plant at the shipping point. The Hardy bay port is required chiefly for the shipment of coal from mines being opened in its vicinity, both on Vancouver and Malcolm islands.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ended March 6 were: Buffalo, 45,210 lb.; Chambers-Ferland, 60,000; Crown Reserve, 62,220; City of Cobalt, 75,000; Coniagas, 62,500; La Rose, 105,000; Nipissing, 384,410; Peterson Lake, 51,400; Temiskaming & Hudson Bay, 60,000; Trethewey, 60,000; total, 1,055,740 pounds.

Dividends—Recent dividends of Cobalt companies are: City of Cobalt, 3 per cent., quarterly, April 15, on the new capitalization of $1,500,000. Crown Reserve, 6 per cent. quarterly and 9 per cent. bonus, March 31. Temiskaming, 6 per cent., quarterly, April 1.

Chambers-Ferland—In crosscutting at the 80-ft. level in No. 2 shaft a new Cobalt vein was encountered March 11, which is 4 to 6 in. in width. Considerable high-grade ore is being extracted at the 150-ft. level of No. 1 shaft, where drifting north and south is being carried on.

Columbus—A 2-ft. body of galena has been encountered at a depth of 250 ft., and 51 ft. east of the shaft.

Hargrave—A tunnel is being driven in to cut a strong vein known as the West Center vein, being started about 100 ft. below the apex of the vein. A shaft has been put down 170 ft., from which a crosscut will be run to strike the rich No. 3 vein of the Kerr Lake, which runs into the Hargrave location.

Station Grounds—This company has commenced operations from the main underground workings of the Cobalt Lake Company with power supplied by the latter.

Mexico

Chihuahua

American Smelting and Refining Company—Three furnaces are in blast at the Chihuahua smelter. It is stated that owing to the diversion of ore hitherto going to the El Paso plant, makes necessary the early erection of two additional furnaces whereby the plant's capacity will be about 1250 tons daily.

San Toy—Shipments have been curtailed on account of fire destroying the lower tramway terminal and it will be several weeks before normal production will be resumed. During the last few weeks the average grade of the ore has been somewhat higher, due to opening the new orebodies.

Dolores—The recently published annual report shows the earnings for the year ending June 30, 1908, to have been $360,359, the total income being $863,096 and the total expenditures $502,737.

Hidalgo—This Parral company has purchased the Nopal mine on the Veta Colorado lode. This acquisition is important inasmuch as it gives the company a mile of connected workings. Experiments are now being prosecuted with the view of erecting a cyanide plant. James I. and R. J. Long are at the head of the enterprise.

Mines of Mexico—Plans are announced for the installation of a large electric power plant utilizing the waters of the Mayo river in the Sierra Madre mountains. The company has a large mineral and timber tract in the Los Otates section. The control of this company is in the hands of Denver men, among whom are W. G. Boyle and W. O. Temple.

Mexican Northern Electric—This is a Canadian concern, lately organized in Montreal for the development of electric power throughout Mexico, and especially the La Joya site on the Conchos river. The largest stockholders are to visit Mexico during March.

International Oil and Gas—This Indianapolis company expects to begin active drilling operations on its concessions in eastern Chihuahua. The managing director, G. A. Deitch, general manager, A. M. Nelson and secretary, C. R. Troxel are now on the ground.

Sierra Madres—An unfortunate water shortage is reported in the western part of the state. The Otates and Santa Brigida mines have closed down and others, including the Rio Plata and Watterson, are using, to full capacity, their auxiliary steam plants. It is a number of years since so dry a season has been known and with the very light snowfall the indications are that the summer's operations at a number of mines must necessarily be curtailed.

Rio Plata—The report of January operations is as follows: Net returns on shipments, $27,568; concentrates production, 60,190 ounces silver; operating expenses, $8270; paid on account mine indebtedness, $19,298, leaving a total mine indebtedness Feb. 1 of $71,434. The power plant will be in readiness early in April when the completed cyanide plant will start on the accumulated tailings.

Parral Production—The output of the Parral camp for the week ending Feb. 26 was 9855 tons and for the following week 9390 tons. The February output was 45,000 tons as compared with 43,574 tons for January.

Sonora

Greene Gold-Silver—The directors, who are being sued by the New York State receiver to recover something like $49,000 in dividends alleged to have been paid out of assets, have put the company into bankruptcy in West Virginia, where the concern is incorporated.

Martin Conboy of counsel for the directors said yesterday that the Federal bankruptcy proceedings would in no way interfere with the action of creditors against the directors. The directors in their answer to the New York State receiver's suit have taken the ground that in declaring dividends they acted on information of the company's condition supplied by Colonel Greene and the proper officers of the company, which they believed to be correct and given in good faith.

New Caledonia

Exports of ores from New Caledonia for December and the year ended Dec. 31 are reported by the *Bulletin du Commerce*, of Noumea as follows, in metric tons:

	December.	Year.
Nickel ore	5,115	120,028
Cobalt ore	.....	3,405
Copper ore	.....	10
Iron ore	10	64
Chrome ore	...	46,309

In addition there were reported for the year shipments of 5 tons lead and 5020 kg. silver.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 17—The coal trade in the West is beginning to take on a more hopeful tone. This is a result of increased orders for steam coal which have appeared in some quarters. Mines are generally making better time, though shipments to consuming centers are still restricted in order to prevent accumulations which will reduce prices.

The bituminous trade in the East is beginning to wake up a little, though it is still inclined to be rather irregular. However, taken as a whole, an improvement is manifest and there is little doubt that more coal has been sold.

The anthracite trade depends entirely on the negotiations for a renewed agreement. Just now everything is in the air, and the miners and operators alike are uncertain whether there will be a general stoppage of mining or not. Opinions vary widely and there is really nothing to base positive predictions upon. Notes on the situation will be found on another page.

The coke trade has had rather a setback, the increase in production having called out a larger supply than was really needed at the present time.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 6, short tons:

	1908.	1909.	Changes.
Anthracite	941,086	838,722	D. 102,364
Bituminous	6,869,931	6,157,234	I. 287,303
Coke	1,302,635	1,799,500	I. 496,865
Total	8,113,652	8,795,456	I. 681,804

The total increase thus far this year was 8.4 per cent.

Coal and coke tonnage, Chesapeake & Ohio railway, seven months, July 1 to Jan. 1, short tons:

	Coal.	Coke.	Total.
New River	3,849,142	135,529	3,984,671
Kanawha	3,068,051	17,689	3,085,740
Kentucky	210,232	.....	210,232
Connecting lines	151,995	44,489	196,484
Total	7,279,420	197,707	7,477,127
Total, 1907-08	6,855,741	224,860	7,080,601

Deliveries this year to points west of mines, 3,816,156 tons coal and 116,834 coke; points east, 905,101 tons coal and 80,873 coke; tidewater, 2,552,911 tons coal; anthracite to line points, 5252 tons.

Shipments of coal for the year ended Dec. 31 from the Cumberland region—including the North Potomac basin—are reported as follows: Baltimore & Ohio, 2,554,779 tons; Pennsylvania Railroad, 354,613; Western Maryland, 1,886,257; Chesapeake & Ohio Canal, 190,336; used at mines and sold locally, 798,606; total, 5,784,591 tons. The total in 1907 was 7,360,336; the decrease last year, 1,575,745 tons, or 21.4 per cent. The largest shippers in 1908 were the Consolidation Coal Company, 1,938,569; Davis Coal and Coke Company, 1,765,789 tons.

New York

March 17—The anthracite trade is quiet so far as domestic sizes are concerned. The strike talk has produced much uncertainty, but everyone believes that the companies have sufficient stocks of the large sizes to carry them through. Steam sizes, on the other hand, are scarce and in demand. Consumers of these sizes are anxious to put in stocks ahead if possible, but the production has been moderate for some time, and the companies are holding back considerable quantities at the mines in order to be supplied with fuel for pumps, etc., in case of a stoppage.

The usual April discount of 50c. has not been announced and probably will not be until something definite is known. Prices continue nominally unchanged, but dealers and agents are getting from 5 to 15c. per ton advances on pea and buckwheat. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal market is not exciting. There has been a little improvement, but it is irregular and trade is very bunchy. Nevertheless, there is an improvement which is noticed most by the commission houses. Orders are generally for as quick delivery as possible, indicating that stocks are low. Some more contracting has been done, but slowly and with a good deal of dickering. A number of contracts are about 25c. below last year. The best trade just now is coming from the Sound, but the far East is reported to be pretty well cleared out of coal.

All-rail trade continues to hold its own fairly well. Transportation is fully up to schedule and car supply abundant. New York harbor is a little irregular, but prices remain unchanged at $2.40@2.50, f.o.b. harbor shipping points, for good steam coal, with lower grades about 20c. less.

In the Coastwise trade vessels are slowly coming out of winter quarters and captains are actively hunting for charters, which has brought about a decline in rates to a very low point. We quote for large vessels from Philadelphia: To Boston, Salem and Portland, 70c.; Lynn and Bath, 75c.; Portsmouth, 75c.; Newburyport, 80c.; Providence, New Bedford and the Sound, 55c. The peg of 75c. for around Cape Cod has at last been removed.

Birmingham

March 15—The coal trade in Alabama continues dull with no indications of an early improvement.

During the past week State Mine Inspector Flynn gave out some official figures as to the coal production in Alabama during 1908. A few mines are yet to be heard from which, it is estimated; will add about 500,000 tons to the figures now worked up. The figures in hand already total 10,474,591, against 14,424,863 tons in 1907. There were 118 men killed in the coal mines of Alabama during the year.

The coke production, which was reduced a few weeks since, will shortly be started up again, several batteries of ovens resuming operation shortly. The Tennessee company still has a large quantity of coke stacked up.

Chicago

March 15—Firmness exists in all branches of the coal trade. For steam uses both Western and Eastern coals find a quietly improving market; the domestic trade has dwindled to a condition of week-to-week supply. The market is notably bettered as to demurrage troubles. Little coal is depressed by reason of too great shipments and forced sales.

Contract business shows fair bookings to date, but the old trouble exists in the realization by consumers that retail prices will probably continue low because of large production and relatively small consumption. Fine coals show stronger tendencies with the advance of spring conditions.

Prices show little change. Illinois and Indiana lump and egg is quoted at $1.75@2.40; run-of-mine at $1.60@1.75 and screenings at $1.25@1.55. Eastern coals show a firmer tendency; smokeless Pocahontas and New River lump bringing $3.15@3.45 and run-of-mine $2.85@3.15; lower-grade smokeless sells for $2.95@3.30, lump or egg, and $2.85@3, run-of-mine. Hocking coal has been withheld from this market, with the result that it is made firmer,

selling for $3@3.15. Youghiogheny is quiet and steady at $2.15 for ¾-in. gas, and Pittsburg No. 8 brings $2.75@2.85 for the same size.

Anthracite is very dull. The threats of labor troubles have not yet affected the market.

Cleveland

March 16—Prospects are not good for an early opening of Lake trade. Reports from the Northwest are that there are still large stocks of coal, which are being drawn on very slowly. Shippers are holding back on charters until they can get some line on probable demand.

Local coal trade is dull and there is a surplus supply, which has made prices weak. Eastern Ohio ¾-in. can be had around $1 at mine, and slack at 55c. Some sales of slack are reported at 50c. at mine.

Indianapolis

March 15—The most encouraging feature of the coal-mining industry in this State is the increasing demands for coal, which kept the mines running more regularly during the past week than for some time. This condition has occasioned the operators to become more optimistic. There is little or no fluctuation in prices and no attempt is made to secure large contracts by shading prices at the mines. The loss of a large amount of Pennsylvania coal by the sinking of barges in the Ohio river near Evansville, has occasioned quite a stiff demand for Indiana coal to supply the demand for lower river towns.

Pittsburg

March 16—Few mines in the district, outside of the river mines, are running more than three days a week, and production at the railroad mines in the district is estimated at about 30 per cent. of capacity. No large contracts have been made, and orders are for small tonnages compared to the buying formerly at this season of the year. Prices are being firmly held by the large producing interests on the basis of $1.15 for mine-run coal at mine. This price, however, has been shaded by small operators. The river mines continue to run full, and there are plenty of empty coal boats and barges. Several tows were sent out during the week, cleaning up all the coal that was ready for shipment.

Connellsville Coke—There is no improvement in the trade. Lower prices are being quoted, but this has not induced buying. Sales of spot furnace coke have been made as low as $1.50, but on contract the price is being held by large producers at $1.75. Foundry coke for prompt shipment has declined to $1.90, and it is believed contracts can be made at that rate until July 1; but the regular contract quotation ranges from $2@2.15. The *Courier* gives production in both fields at 260,987 tons. The shipments were 9427 cars as follows: To Pittsburg district, 3138; to points west of Pittsburg, 5543; to points east, 746 cars.

Foreign Coal Trade

Austrian Coal Trade—Imports and exports of fuel in Austria-Hungary, year ended Dec. 31, metric tons:

	Imports.	Exports.	Excess.
Coal	9,995,289	768,445	Imp. 9,226,844
Brown coal (lignite)	30,432	8,596,104	Exp. 8,565,672
Coke	851,098	183,278	Imp. 667,820
Briquets	106,516	100,264	Imp. 6,252
Total	10,983,335	9,648,091	Imp. 1,335,244
Total, 1907	10,538,619	10,140,841	Imp. 397,778

The total increase in imports in 1908 was 4.2 per cent.; the decrease in exports, 4.9 per cent.

French Coal Production—Output of the Nord and Pas-de-Calais—the two chief coal-producing districts of France—for the full year was, in metric tons:

	1907.	1908.	Changes.
Coal mined	24,738,628	25,521,605	I. 782,977
Coke made	1,946,757	1,781,347	D. 165,410
Briquets made	1,191,297	1,339,817	I. 148,520

Of the coal mined in 1908 the Nord furnished 6,963,774 and the Pas-de-Calais 18,557,832 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 6; Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.86. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 17—The iron and steel markets generally have lapsed into rather a waiting condition. While price considerations have more immediate effect than the tariff revision, there are quite a number of buyers who deem it prudent to wait until something definite is known. No one expects that there will be any heavy importations of iron and steel, but the reduction of the tariff may have a considerable effect upon prices. The first draft of the new tariff bill, made public today, proposes large reductions in duties on pig iron and steel, and a removal of the duty on iron ore. These changes had been expected.

Pig iron has been more active and quite a number of contracts have been placed for foundry and basic. These are being generally taken at a reduction, mostly for immediate delivery, very few of them running beyond June. Southern furnaces have been rather scrambling for orders, and several contracts have been reported taken at $11.50 and even $11 Birmingham, for No. 2 foundry. On the other hand, some of the large companies have declined to take less than $12, Birmingham. Virginia furnaces have also cut the prices, but Northern merchant furnaces are rather inclined to hold back.

Finished material has been only moderately active, with the exception of structural steel. A number of contracts have been placed for building material and there seems to be a general disposition to go ahead with bridge and building projects.

The Pennsylvania and the Maryland steel companies have announced reductions of 10 per cent. in wages. It now seems probable that other companies will follow the same course. The Steel Corporation has made no announcement as to its intentions.

Iron-ore Movement—Imports and exports of iron ore in the United States, month of January, long tons:

	1908.	1909.	Changes.
Imports	67,659	105,233	I. 47,574
Exports	5,463	4,225	D. 1,238

Of the imports this year 70,525 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore in January, 35,019 tons in 1908, and 14,942 in 1909; decrease, 20,077 tons.

Baltimore

March 16—Exports from the port of Baltimore for the week included 876,646 lb. scrap tin to Rotterdam. Imports included 1061 tons ferromanganese and 125 tons manganese ore from Liverpool; 119 tons manganese ore from Rotterdam; 7581 tons pyrites from Spain; 10,100 tons iron ore from Cuba.

Birminghan

March 15—There is a better sale of iron going on in the Southern territory, but the market is still quiet. There is some improvement noted. Quotations are still weak—$12 per ton, No. 2 foundry—but hardening, though there is a report that one or two companies are still selling under that figure. One or two companies are holding out for $12.50 per ton. The cast-iron pipe concerns in this territory have a large amount of business in hand and have recently received other orders that warrant a steady operation through the balance of the year and longer. The pipe makers have been the best patrons in the last few months of the Southern furnaces. There has been no reduction in the make of iron in this district.

All kinds of reports are current in reference to the Ensley steel plant of the Tennessee company, shutting down April 1. There is no denial or verification. There is some accumulation of steel, though it is understood that the rolling mills of the company at Bessemer, Ala., will resume operation shortly and will use considerable steel.

Chicago

March 15—The iron market is gradually assuming confidence as regards manufactured products, and is buying well. As regards pig iron only slight improvement is

visible; the ordinary consumer prefers yet to buy from hand to mouth. He will not take, as a rule, more than a carload to 200 tons at a purchase, and he will not buy even so small an amount unless he can see use for the iron within the next three months. This condition seems bound to continue, for the subject of tariff legislation seems to be uppermost in the minds of all melters of iron. They are speculating little on possible changes.

Prices remain vague. Some Southern iron is said to have sold below $12 Birmingham ($16.35 Chicago), but that figure is still quoted nominally and doubtless represents some transactions. Northern at $16.50 remains firm in general: special contracts may receive lower quotations, but not the average consumer. Business for the second half is generally regarded as non-existent. Lake Superior charcoal sells for $10.50, with fair demand.

Coke is somewhat firmer, the best Connellsville bringing $4.85 with shipments well held down.

Cleveland

March 16—Nothing definite has yet been done about ore prices. Some small sales have been made by an outside interest at last season's prices, but this is not considered as of importance, so far as the general market is concerned.

Pig iron is dull, and only some small local sales have been made, chiefly of foundry. Prices have been around $16, Cleveland, for No. 2 foundry, and $14 for gray forge.

In finished material business is growing, and a number of transactions are reported. Individual orders are not large, but the aggregate is increasing considerably.

Philadelphia

March 17—The past week has been almost lifeless, so far as pig iron is concerned. A few of the larger consumers, among which were several foundry interests, made propositions a week ago to buy special iron but withdrew them suddenly. Makers of pig iron are showing a desire to secure business, but are not able or willing to make any further concessions than those announced two weeks ago. The forge iron buyers are absolutely out of the market.

Steel Billets—The reduction in steel billets has led to the opening of negotiations or inquiries as to how far ahead manufacturers will be willing to make deliveries if orders are placed at this time.

Bars—Steel bars have been selling somewhat better within the past week and mills are now running on fair sized orders. There is also some additional business in common iron for the general trade: refined is weak and quotations are 1.45@1.50c. Common has sold as low as 1.20@1.25c., tidewater.

Structural Material—Apart from some little inquiry nothing of importance has been done in this market in structural material.

Scrap—There is no activity and stock is accumulating. Several dealers are making efforts to get all the heavy cast scrap and railroad scrap they can get. Prices are weak.

Pittsburg

March 16—The unexpected determination of the Steel Corporation, through its tinplate subsidiary, to cut prices $5 per ton which was reached during the week after a careful consideration of the situation undoubtedly will prove of benefit to that interest. The independent concerns, however, were opposed to the cut and contend that it will seriously affect their trade unless a corresponding cut is made in tinplate bars. The recent cut in bars was but $2 per ton, making the price $25.50 delivered in Steubenville, Wheeling, Sharon, McKeesport and adjacent territory. If this rate is lowered it will be necessary to reduce steel billets, the price of which was fixed at $23, Pittsburg. To lower the billet price would increase the differential between billets and steel rails. Producers declare positively that these prices will not be disturbed, and that when the tariff legislation is ended conditions will immediately begin to improve.

As a result of the cut of $5 per ton, or 25c. a box, in the price of tin and terne plates the American Sheet and Tin Plate Company is preparing to start a number of idle mills. It has been running 164 tin mills for several weeks, and on Monday will increase the active mills to 213, the highest number operated in two years.

In finished steel the Carnegie Steel Company has taken on considerably more business since the readjustment in prices, and its capacity is being increased. One of the two new blast furnaces which were added to the Duquesne group was blown in this week, and the other will be started in a short time. The company is now operating 35 of its 59 blast furnaces. Rail business is dull, and the three mills at the Edgar Thomson works are only being operated at about 40 per cent. of capacity.

Pig Iron—The market is practically dead, and unusually low prices are being named in order to induce buying. Some furnaces are quoting standard bessemer at $14.75; malleable bessemer, basic and No. 2 foundry at $14.50; gray forge at $13.50, all at Valley furnaces. Other quotations are 25c. a ton higher, but there have been no sales of any consequence outside of one lot of 1000 tons off bessemer bought by the Westinghouse Air Brake Company at $14.60, Valley.

Steel—Sales are light and prices unchanged as follows: Billets, $23, Pittsburg; sheet-bars and tinbars, $25.50; merchant-steel bars, 1.20c., and plates, 1.40 cents.

Sheets—Some new business is being placed at the ruling quotations, which are 2.30c. for black, and 3.30c. for galvanized sheets, No. 28 gage.

Ferro-manganese—Prices are much lower, $41@41.50 being quoted.

Metal Market

New York, March 17—The metal markets continue in about the same condition as last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,725,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,255,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended March 13: Gold, $3,823,050, chiefly to Argentina; silver, $829,490, to London and Paris. Imports: Gold, $608,250, from France, Central and South America; silver, $89,037, from the West Indies and Mexico.

Foreign commerce of the United States, two months ended Feb. 28, reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 373,871,750	$ 282,720,414
Imports	169,750,165	222,243,508
Excess, exports	$ 204,121,585	$ 60,476,906
Add excess of exports, silver		2,221,020
Add excess of exports, gold		9,729,574
Total export balance		$ 72,427,500

The gold and silver movement in detail is given in the table at the head of this column.

The Treasury Department's estimate of the amount and kinds of money in the United States on March 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 186,394,881	$ 609,988,359
Gold certificates	47,599,690	812,642,179
Silver dollars	6,878,913	72,158,899
Silver certificates	13,342,608	471,411,392
Subsidiary silver	24,855,000	130,757,140
Treasury notes of 1890	15,336	4,452,664
U. S. notes	10,922,510	335,758,506
Nat. bank notes	30,686,733	647,598,867
Total	$320,795,671	$3,084,778,006

Population of the United States March 1, 1909, estimated at 88,448,000; circulation per capita, $34.88. The total circulation March 1 was 7,888,635 less than on March 1 of last year.

Gold and silver movement in France, year ended Dec. 31:

	Imports.	Exports.		Excess.
Gold..	Fr.1,013,750,000	F.23,379,000	Imp.	Fr.990,371,000
1907...	444,431,000	154,573,000	Imp.	289,858,000
Silver..	174,099,000	175,893,000	Exp.	1,794,000
1907...	360,860,000	215,501,000	Imp.	145,359,000

Imports of copper and nickel coins, 109,000 fr. in 1907, and 73,000 fr. in 1908; exports, 703,000 fr. and 753,000 fr., respectively.

Gold and silver movement in Great Britain, month of January:

	Imports.	Exports.	Excess.
Gold	£ 3,228,260	£ 5,460,845	Exp. £2,232,585
Gold, 1908	3,225,392	2,938,590	Imp. 286,802
Silver	1,210,533	1,033,670	Imp. 176,863
Silver, 1908	569,555	1,436,570	Exp. 867,015

The excess of exports of gold and of imports of silver shown this year are both unusual conditions.

Gold—There has been no special demand for gold on the open market in London and prices remain at the mint value, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American eagles. The Bank of England has absorbed most of the supplies. In New York shipments have been made this week of $2,400,000 to Argentina and $2,500,000 to London; while it is reported that more will go on Saturday.

Platinum—Business has been a little better, but there are no signs of any change in price soon, though there is an impression that higher prices will come when demand improves. Dealers quote $24 for refined platinum, $26 per oz. for hard metal and $19@21 for scrap.

Our special correspondent writes from St. Petersburg, under date of Feb. 18, that expectations of higher prices have not been realized, and large dealers now believe that there will be no change for some time. Crude platinum, 83 per cent. metal, is quoted at Ekaterinburg 5 rubles per zolotnik; in St. Petersburg, 20,000 rubles per pood. These prices are equivalent to $18.80 and $19.55 per oz., respectively. The annual conference of the Ural platinum miners, held at Ekaterinburg, Feb. 6-9, decided to petition the Government to make loans to miners at the rate of 16,000 rubles per pood of crude platinum.

Silver—The market has remained quite steady. The fluctuations have been slight, and the tendency is toward a movement within a small compass.

SILVER AND STERLING EXCHANGE.

Mar.	11	12	13	15	16	17
New York	50⅞	50⅝	50¾	50⅝	50¾	50½
London	23⅞	23¾	23¾	23⅝	23¾	23¾
Sterling Ex.	4.8810	4.8810	4.8810	4.8815	4.8820	4.8820

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 4:

	1908.	1909.	Changes.
India	£ 1,400,538	£ 818,200	D. £ 582,338
China	496,400	240,000	D. 256,400
Straits	78,270	82,900	I. 4,630
Total	£ 1,975,208	£1,141,000	D. £ 834,208

Imports for the week, £3000 from Mexico and £200,000 from New York; total, £203,000. Exports, £22,000 coin to the Straits and £6000 in bars to India; £28,000 in all.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
11	12½ @13	12¼ @12⅜	56	29	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
12	12½ @13	12⅛ @12⅜	55⅞	29	3.97½ @4.00	3.82 @3.85	4.60 @4.62½
13	12½ @13	12⅛ @12⅜	....	28¾	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
15	12½ @12¾	12⅛ @12¼	54¾	28½	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
16	12½ @12¾	12 @12¼	54⅞	28⅛	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
17	12½ @12¾	12 @12¼	55¼	28⅛	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The singular lack of interest which domestic consumers show in the present low level of prices has created considerable nervousness among selling interests. The selling pressure concentrated upon Europe, some business in electrolytic for export thither being done from day to day at receding prices, though the tonnage was relatively unimportant, owing to the fact that European buyers had well supplied themselves during the activity of about two weeks ago. Little or no business in Lake copper has been done, and quotations for that quality are nominal, the producers being in no way prominent in the market. The market closes barely steady at 12½@12¾c. for Lake copper; 12@12¼c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12@12⅛ cents.

Copper sheets, cold-rolled, are quoted 17.3c. per lb., large lots; and hot-rolled, 16.5c. Copper wire, 14¼c. base, carload lots at mill.

After holding fairly steady until the close Friday, the London standard market opened on Monday with a sharp decline, and on the second exchange on that date reached the lowest figures, £54 15s. for spot, £55 10s. for three months. Since then, under bear covering, there has been a recovery, the close being steady at £55 5s. for spot, £56 for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 100 tons.

Refined and manufactured sorts we quote: English tough, £59 10s.; best selected, £58 10s.@£59 10s.; strong sheets, £70 10s.@£72 10s.

Copper exports from New York and Philadelphia for the week were 5538 long tons. Our special correspondent gives the exports from Baltimore for the week at 1028 tons of copper.

European stocks on March 1 are reported as below, in long tons, by Henry R. Morton & Co., of London:

Visible stocks, Feb. 1	52,935
Supplies during February	24,653
Total	77,588
Deliveries in February	25,293
Stocks, March 1	24,295

Stocks include 38,242 tons in England; 6253 tons in France; 7700 tons afloat from Chile and Australia.

Tin—The bull party in London suddenly turned sellers, and prices consequently declined. The reasons for this change of front are not given, and it is hard to follow the tactics of these London speculators. The market closes steady at £129 for spot, £130 12s. 6d. for three months.

There is very little activity in the domestic market, the only remarkable feature being an over-supply of spot material which is pressed for sale. The quotations at the close are made at 28½ cents

Lead—The market has quieted down after some large transactions early in the week, but is holding well, as the recent activity has taken care of the cheap offerings and sellers can afford to be independent. The close is steady at 3.82½@3.85c. St. Louis, 3.97½@4c. New York.

The London market has been depressed throughout the week and the close is cabled at £13 5s. for Spanish lead, £13 7s. 6d. for English lead.

Spelter—Business has again fallen off to minimum proportions. On the one hand, consumers are well supplied, and, on the other, there is no pressure to sell. The close is steady at 4.60@4.62½c. St. Louis, 4.75@4.77½c. New York. The New York price was 4.75@4.77½c. throughout, March 11-17, inclusive.

The London market has again declined, and the close is cabled at £21 5s. for good ordinaries, £21 10s. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The New Jersey Zinc Company announces that after March 22 its offices will be in the National City Bank building, 55 Wall street, New York.

Other Metals

Antimony—Business is extremely quiet. Prices nominally unchanged at 8@8¼c. for Cookson's; 7⅞c. for Hallett's; 7⅜@7⅝c. for ordinary brands.

Aluminum—Nothing new is reported. The Aluminum Company of America still quotes 24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—New York quotations, $45@46 per flask of 75 lb. Business continues fair. San Francisco nominal at $45 for domestic, and $43 for export. London,

£8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

German Metal Imports and Exports

Imports and exports of metals in Germany for the full year are reported as follows, in metric tons:

	Imports.	Exports.	Excess.	
Copper	175,184	69,925	Imp.	105,259
Copper, 1907	144,002	62,511	Imp.	81,491
Tin	14,243	6,122	Imp.	8,121
Tin, 1907	13,020	6,848	Imp.	6,172
Lead	77,649	40,626	Imp.	37,023
Lead, 1907	75,200	38,259	Imp.	36,941
Zinc	35,003	97,008	Exp.	62,005
Zinc, 1907	29,843	93,649	Exp.	63,806
Nickel	3,119	1,604	Imp.	1,515
Nickel, 1907	2,294	1,265	Imp.	1,029
Aluminum	3,278	1,210	Imp.	2,068
Aluminum, '07.	3,974	1,926	Imp.	2,048
Minor met'ls	1,043	10,644	Exp.	9,601
Minor met's '07	980	9,679	Exp.	8,699

The totals include alloys and metals in manufactured form.

Imports and exports of metallic ores for the year were, in metric tons:

	Imports.	Exports.	Excess.	
Gold ore	180	.....	Imp.	180
Gold ore, 1907	95	.....	Imp.	95
Silver ore	1,742	5	Imp.	1,737
Silver ore, '07	3,506	47	Imp.	3,459
Copper ore	17,456	21,741	Exp.	4,285
Copp'rore,'07	19,295	20,946	Exp.	1,651
Tin ore	11,420	29	Imp.	11,391
Tin ore, 1907.	9,971	31	Imp.	9,940
Lead ore	133,597	1,189	Imp.	132,408
Lead ore, '07	137,861	1,296	Imp.	136,565
Zinc ore	199,840	39,450	Imp.	160,390
Zinc ore, 1907	184,703	34,863	Imp.	149,840
Nickel ore	17,402	.....	Imp.	17,402
Nickel ore,'07	29,296	.....	Imp.	29,296
Tungsten ore	2,308	133	Imp.	2,175
Tung. ore, '07	2,239	195	Imp.	2,044
Other ores	2,618	603	Imp.	2,015
Other, 1907	6,073	929	Imp.	5,144
Chrome ore	16,975	111	Imp.	16,864
Chrome, 1907	19,508	148	Imp.	19,360
Pyrites	334,133	16,384	Imp.	317,749
Pyrites, 1907.	393,327	24,183	Imp.	369,144

Other ores include uranium, molybdenum and other minor metals, with some mixed or complex ores.

Zinc and Lead Ore Markets

Platteville, Wis., March 13—Prices continued the same as last week; $37.50 per ton being the basis paid for 60-per cent. zinc. No premium was paid. For 80-per cent. lead ore, $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 13

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green	343,300	.....	281,050
Platteville	242,500	54,000	.....
Benton	221,570	.....	.....
Linden	168,810	.....	.....
Livingston	160,000	.....	.....
Galena	88,000	.....	.....
Strawbridge	88,000	.....	.....
Cuba City	82,640	.....	.....
Harker	39,230	.....	.....
Total	1,434,050	54,000	281,050
Year to Mar. 13	21,365,239	710,180	1,980,650

In addition to the above there was shipped to the American Zinc Ore Separating Company 190,410 lb. zinc ore.

Joplin, Mo., March 13—The highest price reported for zinc sulphide ore was $40 per ton, the base ranging from $35.50 to $38 per ton of 60 per cent. zinc. Zinc silicate sold at $25 highest, on base of $18@20 per ton of 40 per cent. zinc. Zinc, all grades, averaged $34.24 per ton. Lead sold as high as $50.50, the bulk of the ore selling around $50 averaging, all grades, $49.86 per ton.

The general decrease of the wage scale has made it possible for most of the mines to continue outputting on the present level of prices, even though the margin of profit is small; weather and general conditions are so favorable that the output continues to increase.

SHIPMENTS, WEEK ENDED MAR. 13

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,312,820	753,220	$ 96,460
Joplin	1,675,460	337,990	39,316
Miami	844,200	171,000	15,671
Alba-Neck	774,650	.....	14,330
Galena	617,290	95,200	13,581
Duenweg	717,740	12,790	12,894
Spurgeon	638,740	138,230	11,742
Oronogo	645,030	.....	11,158
Prosperity	416,390	109,040	10,220
Granby	646,360	2,300	7,715
Aurora	474,010	.....	7,054
Badger	295,680	19,310	5,930
Carthage	290,080	.....	5,366
Quapaw	213,270	9,020	3,632
Sarcoxie	224,250	.....	3,221
Carl Junction	109,490	4,210	2,182
Zincite-Sherwood	117,540	.....	2,115
Cave Springs	62,770	.....	1,161
Redds	44,180	.....	630
Totals	13,019,950	1,652,310	$264,268
Eleven weeks	122,109,580	18,401,780	$2,663,824
Zinc value, the week, $222,979; 11 weeks, $2,195,429			
Lead value, the week, 41,279; 11 weeks, 468,395			

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	35.94	34.92	34.37	49.72	50.50
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.65	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	36.94	34.44	.....	64.69	.....
October	36.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 17—A fair amount of business is being transacted in small sales, although the market remains generally quiet.

Copper Sulphate—The market is quiet with no big sales reported. Prices hold at $4.60 per 100 lb. for carload lots and $4.85 per 100 lb. for smaller parcels.

Arsenic—Sales for the week amount to about 200 tons at 2⅞c. per lb. The market is not active and the price quoted is 3c. per lb. on white arsenic.

Nitrate of Soda—Quotations have been 2.15@2.17c. per lb. There has been some improvement in the market during the week.

Potassium Salts—Exports of potassium salts from Germany for the year are reported as below, in metric tons:

	1907.	1908.	Changes.
Kainit, kieserit, etc.	839,889	818,569	D. 21,320
Potassium chloride	173,638	174,359	I. 721
Potassium sulphate	46,158	48,804	I. 2,646
Pot.-magnesium sulph'te	128,344	132,943	I. 4,599

Exports to the United States in 1908, included in the above totals, were 364,731 tons kainit, kieserit, etc.; 100,587 tons potassium chloride; 25,957 tons potassium sulphate; 50,869 tons potassium-magnesium sulphate.

Petroleum Exports

Exports of mineral oils from the United States, two months ended Feb. 28, in gallons:

	1908.	1909.
Crude petroleum	14,899,445	17,832,045
Naphthas	3,829,138	6,410,792
Illuminating oils	161,995,537	152,036,316
Lubricating oils	25,123,918	20,509,612
Residuum	9,673,416	12,061,498
Total	215,521,454	208,850,263

Paraffin is included in lubricating oils. The total decrease this year was 6,671,191 gal., or 3.1 per cent.

Mining Stocks

New York, March 17—The general stock market has been distinctly narrow with some tendency to weakness. This tendency, however, has not been so marked as the unwillingness to trade much at present and the desire to await further developments especially in the industrial field. The special session of Congress began on Monday and the Exchange seems to be holding back until it can see what turn the tariff legislation will take.

On the Curb trading was not very heavy. The copper shares displayed considerable weakness, and buyers were not strongly disposed to take them up. Other stocks followed this lead and were inclined to be weak on moderate trading but without any heavy actual loss in prices.

The Curb was stirred up on Monday by an unusual out-pouring of "cats and dogs." There was a sale of 190,565 shares in all, made to close out an account. The prices were something startling to those brokers who have memories long enough to remember the quotations of a year or two ago. Among them were the following: Nevada Exploration, 60,000 shares at $100 for the lot; Round Mountain Red Top, 35,000 shares at $100 for the lot; Roanoke, 3950 shares at $8 for the lot; Mohawk Extension, 1½c.; Gibraltar, 5½c.; Tramps Consolidated, 6c.; North Butte Extension,

4½c. Montgomery Shoshone held up best of all, bringing $1.37½c. per share.

Boston, March 16—Notwithstanding the fact that there is little interest manifested in mining shares prices hold wonderfully well. The annual reports of the various mining companies, now coming out from time to time, show lean treasuries. As a rule it is a surplus of liabilities.

Parrot has been a strong feature, advancing $2.25 to $32.12½, with fractional setback from this. Favorable developments in the lower levels are coming from the property. North Butte rose from $67.50, ex-dividend, to $68.50 and Calumet & Hecla is off $15 to $610. Osceola is off $2 to $128. The 1909 annual meeting resulted in a complete change in the directorate, Calumet & Hecla officials taking the places of the old board. The same people have issued the call for the annual meeting of the Isle Royale when a complete change in the management will take place.

Utah Consolidated directors have declared the usual 50c. quarterly dividend. Arcadian showed activity and a degree of strength. Reports have been current of Calumet & Hecla interests in this property but there is no foundation for them.

Nipissing and Ohio Copper were the Curb features.

On the Curb market hereafter there will be two departments, stocks being known as "qualified" and "unqualified," according to the degree in which they meet the requirements of the governing committee.

STOCK QUOTATIONS

NEW YORK	Mar. 17	BOSTON	Mar. 17
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.23	Adventure	‡7⅝
Amalgamated	68	Allouez	‡39⅝
Anaconda	41⅝	Am. Zinc	‡25
Balaklala	‡2½	Arcadian	‡5⅝
British Col. Cop.	6¾	Arizona Com	34¾
Buffalo Mines	13	Atlantic	14½
Butte Coalition	22¾	Boston Con	11¾
Colonial Silver	¼	Calumet & Ariz	100
Cum. Ely Mining	7¾	Calumet & Hecla	610
Davis Daly	4⅝	Centennial	29¾
Dominion Cop.	‡.12½	Con. Mercur	‡.30
Douglas Copper	2¾	Copper Range	76
El Rayo	2¾	Daly-West	9¾
Florence	3⅛	East Butte	14¼
Foster Cobalt	.34	Franklin	14
Furnace Creek	.11	Greene—Can	9¾
Giroux	8⅛	Isle Royal	26⅛
Gold Hill	¾	La Salle	14¾
Goldfield Con	7½	Mass	5
Granby	92¾	Michigan	10½
Greene Gold	¼	Mohawk	60⅝
Greene G. & S.	7	Nevada	17¼
Guanajuato	1⅝	North Butte	68¼
Guggen. Exp	175⅛	Old Colony	‡.60
Hanapah	.15	Old Dominion	48¼
Kerr Lake	8½	Osceola	128
McKinley Dar	.85	Parrot	31¼
Miami Copper	13½	Quincy	185
Micmac	1¼	Rhode Island	‡4¾
Mines Co. of Am.	⅜	Santa Fe	2
Mitchell Mining	⅛	Shannon	14
Mont. Sho. C.	1½	Superior	41¼
Nev. Utah M. & S.	2⅛	Superior & Pitts.	13¾
Newhouse M. & S.	3½	Tamarack	80
Nipissing Mines	10⅞	Trinity	13¼
Old Hundred	⅝	United Cop., com.	‡11⅞
Silver Queen	.60	U. S. Oil	31¼
Stewart	⅝	U. S. Smg. & Ref.	40
Tennessee Cop'r	41	U.S. Sm. & Ref., pd.	45
Tri-Bullion	1¼	Utah Con	39¾
Union Copper	1⅛	Victoria	4⅝
Utah Apex	6⅛	Winona	16
Utah Copper	43¼	Wolverine	140
Yukon Gold	4⅛	Wyandotte	2⅛

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38
Am. Smelt. & Ref.	83⅝
Am.Sm. & Ref., pf.	102⅞
Colo. Fuel & Iron	32¾
Federal M. & S., pf.	‡80¼
National Lead	75½
National Lead, pf.	106⅝
Pittsburg Coal	‡10¼
Republic I. & S.	20¼
Republic I.& S., pf.	71⅝
Sloss-Sheffield	73
Standard Oil	667
U. S. Steel	45⅛
U. S. Steel, pf.	110⅞
Va. Car. Chem.	43¼

BOSTON CURB	
Ahmeek	‡145
Black Mt.	1⅛
Chemung	‡21
Globe Con	‡5
Hancock	11⅜
Helvetia	3¼
Keweenaw	‡4¾
North Lake	‡7⅝
Ojibway	‡13⅞
Superior & Bost.	‡15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS		Mar. 13
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.04
Center Cr'k	1.50	1.25
Cent. C. & C.	83.00	81.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	20.00	19.00
Joe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON	Mar. 17
Name of Com.	Clg.
Dolores	£1 58 0d
Stratton's Ind.	0 2 9
Camp Bird	0 15 6
Esperanza	2 10 0
Tomboy	0 18 9
El Oro	1 3 9
Oroville	0 10 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 17.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.40	St. Ives	.13
Best & Belcher	.32	Triangle	.03
Caledonia	.13	BULLFROG STOCKS	
Challar	.07	Gibraltar	.05
Comstock	.25	Homestake King.	.05
Con. Cal. & Va.	.29	Mont. Shoshone C.	1.50
Crown Point	.45	Tramp Cons	.05
Exchequer	.20	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	.03
Hale & Norcross	.17	Lee Gold Grotto	...
Mexican	.59	Nevada Hills	1.12½
Ophir	.97	Nevada Smelting.	1.00
Overman	.10	Nevada Wonder	.80
Potosi	.09	Nevada-Utah	2.93¾
Savage	.10	Penn-Wyoming	.03
Sierra Nevada	.22	Pittsburgh S. Pk.	.67
Union	.22	Rawhide Caol't'n.	.05
Utah	.03	Round Mt. Sphinx	.05
Yellow Jacket	.56		
TONOPAH STOCKS			
Belmont	.80		
Extension	.62		
Golden Anchor	.01		
Jim Butler	.18		
MacNamara	.33		
Midway	.20		
Montana	.69		
North Star	.02		
Tono'h Mine of N.	6.50		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.11		
Blue Bell	.02		
Booth	.17		
Columbia Mt.	.10		
Comb. Frac	.02		
Con. Red	.06		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06		
Goldfield Bolmont	.06		
Goldfield Daisy	.48		
Great Bend	.17		
Jumbo Extension	.12		
Kendall	.06		
Lone Star	.04		
May Queen	.04		
Oro	.07		
Red Hill	.07		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS	Mar. 12
Name of Comp.	Clg.
Acacia	‡6¾
Black Bell	....
C. C. Con	3½
Dante	6¾
Doctor Jack Pot	8½
Elkton	71⅝
El Paso	48½
Findlay	‡15
Gold Dollar	12⅜
Gold Sovereign	3⅛
Isabella	25⅞
Index	....
Jennie Sample	8¾
Jerry Johnson	6⅜
Mary McKinney	37
Pharmacist	3¾
Portland	1.01
Un. Gold Mines	6
Vindicator	74
Work	7⅜

Assessments

Company.	Delinq.	Sale.	Amt.
Atlantic, Ida	Feb. 20	Mar. 22	$0.001
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
Caledonia, Nev	Mar. 16	Apr. 16	0.05
Challenge Con., Nev	Mar. 19	Apr. 9	0.05
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crater, Ida	Feb. 23	Mar. 27	0.001
East Hercules, Wash	Feb. 15	Mar. 15	0.001
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Reindeer, Ida	Feb. 16	Mar. 15	0.10
Silver Hill, Nev	Feb. 25	Mar. 30	0.05
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.005
Utah Arizona, Ariz	Feb. 25	Mar. 18	0.001
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.993	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.677	.....	September	28.816	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.976	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.516	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.076	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.876	.....
December	5.137	.....	4.987	.....	20.626	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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The Mount Morgan Gold and Copper Mine

Three Distinct Methods of Mining Are Employed, the Open Cut with Steam Shovel, the Milling System and Square-set Supported Stopes

BY GERARD W. WILLIAMS*

The Mount Morgan mine is situated 25 miles south-southwest of Rockhampton in Central Queenland. The mine itself is only a few miles south of the tropic of Capricorn. It was discovered in 1883 by Messrs. Morgan, who had been prospecting in the neighborhood. Since its discovery the mine has chlorinated 3,250,000 long tons[1] of ore for a return of approximately an ounce to the ton, while half a million tons have been smelted for a return of about 3 per cent. copper and 8 dwt. gold per ton. To July 10, 1908, the total value of gold and copper produced amounted to slightly more than $70,000,000, of which $37,000,000 has been paid in dividends. The nominal capital of the company is £1,000,000.

The surrounding country is composed of highly altered sedimentary rocks traversed by a large series of dikes of varying geological age. The orebody in outline resembles an irregular ellipse, the longer axis running northwest-southeast. In the open cut the axes of the ellipse attain a maximum of 940 and 590 ft. The lowest level (950 ft. vertical) is opened up for more than 600 ft. in length and 250 ft. in width, but ore is still in the face and both width and breadth will be considerably exceeded.

The orebody is traversed by numerous dikes, of which four are extremely well defined. The north and south dikes run parallel, about 450 ft. apart and strike northwest-southeast. These dikes are almost vertical and average 20 ft. in width. The south dike is still in the ore in the bottom level, but the north dike leaves the lode and passes into the country at 650 ft. The east dike is a branch of the south dike and runs in a general northeast direction.

The biggest dike is known from the nature of the rock as the andesite dike. This dike runs north and south and crosses the south dike above the 750-ft. level. This dike was formerly considered the limit of payable ore, and it is only since diamond-drill work was started that the country beyond the dikes has been opened up. Practically the whole of the copper ore, now estimated at more than 3,000,000 tons, lies to the west of the andesite dike. The dike itself averages 20 ft. in width and is almost vertical. It runs across the open cut and standing out from the softer ore it forms a conspicuous feature.

Nature of the Orebody

There is practically no contact enrichment at the dike faces, which show slickensides in some places in the dike matter itself, but give no evidences of having faulted the orebody. The dike material has been considerably altered, the smaller dikes being completely kaolinized; even at the lowest level the surface of the larger dike shows signs of alteration. When one considers that the unoxidized ore averages 25 per cent. pyrites, and that more than 2,000,000 tons of leached ores have been excavated from the open cut the quantity of acid produced by oxidation must have been enormous. It is not surprising, therefore, that all the rocks have been highly altered. The nature of the unoxidized ore varies widely from ultra basic (10 per cent.

OPEN CUTS AND DUMP, LOOKING SOUTH. CONTOUR OF ORIGINAL HILL SHOWN BY DOTTED LINE

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[1]Throughout this article all tons are of 2240 lb. The short ton is not used in Australia, except in West Australia.

silica) to ore containing 80 per cent. silica. Generally speaking, the highly mineralized basic ores are high in copper and low in gold, while the silicious portions of the orebody are rich in gold, but low in copper. The whole of the unoxidized ore may be averaged at 65 per cent. silica and 3 per cent. copper, the balance being chiefly iron pyrites.

Several theories as to the genesis of this orebody have been put forward. The oldest and best known theory was advanced by Dr. Logan Jack, that the deposit was due to a vast geyser. This theory has been completely abandoned, the silicious sinter which was supposed to occur in the open cut having been shown to be really a stockwork of small veins of infiltrated silica. In the light of recent work at depth it would seem that the ore was deposited from ascending mineral-bearing solutions which permeated a zone of crushed or weakened sedimentary rocks. These rocks were completely altered in their composition and in addition to the deposition of sulphide of iron considerable infiltration of secondary quartz took place.

It is noteworthy that the lode does not shade off into the country rock, but that the line of demarkation of the elliptical orebody and the surrounding rocks is well marked. It is certainly somewhat difficult to account for a crush zone of this shape, and this is the strongest argument against this theory. J. Bowie Wilson, late mine manager at Mount Morgan, recently published several valuable papers[1] dealing with the genesis of this deposit, and from his long association with the mine he is fully qualified to express an opinion. While adopting the theory of upward percolation through a crush zone he finds it impossible to account for the sharp demarkation between lode and country rock.

The gold contents show a natural decrease from the outcrop downward, but in the copper mine the value appears to be fairly uniform. All the copper occurs as chalcopyrite; there are no carbonate ores. Black sulphides occur but rarely and then as impregnations in felsite dikes.

Methods of Mining

The mining methods may be divided into three classes: Open cut in the oxidized ore for supplying oxidized ore for the west chlorination works, the "mundic" stopes, which send ore to the mundic works for roasting and chlorination and the copper mine. The oxidized ore extends to a depth of about 400 ft. below the old hill top; the mundic stopes follow down 500 ft. vertically and then appear the newly opened stopes of the copper mine, which have been opened up down to 950 ft. The whole orebody is continuous and the above divisions are purely arbitrary, for silicious ore low in copper and high in gold occurs in the copper stopes and basic ore low in gold and high in copper has been won from the mundic stopes.

The open cut covers an area of 11.2 acres and measures 1050 ft. and 710 ft. in greatest width and breadth; of this 940 ft. by 500 ft. represents ore.

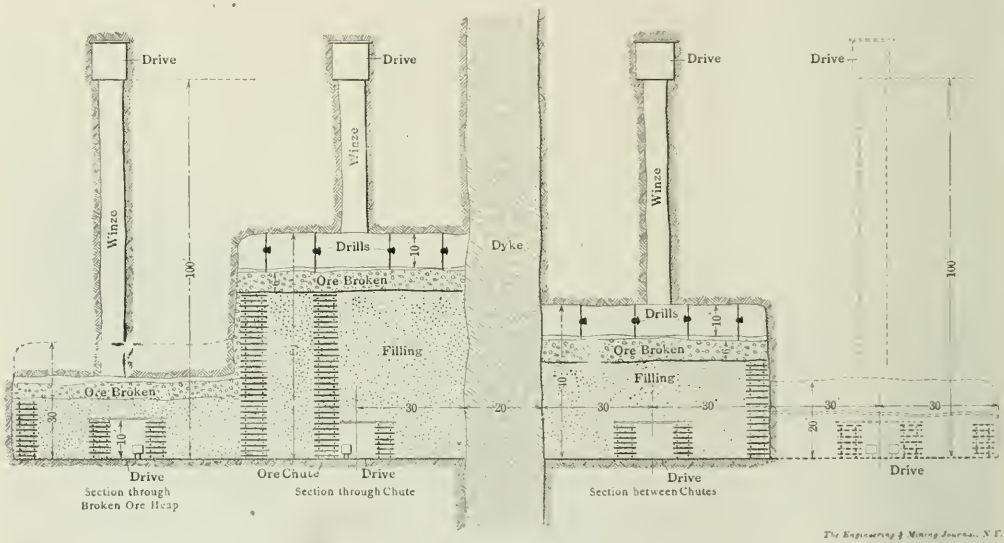
In the old days the rich gold ore, which occurred in very irregular shoots in the mass of the orebody, was stoped out with square setting from adit levels driven from the hill side. A few years ago the present management decided that the bulk of the ore would pay to remove for treatment and the present open cut was started. Working down on benches the steam shovels remove the old stope fillings, dike matter and overburden and load it upon electric trams which carry it out through adits in the hill side and tip it into the valley at the side of the mine, or to winzes leading to the stopes below. Two steam shovels are in constant use, a small one having a capacity of 450 tons per shift which is used for opening up new benches and a larger one which follows in the wake of the small one and removes from 800 to 1200 tons per shift.

At the time the estimate was made the ratio of overburden to ore was placed at 4 to 1, but this ratio has been slightly reduced owing to the fact that in many cases the old stope fillings paid for treatment. The cost of removing overburden and waste varies from 10 to 15c. per ton. The bulk of the overburden has been removed and for the last 12 months the ratio of overburden to ore was only 1 to 1.8.

The ore is won by benching and by "milling." In the former method the faces of ore left by the steam shovels are broken down by deep, vertical "jumper" holes and the broken ore is shoveled into ore passes leading to the 450-ft. level below, or is removed by the small steam shovel.

Milling System

The milling system was borrowed, I think, from America. It certainly merits a few words of description for it is not so well known as it should be. A level is driven into the face of the ore from the floor of the cut and from the end of the



CROSS-SECTION, COPPER MINE

[1] Aust. Mining Standard, Aug. 12, 1908, et seq.

level a rise is put up to the surface. The rise is fitted up as an ore chute and rails are laid into the level. Starting at the surface opening of the rise the ore is broken into it from all sides. The miners work back from the opening of the ore pass in such manner that the sides of the conical "rill" are steep enough to allow all broken ore to fall down to the ore pass in the center.

Viewed from the crest of the big andesite dike which crosses the open cut the "mills" appear like so many gigantic antlions' pits. Some of these mills measure 200 ft. across; but their size naturally varies within wide limits as adjoining mills encroach on each others' territory.

COMPARISON OF COSTS OF MINING, PERIOD OF SIX MONTHS.

BENCHING SYSTEM.	
Ore and waste (65,103 tons)	49c.
Ore charged with waste (32,962 tons)	82c.
MILLING SYSTEM.	
Ore and waste (71,632 tons)	26c.
Ore charged with waste (32,962 tons)	43c.

All labor in the open cut is by day's pay. Miners earn from $2 to $2.24, and machine men $2.24 to $2.40 per eight-hour shift. The floor of the open cut is now 340 ft. below the crest of the old hill. The dotted line in the accompanying illustration shows the former contour of the hill.

THE MUNDIC MINE

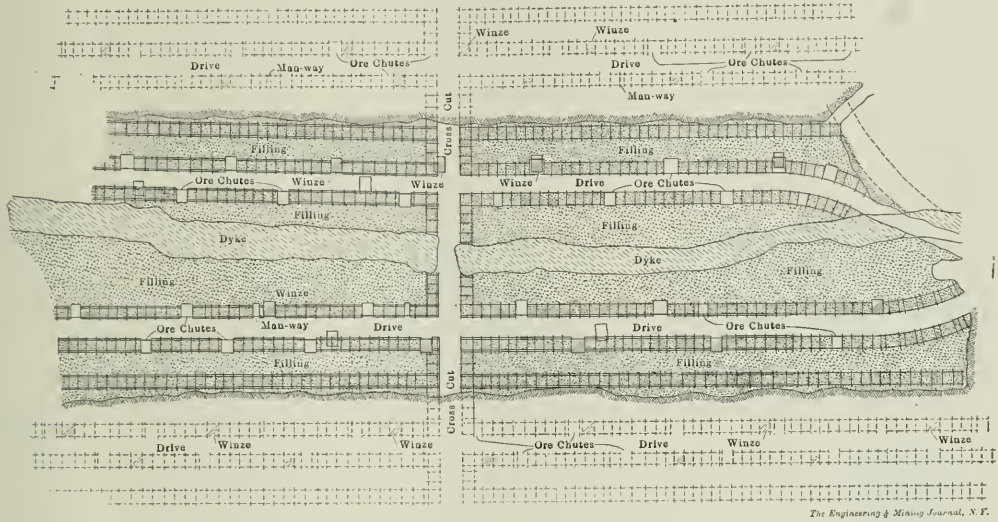
The stopes in this portion of the orebody are worked by the square-set method. The sets measure 6x5 ft. between centers on the sill and 7 ft. 9 in. in hight. The timber is all square-cut 9x9 in., and is joggled in the usual manner except that the struts are given a 1-in. shoulder instead of carrying the full-sized tenon. The wood used is known as spotted gum and is obtained locally. It is stronger than Oregon pine and stands well. It does not, however, "talk" when taking weight, but is liable to snap suddenly. The timber costs $3.40 board measure and is cut from the logs in the company's mills. Per ton of ore the cost of timber averages 44 cents.

The ore is mined by contract, the contract price being based on the number of square sets and not on footage nor tonnage. On swinging sets the price for breaking ore and erecting sets varies from $16.20 to $22.40 per set, and for sill floor sets from $30 to $42. A set averages 23 tons of ore.

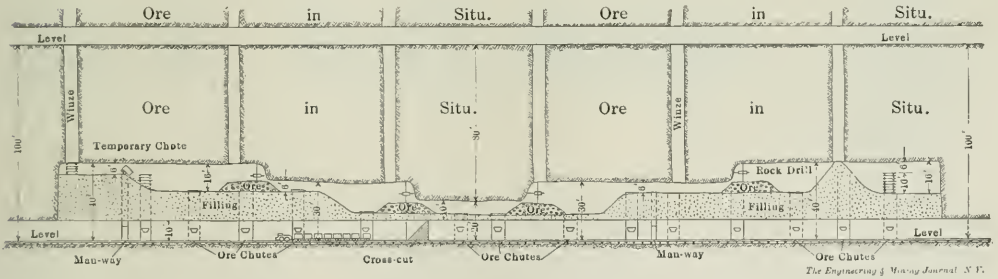
The total costs average $2.97 per ton, and development 50c. per ton mined.

THE COPPER MINE

The copper stopes are all to the west of the big andesite dike, which for many years was considered to be the eastern limit of the payable orebody. Six years ago diamond drilling was started and large masses of copper ore were located. For three years systematic exploratory work was carried out and at the end of that time 3,000,000 tons of 3.5-per cent. ore had been located. This drill work cost $150,000. As soon as the ore was proved a smelting plant was erected at a cost of more than $1,000,000 and was paid for out of the profits on one year's work. Without calling up a cent of capital and without interfering with the production of gold the Mount Morgan mine commenced a new existence as a copper-smelting enterprise. Typical secondary



PLAN OF COPPER MINE



LONGITUDINAL SECTION, COPPER MINE

ores were entirely absent from the upper levels and the portion of the orebody which contains the copper ore was previously regarded as valueless.

The mine is opened up with levels at 450 (the mundic level) 574, 650, 750, 850 and 950 ft. vertical depth. Only the 750- and 850-ft. levels in the copper mine are at present being stoped. The main underlay shaft is down 1035 ft. vertically.

The orebody, which may be taken as 650 ft. in length and anything above 260 ft. in width is opened up by means of drives parallel with the longer axis of the orebody and 60 ft. apart. Large crosscuts run at right angles to the main drives. This method of development blocks the ore out into panels or chambers 60 ft. wide and usually 250 ft. to 300 ft. in length. The ground plan of the sill floor thus determined, stoping commences in one or other of the center chambers.

Method of Working

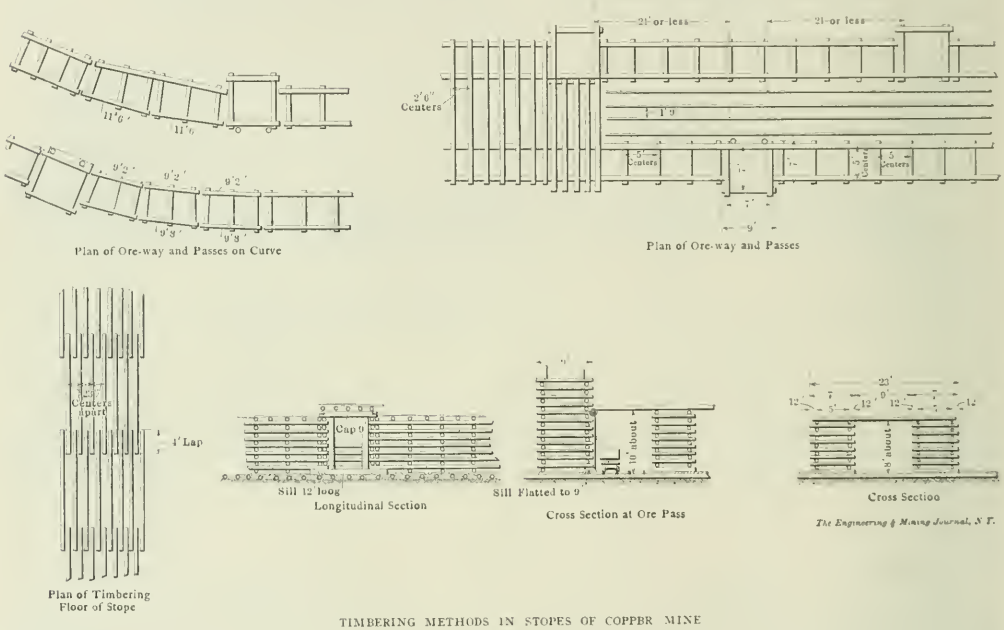
The ore being vertical there is no need to begin from the footwall side. The sill floor is cut out and the leading stope carried to a hight of 14 ft. above the floor of the sill. Bulks of timber, composed of old square-set timbers recovered from the old stopes laid bare in the open cut, are used to support any heavy ground in the roof. The sill floor is laid with logs of brigalow, a cheap timber which occurs locally and which stands well underground. The bed logs are floored with 4-in. planks of Colonial pine.

Along the sides of the chamber a continuous line of solidly built pigsties is erected which form the sides of the drives and crosscuts and ultimately convert the whole chamber itself into a gigantic waste-filled pigsty. Waste is sent down from the open cut and distributed by winzes to the chambers. Ore passes are placed in the level every alternate 15 ft. Once the sill sets are in and the waste spread and leveled out, another face is taken off the stope and the filling repeated. Meantime the adjoining chambers are working up, each inclosed in its wall of pigsties.

The accompanying plans, supplied by the management for the purpose of illustrating this article, explain the whole system very clearly. It will be noticed that all drive timbering is done away with and the expensive sawed timber sets are replaced by a wall of round logs slightly joggled into each other.

In every way the method appears to be extremely safe; not only does the panel system eliminate the possibility of "creeps" caused by the crushing of wide spans of ore as the stope works up to the level above, but by the use of bulkheads the danger of small falls of rock is lessened or entirely done away with. At the time of my visit a few months ago 300,000 tons of ore had been excavated without a single accident; then, without warning, came three disastrous falls, two of which were attended by serious loss of life. The ore, although apparently absolutely solid gave way in masses weighing several thousand tons and crushed down the bulkheads until it rested on the waste beneath.

The government is at present holding an inquiry into the causes of the accident, and will doubtless recommend some other form of stoping practice. Probably the use of a larger number of bulkheads in the working faces, each bulk being filled up with broken rock, will enable the present method to be continued. The frequency or otherwise of serious accidents is not always a fair criterion of safe working, for there is at times something of "cussedness" in inanimate matter that defies all laws, and it is not improbable that were the present method continued no more accidents would occur.



TIMBERING METHODS IN STOPES OF COPPER MINE

Labor and Wages

All miners, except those employed in the open cut are contract workers. In the copper mine the men work in gangs of 16 to 24. Usually the gang or party rig up and bore out a face right across the chamber; the face in then fired and while one machine is employed squaring off the face the rest of the party spall up the ore and deliver it to the ore passes.

The ore is taken to the plat by an electric tram and every truck is weighed as it passes to the plat. The contract men are paid on the actual weight of ore sent up. The price paid varies from 60c. to $1 per ton, the higher rate being paid in the sill-floor stopes.

Mining costs in the copper mine are abnormally high at present; out of six work-

ing stopes four are on the sill floor and the cost of flooring boards, etc., runs the costs up. Dike material represents 13 per cent. of the total ore broken. This is sorted in the chambers; at one time it was sorted on a belt at the surface but the cost was too high. The main underlay shaft carries two skip ways; each skip carries from seven to ten tons according to the nature of the ore. The trucks from the levels are tipped into bins in the floor of the level which discharge through chutes to the skips.

Mining costs for the six months ending May 31, 1908, averaged $2.28 per ton. The ore reserves of the copper mine (down to the 850-ft. level) are estimated at 1,280,000 tons containing 3.5 per cent. copper and 8 dwt. gold and 1,700,000 tons containing 3 per cent. copper and 2.5 dwt. gold. This does not include ore in the mundic stopes or in the open cut. The former is estimated to be equal to ten years' supply for the mundic plant, approximately a million tons.

Short Talks on Mining Law—XIV

By A. H. Ricketts*

The use of water on the public domain was primarily regulated by miners' rules, regulations and customs. The vested and accrued rights in water, recognized and given by local legislation and the decisions of the courts, received early recognition and sanction from Congress. The appropriation and use of water are now regulated by local statutes, which vary in detail, and the rights of the appropriator depend upon his compliance with these local laws. Grants of the public lands are made subject to all water rights that may have previously accrued to any person other than the patentee. In forest reserves rights of way for the construction and maintenance of dams, reservoirs, water plants, ditches, flumes, pipes, tunnels and canals within and across the forest reserves of the United States are granted by congress for mining purposes and for the reduction and milling of ores during the period of their beneficial use under such rules and regulations as may be prescribed by the secretary of agriculture, and also subject to local statutes. Congress has also provided for rights of way through the public lands, forest and other reservations of the United States, and through the Yosemite, Sequoia, and General Grant national parks, of California, for canals, ditches, pipes and pipe lines, flumes, tunnels, or other water conduits, and for water plants, dams and reservoirs used to promote mining or quarrying or the cutting of timber. Lands valuable for mineral deposits and embraced within a withdrawal of lands susceptible of irrigation by means of a reclamation project under the Act of June 17, 1902, are not taken out of the operation of the mining act, but continue open to exploration and purchase under such law.

*Member of the San Francisco bar, Kohl building, San Francisco, Cal.

Water Rights

All surplus water over and above that necessarily used for the purposes of irrigation and reclamation of desert land, part of the public domain, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable may be appropriated for mining purposes when not violative of the reasonable rights of others. But the right to appropriate water is not confined to streams running over public lands of the United States, but exists whenever the appropriator can find water which has not been appropriated or in which no other person has or claims superior rights and interests and by the latter only as far as there is a conflict.

The size of the stream is immaterial. It may run upon or beneath the surface of the land (but it must be separate and distinct from the soil whether produced by percolation, filtration or otherwise), flow in a river or down a cañon or ravine, or it may consist of percolating waters collected or gathered in a stream running in a defined channel or of water flowing from a well, whether flowing away or standing in a pool or a small lake, or flowing from springs or developed in a tunnel and conducted away, by owners of adjoining lands, from land where the waters would otherwise in their natural course sink into the ground and be lost. A person who enters upon the public lands and digs a well has a superior title to the use of the waters from the well. Until the performance of the conditions upon which the right to forever maintain possession is based, the person taking possession has no title legal or equitable as against the Government.

Tide Lands

Lands "under tide water" or "below high-water mark," "lands flowed by the tide" and other expressions of like import are usually employed in defining tide lands. The term "shore line" has been construed to mean high-water line. Lands under tide water are vested in the United States and are not subject to exploration, occupation or location under the mining act, except that in Alaska temporary possession thereof may be had for mining purposes subject to such general limits as may be necessary to exempt navigation from artificial obstruction. So, a mill-site location cannot lawfully be made in Alaska within 60 ft. of the "shore line" of navigable streams, etc.

The term "miner's inch" is not definite without specification of the head or pressure. In California the standard miner's inch of water is equivalent to 1½ cu.ft. of water per minute measured through any aperture or orifice.

Timber Cutting

Timber on mineral lands may be felled and removed by citizens and *bona fide* residents (but not by railroad corporations) of Arizona, Colorado, North and South Dakota, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming and all other mineral districts of the United States for mining, smelting, roasting of ores or other domestic purposes.

Land chiefly valuable for timber may be acquired under the provisions of the "timber and Stone act." Where the character of land sought to be acquired under that act is put in issue, entry will be allowed by the Land department only when it appears that the growth of timber thereon is so extensive and so dense as to render the tract as a whole, in its present state, substantially unfit for cultivation, and that the land is chiefly valuable for the timber thereon.

Miners and prospectors have the free use of timber and stone within a forest reserve for mining, prospecting and other domestic purposes under such rules and regulations as may be prescribed by the Government. The secretary of agriculture may permit the exportation of timber cut or removed from the forest reserves of the United States or the district of Alaska, except the Black Hill forest reserve in South Dakota and the forest reserves in Idaho.

A valuable growth of timber upon land located as a placer claim may properly be an incentive to its location; the validity of this location will be upheld if otherwise unobjectionable. So, if any land is in fact mineral in character, title to the land, together with the timber thereon may be acquired under the mining act and, if vacant and non-mineral and chiefly valuable for timber, but unfit for cultivation and containing no mining or other improvements, it may be purchased under the provisions of the "Timber and Stone act."

The Victorian government's antidote for cyanide poisoning is put up in the form of a package containing the following: A hermetically sealed bottle containing 7½ grams ferrous sulphate dissolved in 30 c.c. water; a bottle containing 1½ grams caustic soda, dissolved in 300 c.c. water; and a tube containing 3 grams of magnesia. The ingredients are to be mixed and introduced into the patient's stomach through a rubber tube which acts as a siphon for emptying the stomach of its poison. The package is to be hung in some easily accessible place in the mill.

Mine timbers placed near decaying wood, according to a bulletin of the U. S. Forest Service, decay much more rapidly than if they are isolated, infection being communicated from the diseased to the new timber.

Tonnage Estimation in Dumps, Open Cuts, Etc.

The Density Factors for Solid and Broken Ore, Tailings and Slime Are Discussed, and Different Methods of Measuring Tonnages Described

BY R. J. DONALDSON*

In estimating the weight of material in any orebody, bin, or heap, the volume is first found, and then divided by a density factor, generally the number of cubic feet per ton. I will deal with the determination of this factor first, and for shortness will refer to it simply as the factor for the material under notice.

Density Factor

This determination is really the most difficult and unsatisfactory operation in the estimation of tonnages. The value of the factor may vary largely for any material according to conditions in themselves impossible to determine. For instance, take rough, crushed ore in a bin. A mixture of sizes is heavier, bulk for bulk, than any one size alone, so that the factor for the crushed ore will vary with the proportion of coarse to fine. The factor used will nearly always be so many cubic feet per ton dry weight, but the moisture content may make a big difference in the packing of the ore, and, of course, differences in the assay value and in the constituents of the gangue will affect the figure.

These variations in the factor may be so great as to render an estimate little better than a guess. The concentrates from the various flotation processes are particularly liable to vary, and I have known one case in which the factor ranged from 15 up to 30 cu.ft. per ton.

Relations of the Factor for Solid to that of Broken Ore

In the appendix to "Ore Dressing," by Prof. R. H. Richards, the following authorities are quoted: Vezin, for "fairly finely crushed" ore, makes the factor for broken ore 1.75 times that for solid; Kirby, for run-of-mine ore, broken, 1.53 to 2 times the solid; McDonald, probably for run-of-mine ore, factor for broken 1.74 to 1.85 that for solid ore.

Examples of Broken Hill practice are 1.6 to 1.73 times the solid factor. Trautwine states that 1 cu.yd. solid breaks to from 1.75 to 1.9 cu.yd. in ordinary excavating. He also gives figures for three sizes of clean quartz sand. The coarsest contains 41 per cent. voids, the finest 50 per cent., i.e., the factors are 1.7 and 2 times the solid factor respectively. This is for loose sand. The medium sand gives intermediate values.

These figures for sand, taken by themselves, seem to confirm the often printed statement that the finer the crushing the bigger the percentage of voids, and, therefore, the higher the factor. But compare the coarse-sand factor with that given by the same authority for rough, broken material, and the two are found to be the same. Again, the coarse sand well shaken and jarred has a factor of only 1.47 times that for solid, and so is then heavier than rough, broken material.

In this connection the following table of factors (cubic feet per long ton) for different sizes of anthracite, given by C. Enzian, in a paper in the Engineering and Mining Journal for July 27, 1907, is interesting:

CUBIC FEET OF ANTHRACITE PER LONG TON.

Buckw't.	Pea.	Nut.	Stove.	Egg.	Broken.	
41.4	42 1	38 4	38 5	38 8	39.4	—Lehigh.
40.4	41 1	39 4	39.8	40.0	40.1	Wyoming.

It appears that the factor drops, i.e., the material gets heavier as the size diminishes from "broken" to "nut," jumps to a higher value than ever at "pea" size, and then falls again at "buckwheat."

The truth seems to be that the finer the crushing the lighter, bulk for bulk, the material may be, but at the same time it becomes more compressible, and the factor is affected to a much greater extent by the conditions of deposition.

The following experiments on the factor for Broken Hill mill slimes show how greatly it, a very fine material, varies in weight according to these conditions. The experiments were carefully conducted in a strong tin holding about ¼ cu.ft., the volume being found by weighing it empty and then full of water.

The values for tailings show that they are less sensitive to conditions of deposition, but still vary greatly.

By measuring a dump of tailings before and after a known weight—some hundreds of tons—had been removed, a factor of about 18 was obtained.

Unfortunately there is no connection between the two sets of figures, and a set of careful experiments seems to be needed on the density of the same material in different sizes. I have come across very little literature on the subject.

The Actual Determination of Factors

In estimating the tonnage in any underground orebody, it is necessary to know the number of cubic feet of solid ore required to weigh a ton. The determination of the specific gravity of specimens will give an approximate figure, but an allowance, say, 5 or 10 per cent., or even more, will almost always be necessary for vugs, etc. In the case of lode material which varies in density, the specific gravity of typical specimens of the different classes of ore should be found, and an attempt made to average the figures obtained, according to some estimate of the relative quantities of the different classes.

Much the best way, however, in an established mine with reliable records, is to measure the volume of the depleted stopes on any one level, from the cross-section, in the same way as the reserves would be measured or the volume might be calculated from the floor plans. From this volume and the recorded extraction from the level, the factor is easily obtained. It is generally possible to find a recently opened level with a reliable record of extraction. The factor got in this way is, of course, exactly the figure required, being the number of cubic feet as represented on the cross-sections or floor plans necessary to be mined to produce one ton of ore. It should agree approximately with the theoretical factor; otherwise there is likely to be some serious error in the method used for finding the volume.

DENSITY FACTOR FOR SLIME UNDER DIFFERENT CONDITIONS.

	Cu.Ft. per Ton (dry).
Dry slime, lightly shaken	25 8
Slime with 2 per cent. water, well rammed	19 6
Slime with 9 per cent. water, well rammed	18.4
Paste, 23 per cent. water	22 0
Same paste, dried in sun to 6 5 per cent. water	18 0
Weighing the slime dug from a hole in a dump 2-ft. cube gave a factor on the average of	19 0

DENSITY FACTOR FOR TAILINGS UNDER DIFFERENT CONDITIONS.

	Cu.Ft. per Ton (dry).
Loose, dry	20 32
Dry, well rammed	17 08
Dry, well rammed (repetition)	16 83
2 per cent. water, well rammed	18 04
15.5 per cent. water, well rammed	18 08

Factor for Rough Broken Ore

Estimating the factor for rough broken ore is difficult. Having found the factor for ore in place, it may be multiplied by one of the figures given by Trautwine and other authorities to get the factor for broken ore. Sometimes an opportunity occurs for measuring a bin before and after a known weight of ore has been put into it. Or a railway truck full may be very carefully measured up and weighed.

Factor for Tailings and Concentrates

As mentioned before, the conditions of

*Broken Hill, New South Wales, Australia. Note—Abstract of paper read before the Scientific Society of Broken Hill, and published in *Aust. Min. and Eng. Review*, Dec. 5, 1908.

deposition affect the figure for these fine materials so much that the determination is very difficult and unsatisfactory. In the case of concentrates it is generally possible to get a figure by shipping and weighing the whole of a heap (or contents of a bin) previously carefully measured. In the case of tailings and slimes, it is not often that this can be arranged, and we have to fall back on weighing a known and necessarily small volume. The figures already given show how unreliable the data obtained in this way may be. It is obvious that, under these conditions, it is absurd to waste time on a fine determination of volume when an error of 5 per cent. or more may unavoidably occur in the density factor. It is also obvious that an estimate can only be after all an estimate, and not an exact measurement.

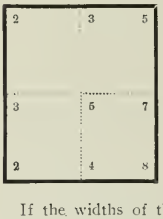
Measurement of Volumes Underground

The chief problem is the estimating of ore reserves. In a lode of uniform width, the area of proved but unstoped ore as shown on a projected longitudinal section should be taken and multiplied by the width measured normal to the section. Sometimes a simple arithmetical calculation is all that is necessary. In a wide, irregular lode, such as the Broken Hill lode, there are two chief methods. The first is to multiply the mean of the proved ore areas (whether stoped or not) on two adjacent levels by the distance between them, and afterward to subtract the recorded extraction between these levels. As the mean-area method gives a value too high when the end areas differ much, in such a case it would be better to use the prismoidal formula. The middle area would be got by plotting a plan halfway between the levels, by the aid of the sections and floor plans. The second method is much better. It is, however, necessary to have accurate cross-sections of the lode at frequent intervals, the frequency, of course, depending on the irregularity of the orebody. In Broken Hill practice the sections are spaced at intervals varying from 20 to 50 ft. The mean of the areas of proved unstoped ore on any two sections is multiplied by the distance between these sections. This method is more laborious, but much more exact, as it takes into account bulges, etc., between the levels. It has two other great advantages. No reliance is placed on records of extraction, which are often very unreliable indeed, especially in the older levels; and the tonnages are obtained separately for each section of each level—a very important point, as it is often desirable to know the approximate tonnage to be won by carrying out some particular piece of repair or development work.

An estimate of ore reserves might, of course, be made by finding the area of ore left unmined on each floor plan, but the conjectured wall would generally have to be drawn in on the cross-sections, and transferred to the floor plans; moreover, the tonnage in each separate floor of a level would be a figure of no practical value.

Underground Excavations

In Australia these are generally measured in cubic fathoms. In the case of measuring up fathomage for stoping contracts in a narrow lode of fairly uniform width, the stoping may be plotted on a projected longitudinal section, and the measured widths (normal to the section, not necessarily to the lode) figured on in their correct positions. By narrow lode, I mean one in which the whole lode from wall to wall is taken out in one stope. The area of stoping on the longitudinal section is then multiplied by an average of the widths over that particular area. Care should be taken in averaging the widths over any area to give each measurement its proper value. For instance, suppose we have a square with widths as shown, the mean width is not the sum of the widths divided by nine, but is obtained thus:



2x1	—	2
3x2		6
5x1		5
3x2		6
5x4		20
7x2		14
2x1		2
4x2		8
8x1		8
	16)71	
	4.43	

If the widths of the small squares are averaged separately, and the mean width of the four averaged again, the corner widths will be used only once, the side widths twice, and the center width four times.

This is a very simple example. In an irregular area judgment must be used in valuing the measurements. In irregular underground excavations, cross-sections at intervals depending on the change of form of section must be used. These cross-sections would be taken with the level and staff, the staffman measuring the hight to the back, and calling it to the instrument man at each level point. With much of this work to do it would pay to have a special column marked, "hights to back," in the level book.

Measurement of Contents of Bins

In irregular box-like bins, never surcharged, the simplest method is to take a number of measurements at regular intervals from the top down to the surface of the material, and then average these depths (according to the method of averaging mentioned before). Knowing the whole depth of the bins, we can then get the average depth of ore. In bins with hoppered bottoms of various shapes, the same general method may be followed, if the capacity of the bin for each foot in depth is first calculated. Surcharged bins or bins in which the surface of the material or the bin bottom is very irregular, are best measured by plotting cross-sections, and taking out the areas in the usual way. Where bins of irregular, empty section have to be measured, it pays to have the sections of the empty bin plotted to scale in ink in a notebook of handmade paper. The surface of the contents of the bin may often then be simply sketched on the section in pencil, and rubbed out before the next measurement. Having the empty section already drawn saves a lot of time in the field.

Measurement of Dumps

To estimate the contents of a dump or pile of ore is frequently necessary. If the dump is of great area, and there are no records of the original surface levels, the estimate can only be approximate. In the case of large, flat-topped tailings dumps, in which the top area is not very different from the bottom area, and on fairly level ground, or ground of small uniform slope, an estimate may be made from a plan showing the edge and the toe. A series of levels should be taken around the toe, and another series to the same datum at intervals on top. The top of such a dump is generally fairly level, so that no particular care is needed in spacing the levels. The dump may then conveniently be divided into sections or divisions, the area of the top and of the bottom of each division taken, and the mean reduced level of the top and of the bottom found separately by averaging. By simply taking the mean of the top and bottom areas, and multiplying by the difference of the mean levels, we get an approximation, but for closer work the prismoidal formula should be used. Since the batter of a dump is usually uniform at any one place, even if part of the dump has been removed, the middle area may easily be found by drawing a line around the dump half way between the edge and the toe. If the dump lies on steep or irregular ground, the calculation should be made from cross-sections, taken at right angles to the top center line. The right angles may be laid out by optical square or pocket transit. The center line, of course, should be approximately the greatest length of the dump. As long as the cross-section keeps about the same value, 40- or 50-ft. intervals along this line on a big dump, together with the use of the mean area method, will be sufficient. At the ends the sections must be closer, and the prismoidal formula should be used. In settling this important question of the spacing of sections in any estimate, it must be constantly remembered that the prismoidal formula is mathematically correct, and the mean area method an approximation, for any solid with parallel ends, and capable of being generated by a right line moving on the boundaries of the end areas—in other words, for any prismoid.

Measurement of Long Heaps

In measuring long-shaped heaps of small section, such as heaps of coal or concentrates piled along railway lines for subsequent reloading, it is, however, impossible without the use of a multitude of sections to adhere closely to this rule. The sections can with practice be so placed at fairly long intervals—say, 30 or 40 ft.—that the material lying between them could be shoveled up into an approximate prismoid. In dumps of this sort, a close estimate can, of course, be made mechanically by spacing the sections at regular short intervals—5 or 10 ft., according to the regularity of the heap. This way, again, would mean a multitude of sections to take, plot and calculate, but this method must be followed for periodical measurements, if the area under the dump is very irregular. Bottom sections should be taken before the dump is formed, at, say, 10-ft. intervals, and plotted in ink, the sections of the dump itself being taken at the same points, and plotted in pencil on the bottom sections. When called upon to measure a dump on irregular ground, with no previous levels on record, a vivid imagination is exceedingly useful. A party of three men can very quickly estimate these long dumps—3000 or 4000 tons spread over ¼ mile of railway can be measured up in about four hours as far as the field work is concerned. A good system is this: The leader pegs out half a dozen sections, at the greatest intervals at which he can mentally shape all the material between them in prismoids, with the pegged sections as end areas. He then records the sections distances and offsets as they are taped and called out by the other two men, then leaves them to get the levels (with a dumpy, which is much quicker than any pocket level), and proceeds to peg out sections on another length of dump until the first lot of levels is completed. Where much of this work has to be done, it pays to have special books or sheets printed for recording field notes, thus:

Section.	Staff Reading.	Offset.	Remarks.

A complete set of notes can then be taken on one page of a book, or on half a sheet where the loose-leaf system of recording field notes is used. Each section is complete in itself, as where stuff has to be shoveled out of trucks and in again it will never be piled so high that all the levels cannot be taken off one set up. There is, therefore, no need to reduce the levels, but the section can be plotted direct off the line of sight of the instrument as datum line.

Measurement of Irregular Cones

In calculating the tonnage in irregular cones the best method is to make a contour map of it. A rough theodolite traverse should be run around the toe, and from each station bearings, vertical angles and slope distances taken to any changes of slope in the sides and to one point on top. Then find the reduced levels of the station points around the base, make a rough survey of the top off the point fixed by slope from the bottom survey, and take levels over the top reduced to this point as datum. Now plot the whole survey in plan, and figure on the reduced levels, calculated to the one datum, at all the points fixed. Contours at any desirable intervals may then be plotted by interpolation. The areas of the contours may then be taken out, and the volume calculated by either the mean area or the prismoidal formulas. In taking out all these irregular areas, a planimeter is almost a necessity, although tracing linen or paper ruled into small squares will do as a makeshift. A planimeter should be occasionally tested on a carefully plotted square of known size. Even on small areas of 1 or 2 sq.in. area, the planimeter will give results within about 1 or 2 per cent. Where sections are to be used only once, it pays to plot with a hard pencil, grooving the lines well in so as to facilitate guiding the point of the planimeter. Of course, where the top section is plotted on a permanent bottom section, and rubbed out so that the latter can be used again, a soft pencil is necessary.

Measurements of Excavations, Such As Quarries and Open Cuts

This is a branch of work in which I have had very little experience. The same general methods of plotting cross-sections and calculating the volume from their area would be followed, but the difficulty would lie in taking the sections across steep and irregular falls. I have raised the point in the hope of discussion.

In discussing the above paper, C. W. Matters suggested a useful method for measurements of open cuts. A center line is first pegged along the bottom of the quarry. A theodolite is then set upon the section points (at suitable intervals), and a right angle turned and the section marked out. For the bottom of the open cut the theodolite is used as a dumpy level, and offset distances and levels taken as usual. For the irregular sides vertical angles are taken, and slope distances to the points measured with a steel tape. The chainman takes a level staff with him. Where possible the angle and slope distance is read direct to the point on the side, but where hummocks of rock, etc., intervene to hide the actual point, the staff is held vertically on it, and the angle and slope distance read to a figure on the staff, which is recorded in a separate column.

H. Warlowe Davies considered that Mr. Matters' method would be slow, as leveling with a theodolite is not so quick as with a dumpy, and an optical square would be much quicker and quite accurate enough for marking off the sections at right angles. He preferred the use of a pocket level or clinometer to overcome difficulties in the side measurements. A parallel base line would also be necessary on top. Mr. Davies also discussed several other points, and advocated determining ore reserves off the floor plans, as being sections only 7 or 8 ft. apart, and suggested reading the staff inverted against the back as a safer method for measuring the hight to the back in underground excavations. He mentioned the following factors:

	Cu.Ft. per Ton.	
Coal	39 17	(careful measurement of a truck)
Coal	40	(usual practice
Friable ore in place	8 4	from a square set)
Run-of-mine ore	16	
Slime	20	
Tails	18	
Fine jig tails	?	

In his reply to the discussion Mr Donaldson said that the two methods of measuring open cuts seem to be suitable for two classes of excavation, Mr. Matters' (theodolite) method being adapted to deep, more or less V-shaped cuts, and Mr. Davies' to flat-bottomed quarries, in which the irregularities of the sides do not greatly affect the volume. He also thought Mr. Davies' suggestion for inverting the staff in measuring stopes, etc., was good. He also gave the following factors:

	Cu.Ft. per Ton.	
Ore in place	9 5	(from measurement of stopes or several levels with known extractions)
Coal	40	
Run-of-mine ore	16	
Tails	19	
Slime	19	

Indian Gold Mines

The gold production of the Kolar field, in Mysore, India, in February was 41,898 oz. bullion, the smallest in a long time. This was due chiefly to a fire, which stopped production in the Nundydroog mine for a time. The output for two months ended Feb. 28 was 83,807 oz. bullion in 1908, and 88,019 oz. in 1909; a decrease of 888 oz. The bullion reported this year was equal to $1,654,158, or 80,027 oz. fine gold. The report includes two mines—the Hutti-Nizam and the Dharwar Reefs in the Deccan.

In drifts at the Van Dyk Proprietary mines (*South African Min. Journ.*, Jan. 9, 1909), the average advance for each face throughout the mine was in December, 217 feet per month. There were seven drifts, five driven double-shift and two single shift.

Gold Dredging Ground in the Upper Amazon Valley*

The first mining concession granted by Peru for working the gold alluvials of the Inambari was confined to the torrential district and did not extend to the lower and far richer region. The gold here was discovered in connection with the india-rubber industry. The rubber men, while building a road down to and along the lower course of the Inambari as far as the head of navigation, discovered that natives and also their own rubber-pickers spent much of the time washing gold. Thus prompted, the English managers made experimental washings, and after professional assistance, an elaborately organized expedition was sent out from England, and more ground was examined with the same result. The gold from the Inambari resembles in form and quality the gold obtained from the Kaka. It is flat and relatively thick, having evidently been subjected to pressure after leaving its original vein. When a pan of gravel is washed the heavy residue containing the gold is a black sand. An analysis of a sample from the lower Inambari gives the following results:

	Per Cent.
Silica	8.50
Gold	0.27*
Silver	0.024†
Copper	0.55
Arsenic	0.50
Iron	37.10
Alumina	24.30
Titanic oxide	4.18
Manganese	1.50
Sulphur	1.57
Oxygen (by difference)	21.406

* 88.20 oz. per ton. † 7.84 oz. per ton.

Thus far all we know about the Incahuara and Inambari gravels is the result of exploratory expeditions; but companies are now proceeding to test these gravels by actual working, and their results will be watched with interest. All that the various experts have done is to ascertain surface richness. At Incahuara, however, the ground was explored to a depth of 16 ft., and found to be equally rich all the way down. At no place has bedrock been reached, because the water poured in when the river-level was reached. Neither has the bed of either river been examined.

Method of Working

Only one method of working these gravels is practicable, i.e., dredging; the ground does not fall steeply enough for sluicing or hydraulicking. At Incahuara, for instance, and along most of the reaches of the lower Inambari (except where torrential side streams enter it) there are no boulders. On neither river, again, is there hard clay; the ground is loose, a mere compound of stones and sand. Again, at Incahuara the bedrock is friable and easily scraped by the lip of the dredge buckets, and a similar bedrock appears on the Inambari.

The current of neither river at the points of interest to the gold dredger is swift enough to cause any danger to the vessel. In flood time it can float over and excavate the banks, or can be worked in a paddock. During low river it can delve up the bed of the stream.

The transport of dredges to these remote places is difficult and costly; but in the case of the Incahuara dredger a considerable part of the machine is said to have been already transported to the site. According to report, the Ollachea road presents no greater difficulties than does the Caravani.

Extent of the Deposit.

The question that has to be answered is: What is the extent of these two dredging grounds? The answer can be only hypothetical. The only part of the ground on the Inambari or Beni rivers that has been examined by competent men is the Incahuara basin, which contains about 10,000,000 cu.yd. of dredgeable gravel. Its surface has nowhere yielded less than 19d. to the cubic yard, while large areas of it average at least a dollar, and many places very much more. The bedrock value is likely to be much higher.

An average value of 3s. per cubic yard is not an extravagant estimate. Of course, local authorities put the average very much higher. At this rate the Incahuara basin alone contains £1,500,000 worth of gold. For 100 miles below the Incahuara basin it is believed that the Beni gravels yield gold; there are numbers of places where it has been definitely located, so that in all probability the Incahuara basin is a mere fraction, probably not more than the hundredth part of the dredgeable ground on the Beni.

On the Inambari, if no spot has been so carefully examined as the Incahuara, a much longer stretch of the river has been rapidly sampled by more than one expert, and values as high, for instance, as 22s. to the cubic yard have been revealed. The Inambari, therefore, is likely to yield as much gold as the Beni. The lower tributaries of both rivers are margined by gold alluvials.

Lode Mines

Something is to be expected, too, from the substance of the hills through which these rivers flow. At a point situated between the basins of the Inambari and the Beni, one gold mine has been worked for some years by an American company. Its output of gold is known to have run to several millions of dollars. During his explorations of the province of Caupolican Doctor Evans observed many signs of old workings in the rocks bordering the Beni. It is unlikely, then, that dredging will be the beginning and end of the exploitation of this region.

As far as we now know, all the indications seem to point to the conclusion that this part of the eastern slope of the Cordillera is a real goldfield of great size and importance. Its southern limit seems to be somewhere about the latitude of Mount Illimani; but as to the limit of its northern extension we know nothing. It will probably be long before we have exact knowledge over so large an area, so difficult of access.

Dense tropical forests render prospecting extremely difficult; only along the river banks has it thus far been seriously attempted. The climate at the level we are considering (about 1000 ft. to 2000 ft. above sea) is healthy; once plantations have been cleared, roads made, and suitable houses built, people can live there in comfort all the year around. All that is needed is a flow of population in this direction; for it is probably the richest but least developed part of the world.

*From a paper by Sir Martin Conway, read before the Society of Arts, and published in the London *Min. Journ.*

Electric Motors in a Concentrating Plant

The concentrating plant at the Washoe smelter, Anaconda, Mont., was one of the first in the country to be driven by electric power exclusively, four large induction motors being used for this purpose. The concentration building is 600 ft. long, with the steam plant, heretofore used for driving it, located in the center. The jigs, tables, etc., are driven from a main line shaft 500 ft. long, to which the steam engines were connected by rope drive and friction clutch pulleys. The steam plant has been kept intact, to be used as a reserve in case that the electric power fails. The mill as a whole is divided into eight sections, four on each side of the engine room. Two induction motors are installed in each half of the mill, and connected to the main shaft by rope drive and friction clutch pulleys.

These large motors are notable because of their having squirrel-cage rotors, something unusual in motors of this size. Their guaranteed full-load efficiency is 91 per cent. and full-load power factor 92 per cent. Squirrel-cage motors were chosen because the starting conditions are favorable and the power factor of this kind of motor is higher than that of the wound-rotor type. The general construction of these large induction motors is practically the same as that of the smaller ones built by the Allis-Chalmers Company.

In addition to the four large motors and the 200-h.p. variable-speed induction motor for operating the pumps in the mill, the Allis-Chalmers Company also furnished for this plant three synchronous motor-generator sets of 300 kw. output each, and one small induction-motor generator set for starting and exciting the synchronous sets.

Skips or Buckets in Sinking Vertical Shafts?

Sinking with Buckets Is More Dangerous, and If Much Water Is Encountered, More Expensive, While Timbering Is Much More Difficult

BY CHARLES B. SANER*

Most vertical shafts on the Rand have been sunk by means of kibbles or buckets, with or without crossheads. All modern shafts on the Rand, South Africa, are rectangular; and until lately all the shafts were sunk with their long axes parallel to the strike of the formation, but now that the mines have become so deep that compound shafts are not economical, it has been found better to sink the shafts at the deeper-deep mines with their long axes in line with the dip, and at right angles to the strike.

In a number of instances hauling engines have been installed that cannot hoist from the extreme dip of the property in one lift, a grave error in design, so that the present amalgamation era will bring relief to many a mechanical engineer. Here I may be allowed to make a complaint, that those who design new plants, whether for surface or underground equipment, seldom take the trouble to consult those who have to work the plant; upon whom in the end the blame falls if things go wrong, but seldom the credit if all goes well.

Two methods are employed in sinking vertical shafts: machine drilling and hand drilling. Sometimes a combination of both methods is used.

Shaft Sinking by Means of Air Drills

On the Rand machine sinking has been proved less expeditious and more costly. The great drawbacks are the necessity for irregular working shifts, both for drilling and shoveling, and the raising and lowering of the gear that causes loss of valuable time. If the formation passed through is in any way disturbed, the heavier charged machine holes break wider and make the sides of the shaft bad and heavy while more timbers are broken than when the shaft is sunk by hand. If the cut does not come, the whole round is hung up; that means loss of time and added cost in blowing out the holes and reblasting.

At the Village Deep No. 2 shaft, as native labor was scarce immediately after the war, sinking was done by machines and shoveling by one gang of 20 whites and another of 20 natives. The best footage done was in October, 1904, when 150 ft. was sunk in 31 days, a world's record for machine sinking.

Twelve machines were used on four bars; the cut holes were drilled 9 to 10 ft. deep and the other holes 8 to 9 ft. deep. The details are: Number of rounds drilled in the month, 20; average number of holes per round, 32.5; average time drilled, 8.28 hours; average time cleaning out, 27.27 hours; average time per round, 37.40 hours; average depth sunk per round, 7.5 ft.; number of ton buckets of rock broken per round, 231.

The whole round was blasted together, and it took two shifts to clean out; a task of 80 buckets was set for the first shift, and the second shift cleaned up. The sockets of the holes were then blown free of dust with compressed air, and again charged and blasted, the first shift coming in again and completing the cleaning up. Two engines and buckets were used. The timber was usually lowered just before the drilling shift went down—10 wall plates, or five sets at a time; the filling-in was done during lashing.

This method is bad, as there are no allotted hours of work for the men; this generally resulted in a rush. But as far as could be seen, no better system could be devised, as it was no use blasting the round until every hole was drilled to the proper depth; one awkward hole delayed the whole shaft. The great job of loosening the bars and machines, raising the hoses and bringing everything to the surface, is an undertaking that operates against speed in machine sinking—not to mention the waste of labor which, in order to be available, at any time day or night must be paid for, but which half the time is unemployed.

Shaft Sinking by Hand Drilling

It has been stated that where very hard ground or water is met with, machines will replace hand labor; but I fail to see it. The hardest ground can be more cheaply and as effectively sunk through by hand as by machines.

In the Turf Mines shaft a very hard dike was passed through and a square shaft cut by hand. If machines had been used, the blasting of the large holes would have made a wide ugly shaft, necessitating extra timbering, and the hauling and shoveling of unnecessary rock. With hand labor excellent results have been and are being obtained. The shaft is cut almost to exact required size, regular shifts are employed, and greatly increased speed has resulted.

In the latest large seven-compartment shafts the method of procedure is somewhat as follows: Three 8-hour shifts were worked, consisting of from 75 to 85 boys, under the charge of a white sinker and an assistant. The rock broken by the previous shift is shoveled into buckets or skips, and then from 35 to 45 holes from 30 to 50 in. deep (according to the nature of the rock) are drilled, mostly double hand, and blasted in the eight hours.

The holes are usually put in at right angles to the dip of the formation (or even flatter). When the shaft is sunk with the dip, practically no sump is carried, but instead a sort of vertical stope face, with the benches well defined, the north and south ends being, as a rule, a little higher than the center. With the formation dipping 30 to 40 deg., as in the central Rand, most of the rock in blasting is hurled to the north or rise end of the shaft, so that shoveling is mostly at one end. This is a serious drawback, as rapidity of sinking depends upon the speed of getting out the broken rock. The more time there is to drill, the deeper the holes, and the better the footage.

Various forms of receptacle are used to clear out the débris from the shaft bottom—cages carrying one or more trucks, buckets and skips. Mention is only made of the first as an old, and, as far as the Rand is concerned, a disused system. The other two systems are used on the Rand, and have ardent advocates. I will endeavor to give the advantages and disadvantages of each, claiming that privilege, as I have had experience with both.

Although it may be presumption on my part to criticize well known experts, I may mention that all those who have sunk with both buckets and skips have no hesitation in their preference; while those who have only had experience with buckets, naturally pin their faith to that system, knowing little of the other. In the large shafts two engines are usually employed, and to the winding ropes are attached buckets or skips.

Sinking With Buckets

Buckets are made of iron or steel and have a capacity of 10 to 20 cu.ft., they are usually oval or cylindrical in shape, about 4 ft high, and attached to the rope by a ball-bearing swivel, to bale or bow, or by a chain of iron or steel, bent to form a loop in the middle or provided with a hole for attachment. Some buckets are hung just above the center of gravity, and are held in position by two fingers above the bucket, which are turned back when

*Mine manager, Turf Mines, Johannesburg, South Africa.

NOTE: Abstract of a paper in the *Journal* of the South African Association of Engineers for October, 1908.

dumping. Other buckets are hung by a chain, with a large link in the middle, attached to two lugs on the top of the bucket, and are tipped by inserting a hook in a ring at the bottom of the bucket and allowing the winding rope to lower slightly.

The bucket may also be tipped on inverted V-hinged doors, or into a swinging chute. Four or more buckets are always in use; the great secret is always to have two in the bottom being filled. Crossheads of various makes are used to keep the bucket from swinging too much in the shaft.

An empty bucket is lowered by the engineman to within 10 ft. of the bottom, and on the signal to lower, he does so slowly. The sinkers below seize the bucket and push it to the desired position most suitable for loading, and detach the rope at once. Meanwhile the bucket on the other rope of the same engine, which is at the surface, is tipped. The rope in the shaft bottom is then attached to a full bucket, and on the signal being given, is raised slowly about 5 ft., is steadied vertically below the rope by the shaftmen, and then sent away. The engineman slows up on taking the crosshead at the timbers, which are from 40 to 140 ft. above the bottom of the shaft, and then speeds up to surface. From the bottom of the timbers the bucket is free to revolve, and sometimes does at a great speed before engaging the crosshead.

The buckets being usually of small diameter the shovelers can crowd around for loading. When nothing but dry rock has to be handled the bucket is very adaptable; but if any quantity of water has to be baled as well, its drawbacks are soon manifested. The steadying at bottom and tipping at top cause serious delays. The carrying capacity is limited, and it cannot with advantage be made much larger. When lowering timber and boys, limited capacity of the bucket is again a serious drawback; and when taking timber out at the bottom set, it is dangerous on account of its swinging. Drills can be lowered to the bottom, and, by overturning the bucket, are at once deposited on the shaft bottom. Few repairs are necessary for upkeep. Small-diameter ropes can be used—a saving in cost.

Many more trips are required to lower and raise the boys and material and timber, 6 to 8 boys only being carried at once. A form of bucket used by me was oval in shape, only 3 ft. high and from 3 to 3 ft. 6 in. diameter. It was easy to shovel into this bucket, and because of its shape the bucket was not so liable to catch in the timbers; but it was not very safe for boys to ride in, as they might be jerked out.

In blasting with buckets, after the warning signal has been given, the driver raises the bucket a few feet and lowers again. He is liable to let out a little slack rope, and on account of the irregular bottom, especially in shafts cut with the dip, the bucket will not stand upright nor steady; when the "rightaway" signal is given, the engineer takes the bucket away too quickly. This causes swinging, and there is every chance of fouling the timbers. Because of this swinging, a bucket cannot safely be quite full.

It is difficult to examine and clean down the shaft timbers and sides, especially between the last set and the bottom of the shaft—the place from which most of the rocks that cause accidents slab off. As it is almost impossible to remove bad or loose ground from a swinging and revolving bucket, the slab is left, with the hope that it will hang there until the timber reaches it. When using buckets in timbering, several sets are usually hung at a time; this means a rush of work for the timbermen, and then a slack time. The timber being farther away is little damaged with blasting. In some shafts extra boys are stationed on the timbers to steady the ascending bucket before it takes the crosshead.

Sinking with Skips

Skips are rectangular boxes of steel or iron, supported on the bottom by a shafting on which the box revolves, and in a framework with shoes running on guides. These shoes, during sinking, are 18 to 35 ft. long; the skips are self-dumping, and have a capacity varying from 20 to 40 cu.ft. The following are the dimensions of a skip frequently used: Three ft. 8 in. by 3 ft. 8 in. by 3 ft. 6 in. high. The important point is to have the loading box low enough so that rock can be thrown in over a shoveler's head from anywhere in the shaft. In the large shafts the best arrangement is to have one engine running the two skips in Nos. 2 and 3 compartments, and the other engine to run in Nos. 5 and 6 compartments.

The native gang is divided into three parties so as to have a regular set of men in each of Nos. 1, 4 and 7 compartments. Each party is again divided into two shoveling and one picking units.

One skip comes to the bottom, and 12 to 14 boys immediately load it—5 on each side and one at each corner, throwing over his shoulder. Immediately the skip is full—and it can safely be filled quite full—it is rung away and the driver can pull away and gather up speed at once. Meanwhile the pickers loosen the rock while the other skip is descending. When the empty skip gets to the bottom timbers, the loaded skip is tipping automatically, and no time is lost. After tipping the skip is drawn farther up the headgear, there being 30 ft. of head room above the tip, while the other is lowered in the shaft bottom. Loading is begun at once.

The timber is kept 20 to 30 ft. away from the bottom; short, temporary, 6-ft. lengths of steel guides are put downward projecting 3 ft. below the last set of timber, so that there is never any chance of the skip's shoes coming out, thereby insuring perfect safety.

When six 6-ft. lengths are in, they are taken out in one lift of two 36-ft. guides, and the permanent steel guide, 30 ft. long, with a temporary 6-ft. length, fastened by fishplates to the lower end, so as to take any blows of rocks from blasting, is bolted securely in place.

To take out the two 36-ft. lengths and bolt the two permanent lengths in place takes only from half to one hour, and is done while the bottom is being drilled over; that is, between 12 and 2 midday. The holes in the dividers are drilled on the surface before the dividers are sent down, and the steel guides punched from measurements taken in the shaft.

One set is lowered at a time, and the system adopted is as follows: First thing in the morning the timbermen descend and, while the débris is being cleared up from the shaft bottom, block the set lowered and filled in the day previous; then when the boys are drilling and the engines are free, four half-wall plates are hung in pairs and filled in 1 to 1½ hours. The corners are temporarily blocked and the short guides bolted on. The sides and ends, between the two bottom sets, are carefully examined and all loose rock is taken down. Thus the shaft is being examined and trimmed down daily, and if there is any dangerous rock, the boys can easily be moved to one side by shouting, and the rock dislodged and sent to the bottom without any mishap or delay, it having no distance to fall. When the wall plates are being hung, the south skip of one engine and the north skip of the other engine (skips in 2 and 6 compartments) are filled with the end pieces, studdles and dividers, and with compartments 1, 4 and 7 staged over, the filling in of the set is soon done, for one more skip load, or three in all, completes the whole set. All this timber can be taken out of the skip easily and with comparative safety, as the skip does not swing.

Skips have to be periodically repaired, for the liners to shoes and other parts wear out. Large diameter ropes have to be used; there is greater safety with skips than with buckets; better and more work is done, and, given equal conditions, just as great speed can be made.

I may mention that at the Turf mines, while sinking with skips from a depth of from 640 ft. to 3007 ft., there has not been one blasting accident, and only two from falling rock, which came from faulty ground.

During drilling, the sides can be easily examined and loose rock can be removed with safety from the timbers. A skip can be well filled, and when the signal is given, it is at once hoisted to the tip, with no jar or trouble, and automatically emptied. If the rope winds badly on the drum, there is no danger to the skip as the shoes run-

ning on the guides prevent its swinging, and there is also regularity of work.

Greater loads can be handled at one time, and the capacity of the skip can be increased while that of the bucket is limited. If water is met with and has to be handled before pumps can be installed, buckets are out of it, whereas skips can easily handle a fairly large quantity.

At the Turf mines the shaft has been cleaned up, one set blocked, another lowered and filled in, two 36-ft. lengths of temporary steel guides taken out, and the permanent ones put in place in seven hours, and without delaying the sinking operations below.

Comparison of the Two Methods

Excellent work has been done with both buckets and skips, but up to the present, because of meeting the most favorable conditions, buckets have done the quicker sinking.

It is impossible to make comparisons between two separate shafts, just as it is impossible to compare two adjacent mines as to working costs, or profit per ton—so many factors affect the issues, such as dip of ground, hardness and stratification of rock passed through, quantity of water, dikes, etc. The following are the best performances with each appliance:

At Brakpan No. 2 shaft, 204 ft. were sunk in one month and an average of 161 ft. in 14 months; the dip of the formation was about 8 deg. This was done with buckets.

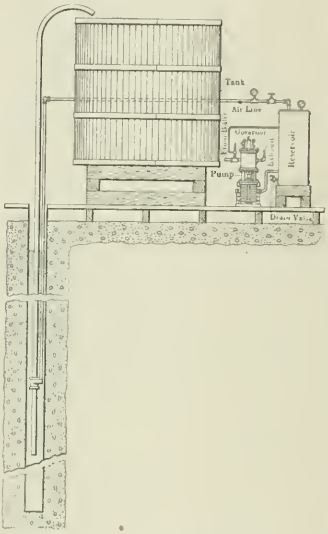
At Turf mines, 162 ft. were sunk in one month, and an average of 143 ft. in 14 months; the dip of the formation was from 32 to 44 deg. This includes one month when only 87 ft. were sunk owing to faulted ground necessitating stoppage for extra timbering. During the 14 months four dikes, totaling 98 ft., were passed through. This was with skips.

In examining the published statistics of accidents, the following figures are significant: From 1903 to 1907 there were 15 fatal and 15 nonfatal accidents due to the swinging of the bucket. From July 1, 1903, to Dec. 31, 1906, accidents due to the swinging of the bucket or the crossheads catching, men standing on edge, or rock falling out of the bucket or skip were, with buckets, 57; with skips, 8. Between 1902 and 1908 the number of accidents, including falls of rock from shaft sides, or out of tip (excluding blasting accidents) were, with buckets, 97; with skips, 23. Unfortunately I have been unable to get the exact footage sunk by each method during that period.

In reading the evidence given before the Rope and Safety Catch Commission, one is struck by the diversity of opinion expressed by the advocates of each system, but one notices that those who have used both buckets and skips are almost all in favor of the latter, and to that opinion I most strongly adhere

Raising Liquids by Compressed Air

The use of compressed air in pumping, especially from deep wells, is increasing on account of the simplicity of the system and the low cost of maintenance. In this method there are no moving parts; the only requirement is that the size, length and connections are properly designed so as to obtain maximum efficiency. Still, while pumping by compressed air is simple, the problem is better solved by tests than by mathematical calculations. The Westinghouse Air Brake Company, of Pittsburg, has lately completed a series of



WESTINGHOUSE AIR-PUMPING INSTALLATION

nearly 2000 tests covering a range of from 350 to 400 different conditions in deep-well pumping in order to obtain data concerning the amount of water delivered, air consumed, and the best proportions for and arrangement of piping and apparatus. The accompanying illustration shows the system as frequently installed by that company.

The council of the chamber of mines of Victoria has passed a resolution emphatically protesting against the "very lenient and inadequate sentences" given by magistrates in many cases of convictions under the Gold-buyers Act. Members expressed the opinion that the crime of gold stealing will never be checked while lenient sentences are given. In recent cases fines of £1 and £2 10s. have been assessed for offenses against the act—amounts which the council considers altogether inadequate

The London Silver Movement

The imports and exports of silver in Great Britain are a matter of much importance, since London still remains the great silver market of the world, and by its fluctuations the prices and movements of silver are largely governed. The totals of this movement have been given heretofore; in the following tables the details are stated, as they are reported in the annual statement of Messrs. Pixley & Abell. According to this statement the imports of silver into London for two years are valued as below:

From:	1907.	1908.	Changes.
United States...	£11,961,701	£ 8,305,976	D. £3,655,725
Canada.....	129	240,532	I. 240,403
Mexico and S. America.....	255,515	211,267	D. 44,248
Australasia.....	125,944	120,241	D. 5,703
Africa	64,017	196,469	I. 132,452
India.....	1,218,473	271,000	D. 947,473
China.....	377,485	.....	D. 377,485
The Straits.....	958,148	46,666	D. 911,482
European countries.....	997,138	924,713	D. 72,425
Other countries.	25,342	10,025	D. 15,317
Total.....	£15,983,892	£10,326,889	D. £5,657,003
Approx. ounces.	55,660,500	46,883,600	D. 8,776,900

The total imports do not include silver in ores, which was valued at £2,244,030 in 1907, and £2,148,680 in 1908; raising the approximate quantities imported to 63,898,000 oz. and 56,639,000 oz. in the respective years. The decrease in values was much less than that in quantities, owing to the lower average price of silver in 1908. It must be remembered that a considerable part of the imports credited to the United States is derived primarily from Mexico, and a smaller portion from Canada; this silver being smelted or refined in this country from ores and base bullion from those countries. The British returns, of course, are based on the port of last shipment.

The exports for two years are reported as follows:

To:	1907.	1908	Changes.
India.....	£11,163,424	£ 8,836,820	D. £2,326,604
The Straits.....	1,029,356	584,848	D. 444,508
China	559,450	822,300	I. 262,850
Total.....	£12,752,230	£10,243,968	D. £2,508,262
Africa, inc. Egypt	1,057,252	281,890	D. 775,362
Australasia	372,130	163,750	D. 208,380
United States..	660	200,598	I. 199,938
Canada.....	135,298	25	D. 135,273
Mexico and S. America.....	479,610	354,246	D. 125,364
European countries.....	2,098,659	1,925,677	D. 172,982
Other countries.	25,010	113,734	I. 88,724
Total.....	£16,920,849	£13,283,888	D. £3,636,961
Approx. ounces.	62,164,000	60,308,000	D. 1,856,000

While the decrease in values was 21.5 per cent., that in quantities was only 3 per cent.; this difference being due to the lower price of the metal in 1908. The causes for the decline in values have heretofore been explained

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In New Zealand applications for assistance in prospecting operations are presented to the local governing body, or a miners' association, which body may make a recommendation to the minister

Electrically Operated Coke-squeezing Machines

By Alfred Gradenwitz*

The use of electricity in connection with mining and metallurgy has brought about a revolution in these branches of engineering work; electric operation has been adopted everywhere, not only in connection with the main work, preferably to other methods, but also with accessory operations, owing to the small space requirements and high safety characteristic of the electro-motor. This power is also used to facilitate handling, as is shown by electrical controlling apparatus in connection with all kinds of lifting and charging machinery.

Electro-motors have thus found an interesting scope in connection with the operation of coke-squeezing machines, as is illustrated by the accompanying photographs.

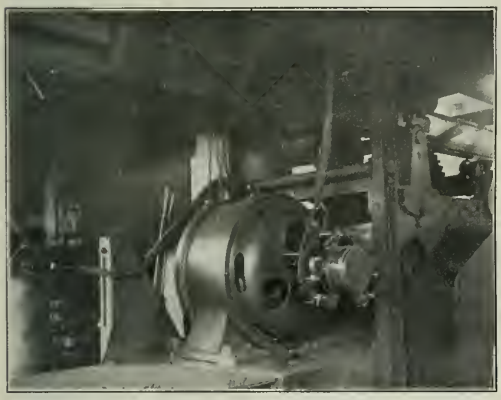

FIG. 1. INSIDE VIEW OF ELECTRICALLY OPERATED COKE-SQUEEZING MACHINE

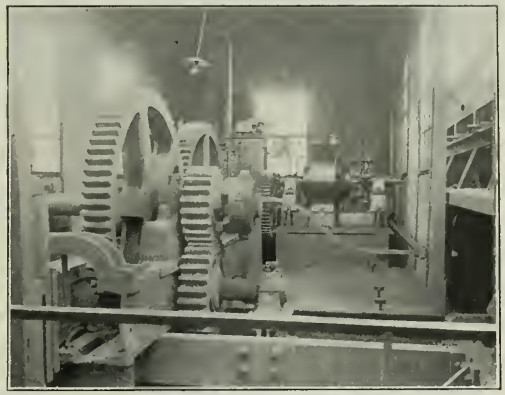

FIG. 2. INSIDE VIEW OF COKE-SQUEEZING MACHINE IN "PRINZREGENT" MINE NEAR BOCHUM

Operation of the Machines

Coke-squeezing machines are transportable devices serving to squeeze the ready-made coke out of the retort by means of a stamp. Four operations would have to be performed in this connection; first, right-hand traveling of the machine; second, left-hand traveling of the machine; third, introduction of the stamp into the retort; and, fourth, withdrawing of the stamp from the latter. An essential requirement of this kind of machinery is that the traveling motion and the operation of the stamp should never be carried out simultaneously; therefore, the operation generally requires only one reversible motor, starting from its position of rest under full load, and being connected by a clutch, as the case may be, to the traveling gear or the driving gear of the stamp In some special cases, however, other equipments, including two motors, are preferred, one motor being used in actuating the stamp.

Fig. 3 shows an outside view and the electric drive of a coke-squeezing machine used in the Prinzregent mine, near Bochum. As in most plants of this kind, the coke ovens have been constructed with a view to arranging the several compartments like batteries, in long rows, one beside the other. Each of the compartments is about 2 m. in hight, 6 m. in depth and 7 m. in width; at either end there is a door, enabling the coke cake, formed from the mineral coal, to be removed with the aid of a long stamp.

The coke-squeezing machine is installed on a fairly heavy truck, running on six wheels, and carrying the driving gear with a movable stamp. The latter comprises a substantial iron shield of about the cross-section of an oven, and which is carried by a long rack, running on long rollers and being moved in a horizontal direction by gearing. The driving mechanism consists of a 45-h.p. direct-current Lahmeyer motor, running at a speed of about 1000 r.p.m., under a tension of 220 volts, and operating the rack through a multiple-toothed wheel gearing. In order to allow the ovens to be discharged successively, the whole machine can be made to travel on rails in a direction parallel to the ovens. The same motor which is used in moving the stamp, also serves for driving the truck, to which effect it is switched over by means of a clutch to the driving gear of the truck.

A Universal controller is used in steering the motor, all operations being controlled by the same apparatus. An armature short-circuit brake serves to instantaneously stop the motor.

Current is supplied to the motor in a way similar to tramway motors, by trolleys, fixed, as seen from the figure, to a framework pole. In order to protect this against atmospheric influences, the truck of the coke-squeezing machine is covered by an undulated sheet cabin.

Alternating Current at 1000 Volts is Used

Fig. 4 shows the drive of a coke-squeezing machine of the mine Rheinpreussen, near Homburg, where alternating-current at 1000 volts is used. A 30-h.p. alternating-current motor is designed with pole-switching for two different numbers of turns. As seen from the figure, a double controller and two stator oil-switches have been provided for steering the machine. The rack is moved in the direction corresponding to the coke-squeezing operation, at a lower speed, agreeing with the smaller number of revolutions of the motor, and in withdrawing the stamp, at higher speed.

In both of the plants above described, the same motor is used in actuating the squeezing machine, and in effecting the traveling motion of the whole system, by the aid of a mechanism operated with the hand lever visible in the figure.

In the department set apart for the working of by-products at the works of the Eschweiler Mining Association, two coke-squeezing machines have been equipped with Lahmeyer motors; with each of which there is used a 40-h.p. motor running at 750 r.p.m. under a tension of 500 volts. Fig. 1 shows one of these drives, the motor operating both the machine-traveling gear, squeezing stamp and planing rod. After the traveling gear has been thrown out by the aid of a hand lever, the two latter are likewise moved with a hand lever until a tooth of the rack engages with a toothed wheel arranged below the same, when the rod is moved on by the motor-actuated gear.

In Fig. 5 are seen two coke-squeezing machines, installed for electrical operation

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in the Röchling Iron and Steel Works at Voelklingen. Each of these machines comprises an alternating-current motor, which effects the motion of the squeezing rod, and after causing a wheel gearing to engage, also causes the traveling motion. The output of each motor is 30 h.p. at 1000 r.p.m., at 400 volts tension, and 15 h.p. at 500 r.p.m., the low number of turns being required in coke-squeezing and in moving the pressure rod, and the high speed, in withdrawing the rod.

Fig. 6 finally shows the drive of a coke-squeezing machine, a distinctive feature of which is the fact that special motors are used in operating the traveling gear and squeezing stamp respectively. The two 4-pole direct-current motors, in addition to the starting and controlling apparatus, have been constructed by the Lahmeyer company for an iron and steel works in Upper Silesia.

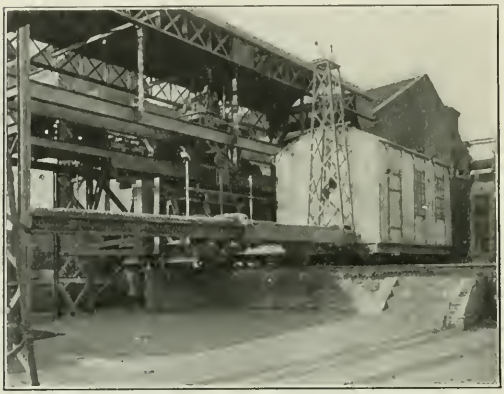


FIG. 3. OUTSIDE VIEW OF COKE-SQUEEZING MACHINE AT THE PRINZREGENT MINE

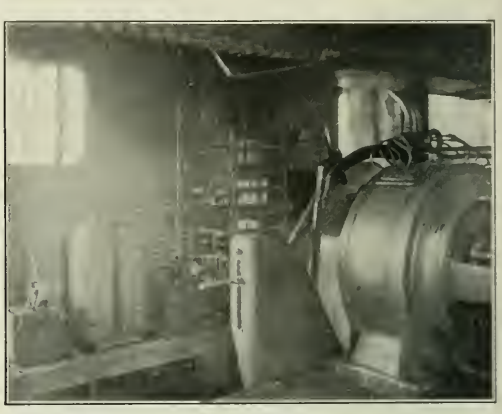


FIG. 4. DRIVE OF COKE-SQUEEZING MACHINE AT RHEIN-PREUSSEN MINE NEAR HOMEURG

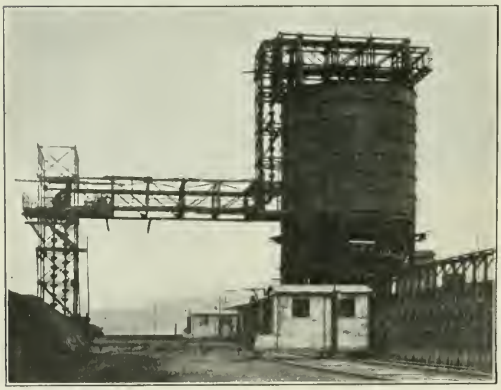


FIG. 5. COKE-SQUEEZING MACHINE OF THE RÖCHLING IRON AND STEEL WORKS AT VOELKLINGEN

FIG. 6. INTERIOR OF MACHINE SHOWING ARRANGEMENT OF THE MACHINERY

Coal-mine Legislation in Kansas

The new Kansas legislation forbidding the use of explosives in coal mines became a law last week. The new law provides:

"Section 1. It shall be unlawful for any person or persons engaged in coal mining to use or cause to be used dynamite, or other detonating explosives in the preparation of any blast or shot in any coal mine within the State of Kansas; provided, however, that dynamite or other detonating explosives may be used under such rules and regulations as may be agreed upon between the employer and the employees, same to be approved by the State mine inspector. All rules, regulations and permits to use dynamite or other detonating explosives as herein provided, shall be in writing.

"Section 2. It shall be unlawful for any person, firm, or company to direct any of its or their employees to go into any sinking shaft or development work in a coal mine, after shots have been discharged in which dynamite or other detonating explosives have been used, before having removed all smoke, gases or other unsanitary conditions that may have been created by the use of dynamite or other detonating explosives.

"Section 3. Any person violating the provisions of section one of this act, shall be deemed guilty of a misdemeanor and upon conviction shall be fined in any sum not exceeding twenty-five dollars.

"Section 4. Any person or corporation violating the provisions of section two of this act shall be deemed guilty of a misdemeanor and upon conviction shall be fined in a sum not exceeding one hundred dollars."

Coal Cutting by Machinery in England

By J. Hinton*

American readers may be interested in the following notes, which express the opinions of English mining experts on the subject of coal cutting by machinery. During the last 10 years or so, the question of coal cutting by machinery has commanded a considerable amount of attention in Europe, and English mining engineers have been more disposed to examine the economic advantages, which are claimed to result from the employment of coal-cutting appliances.

It has been found that when the coal seams and other conditions are favorable, the output per man may be doubled when machines are used, while the cost of production is appreciably reduced and an increased value of output per ton is obtained. In specific cases the cost per ton has been 42c. where hand labor had cost 60c.; the output per man being 4 1/5 tons as compared with 2½ tons. The proportion of round coal with machines, has also been raised 25 per cent. and greater safety has been insured to the miner.

Machines Afford Greater Safety

At one English colliery there was a serious accident when the work was done by hand for every 77,000 tons of coal mined; the proportion when machines were introduced was only one serious accident for every 450,000 tons produced.

It must be confessed, however, that in some seams machines have proved unsatisfactory; this is the case in what may be called the South Wales area, embracing the Cardiff and Swansea districts. The united coal output of these districts is not much short of 50,000,000 tons per annum, but the amount won by machinery last year was only 105,000 tons, the number of coal-cutters in use being only thirty. Two of the probable reasons for machines not finding favor in the South Wales area are that comparatively little holing is required, while the roads are of such a nature that close propping is absolutely necessary for safety. It is not likely that there will be any increase in the employment of cutters where the coal seams are thick, and lines of cleavage occur with regularity, so that there is not much labor required in working the coal.

Some statistics for 1906 and comparisons with former years will show what progress has been actually made in the introduction of coal-cutting machinery into English mines. In 1906, coal was raised from 3295 mines in Great Britain as compared with 3461 in 1902; the number of machines at work during 1906, was 1136, which compares with 483 in 1902, an addition of 653 cutters. From this it will be apparent that except in South Wales, machines are rapidly growing in favor, a considerable proportion of the increase occurring in the East and West of Scotland, Yorkshire, the Midlands and Durham.

Electric Power vs. Compressed Air

The driving or motive power, continues to be a debatable point. In Scotland, electricity is chiefly in favor, 171 machines being driven by it; 134 are driven by compressed air. Electric power has grown in favor most rapidly. On the other hand on the Newcastle, Durham districts compressed air is used for 140 machines, while only 79 are driven by electricity. In Yorkshire the proportion is 158 to 94, and in Lancashire 146 are driven by compressed air and only 14 by electricity.

The total coal production of the United Kingdom in 1906 was over 251 million tons; in 1902 the output was about 227 million tons. Of this production, the machine-mined coal in 1906, was 10,202,000 and in 1902, only 4,161,000 tons. A simple calculation shows though the experimental stage has been passed, the production per coal-cutter has only increased from 8615 to 8981 tons. The increase in the number of machines and the total output from them is, therefore, more significant than the amount of coal obtained by each machine, the reason probably being that a great many machines were started too late in 1906 to appreciably affect the output. A broader view of the question of coal cutting is now being taken; the miners do not now object to the use of the machines as they did some ten years ago; in 1902 only one ton in fifty was machine mined, while in 1906 the proportion was one in 25.

Many experts are of the opinion that coal-cutters are of considerable value in thin seams. It is the experience of many English authorities on coal mining that if the mining and hauling price in a seam worked, is less than 60c. per ton, a cutting machine would hardly effect an important economy. This probably explains why in the Midland districts of England, where 33¼ million tons of coal are annually obtained, there are only 140 cutters, while there are about 176 cutters in the east of Scotland, where the total output is not much in excess of 19 million tons.

Danger is feared from electrically driven machines in fiery or gassy seams. Some engineers suggest that in fiery mines, suitable air compressors should be erected and driven by electric motors, duly incased and placed in main intakes at safe distances from the face, and that the coal-cutters should be driven by compressed air from them. This method would be a practical and useful adaptation of electricity to the present method of working by compressed air, thus avoiding the serious risk which would be incurred by carrying the currents to the faces.

The advantages of coal cutting have been summed up as follows: An increased percentage of large coal is obtained, and the coal mined is in a firmer and better condition; a more regular line of face is obtained leading to more regular and systematic timbering; increased safety conditions for the workers; thin seams can be profitably worked; less small is made than in holing by hand; increased output and greater regularity; facility of supervision. Fewer explosives are required for getting down the coal and in some cases none.

*87, Atlantic Chambers, Manchester, Eng

The Cost of Diamond Drilling for Coal in Pennsylvania

By E. E. White*

The following notes on progress and cost of drilling in the coal measures of Greene county, Penn., were taken from April 20, to July 13, 1908. I was on the ground practically all of the time, representing the company who had optioned the coal, and so had a chance to obtain correct figures on the progress of drilling. The costs are not as accurate, but are essentially correct.

The cost of superintendence and carbons is estimated. The superintendent, C. C. Hoover, of the Birdsboro Steel Foundry and Machine Company, which concern took the contract for drilling, was on the ground only one day. As he was looking after about half a dozen other drills, the estimated cost for superintendence is liberal. The cost for carbons would have been much less but for the fact that 2¼ carats were broken at a depth of 21 ft. in the first hole, probably by a piece of steel in the hole. This bore was abandoned and another started 2 ft. away.

The drill only worked a day shift, and was run by two men, the drillman, H. N. Wighaman, and a fireman. Bits were set in the company's shop, not in the field. The hours in the progress table refer to the drill, that is, to two men, except in the case of hours setting bits.

The drill had a hydraulic feed and a double-core barrel, taking a 2½-in. core. This type was described by W. F. Murray in the Journal of Feb. 23, 1907, and by the Sullivan Machinery Company, in *Mines and Minerals* for October, 1906. The outfit, with one good diamond bit, is furnished by the Birdsboro Steel Foundry and Machine Company, of Birdsboro, Penn., for about $3500.

Boiler and Pump Trouble

Considerable trouble was experienced with the boiler on the first two holes, which was accountable for a large part of the hours' delay on these holes, shown by the progress table. The boiler was of the upright type, set behind the machine on the heavy wagon frame. There were

*Carterville, Missouri.

no stay bolts, and the flues frequently had to be rolled every three or four days after the first week, and finally were rolled every day for three days in succession. After stay bolts were put in, the flues were not rolled again on the job. Except for the boiler and a troublesome donkey pump which supplied the water tank, the outfit was excellent. The delay on the last hole was mostly waiting for water, which had to be pumped a little over a quarter of a mile.

The expense of pumping on the last hole is not included, as it was borne by the owners of the coal. The contract read that water should be furnished within 100 ft. of each hole. The cost of moving on and off the ground is not included, as it would be variable, according to the distance and means of transportation. The distance moved between holes averaged about a mile by road. It was open country with good roads, so that moving was not expensive.

The core obtained was practically complete, both of rock and coal. The surface was from 6 to 19 ft. deep, averaging 9 ft. 9 in. It was clay, with no boulders, and was drilled out with a mud bit.

The table showing rates of drilling in different kinds of rock is the average of many observations on the five holes. The rate is, of course, dependent largely upon the drillman and how much pressure he cares to put upon the bit.

Both cost and progress tables are from the time the drill reached the ground until ready to leave:

RATE OF BORING.

Kind of Rock.	Ft. per Hour Actual Cutting.
Shale.	7 05
Fireclay.	7 10
Limestone.	7 20
Sandstone.	9 35
Coal. . . .	15.15

COST TABLE.

	Cost.	Cost per Ft.
Drillman	$307 70	$0 169
Fireman	192 31	0.106
Blank bits.	5.00	0 003
Setting bits.	10.00	0 005
Carbons (4¼ carats at $90).	382.50	0 210
Fuel (1050 bu. coal)	67.17	0 037
Oil and waste	11.00	0.006
Repairs	24.85	0 014
Moving	36 00	0 020
Superintendence	200 00	0 110
Total working cost	$1236 53	$0 680
Depreciation of outfit (20 per cent. on $2000 for 3 mos.*)	100.00	0.055
Total costs exclusive of freight and hauling on drill and wages and expenses of drillmen to and from Greene county	$1336.53	$0.735

* The outfit exclusive of the bit is worth about $2000.

PROGRESS TABLE.

	Hole No. 1.	Hole No. 2.	Hole No. 3.	Hole No. 4.	Hole No. 5.	Totals and Averages.
Feet drilled	377.5	358 0	279.4	236 4	568.7	1820 0
Hours actual cutting	54 44	40.00	35.07	27.45	75.90	232 86
Hours pulling core, lowering rods, etc.	38 81	31 00	23.43	18.30	60.85	172.39
Hours drilling	93.25	71.00	58 50	45 75	136 75	405 25
Hours delay, steaming, repairs	66.50	62.25	11 75	18 75	63 00	222.25
Hours tearing down, moving, setting up	20.00	30 00	25 00	20 00	46 75	141 75
Total hours	179.75	163.25	95 25	84 50	246 50	769 25
Hours setting bits	8	4	4	0	4	20
Feet per 10 hr. shift after setting up*	23 60	31 58†	39 83	40.83	28.50	29 97†
Feet per drilling hour*	4 05	5 05	4 75	5.15	4 15	4 49
Feet per hour actual cutting*	6 94	8 95	7 95	8 62	7 50	7 82

† Excludes 20 hours putting stay bolts in boiler.
* Excludes hours setting bits.

BITS USED.

	Distance Drilled.	Estimated Carbon Wear.
Mud-bit	48 ft. 7 in.	
Diamond bit No. 1 (carbons broken by steel?)		2¼ carats
Diamond bit No. 2 (hole No. 1)	369 ft. 8 in.	½ carats
Diamond bit No. 3 (hole No. 2)	339 ft. 0 in.	½ carats
Diamond bit No. 4 (holes Nos. 3, 4)	500 ft. 1 in.	½ carats
Diamond bit No. 5 (hole No. 5)	562 ft. 8 in.	½ carats
	1820 ft. 0 in.	4½ carats.

Mr. Hoover, of the Birdsboro Steel Foundry and Machine Company, makes the total cost $1.13 per foot, but I think that figure must be rather high. Four holes put down by the same company in Raleigh county, West Virginia, are said to have cost $2.00 per foot.

Ankylostomiasis

SPECIAL CORRESPONDENCE

Professor Gréhant, of the Academie de Médecine in Paris, has been reporting the result of the studies he was entrusted with by the Ministre de l'Instruction Publique on ankylostomiasis. This disease is due to the presence of a worm inside the intestinal tube. The larvæ enters the system either by the mouth or through the skin and makes its way to the duodenum where it settles. The eggs only develop in the open air, when eliminated from the system, on the soil of the mine galleries at a temperature between 20 and 30 deg. C. Thus one man who is infected, can contaminate many fellow workers. In many mining centers, such as Anzin, Mons, Liége, every man undergoes a medical examination before being engaged. The diagnosis of ankylostomiasis is obtained by means of a microscope of 400 diameter magnifying power. The most effective cure for this disorder seems to be a mixture of etherized extract of male fern and castor oil, taken in pills or by spoonfuls for about a week.

Thanks to the precautions that have now been taken for some time, the disorder has notably decreased, but Professor Grehant doubts its ever disappearing entirely owing to the tenacity and extreme mobility of the larvae.

Temporary Fire Walls for Coal Mines

Near Saarbruck, in Rhenish Prussia about 40 miles in a southeasterly direction from Treves on the Saar, a unique type of temporary barrier is used for inclosing burning portions of coal mines. By this system a speedy shutting off of all air supply is accomplished which is the first necessity in dealing with underground fires.

The Prussian method is peculiar in the material used for building the temporary fire-walls. It is hay, compressed in the form of blocks. The material is so light that two men can, in half an hour, erect a tight wall across an ordinary entry, and furthermore, the wall will be air tight.

This is accomplished simply by filling up the cracks between the blocks with loose hay and then sprinkling the wall with water. The water causes the blocks to swell so that a perfectly air-tight barrier is made shutting off all air supply, through the entry, to the fire. Behind the temporary wall a more permanent wall may be erected if the conditions warrant. In case of overpowering gases or smoke, the miners wear a smoke hood to enable them to breath as they are erecting the partition. In commenting, *Der Bergbau*, Feb. 25, 1909, says this scheme has proved highly successful at the mines where it has been tried.

At the Komata Reefs mine, New Zealand, where the Brown (Pachuca) agitation tank was originally, and is still, used, the ore is crushed by 20 stamps through 4-mesh screens, and fine-ground in two 16x4-ft. tube mills so that 60 per cent. of the pulp will pass through a 200-mesh screen. The pulp is separated into sand and slime. The slime is agitated in high tanks, while the sand is treated by percolation. The extraction on the gold is 93 per cent and on the silver 83 per cent. The value of the ore treated is about $8.75 per ton.

Notes on Tin Ore Dressing at South Crofty

At the meeting of the Institution of Mining and Metallurgy held at London in November, 1908, H. W. Hutchin described an instructive set of investigations on tin-ore dressing performed at the South Crofty mine, Cornwall, England. The work covers in particular the preparation of concentrates for the calciner.

The plant at the South Crofty, recently enlarged, now has forty 1050-lb. stamps and a Cornish battery of 30 heads, operated under a 7½-in. drop and at the rate of 102 drops per minute. All the machinery is electrically driven, everything being controlled from one board in the motor house. There are four 30-h.p. motors, one driving each section of 10 stamps. The cam shaft is so arranged that only five stamps need be hung up at a time when repairs are necessary. The 40 new stamps give a capacity of 3500 tons per month.

In the new part of the mill the pulp flows from the stamp battery to Lührig patent classifiers which deliver four sizes of product all carrying more or less slime. The firsts pass directly to six Buss tables, producing tailings, middlings and concentrates, the seconds and thirds to 16 Frue vanners and the fourths partially to each. There are also three barrel pulverizers driven from overhead shafting by a 20-h.p. motor. Frues and Buss tables are driven by two 20-h.p. motors. This scheme of treatment gives a cost of milling and dressing of 33.6c. per ton.

The ore treated is of a complex nature with an average value of 25 lb. of tin and 12 lb. wolframite per ton, 0.25 per cent. metallic copper, and 1.5 per cent. arsenic, in a gangue of quartz, feldspar, mica, tourmaline, chlorite and fluorspar. The accompanying table of determinations of concentrates gives an idea of the nature of the ore.

Nature of Concentrates.	Insol.	SnO_2.	Wolframite.	Copper Pyrites	Mispicked.
1. Firsts	46.1	7.08	3.48	2.89	11.4
2. Seconds	46.22	4.61	2.92	2.89	8.3
3. Thirds	46.85	4.74	3.33	3.03	7.25
4. Slimes	42.39	5.18	3.93	2.75	11.03
5. Firsts	26.47	10.87	5.00	1.87	24.5

The first four in this table are concentrates from development stuff, the last one from stoping ore.

The Samples

For the systematic investigation of the battery tailings only tin was determined and reported as pounds of cassiterite per ton. The assays were all made by reduction with zinc vapor after the improved method of J. J. Beringer, of the Camborne School of Mines. Dip samples were taken from the tables and from the joint tailings of the mill. These tailings were deposited in a series of ponds so that check samples of the accumulated tails could be taken.

Three samples were taken from the stream carrying the joint tailings from the battery. The first, in which water and sediment were allowed to run into the overflow from the bucket, thus saving practically only sand, gave an assay of 2.5 lb. per ton. The second, where overflow was avoided assayed 7.9 lb. per ton, and the third, taken in the same manner, gave a value of 6 lb. per ton. In this case a screening test was made with a 60-mesh sieve, that which passed through being separated into fine sand and slime by decantion. The results are given in the accompanying table.

Product Assayed.	Per Cent. by Weight.	Assay, Lb. Per Ton.
Coarse sand	28.1	2.8
Fine sand	34.3	5.0
Slime	37.5	9.83

Calculating the total value from the parts gave an assay of 6.2 lb. per ton.

At this point in his investigations Mr. Hutchin realized that supplementary tests were necessary to ascertain the relative proportions of fixed tin to tin in free grains. Considering ultimate recovery, he saw that it was essential to know whether the whole, or, if not, what portion of the cassiterite was present, as (1) detached particles, (2) as adherent to the original gangue. One enters as a factor of crushing, the other as a factor of the ore dressing. With this in mind the Buss tailings were first investigated with the stamps crushing through 25-mesh screens. The results were as follows:

	No. 1 Table.	No. 2 Table.	No. 3 Table.
Tailings	6.0 lb.	5.0 lb.	2.8 lb.
Middlings	4.4 lb.	3.1 lb.	3.1 lb.

From screening tests of the first two these results were obtained:

	No. 1 Tailings.	No. 1 Middlings.	No. 2 Tailings.	No. 2 Middlings.	No. 3 Tailings.
Coarse.	3.1	3.4	2.85	2.8	1.2
Fine.	4.75	4.5	4.1	4.1	1.9
Slime.	10.1	No slime.	10.6	No slime.	13.0

These results showed that the "coarse" fraction from No. 2 middlings (assay value 2.8) showed no evidence of the presence of grains of free cassiterite, while in the case of the "fine" fraction there was decided concentration presumably of free cassiterite. Of the 4.1 lb., assay value, 2.5 lb. was free for recovery by concentration, while 1.6 lb. was locked up in the gangue so as to require finer crushing.

The results of a test of Frue vanner tails show the proportion of slime to sand to be 4 to 1, and give the assay value of the whole calculated from the fractions as 9.2 lb. These tests were so satisfactory that further work on the same line was followed out using samples of the tailings in bulk obtained from settling ponds.

Screen Opening

Another point tested was the most advisable size of screen opening. Magnetic separation to reduce the amount of fine wolframite had been decided upon, so coarser crushing was tried using a 20-mesh instead of a 25-mesh screen. This gave results which at first seemed inconclusive, but pointed toward the idea that one size of mesh would give about the same results as the other. After considerable experimenting it appeared clearly that under normal conditions the change from 25- to 20-mesh battery screens was not accompanied by any appreciable increase in the loss as far as the bulk of the tailings was concerned, while the coarser crushing reduced the amount of slime and aided magnetic separation.

The work of the pulverizers and the conditions in working the coarse sands rejected from dressing the burnt concentrates on buddles called "burnt leavings," were next investigated. By treating some of these burnt leavings on a Buss table it was at once apparent that considerable tin was present as separate grains for the table gave concentrates assaying 6.6 per cent. cassiterite with middlings running only 1.7 per cent. This tin was, however, low in value on account of adherent particles of iron oxide. The pulverizers with their combined scouring and flouring action tended to make this tin available.

At first the burnt screenings were screened and vanned, but as previously vanning with rich tailings had been unsatisfactory another method was adopted. Sonstadt's solution of mercuric-potassium iodide of a specific gravity of 2.82 was used to separate the heavy constitutents from the light, so that the nature of each could be investigated. In general this method is not as accurate as the vanning method and is besides more expensive. However, it is useful in cases where vanning is inapplicable and for a check method. In this case it certainly proved most useful. Ten grams of the coarse portion of the burnt leavings were cleaned of iron oxide with cold hydrochloric acid, washed and dried. This gave 6.562 grams cleaned product of which 1.524 grams were heavy and 5.04 grams light. The heavy assayed 723 lb. cassiterite per ton, the light only 5 lb. The fact that 15 per cent. of the material carried 723 lb. per ton is suggestive of the function of the pulverizers.

Slimes and Hight of Discharge

Next in order to cut down the proportion of slimes the hight of discharge in the stamp batteries was reduced from 7 to 3 in., and 20-mesh screens substituted

for 25-mesh ones. The percentage of coarse sand was 48; of fine, 52.

At the South Crofty mine the joint tailings from the mill are conveyed by a leat 3 ft. wide to ponds about 50 yd. away. From the latter part of the leat, which is on the sloping ground the tailings deposited were stripped and treated on Buss tables without pulverization. With daily stripping these concentrated only to about 2 per cent. cassiterite, although the proportion of mispickel was high.

Results of the Tests

All this investigation served to show the losses in the first stage of concentration as due either to insufficient crushing or to leakage on the concentrating tables. From the probable distribution of the tin as figured by the use of heavy solutions it appears that extremely fine crushing is necessary for a good recovery. On the other hand the change from 25-mesh screens to 20-mesh ones, as before noted, was accompanied by no higher losses. More experiment on this point of coarse crushing would be exceedingly instructive.

A comparison of the results obtained at three different mines using the same general milling practice on similar ore brings out more than anything else the nature of the ores treated as regards concentration. Mr. Hutchins finds the practice of pulverizing burnt leavings good, but finds no evidence to support such treatment of middlings from Buss tables. He takes only one head from his tables although the more recent plan is to take two, retreating the second heads from two or more tables on another one.

In general the tests show that coarse grains in the tailings carry higher cassiterite than fine ones, but the difference is not very apparent except in the case of rich tailings. The experiments with Sonstadt's solution indicate that a fairly large proportion of the cassiterite-carrying grains were of low specific gravity and even in the strippings from the leats where there was a certain proportion of similar grains presumably of higher specific gravity it is doubtful if their density was even high enough to class them as middlings. Coarse crushing was found to give coarse grains showing increased value, while too fine crushing gave slimes of high value.

The discovery of a new element is announced by M. Ogawa, of the University of Tokio, in the rare mineral thorine, in which it occurs as small yellow or red crystals, hard enough to scratch glass. These are found to be a double silicate of the new element and zirconium. The new element has been named nipporium; its symbol will be Np.; its atomic weight is probably 100.

Colorado State Geological Survey

A report of progress recently issued shows that field work in the past year includes four important areas: (1) The area about Hahn's Peak in Routt county, 110 square miles. (2) The tungsten field of Boulder county, 90 square miles. (3) The sedimentary formations flanking the foothills from the Wyoming line southward for 75 miles. (4) The Montezuma area in Summit county, 22 square miles.

Rock Mineral Analyses

In connection with the field work of the Survey about 50 complete chemical analyses and assays, and upward of 100 other determinations have been made. The State Survey will not do work which should go to private chemists and assayers, but only that demanded by its own reports.

Topographic Map of Colorado

The Hayden survey of the Territories, completed in 1878, made a topographic map of about two-thirds of the State. The King survey of the Fortieth Parallel included a narrow strip about two-thirds of the way across the southern border of the State. Of the area not covered by these two surveys, over one-half has been mapped in detail by the present United States Geological Survey. The other half has been mapped in less detail. The maps of the earlier surveys are available to but a very small number of people, and those of the present survey are contained in about 60 separate sheets.

The State Geological Survey has compiled a topographic map of the State on a scale of 1 in. to 8 miles, combining, so far as the scale would permit, the results of these various surveys, and including all the geological details usually found in a complete State map. This map will be used as a base for the revised geological map, and for maps showing the various mineral deposits, water resources and other economic features of the State. The map is almost ready for the engraver.

Geological Map of the State

The only geological map covering the State is a small one, on a scale of 12 miles to the inch, published by the Hayden survey in 1879 and 1881. This is very general and incomplete. The larger Hayden atlas covers only two-thirds of the State. A vast amount of detailed geological work has been done in Colorado during the last 30 years, and has modified in many important ways, the conclusions reached by the Hayden geologists in their hurried survey. The results of this later work are published in perhaps 40 separate maps, many of which are not easily available.

The State Geological Survey is compiling a map, on the same scale as the topographic map, which shall bring together, so far as the scale will permit, the results of all geological work done in this State up to the present time. The drafting is probably three-fourths done, and the explanatory sketch of the geology, to accompany the map, is also well under way.

A map showing the various metalliferous deposits of the State is approaching completion. Another showing the location of the coalfields is ready for the draftsman.

A bibliography of the geological literature of Colorado is well under way, and already contains over 5000 classified entries, together with reference letters indicating the important libraries of the State, in which the book, article or report may be found.

Other Work Commenced

A report on the distribution, qualities and value of the clays of the State. (Prof. G. M. Butler, School of Mines.) The building stones and marbles of Colorado. (R. D. George and A. P. Poorman.) Cement materials, limestone and gypsum. (Direction of R. D. George.) Descriptive geology of the State in two bulletins: (1) General geology; (2) economic geology. (R. D. George and Professor Crawford.)

Staff of the Survey

Prof. R. D. George, University of Colorado, State geologist; Prof. H. B. Patton, Colorado School of Mines, geologist; Dr. James Underhill, mining engineer, Idaho Springs, geologist; Prof. G. M. Butler, Colorado School of Mines, geologist; Prof. R. D. Crawford, University of Colorado, geologist; Prof. C. E. Smith, Colorado School of Mines, geologist; Prof. Junius Henderson, University of Colorado, paleontologist; Prof. J. B. Ekeley, University of Colorado, chemist; C. C. Williams, A. P. Poorman, draftsmen; B. H. Jackson, W. M. Lewis, T. D. Benjozsky, field assistants; R. M. Budtters, G. D. Kendall, H. Whitaker, F. H. Millard, chemical work of various kinds.

The vagaries of boreholes have recently had a fresh illustration, says the Kalgoorlie correspondent of the *Mining Journal*. Some years ago a hole was put down at an angle from the surface of the Central Boulder lease, and at a depth of 1500 ft. a rich vein of telluride ore was cut, in what was then thought to be the Central Boulder ground. A subsequent survey of the hole showed that the drill had diverted, and it was then announced that the telluride was in the Oroya South lease, and not in the Central Boulder block. Now comes the news that the bore hole has been struck at 1200 ft. in the Kalgoorlie lease, which lies east of the Oroya South block, and which is now owned by the Oroya Brown Hill Company.

A new tin find is reported from the Stannary Hills district, Queensland (*Aust. Min. Stand.*, Dec. 16, 1908), the discovery being near the Lass o' Gowrie mine.

Sinking in Wet Ground by Injecting Concrete

After Sealing Fractures in Surrounding Rock by Injections from Churn-drill Holes, the Shafts Were Easily Sunk through Very Wet Ground

BY JULES LOMBOIS*

The Compagnie des Mines de Béthune has had to sink three shafts through watery ground; in each instance a cementing process was employed. The shafts were sunk in successive years, so the experience gained in each was brought to bear on the next. Consequently a record of our operations ought to be instructive to other engineers engaged in the same kind of work.

In the vicinity of shafts 11 and 11 *bis*, the coal seam is covered by 150.4 m. of Cretaceous sediments, composed of the following strata: Fissured white limestone, 46.2 m.; hard sandstone, 0.8 m.; gray phosphatic limestone, 6.3 m.; bluish marly limestone, "*bleus*," 32.7 m.; greenish marly limestone, "*diêvies*," 32.5 m.; slightly argillaceous white limestone, 22.5 m.; conglomerate, 3.4 m.; shales, 6 m.

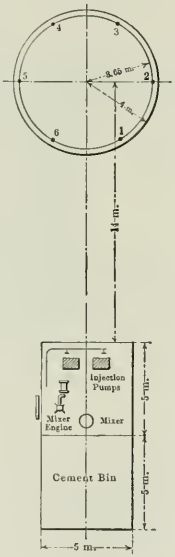
The fissured white limestone is the source of the most of the water. The gray limestone yields only a little. The blue limestone is only slightly fissured, but occasionally affords a strong flow of water. The green and the lower white limestones are both compact. The problem was thus to solidify, by cementation, the white, the gray and the blue limestones by bore holes regularly distributed around the circumference of the proposed shaft.

I shall first outline the mode of operation at shaft No. 11, in 1904, and at shaft No. 11 *bis*, in 1905, pointing out such improvements as occurred, and shall then describe, in some detail, the sinking of shaft No. 7 *bis*, in 1906 and 1907.

Shaft No. 11

This shaft was first dug with a diameter of 5.2 meters to a depth of 4.2 meters. Four holes were then bored, equidistant from each other, and at 2.36 m. from the center. On account of the long time required to sink holes and cement them in the usual way, by successive advances, it was decided to inject cement into two of the holes while they were being bored. Two of the holes, of 300 mm. diameter, were therefore bored and injected with cement in alternate stages, while in the other two, of 180 mm. diameter, boring and injecting went on at the same time. A churn drill was used for all.

The cement mortar was mixed by hand, using ordinary portland cement, and was then injected into the holes, the tops of which were closed by iron pipes with the necessary connections, by a Burton pump, affording a maximum pressure of 4 kg. per sq.c. The holes were lost twice owing to the premature setting of the mortar. Operations lasted a little over two months, during which time 1776 sacks of cement, weighing 50 kg., were injected; of this, 70 per cent. was absorbed by the holes bored in the ordinary way, and 30 per cent. by the holes which were injected during boring.



GENERAL PLAN OF INSTALLATION

As the rock was exposed by subsequent sinking, the following facts were noted: In the white and gray limestones, the fissures were perfectly filled but the seams of cement were very variable, being compact and hard in some places, but in others soft and yellowish, imperfectly set, and without strength. These poor results were attributable to the coarseness of the original cement, which permitted separation of its coarse and fine particles, and to incomplete mixing of the mortar. In the blue limestone, solidification was fairly complete in the upper portions, which were only slightly argillaceous, but below this, where the marls contained around 18 per cent. of clay, all traces of cementation had disappeared. The poor success in this rock was due to chips of clayey material which would lodge in the crevices and resist the injection of cement even under a pressure of 10 kg. per square centimeter.

Shaft No. 11 *Bis*

This shaft is at a distance of 48 m. from No. 11. The principal improvements over the operation as conducted at the first shaft were the following:

After the shaft had been sunk and lined with masonry to a depth of 14 m., with an inside diameter of 5.2 m., the four holes were drilled on the outside of the shaft, equidistant from each other and at a distance of 4.07 m. from the center. The holes were all bored and injected alternately, which permitted the application of the full force of the pump. In the white and gray limestone, the holes were bored with a churn drill, but in the blue marl a special auger was used which prevented the choking of the fissures by chips of rock. Three applications of the auger were sufficient to gain 1.5 m. depth, which was adopted as the advance for each stage of drilling and cementing.

Instead of the ordinary portland cement used at shaft No. 11, a specially fine cement was employed, of which only 16 per cent. would not pass a screen having 170 meshes per inch. Mixing was still done by hand.

In the white limestone strata above the water level, the injections were made without a pump, all necessary pressure being obtained by placing the mixing box on a platform at a hight of 4.75 m. above the ground. The object of this was to form, for the upper 45 m., a solid mass of concrete which would withstand the pump pressures required for injecting the lower, water-bearing strata. In spite of this precaution, when the pump pressure was applied openings appeared between the drill holes and the bottom of the 14-meter pit, and it was never possible to hold a pressure of more than 10 kg. in the first two holes. In order to inject the blue limestone thoroughly, the third and fourth holes were cased with pipe, having 3-mm. walls, down to the top of that stratum. Even then two leaks occurred during the injecting of these holes, which had to be repaired by using a 35-per cent. mixture of cement.

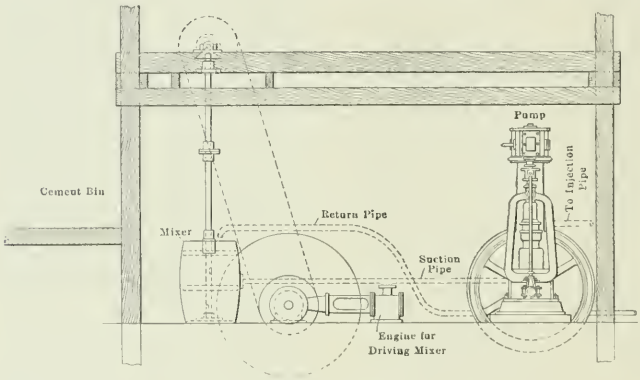
The total amount of cement used in

NOTE—Abstracted from *Bulletin* de la Société de l'Industrie Minérale, Tome IX, No. 4.

*Chief engineer, Compagnie des Mines de Béthune.

this shaft was 4981 sacks (50 kg.). By using the alternating method, and a Weise & Monsky vertical, compound pump capable of high pressures, it was possible to force 3997 sacks of cement into the water-bearing strata, instead of only 761 sacks, as at shaft No. 11.

The results of this method were very satisfactory. Almost all the fissures were found to be well filled with solid seams of cement of grayish black color and homogeneous composition. Only two seams contained yellowish, soft cement and these did not yield much water. At a depth of 88 meters only 5 cu.m. of water had to be raised per 24 hours, as against 145 cu.m. at the same depth in shaft No. 11. Shaft No. 11 *bis* was begun at a depth of 14.9 m. on May 14, and finished completely to 94.92 m. by July 13, 1906. The average daily advances to this depth were thus: For sinking, 3.47 m.; for lining, 2.18 m.; for sinking and lining, 1.34 m. per 24 hours.



MIXING AND PUMPING PLANT

Shaft No. 7 *Bis*

The measures to be perforated at this shaft have a total thickness of 142.5 m., consisting of the same strata as at No. 11 and having about the same relative thicknesses, except that the bluish, marly limestone is somewhat thicker and the greenish limestone much thinner than at the former shaft.

The water level varies from 17 to 29 m. At No. 7 shaft, sunk some years earlier, as much as 1700 cu.m. of water had been pumped, per day, from a depth of 66.5 m. Furthermore, two important seams of coal had already been completely extracted from this vicinity, which gave reason to fear that the overlying strata would be found to be badly fissured. For these reasons it was thought wise to sink six injection holes, instead of four.

A preliminary shaft was first dug to a depth of 3.5 m. in order to facilitate operations and to afford a fairly solid stratum for inserting the injection pipes. The pit was lined with masonry to an inside diameter of 8 m. The six holes, evenly spaced around a circumference with 3.65-m. radius, were then bored and injected in successive stages. As at No. 11, each hole was made with a churn drill in the hard measures and with a rotary, auger drill in the soft argillaceous strata.

In order to guard against leakage around the upper ends of the holes, and to insure the application of the full pump pressure, a little shaft, 5 m. deep and 1.30 m. diameter, was dug at the spot to be occupied by each hole; the lining pipe was then inserted and the space around it was carefully filled with well rammed concrete, with frequent applications of cement grouting. The lining pipe was of steel, 8 mm. thick and with an inside diameter of 300 mm. Its upper end had a cast-iron head, to which the necessary pipe connections were made. A 50-mm. pipe, fitted with a pressure gage and a stop cock, entered the side of the casing pipe just below its head. During the preliminary washing of the hole, which followed each drilling operation, this pipe carried off the muddy water; as soon as the water came up clear, the pipe was connected to the cement mixer in order to return to it the excess of cement toward the end of the injecting process.

For boring through the limestones, the contractor at first tried a drill which was too light and resulted in the loss of two holes; after this had been replaced with a heavier drill, on the Hulster, free-falling system, it was possible to make an injection of cement and bore the hole 5 m. deeper in six hours. For boring in the argillaceous measures, a new auger was made, 2.50 m. long, 175 mm. diameter, with turns pitched 370 mm. apart. The adhesion of the cuttings in marl was sufficient to bring them to the surface, attached to the auger. Three applications of the auger would deepen the hole 3 m. Two reamers, the first of 225 mm. and the second of 245 mm. diameter, were then used to scrape the walls of the hole so as to remove any cuttings from the crevices. The drill stem, formed of steel tubes 5 m. long and of 66 mm. interior diameter, was used for injecting the cement. The force for operating the reamers was furnished by a 12-h.p. portable engine. The time required for advancing 3 m. by this method was a little over 13 hours; toward the end of the operation it became possible to bore and inject 3.10 m. per day.

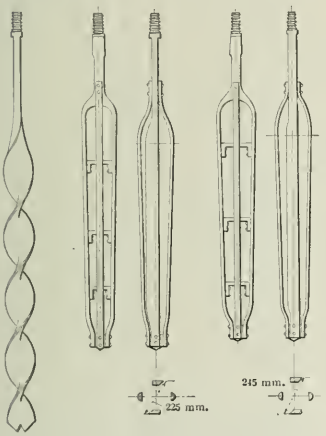
To afford a more perfect mixing of the mortar, as well as to save in labor, a mechanical mixer was installed. It consisted of a 150-liter cask, carrying a vertical shaft to which four paddles were fastened; the shaft making 60 r.p.m. The cement and water were thrown in at the top, and the mixture ran off to the pumps through suction pipes which left the cask at 40 cm. from the bottom, that is, a little above the level of the suction valves of the pumps.

The pumps were of the Weise & Monsky, compound type, with flywheel; the two plungers were of 90 mm. diameter and 200 mm. stroke, yielding, at 75 r.p.m., a flow of 9.5 cu.m. per hour; the suction was 50 mm., and the discharge 40 mm. in diameter. To avoid the corrosive action of the cement, the bronze valves were replaced by steel balls, 105 mm. diameter, weighing 4.52 kg. apiece. The force with which these balls fell upon the bronze seats of the valves kept the latter free from adhesions and maintained a smooth and regular operation. These precautions permitted the passing of 2500 sacks of cement without any difficulty, whereas, at No. 11 *bis*, the valves had to be changed after every five hours, or for every 60 to 80 sacks.

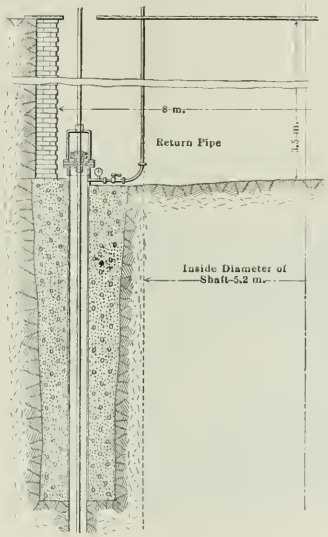
All the strata from the bottom of the casing pipe, at 8.5 m. below surface, down to the bluish marls, were injected in successive 5-m. stages, with the whole pressure of the pump, 20 to 25 kg. per sq.c. The injection pipe was formed of sections 5.4 m. long, having an inside diameter of 40 mm., and connected by outside bronze couplings. The relatively small section of the pipe compelled a rapid circulation of the liquid in the pipe and around the bottom, whereby any tendency of the mortar to separate was overcome. At the surface, the end of the pipe was connected to the pump by a strong rubber hose which permitted a certain amount of vibratory and sliding motion of the pipe, which was given it to prevent accumulations of cement. The procedure was as follows:

After the injection pipe had been lowered to within 1 m. of the bottom of the hole, the head gear of the casing pipe was bolted together. Clear water was then put through the pump, the cock in the return pipe at the top of the casing

being left open; after about an hour the return water would become clear. The cock was then closed and the pump driven to full capacity in order to force any remaining débris as far back as possible into the crevices of the rock; this process lasted about half an hour. Then, without changing any other conditions, cement was added gradually, to form about 5 per cent. by weight of the mixture; after an hour of this, the percentage of cement was raised to 10, if no increase had been noted in the pressure in the hole. As the cement deposited in the fissures of the rock, it became necessary to increase the pressure at the pump. Finally, as the fissures became more thoroughly plugged, in order to avoid too great pressure and the stopping of the pump, the cock in the return pipe had to be opened little by little, the excess of grouting being carried back to the mixer. Toward the end, the consumption of cement was reduced, and the pipe was kept in active motion. The operation was finished when it became necessary to keep the return pipe entirely open to maintain the operation of the pump. The pump and the pipes were then cleaned by a current of water, after which the pipe was withdrawn and the hole was left eight hours to allow the cement to set.



AUGER AND REAMERS



SECTION THROUGH ONE BORE-HOLE

It was often noted that the pressure in the pipe would suddenly drop. This event was due either to the dislodging of a partially solidified cement plug, or to the opening of a channel connecting the hole with the surface. The latter case occurred frequently when the upper part of the section of rock to be cemented was soft. Crevices of this sort were stopped by injecting a thick mortar, 30 to 35 per cent. cement, under low pressure. Another way was to line the hole, down to some solid stratum generally at 20 m., with a pipe slightly smaller than the upper casing pipe. Occasionally, also, the cement injected in one hole would reach and flow into another hole which had been temporarily abandoned upon reaching the marls. To avoid this, whenever work was suspended in any hole, it was filled with sand; the sand could afterward be removed easily by a water jet.

After having injected all six holes down to the marls, these latter were then treated in exactly the same way. The amount of cement used in the limestones was 1514 sacks, and in the marls, 1594 sacks. The time occupied was 10 months and 10 days, including Sundays and holidays when no work was done. This rather excessive length of time was due to the accidents and losses of holes arising from the inexperience of the workmen. Before operations were over, it was possible to sink and inject 5 m. in the limestones and 3 m. in the marls per day.

The holes were bored by a contractor; at the end of each advance, the borers would assist the company's men in making the injections. In addition to the contractor's men, the entire force included a foreman, a fireman, and two laborers.

The sinking of the shaft then began, and was completed in five stages. The strata were found so thoroughly solidified that explosives had to be used. A number of crevices, from 1 mm. to 11 cm. wide, were found to be filled completely. At a depth of 87 m. the total seepage was only 1.166 cu.m. per hour. Down to the 395-m. level, the average daily advances were 3.05 m. for sinking; 4.71 m. for lining; and 1.85 m. per day for both sinking and lining. This excellent speed was mainly due to the freedom from water in the shaft.

The main advantages of this method are its cheapness, in that only a small and inexpensive equipment is required and the cost of labor and material is small; and its practical advantages, in that water is almost completely shut out, the erection of masonry linings is made more secure, the solid wall of concrete makes a lining almost unnecessary, and finally any repairs to the lining are more easily executed.

Phelps, Dodge & Co.

Phelps, Dodge & Company, Inc., reports to the Stock Exchange assets and liabilities as of Jan. 31, 1909, as follows:

Assets.	
Copper Queen Consolidated Mining Company stock, 199,516 shares at $135	$26,934,660
Moctezuma Copper Company stock, 26,000 shares at $307⅓	8,000,000
Detroit Copper Mining Company of Arizona stock, 40,000 shares at $150	6,000,000
Stag Canon Fuel Company stock, 5000 shares at $800	4,000,000
Organization expense	25,000
Total	$44,959,660
Liabilities.	
Capital stock, 449,346 $\frac{2}{100}$ shares at $100	$44,934,660
Phelps, Dodge & Co. (firm)	25,000
Total	$44,959,660

Included in the report to the Stock Exchange are the reports of the Copper Queen Consolidated Mining Company, the Moctezuma Copper Company and the Detroit Copper Company:

Copper Queen Consolidated Mining Company's general balance sheet Dec. 31, 1908, follows:

Assets.		
Mines and mining claims		$500,286
Plant and real estate		2,227,243
Courtland mine development		58,183
Stocks, bonds, etc		2,181,436
Loans and mortgages		288,275
Bills receivable	$36,281	
Accounts receivable	1,476,415	
		1,512,697
Cash		1,428,524
Inventorie		5,336,396
Total		$13,533,043
Liabilities.		
Capital stock		$2,000,000
Accounts and drafts payable		1,181,764
Contingency expense		14,936
Plant renewal		1,440,000
Balance, surplus, Dec. 31, 1908		$8,896,342
Total		$13,533,043

The income accounts of the Moctezuma Copper Company and the Detroit Copper Company for the year ended Dec. 31, 1907, follow:

	Moctezuma.	Detroit.
Net income for year	$833,236	$814,874
Previous surplus	1,182,769	739,621
Total surplus	$2,016,006	$1,554,495
Dividends	130,000	*200,000
Profit and loss surplus	$1,886,006	$1,354,495

*Includes $120,000 plant renewal fund, and $80,000 dividends.

The tube mills used in Australia are smaller than those generally used in the United States, Mexico and South Africa.

A Method for Setting Timber in Inclined Shafts

By C. W. McDougall*

The method of setting timbers in an inclined shaft, which is described in this article, has been found to be very good after a test under various conditions, extending over two years.

The apparatus used consists of a special try-square, a carpenter's spirit level, a wooden straight-edge, 10 ft. long, and a transit. The try-square is made of wood according to dimensions shown in Fig. 1; the target on it is an ordinary level target with alternate red and white quadrants. This target slides on a piece of hardwood attached to the front of the try-square.

The transit is mounted on a bracket which can be attached to the sleepers in the shaft, thus doing away with the difficulties of a tripod set up, especially in a steep shaft where there is danger of the instrument's falling. The bracket also gives more room to the instrument man, while making observations.

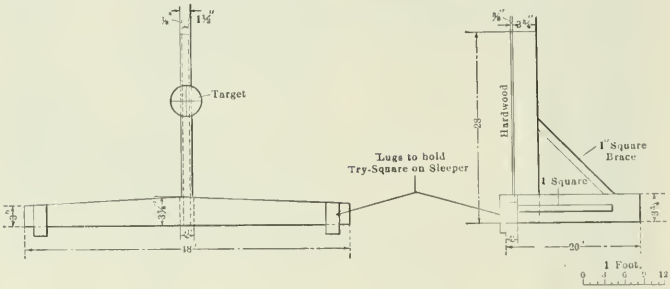


FIG. 1. TRY-SQUARE

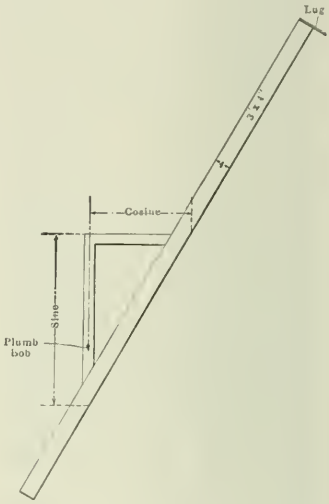


FIG. 2. DIP LEVEL

Method of Setting "Check" Sleepers

The instrument is set up in the shaft on the bracket over a point on the center line of the shaft, or on some line parallel to the center line, and sights are taken to place the line of collimation parallel to the center line of the shaft. Then, after the center line of the transit has been set at the proper dip by means of the vertical arc, the instrument man is ready to proceed.

The try-square is placed in the center line on a sleeper that has previously been set, and the target moved up or down until the horizontal cross wire in the telescope coincides with the horizontal center mark on the target. The target is then clamped in position, and the try-square is moved to the sleeper that is to be set. The try-square is placed on the center line and a sight is taken at the target which, since its position represents the hight of the instrument above the face of the sleepers when set on the proper dip, must not be moved. The sleeper that is being set is then moved either up or down until the center of the target coincides with the horizontal cross wire of the instrument. The sleeper is kept in a level position horizontally by means of a long straight-edge and a carpenter's level.

After the sleeper has been set in the proper position and secured, the balance of the set is trued, and the work of placing the next set begins. In truing the set, and in setting the sleeper, or footwall plate, care should be taken to have the set placed normal to the dip of the shaft, or canted by the same amount as was the original set, otherwise the reading on the target will be wrong in a manner similar to the reading on a level rod when the rod is not held in a perpendicular position.

Care should also be taken to have the center line of the try-square on the line of collimation of the transit. The transit and try-square need to be used only to set sleepers about 50 ft. apart so as to check up the work and keep the shaft in line.

The usual time required to set a sleeper, under ordinary conditions, is 30 to 45 min., divided as follows: Setting up instrument, about 15 min.; setting sleeper depending on the distance it must be moved and whether wedges or jacks are used in moving the timber, 15 to 30 minutes.

Method of Setting Intermediate Sleepers

To set the intermediate sleepers, a dip level such as is shown in Fig. 2 is used in conjunction with the straight-edge and carpenter's level previously mentioned.

The proper dip angle is laid off by means of natural sines and cosines on the bars forming the square mounted on the straight-edge, the two legs of the square being the sine and cosine, respectively, of the dip angle. The accuracy of the triangle formed by the square and straight-edge is proved by calculating the length of the hypotenuse of the triangle.

To use the dip straight-edge, one end is placed on two sleepers that have been previously set and on the center line, and the sleeper to be set is brought to the proper elevation, which will be indicated by the coinciding of the plumb line on the straight-edge with the mark previously made for a guide. Then the sleeper is brought to a horizontal position by using the carpenter's level in conjunction with the transit.

In truing the sets, it was found very convenient to have a large square made in order to test the angle of 90 deg., formed by the end plates and dividers with the footwall plate, or sleeper. When the intermediate sleepers had been set with the dip straight-edge, using a proper amount of care, the greatest error found by checking with the transit was not more than one-half an inch, and this may readily be accounted for by the fact that ordinary squared timbers are seldom exactly true, either in section or longitudinally, and also by the possibility of a slipping of the wedges that held the sets in place.

*Chief engineer, Hancock Consolidated Mining Company, Hancock, Mich.

According to B. I. Collins in a paper before the Chemical, Metallurgical and Mining Society of South Africa, the ultimate mining future of the Rhodesian goldfields lies in the development of the large low-grade bodies of impregnated ironstone, schist, and conglomerate, rather than in the small and non-persistent quartz veins. At present most of the mines work the latter class of deposit and are operated by small workers with rather insufficient equipment. These small operators cannot afford to extend their operations to the big low-grade orebodies, since there the values are irregularly distributed, and extensive prospecting is required to ascertain accurately their value.

The Stephens Climax Imperial Hammer Drill

By Eustace M. Weston*

An English firm, R. Stephens & Son, of Cornwall, has designed a hammer drill built as largely as possible on the lines of a piston drill and having every part readily accessible for inspection; this is the latest type of hammer drill especially designed to meet the conditions on the Rand. In designing this drill, it was determined to construct a machine of the maximum power possible within the limiting weight of 100 lb. laid down as the maximum weight allowed for machines competing for the £4000 prize on the stoping-drill contest. In this drill air consumption has not been considered an important item. The consumption is given as being about three-fifths that of a 3¼-in. drill. It would therefore be about equal to that of a 2¾-in. drill or from 70 to 80 cu.ft. per min. with air at a pressure of 80 lb. per sq.in. The machine complete weighs 95 lb.—20 lb. more than the Gordon drill. With an air pressure of 75 lb. per sq.in., the number of strokes per minute is said to be about 700.

The length of stroke is 5 in.; the diameter of cylinder is 1¾ in. and the weight of the hammer is 6½ lb. It will be seen that this drill is more powerful than any American stoping drill except the Leyner model 6 machine. The general construction of the machine which includes some novel features can be seen from the accompanying sketch sections. Fig. 1 is a longitudinal section; Fig. 2 is a transverse section. The half-tone illustration shows the machine set up for work and also two drill bits. In Fig. 1, *A* is the anvil block. It is about 9 in. long by 1¾ in. diameter; it weighs 8 to 10 lb. The anvil block and pinion wheel *G* are made in one piece and from special steel. This pinion wheel prevents the anvil block's being forced back into the cylinder. It will be noted that it is provided with a taper recess for a taper chuck *C*, having a water-feed channel *W F C* through it. This channel communicates with a brass water-feed ring *W*, which is surrounded by buffer rings made water-tight by packing *P K*. Water is led from the two-way throttle valve, shown in the half-tone illustration, through the channel *W F C*, along the side of cylinder and front head to the brass water-ring *W*.

The amount of water used is regulated by means of two cocks—one on the hose; the other, a brass screwhead, on the machine itself. No air passes down the hollow steel with the water. Any water leaking past the ring toward the cylinder drains away through holes *E S W*.

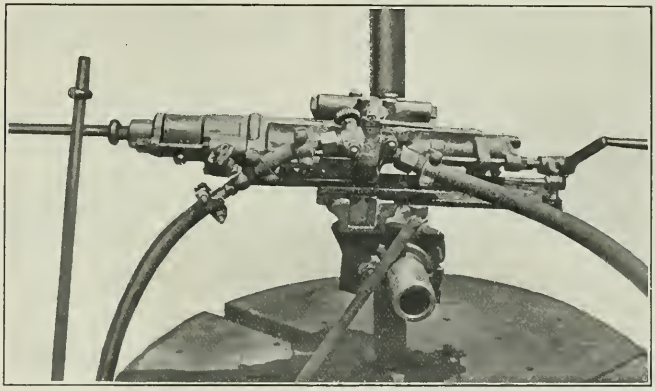
The pinion wheel *S* gears with the spur wheel *G*; this is rotated by the crank handles *R H* to which it is connected by a telescopic rod. The rotation is thus geared and positive being operated by hand similarly to the way that rotation is effected in the Leyner Rock Terrier drill, which this machine resembles somewhat. *G F* is the main cylinder casting and slides in the flat cradle *K*. It is bored out for two cylinders; *A F C* is the air-feed cylinder, *A F P* is the air-feed piston attached to cradle *K*. The air admitted to the machine enters the air-feed cylinder and feeds the machine forward before it enters the main cylinder; as soon as the air is turned off, *A F C* is opened so as to exhaust. The drill must be slid back by hand, but as the drill is light and the holes seldom vertical this can be easily done. Another forward feed is gained (see Fig. 2) by sliding the cradle forward in the clamp. One side of the cradle has teeth on it; when the clamp bolt is loosened the cradle slides easily forward and is then securely fastened again by the toothed clamp when it is tightened. With these two feeds, a total advance of 28 in. is gained; this is ample in the hard ground here, where hammer-drill bits are generally blunted after boring 12 or 15 inches.

The main cylinder *X* is 1¾ in. in diameter. The piston *P* is of shape shown. *P O* and *P O'* are the air ports; *V B* is the valve chest; *V* is a piston valve, and *A V* and *A V'* are two leather auxiliary valves. They are conical leather plugs which control the exhaust from the valve ends. They are pushed down so as to always make an air-tight sliding fit with the piston P, no matter how worn the cylinder may be. Thus the valve movement is kept regular.

The valve action can be seen from Fig. 1. The air is allowed to leak past each end of the valve from the live-air chamber in the center of the air chest in sufficient quantity to throw the valve over when the other end is open to exhaust. The movements of the piston *P* place each end of the valve chest alternately in connection with the atmosphere through *A V* and *A V'*, the recess in piston *R'*, and the two exhaust ports *E X* and *E X'* in the walls of the cylinder. In Fig. 1 the piston *P* has finished its stroke, and *A V'* is open to exhaust so the valve will be thrown over for the return stroke. The valve could be set to cut off and use air expansively on either front or return stroke. This is done in the large piston drill made by the same company, but I do not know whether or not this is done in the hammer drill. It will be noted that the valve motion is simple and that the valve can be easily inspected. The machine is held together by side rods *S R*. The packing in the front head can be readily taken out and changed if it becomes worn.

The novel points about the design are: First, the compact air feed which allows the machine's being kept short and so made similar in shape to a piston drill, and yet without a feed screw; second, the great weight of the anvil block—this would seem at first to be a great mistake in design; third, the adoption of the taper chuck attachment. This makes the anvil block simply a part of the drill bit as it fastens immediately to the drill shank. This construction seems to me to reduce vibration greatly and to be the reason why the makers say that they have had no trouble with breakages of this part, in spite of the fact that it has holes bored in it and of the difficulty that every maker finds in tempering anvil blocks with holes in them. The anvil block is always "up to its work" and there is never any lost motion between it and the drill owing to rebound. Of course, a somewhat harder blow has to be struck to make up for the greater inertia of the combined boring tool, but the advantage gained seems to outweigh this.

The machine does not seem to be very economical in air, for the cylinder volume



STEPHENS CLIMAX IMPERIAL HAMMER DRILL

*Mining engineer, Mbabane, Swazeland.

on the return stroke is large, owing to the fact that there is no piston rod to take up this space. The length of the machine over all is 2 ft. 10 inches.

I witnessed a trial of this machine on a block of granite similar to that used in the South African mines stope-drill competition. The hole drilled was horizontal, the water pressure about 10 lb. and the air pressure 80 lb. per sq.in. The machine bored about 12 in. with a 1¼-in. double-chisel bit, 13 in. with a 1⅛-in. chisel bit and 14 in. with a 1-in. chisel bit; or a total of 39 in., in a total time of 9 min. 22 sec., or an actual drilling time of 8 min. 48 sec. The average speed was 4.23 in. per minute.

In another trial 36½ in. was bored in 12 min. 15 sec.; the bits were chipped and well blended. It will be noted that the width of the bits used was less than that of those used in the South African mines trials; had the drilling been done with 1½, 1¼- and 1⅛-in. bits, the rate of drilling would be slower. In the Government trials in 1909 the finishing gage of the holes at a depth of 48 in. must be 15/16 in. This means that holes will have to be started with 1¾- or 1½-in. bits. I have already shown what effect this has on boring speed. This machine, I should say, has a speed of boring equal to that of a 2¾-in. piston drill having a 6-in. stroke and boring with bits of the same size; but the Stephens is, of course, lighter, smaller and more easily handled than the piston drill, while with a double-pointed wedge key the drill bits are changed very rapidly indeed. The shape of drill bits used is shown in the half-tone illustration. The shank ring is necessary for taking out the bits by means of the key.

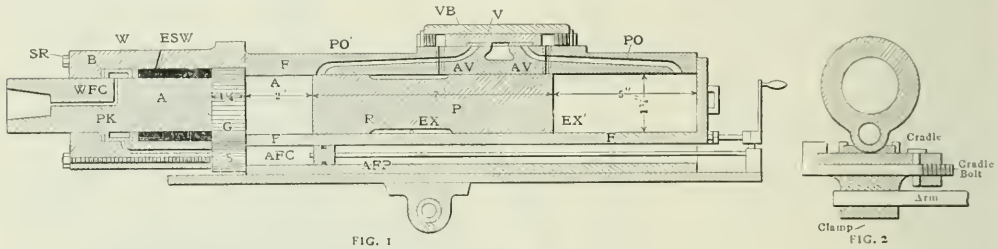


FIG. 1 FIG. 2

STEPHENS CLIMAX IMPERIAL HAMMER DRILL

An increase from 3,500,000 gal. of the oil of coal tar, or creosote, imported into the city of New York in 1904, to an amount estimated to be almost 25,000,000 gal. in 1908, is one of the indications pointing to the progress of the nation-wide movement for the conservation of forest resources. It is creosote which the Government and scores of corporations and private wood users have found to be one of the most satisfactory preservatives of railroad ties, mine props, telephone and telegraph poles, fence posts, and for timbers used for commercial purposes.

Cumberland Ely Copper Company

The report of the Cumberland Ely Copper Company, Feb. 5, 1909, shows that for the year ending Nov. 30, 1908, $1,190,521, was expended in development work, and its proportion of the cost of construction of the Steptoe Valley Smelting and Mining Company's plant.

During the year a four-compartment shaft was sunk and is now in service. A large electric hoisting plant, with self-dumping skips, was installed and has proved most satisfactory. Ore bins were constructed and the requisite number of buildings for the accommodation of employees completed, together with an extensive pipe line which furnishes an abundant supply of water for all purposes at the mine.

The success of the caving system of mining was fully demonstrated, and is producing satisfactory results. Up to Feb. 1, 1909, 198,611 dry tons of ore were mined, of which 177,589 tons were milled, showing an average copper content of 3.1 per cent. The production at the present time is at the rate of 1200 tons per day. The railroad to the concentrating and smelting plant at McGill has been in operation for some time, and is so constructed and equipped that it can readily meet all demands made upon it for the transportation of ore and other traffic.

The average extraction was 71.19 per cent., and during December and January, 73.33 and 76.12 per cent., respectively.

The accompanying table shows comparative assets at the end of Nov. 30, 1907 and 1908.

COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES.

Assets.	November 30, 1907.	1908.
Property account:		
Cost of mine, including expenditures for construction and development	$4,371,017.33	$4,676,538 88
Investment account:		
Cost of capital stock of other companies	3,315,000 00	4,100,000 00
Material on hand	. .	36,222.74
Metals:		
Value of metals refined and in process, less advances on same	. . . . .	353,489 77
Cash and cash items	1,077,243.47	37,783 01
Total	$8,763,260 80	$9,204,034 40

Liabilities.		
Capital stock:		
1,300,000 shares at $5	$6,500,000 00	$6,500,000.00
Surplus account:		
Difference between par value and amount realized for capital stock issued	2,141,122.25	2,141,122 25
Accounts payable	19,093 72	250,488 44
Profit and loss	103,044.83	312,423 71
Total	$8,763,260 80	$9,204,034.40

Pennsylvania Railroad's New Coke Cars

In an effort to provide shippers of coke with an improved car, which can be loaded and unloaded in the shortest possible time, the Pennsylvania lines west of Pittsburg have specified that of the recent order for 2200 new cars, 1000 shall be all-steel cars of new design and of greater capacity than any coke cars hitherto built for regular service.

The main novelty in these cars will consist of four hoppers, with eight openings in the bottom of the car, making the car practically self-clearing. With the doors all open, there will be an open area of 84 sq.ft. This will greatly facilitate unloading. It has been found that three somewhat smaller cars could be unloaded by three men in 15 minutes from the time they were placed on the trestle until the engine moved them away. From the time the drop doors were opened until the coke ran out of the car required 1 min. and 45 sec. The four-hopper car is expected to do even better.

To facilitate loading, it is planned that the old-fashioned coke racks shall be left off these cars, and the sides of the cars will not be as high as in previous designs. This loss is repaired in the greater length, 42 ft., of the new cars. The drop doors are to be provided with operating gear of special design. The total capacity of each of the new cars is 2704 cu.ft., providing for a load of 100,000 pounds.

In breaking ore the face of the stope should be carried so that the greatest advantage can be taken of any weakness in the ore such as schistosity, fracture planes, and jointings.

The United States Steel Corporation

The Returns of the Great Corporation for a Year of Industrial Depression. A Loss of $250,000,000 in Gross Receipts, but Dividends Are Continued

BY FREDERICK HOBART

The report of the United States Steel Corporation, covering the calendar year 1908 gives, as usual, a comprehensive statement of the business of the company. The figures are so large and the transactions covered so varied and extensive, that proper analysis of the report is a work of some time. It illustrates well the great reaction which affected the iron and steel trades in the past year. Thus the gross sales of the company, as compared with 1907, decreased $274,706,928, or 36.3 per cent.; while the net earnings, after deducting all general and operating expenses, depreciation and renewal funds, were diminished by $69,116,963, or 42.9 per cent. Dividends on the preferred and common stock were continued in 1908, but the appropriations for additions to property and new construction—which were $54,000,000 in 1907, and the same amount in 1906—were omitted entirely last year. The surplus over all charges, from which appropriations were made, shows a decrease last year of $58,836,850, or 56.3 per cent. This proportion of decrease was naturally much greater than that in the net earnings, since the charges on the debt were not diminished, but showed some increase, chiefly due to the issue in 1907 of bonds for the purchase of the Tennessee Coal, Iron and Railroad Company stock.

The General Balance Sheet

The condensed balance sheet, reduced to its lowest possible terms, may be stated as follows:

Liabilities.	
Capital stock, preferred	$360,281,100
Capital stock, common	508,302,500
Capital stock, subsidiary companies, not owned	640,302
Total stock liabilities	$869,223,902
Bonded and debenture debts	593,231,209
Mortgages and purchase obligations	4,161,981
Current liabilities	43,031,854
Sinking, depre. and res. funds	64,879,360
Bond sinking funds	38,074,012
Undivided surplus	133,415,214
Total liabilities	$1,746,017,532
Assets.	
Property accounts	$1,474,142,655
Deferred charges	6,306,666
Outside investments	3,083,000
Sinking and reserve fund assets	23,263,035
Current assets	239,222,176
Total assets	$1,746,017,532

The stock accounts were unchanged last year; the bonded debt showed a net decrease of $7,454,957. The undivided surplus—$133,215,414—represents the working capital. The inventory valuation of materials on hand, included in current assets, amounted to $136,188,874 in the close of 1907, and $143,179,629 in 1908.

This condensed balance sheet exhibits the combined assets and liabilities of the United States Steel Corporation and of the several subsidiary companies, based on the valuations at which the stocks of the subsidiary companies and the Carnegie company bonds were acquired by the Steel Corporation; but liabilities from one company to another are omitted from both liabilities and assets. The outstanding capital stocks of subsidiary companies which are not held by the United States Steel Corporation show a net decrease during the year of $121,507. This results from the acquirement during the year by the corporation of an additional $158,405, par value, of Tennessee Coal, Iron and Railroad Company's stock, less the issue to outside holders of $36,897 of that company's stock purchased by them under subscriptions made prior to the date at which a controlling interest in the Tennessee company's stock was acquired by the corporation.

Capital Expenditures

The expenditures made during the year by all companies and properly chargeable to capital account, for the acquisition of additional property and construction, less credits for property sold, equaled $49,422,697. All of the above expenditures comprehend only actual additions and extensions to the plants and properties. The capital expenditures are classified by property groups as follows:

Gary, Indiana, plant	$18,733,841
Other properties: exclusive of Tennessee:	
Manufacturing	14,610,517
Coal and coke	1,938,402
Iron ore	3,103,966
Transportation	7,238,627
Miscellaneous	336,351
Tennessee Co. properties	3,460,993
Total for the year 1908	$49,422,697

In addition to the foregoing amount there was expended the gross sum of $7,453,158 for stripping the overburden from orebodies preliminary to mining ore from open pits, for additional logging equipment, etc. Against this charge was credited $1,813,611 for expenses of foregoing character absorbed in operating expenses for 1908 for mining ore and timber logged, leaving a net increase during the year in the amount invested in stripping outlays and logging equipment of $5,639,547. The total investment at Dec. 31, 1908, in these operations and carried in property account equals $15,936,929, all of which will be absorbed in operating expenses when respectively the ore thus uncovered is removed and timber is cut. Since April 1, 1901 (the date of organization), to Jan. 1, 1909, the amount expended by all companies for additional property and construction equaled a total of $255,497,987.

Income Account

The statements of accounts, statistics, etc., presented in this report comprehend, unless otherwise specifically stated, the combined results for the United States Steel Corporation and all of the subsidiary companies, including the Tennessee Coal, Iron and Railroad Company. A condensed statement of the income account for the year is as follows:

Net earnings for the year	$91,847,711
Sinking funds, subsidiary cos	$1,588,071
Depreciation funds	3,844,214
Replacement funds	11,532,897
Interest on Steel Corp. bonds	23,862,647
Sinking fund Steel Corp. bonds	5,385,203
Total charges	$46,213,032
Net balance	$45,634,679
Add adjustment of accounts	94,035
Total surplus	$45,728,714
Dividends, preferred, 7%	$25,219,677
Dividends, common, 2%	10,166,050
Total dividends	$35,385,727
Undivided earnings	$10,342,987

No appropriations for new construction were made during the year. Such appropriations amounted to $54,000,000 in 1907.

A comparative statement of all receipts and disbursements for two years is given in the following table:

	1907.	1908.
Gross sales	$757,014,768	$482,307,840
Interest on investments	9,748,951	5,786,885
Total receipts	$766,763,719	$488,094,725
Operating expenses	$564,166,767	$367,735,102
General expenses	25,395,379	21,001,037
Subsidiary cos.' accounts	16,236,889	7,510,875
Total expenses	$605,799,045	$396,247,014
Net earnings	$160,964,674	$91,847,711
Interest and sinking funds	$27,719,744	$29,153,815
Depreciation and replacements	28,679,366	16,965,182
Total charges	$56,399,110	$46,118,997
Surplus	$104,565,564	$45,728,714
Dividends	$35,385,727	$35,385,727
New construction	54,000,000	.....
Total appropriations	$89,385,727	$35,385,727
Undivided profits	$15,179,837	$10,342,987

The gross sales represent the aggregate value of the commercial transactions conducted by the respective companies, and include sales made between the subsidiary

companies and the gross receipts of the transportation companies for services rendered both to subsidiary companies and the public. The earnings resulting represent the combined profits accruing to the several corporate interests on the respective sales and services rendered, each of which is in itself a complete commercial transaction.

Production

The production of the several subsidiary properties for the year 1908, in comparison with the results for the year 1907, is shown in the subjoined table. In order to make the comparison upon relatively the same basis, the production figures of the Tennessee company for the entire year 1907 have been included in the results shown below for that year. The figures are in tons, except cement, which is in barrels:

Products.	1907.	1908.
Iron Ore Mined	Tons.	Tons.
In Lake Superior ore region.		
Marquette range	1,170,496	830,087
Menominee range	1,625,358	1,021,598
Gogebic range	1,425,457	1,078,025
Vermilion range	1,724,217	927,206
Mesabi range	16,458,273	11,272,397
In Southern ore region.		
Tennessee Co.'s mines	1,576,757	1,533,402
Total	23,980,558	16,662,715
Coke Manufactured.		
Bee-hive ovens	12,716,013	7,591,062
By-product ovens	828,751	578,869
Total	13,544,764	8,169,931
Coal Mined, not used in making coke	3,550,510	3,008,810
Limestone quarried	3,201,222	2,186,007
Blast Furnace Products.		
Pig iron	11,234,447	6,810,831
Spiegel	130,554	74,716
Ferromanganese and silicon	57,794	48,861
Total	11,422,795	6,934,408
Steel Ingot Production.		
Bessemer	7,556,460	4,055,275
Open-hearth	5,786,532	3,783,438
Total	13,342,992	7,838,713
Rolled and Other Finished Steel Products for Sale.		
Steel rails	1,879,985	1,050,389
Blooms, billets, slabs, sheet and tinplate bars	761,195	551,106
Plates	894,364	312,470
Heavy structural shapes	587,954	313,733
Merchant steel, skelp, hoops, bands and cotton ties	1,338,833	577,591
Tubing and pipe	1,174,629	654,428
Rods	126,095	93,406
Wire and products	1,481,226	1,275,785
Sheets—black, galvanized and tinplate	1,070,752	770,321
Finished structural work	719,887	403,832
Angle and splice bars and other railjoints	195,157	84,669
Spikes, bolts, nuts and rivets	67,991	40,252
Axles	189,006	24,057
Sundry steel and iron products	77,463	54,893
Total	10,564,537	6,206,932
Spelter	31,454	28,057
Sulphate of iron	24,540	26,411
Universal portland cement, bbl.	2,129,700	4,535,300

The total falling off in rolled and other finished-steel products—which is the final form in which the Corporation's products reach the buyer—was 4,357,605 tons, or 41.2 per cent.

Domestic and Foreign Trade

The decrease in domestic sales of all products last year was 41.9 per cent.; in foreign trade, only 21.2 per cent. The report says: "The export business constituted about 12.4 per cent. of the entire shipments of rolled and other finished-steel products. The average prices received for exported material of all kinds, while somewhat lower than were received in the preceding year, compared very favorably with the average for the domestic business. The advantage to both the manufacturer and the employees of the permanent establishment of a fair volume of foreign trade, especially during periods of lesser activity in the United States, was most forcibly illustrated during 1908. An essential feature necessary to the successful conduct of a foreign trade, and one that can be obtained only by remaining continuously in the business, is that the manufacturer, his grades of goods and his methods shall become known to the consumers. Otherwise the use of the foreign market is largely limited to the so-called 'dumping' process, which is only accomplished at profitless prices. In the domestic trade the prices received for steel products shipped in 1908 averaged substantially the same as those received in the preceding year."

Productive Capacity

The total expenditures for new property and construction since the organization of the Steel Corporation have been $348,032,939, including betterments. The effect is shown in the following statement of productive capacity in 1901 and at the close of 1908:

	1901.	1908.
Blast furnace products	7,440,000	14,990,000
Steel ingots	9,425,000	17,070,000
Finished iron and steel	7,719,000	12,900,000
Cement, bbl	500,000	6,100,000

This growth has not, however, done much more than keep pace with the general increase in the trade, as is shown by the following table, which gives the proportions of the total output of the United States furnished by the Steel Corporation and by other manufacturers in 1901 and 1908:

	1901.		1908.	
	U.S. Co.	Others.	U.S. Co.	Others.
Pig iron	43 2	56 8	43.5	56.5
Bessemer steel ingots	70 1	29 9	66.3	33.7
Open-hearth steel ingots	58 8	41.2	48.6	51 4
Total steel	66 2	33 8	56 4	43 6

The Steel Corporation has always been weakest on the pig-iron side. This will be remedied by the new furnaces at Gary. The Gary plant will also increase the proportion of steel to the total output of the country.

Employees of the Corporation

The average number of employees at all plants during the year was:

	1907.	1908.	Changes.
Manufacturing	151,670	118,557	D. 33,113
Coal and coke	21,447	17,164	D. 4,283
Iron ore	16,462	13,135	D. 3,327
Transportation	18,133	14,165	D. 3,968
Miscellaneous	2,468	2,190	D. 278
Total number	210,180	165,211	D. 44,969

The total amount paid in wages and salaries was $160,825,822 in 1907, and $120,510,829 in 1908; a decrease of $40,314,993.

The average payment per employee was $765.19 in 1907, and $729.44 in 1908; a decrease of $35.75 last year.

In January, 1909, there was offered to the employees of the United States Steel Corporation and of the subsidiary companies the privilege of subscribing for 18,000 shares of preferred stock and 15,000 shares of common stock at the price of $110 per share for the former and $50 per share for the latter. The conditions attached to the offer and subscription were substantially the same as those under which preferred stock had been offered in each of the previous six years, excepting as to the subscription price. Moreover, because of the lower price at which the common stock was offered, as compared with the price for the preferred, the special bonus to be paid subscribers who retain their stock for five years was fixed for the common shares at one-half the amount of bonus which is to be received by holders of preferred shares. Subscriptions were received from 19,192 employees for an aggregate of about 23 per cent. in excess of the amount of stock offered. Subscriptions were reduced *pro rata*, except that employees subscribing for stock equaling a value at the subscription price of $110 or less per employee, were allotted the full amount subscribed for. The total number of shares allotted was 18,000 of preferred and 15,318 of common stock. At Dec. 31, 1908, there were 22,960 employees who had purchased preferred stock under offers made by the Corporation, and who on that date either held the certificates of stock or were making monthly payments on account of the purchase price thereof.

Transportation Properties

The railroads worked by the Corporation include 873 miles main line and 575 miles branches and spurs owned, and 435 miles leased; a total of 1883 miles, on which there are 304 miles of second track and 754 miles of sidings. The equipment owned includes 660 locomotives and 45,682 cars. The transportation equipment on the Lakes includes 76 steamships and 29 barges. In connection with these there are owned large shipping docks at Two Harbors and Duluth on Lake Superior, and receiving docks at several Lake Erie ports.

General Improvements

Notwithstanding the industrial depression, new work of considerable magnitude was authorized during the year, principally by the coke properties, to provide the added fuel requirements called for by the additional furnaces completed and nearing completion at Gary, Carrie, Duquesne and

Youngstown; by the iron ore properties in opening and developing mines in order to supply the increased ore tonnage required by these additional furnaces; the increase in the lake transportation facilities by the purchase of two additional 11,000-ton ore steamers; and by the Tennessee company in opening new ore mines and rehabilitating and enlarging the capacity of its blast furnaces. There was also commenced near the close of the year an extension of the cement plant at Universal, Penn., which will increase the daily capacity of this plant from 4000 to 10,000 bbl. With the completion of this extension the annual capacity of the cement plants operated by the Universal Portland Cement Company—a subsidiary company—will be 8,200,000 bbl. of Universal portland cement. In the year 1908 there were shipped to customers 4,138,757 bbl. of cement, against 2,322,875 bbl. in 1907. This increase was made possible through the completion and placing in operation late in 1907 of plant No. 4, at Buffington, Ind., and plant No. 5, at Universal.

At the close of the year there were unexpended on appropriations authorized for construction and improvement purposes the following sums: For all properties exclusive of Gary, $28,200,000; for Gary, $22,500,000; total, $50,700,000. It is estimated that about 75 per cent. of this total will be used during the current year.

Open-hearth Steel

During the last 18 months the subsidiary companies of the Corporation have increased their open-hearth steel capacity by 3,052,000 tons. This includes 500,000 tons of steel capacity controlled by the Tennessee company. During the same period the bessemer steel capacity of the subsidiary companies was reduced—by reason of substitution of open-hearth for bessemer—by 746,000 tons, leaving a net increase in the total steel capacity of 2,306,000 tons, of which 1,806,000 tons resulted from enlargements of old plants and the new plant at Gary, and 500,000 tons by the addition of the Tennessee company.

The Gary Plant

All of the construction work on account of the manufacturing plant at Gary, Ind., the city of Gary and the terminal railroad work adjacent thereto was carried on continuously and actively during the past year.

At the manufacturing plant four of the blast furnaces have been completed, three being now in operation. The first pig iron was produced on Dec. 21, 1908. The remaining four blast furnaces now under construction will be completed during the year 1909. Of the 56 open-hearth furnaces authorized to be constructed, one unit of 14 furnaces is completed, another unit of 14 furnaces is nearing completion and a third unit of 14 furnaces will be completed during the current year. Several open-hearth furnaces in the first unit are now in operation, the first steel having been produced on Feb. 2, 1909. The rail mill is completed and is now in operation, the first rail having been rolled on Jan. 24, 1909, from steel ingots supplied from other plants. The billet mill will be completed by July 1, 1909. Construction work on the 160-in. plate mill, on a group of merchant mills and on the car-axle plant is well under way, the expectation being that all of these finishing mills will be completed and in operation before the close of the present year. A full complement of mechanical shops, including machine shop, foundry, pattern shop, blacksmith shop and roll shop, together with necessary equipment and machinery, has been completed and the several shops are now in operation, furnishing economical facilities for aiding in the general construction work and in the operation of the plant. The vessel slip and docks, including ore-handling apparatus, have been completed. The ore docks have a capacity for handling and storing 2,000,000 tons of iron ore. The organization of the operating force has been developed as the several mill departments have approached completion and at the present time the plant is in readiness to produce pig iron, steel ingots and open-hearth steel rails.

The Iron and Steel Tariff

The bill submitted to Congress by the Ways and Means Committee makes many reductions in iron and steel duties. Iron ore is placed on the free list. The other proposed rates on principal items are shown below, in comparison with the present rates:

	Present Tariff.	New Law.	Change.
Pig iron, per ton	$4.00	$2.50	D. $1.50
Scrap iron and steel, per lb	4.00	0 50	D. 3.50
Bar iron, lb.	0.008	0 004	D. 0.004
Small bars, rounds, etc., lb.	0.005	0.004	D. 0.001
Charcoal bars and rods, ton	12 000	6 000	D. 6.000
Cold rolled bars, additional, lb.	0.0025	0.00125	D. 0.00125
Structural shapes, lb	0.005	0 003	D. 0.002
Plates, over No. 10 gage, lb	0 005 to 0 01	20%	.....
Sheets, under No. 10 gage, lb.	0.007	0 005	D. 0.002
Sheets, under No. 20 gage, lb.	0.008	0.006	D. 0 002
Sheets, under No. 25 gage, lb.	0.011	0.008	D. 0.003
Sheets, under No. 32 gage, lb.	0.012	0.009	D. 0.003
Polished sheets, lb	0 020	0.0175	D. 0.0025
Steel ingots and blooms	0 003 to 0 047	0.00175 to 0.046	D. 0.00125 to 0.001
Rails, lb.	0 0035	0 00175	D. 0.00175
Rail joints, etc., lb	0.004	0.002	D. 0.002
Tin plates, lb	0.015	0.012	D. 0.003
Wire nails, lb	0 005	0.0025	D. 0.0025
Cut nails, lb.	0.006	0.005	D. 0.001
Loco. and car wheels, lb	0 015	0.0125	D. 0.0025

A maximum and minimum feature is incorporated in the bill by the introduction of a special section which, in the case of metal products imported from countries which do not grant their minimum tariff to American goods, levies a retaliatory additional duty of 20 per cent., except as to pig iron and car wheels, upon which the retaliatory rates shall be the rates of the Dingley act.

The definition of steel in the bill is as follows: "All metal produced from iron or its ores, which is cast and malleable, of whatever description or form, without regard to the percentage of carbon contained therein, whether produced by cementation, or converted, cast, or made from iron or its ores by the crucible, bessemer, Clapp-Griffith, pneumatic, Thomas-Gilchrist, basic, Siemens-Martin, or open-hearth process, or by the equivalent of either, or by a combination of two or more of the processes or their equivalent of any, or by a combination of two which produces from iron or its ores a metal either granular or fibrous in structure, which is cast and malleable, excepting what is known as malleable-iron castings, shall be classed and denominated as steel."

Proposed Tariff Changes on Metals

Changes in the duties on metals, as proposed in the tariff bill recently introduced, are given in the table below. Of course, material alterations may be made before the bill passes:

	Present, Cents.	New Law, Cents.	Change, Cents.
Lead in ores, lb.	1.500	1.500	.....
Lead in metallic form, lb.	2.125	1.500	D. 0.625
Lead in manufactures, lb.	2.500	1.875	D. 0.625
Zinc, metallic, lb.	1.500	1.000	D. 0.500
Zinc sheets, lb.	2.000	1.250	D. 0 750
Zinc in ore, lb.	free	1.000	.....
Antimony, metal, lb.	0.750	0.750	.....
Nickel and nickel oxide, lb.	6.000	6.000	.....
Quicksilver, lb.	7.000	7.000	.....
Aluminum, lb.	8.000	7.000	D. 1.000
Aluminum, sheets, etc., lb.	13.000	11.000	D. 2.000

Duties of 2.5c. per lb. are provided for on copper sheets, rods, tubes and other manufactured forms; and of 2c. per lb. on sheathing or yellow metal.

Queensland Gold

Gold production in Queensland in February is reported at 32,500 oz. fine, including 5200 oz. from copper ores. For the two months ended Feb. 28 the production was 57,000 oz., or $1,178,190. Of this total only 900 oz. was from placers.

The coal output for Natal during December, 1908 (*So. African Min. Journ.*, Jan. 23, 1909) was 60,837 tons bunker coal and 49,012 tons exported, a total of 109,849 tons.

The New Tariff Bill

SPECIAL CORRESPONDENCE

The Payne tariff bill was introduced in the House of Representatives March 17, was referred to the House Ways and Means Committee and was reported by that body on the morning of March 18, after 10 minutes of discussion. The bill is accompanied by a report from Chairman Payne summarizing the measure and pointing out the reasons for attempting a revision of the tariff at the present time. Discussion was begun in the House on the morning of March 22.

Notes of the principal proposed changes in the metal and the iron and steel schedules were published in the JOURNAL of March 20, and elsewhere in the present issue.

MAXIMUM AND MINIMUM RATES

The special characteristic of the Payne bill, differentiating it from the tariff measures that have preceded it, is that it provides a maximum and minimum schedule of duties, the latter to become effective at once upon the enactment of the bill, the former to go into effect against such countries as refuse to give our exports entering their ports rates as favorable as those accorded to the goods of any other country. These maximum rates apply to practically all of the items enumerated in the metal schedule. To the items enumerated in 41 of the 80 paragraphs in the metal schedule the Dingley rates in force prior to the passage of the new tariff would be applied as the maximum, while to the rest maximum rates 20 per cent. higher than the minimums mentioned in the proposed new schedules would apply. Those which would take the Dingley rates are chiefly the manufactures of iron and steel, hardware, and the like. Those which would take the advance of 20 per cent. over the minimum, would include lead, zinc, the ferro-alloys, metallic mineral substances in a crude state and some machinery.

DRAWBACKS ON MANUFACTURES EXPORTED

The drawback section is acceptable to metal-manufacturing interests as it will permit the substitution of equal quantities of imported material in exported manufactured products, instead of requiring as at present the absolute identification of the materials entering into each product.

SMELTING IN BOND

Special criticism is offered regarding the provision for smelting in bond, which is less satisfactory than the old one, notwithstanding the efforts to secure a liberalization of the requirements of the law. The section in question is No. 28, and reads as follows:

"SEC. 28. That the works of manufacturers engaged in smelting or refining metals, or both smelting and refining, in the United States may be designated as bonded warehouses under such regulations as the Secretary of the Treasury may prescribe: *Provided*, That such manufacturers shall first give satisfactory bonds to the Secretary of the Treasury. Ores or metals in any crude form requiring smelting or refining to make them readily available in the arts, imported into the United States to be smelted or refined and intended to be exported in a refined but unmanufactured state, shall, under such rules as the Secretary of the Treasury may prescribe, and under the direction of the proper officer, be removed in original packages or in bulk from the vessel or other vehicle on which they have been imported, or from the bonded warehouse in which the same may be, into the bonded warehouse in which such smelting or refining, or both, may be carried on, for the purpose of being smelted or refined, or both, without payment of duties thereon, and may there be smelted or refined, together with other metals of home or foreign production: *Provided*, That each day a quantity of refined metal equal to 95 per centum of the amount of imported metal smelted or refined that day shall be set aside, and such metal so set aside shall not be taken from said works except for transportation to another bonded warehouse or for exportation, under the direction of the proper officer having charge thereof as aforesaid, whose certificate, describing the articles by their marks or otherwise, the quantity, the date of importation, and the name of vessel or other vehicle by which it was imported, with such additional particulars as may from time to time be required, shall be received by the collector of customs as sufficient evidence of the exportation of the metal, or it may be removed under such regulations as the Secretary of the Treasury may prescribe, upon entry and payment of duties, for domestic consumption, and the exportation of the 95 per centum of metals hereinbefore provided for shall entitle the ores and metals imported under the provisions of this section to admission without payment of the duties thereon: *Provided further*, That in respect to lead ores imported under the provisions of this section the refined metal set aside shall either be reëxported or the regular duties paid thereon within six months from the date of the receipt of the ore. All labor performed and services rendered under these regulations shall be under the supervision of an officer of the customs, to be appointed by the Secretary of the Treasury, and at the expense of the manufacturer."

PATENT PROVISIONS

Sharp dissatisfaction has been expressed with the provision of the bill which includes the plan for discrimination against foreign countries that attempt to subject our patents to unfair treatment. This provision is found in Section 41 and reads as follows:

"SEC. 41. That whenever a patent is issued by the United States to any citizen or subject of a foreign country it shall be subject with respect to manufacture thereunder in this country to all the limitations, conditions and restrictions that are imposed by the country of said citizen or subject upon the manufacture in that country under patents issued therein to citizens of the United States."

Transvaal Gold

Gold production in the Transvaal in February is reported at 550,645 oz. from the Witwatersrand and 14,573 oz. from the outside district; a total of 565,218 oz. This is a decrease of 49,995 oz. from January, which was due entirely to the shorter month; the daily average having been 19,842 oz. in January and 20,183 oz. in February. For the two months ended Feb. 28 the total was 1,102,258 oz. in 1908, and 1,180,331 oz.—or $24,397,442—in 1909; an increase of 78,073 oz. this year.

The labor report shows an increase of 7174 Kafirs in February, and a decrease of only 11 Chinese; the total number on Feb. 28 being 157,838 Kafirs and 10,034 Chinese.

The February report includes 69 mines, the mills having 8930 stamps in all. The total ore crushed during the month was 2,338,991 tons, and the general average result was $10.43 per ton.

Indian Gold Mines

The production of the Kolar district in Mysore, India, in February was 40,076 oz. bullion, being 5238 oz. less than in January and 2361 oz. less than in February, 1908. The decrease was due to a fire in the Nundydroog mine. The total for the two months ended Feb. 28 was 86,340 oz. bullion in 1908, and 85,390 oz. in 1909; a decrease of 950 oz. The bullion reported this year was equal to $1,588,570, or 76,851 oz. fine gold.

The output of the two producing mines in the Deccan—the Hutti Nizam and the Dharwar Reefs—was 2083 oz. in February. For the two months ended Feb. 28 it was 3317 oz. in 1908 and 4131 oz. in 1909.; an increase of 814 oz. this year.

Wherever considerable ore is trammed, all turn sheets should be eliminated and curves used, for most up-sets occur at such points, and, besides, slewing a truck is hard work and many times an avoidable loss of energy.

The Saint Croix safety-catch device, which is designed to stop the cage gradually and independently of the guides, is being tried at the Marcus shaft of the Langlaagte Estate, South Africa.

Colliery Notes

All safety lamps should be carried steadily and not jerked or held in a slanting position.

It is estimated that the world contains 200,000 square miles of peat bogs, while of this total area, 36,000 square miles are located in the United States. Canada is credited with 37,000 square miles; Germany, 10,000 square miles, and Ireland 1100 square miles.

Recent estimates place the original supply of coal in Indiana at 44,169,000,000 short tons. The aggregate production of coal in Indiana to the close of 1907 amounted to 159,440,390 short tons, of which 13,985,713 tons, or practically 9 per cent. was produced in 1907. The exhaustion represented by this production is figured at 239,000,000 tons or 0.54 per cent. of the original supply. The coal remaining in Indiana is, therefore, nearly 300 times the production at the close of 1907.

In coaling a large steamer in a Japanese port, about 600 persons are employed. The coal is placed in small baskets, holding a trifle more than a peck, and is passed along the line until it reaches the ship. It takes these 600 people just seven hours to load a steamer with 1500 tons of coal. They receive for this work about 20c. each, in American money, making the cost of coaling the ship about $120. The work could not be accomplished for much less by machinery.

The practice of robbing one or two pillars at varying intervals of time, is most ill-advised. Robbing should not be started until a certain district, comprising say eight or ten pillars, has been prepared for quick drawing. All of the pillars should be brought back together as uniformly and quickly as possible. This plan insures the pressure being brought to bear equally on each pillar, and besides bringing the coal down in larger lumps, causes the roof to subside evenly, preventing a loss of coal through a squeeze.

In firing a furnace, it is best to have the coal broken to a size no larger than a man's fist. The reason for this is, that large lumps do not ignite promptly, and their presence also causes holes to form in the fire, which allow the passage of too much air. Do not land the coal in a heap, but spread it over as wide a space as possible. Fire one side of the furnace at a time, so that the other side containing a bright fire will ignite the volatile gases from the fresh charge. Carry as thick a fire as the draft will allow. Fire little and often, rather than heavy and seldom. In case of a sudden interruption in the amount of steam being used, it is best to regulate the draft by the bottom or ash-pit doors rather than by the stack dampers; when the latter are used, it tends to produce a smoky chimney.

We of the United States, are not alone in our troubles over the questions of labor and wages. In Germany, there is a popular demand for a reduction in the price of coal, and the mine owners reply that such action is impossible owing to the high wages paid miners. The German miners last year earned approximately $1.50 a day and other workers in the mines about $1. These rates were an increase over those of 1905 of about 26 per cent. for the miners, 20 per cent. for other workers underground and 14 per cent. for laborers. German mine owners are now confronted by a number of new laws which will require them to pay a total of about $2,500,000 for the purpose of invalid and accident insurance. To this same fund, the mine workers are required to contribute a similar sum.

Among the new rules to govern the coal industry in Ohio, the mine inspectors have prescribed the following: (1) No wires carrying current shall be extended beyond the outside corner of the last breakthrough between entries or rooms. (2) In no case shall an electric wire be attached to a pipe-line in any mine, and all pipe-lines must be protected from contact with bonded rails or wires used for conducting power for motor haulage or any other purpose. (3) All ventilating fans operated by electricity shall have a direct wire from the generator. (4) No running switches shall be made, either by haulage or gathering motors, where men are traveling in or out in mines. (5) No person shall be permitted to ride on loaded cars or motor, or high-speed haulage trips, unless a special trip is run for the purpose of taking employees in and out of the mine.

In striking contrast to the laxity of our employers' liability laws is the policy of foreign countries, 22 of which have enacted legislation recognizing the principle that the workman is entitled to compensation for injuries from accidents received in the course of his employment. There is variation in the provisions of the foreign laws, but as a general rule, compensation is not payable unless the injury causes disablement for a specified number of days or weeks. The employer may usually be relieved from the payment of compensation if he can prove that the injury was caused intentionally or by wilful misconduct; however, in none of these 22 countries does ordinary negligence on the part of the injured employee work a forfeiture of the right to compensation. In all the countries with the exception of Sweden, the compensation is based upon the wages of the injured person. The acts of nearly all of the countries are framed with a view of obviating the necessity for instituting legal proceedings. Agreements, therefore, are usually made amicably between the employers and the victims of an accident.

The plan of heating the air forced into a mine, for the purpose of raising the humidity, especially in winter time, must be accompanied by an efficient system of putting a large amount of moisture into this air. Up to the present time, the means generally employed for accomplishing this end have been rather primitive, so that it is interesting to note that a system originating in Germany and meeting with much success there, has been introduced into this country. This general scheme consists of mechanically spraying in a fine mist form through a number of specially constructed spray nozzles. The construction of these nozzles is such that when water is forced through them under a pressure of from 50 to 100 lb., it issues forth in the form of a mist without any drops. The nozzles are distributed at intervals in the air shafts and entries through which the air currents pass, and the full discharge from the nozzles is instantly caught up by the current of air and is carried to the remotest corners of the mine; this plan keeps the walls, roof and floor of the mine moist. The system being introduced is known as the Koerting spray system, and the nozzles are being manufactured by the Schütte & Koerting Company, Philadelphia, Pennsylvania.

The question of a proper capping for a winding rope is important. The former practice of turning the wires back in order to form the bulge for the capping to grip has resulted in many accidents of cage falling to the bottom of the shaft. The later scheme of having the wires of the rope gripped within a cone of white metal has proved satisfactory at a number of collieries. Close attention should be given to see that this latter method is properly carried out. The following points are essential to remember: 1. Bind the rope with soft iron wire, at the point at which it is to be opened out. 2. Carefully straighten the wire; open out each wire and straighten the strand curves, so that the wires cannot possibly twist together again. 3. Thoroughly clean each wire, taking off all grease and dirt close up to the wire wrapping. 4. Thoroughly dust the wire with resin dust so that the fluid white metal will freely flow around each wire. 5. After drawing the wires down into the steel socket, a hemp or cloth wrapping may be used to prevent the metal running out. Do not put the socket into use if the white metal does not show outside the steel socket. One of the best mixtures of white metal is the following: Lead, 60 per cent.; tin, 30 per cent.; antimony, 9 per cent.; bismuth, 1 per cent. The antimony adds to the hardness, the bismuth lowers the temperature of fusion and gives a slight expansion in cooling. It is advisable to never remelt and use the same metal a second time. There is no truth in the statement that the hot fluid metal affects the temper of the wires of the rope.

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The Steel Corporation Report

The report of the United States Steel Corporation covers such a wide range of interests and deals with such large figures that it requires much study and careful analysis to get at its full meaning. Not that it is obscure or involved; the present report, like its predecessors, is a full and fair statement of the business transactions of the year. No attempt has been made to cover up the depression in business which marked the period under review, or to disguise the losses of business in comparison with previous years. How great those losses were can be illustrated by a few figures. Thus the gross sales, while approaching very nearly $500,000,000 in amount, were less than those of 1907 by $274,706,928, or 36.3 per cent. The net earnings, after deducting all working and general expenses, depreciation and ordinary renewals, decreased $69,116,963, or 42.9 per cent.; while the surplus over all charges—the final net profit—was diminished by $58,836,850, or 56.3 per cent. The higher proportion of loss in the final net surplus is explained by the fact that the interest and fixed charges are practically the same in a lean business year as in a good one. Perhaps the remarkable point is that with a loss of over one-third of the gross earnings the surplus for the year should have been sufficient to pay the usual dividends, without drawing upon the company's accumulated profits.

The loss in earnings was due entirely to smaller business, since the report tells us that there was little change in the prices realized. What the reduction was is shown by the table of production which notes decreases of 31.7 per cent. in the make of pig iron; 41.2 in steel ingots, and 41.3 in finished iron and steel. The tables are not carried far enough to make statements of average returns and costs practical. A rough determination may be made, however, by taking the quantity of finished iron and steel products, which are the forms in which by far the greater part of the Corporation's output reaches the consumer. On this basis the gross earnings of 1907 show an average of $71.65 per ton, and the net earnings $15.24; the figures for 1908 being $77.71 and $14.80 per ton. These averages are, of course, too high, as they disregard the sales of steel billets and other half-finished forms, and of by-products, like copperas, cement, etc.; but they will serve some purposes of comparison.

As already noted, the final net earnings were sufficient to continue the payment of dividends at an unchanged rate; but the Corporation suspended for the year the appropriations for new construction—that is, for actual additions of property, as distinguished from renewals and the making good of depreciation. Such appropriations in 1906 and 1907 amounted to $54,000,000 in each year. Since its organization the Corporation has spent for such additions a little over $348,000,000, the effect of which has been to double its pig-iron production, to increase its capacity for making steel about 80 per cent. and for finished forms 67 per cent. This has been a wise policy; indeed, a necessary one, if it was to maintain the position in the trade. After all, the additions did not do more than keep pace with the general growth in capacity for making iron and steel. In 1908 the proportion of the total output of the United States furnished by the Steel Corporation was very nearly the same as in 1907.

The report deals fully with the financial side of the year's operations, but has little to say of technical matters, or technical progress. One statement of interest, however, is that while the open-hearth steel capacity was increased during 1908 by 3,052,000 tons yearly, the bessemer-steel capacity was decreased by 746,000 tons, owing to the substitution of open-hearth furnaces for converters.

Another proof of the diminished business of the past year is found in the fact that the average of 210,080 employees in 1907 was reduced by 44,969, to 165,111 men in 1908. The Corporation has continued its policy of placing stock with its employees, and at the end of 1908 had 22,960 who were owners of preferred stock.

Very little is said of iron-ore holdings, the subject being apparently avoided, notwithstanding—or perhaps because—of the recent active discussion of the question of iron-ore supplies and their ownership. The only reference is the statement that prospecting and preparation for increased production from the Mesabi properties were actively carried on, though the output last year was less than for three years preceding.

Upon the whole the report is rather better than might have been expected, and is to be commended for its fullness

There is not space here to discuss the question whether its showing would have been different had the Corporation adopted earlier the economic policy to which it has at last been driven. Little or no attempt is made to discuss or defend that policy in the report itself.

Coal Mining as an Investment

Not for many years has the coal-mining industry been so completely enshrouded in a cloud of despondency as at present. Those who are financially interested in the production of coal are dubious as to how they are going to come out, and the more timid, either from inexperience or from short memory, are predicting dire results for the industry. When prices are high and consumption is breaking all records, eyes are shut to the recessions that will come, and similarly during a period of depression, some fear that the days of plenty have permanently forsaken them.

Some prominent operators are now thinking that there will be no improvement in the situation, unless there is a radical change in the conditions that govern the industry. They reason that new mines are being opened in such numbers that production is certain to exceed demand, even when business again reaches the prosperity of 1906-07. It is further asserted that coal mining is disorganized, and that this condition will prevent business from being brought to a profitable basis; also that each independent operator endeavors to mine and market his maximum production, undercutting his neighbor and thus spoiling his own market.

In all times of depression, the same cry has been raised and the prospective investor has been deterred from accepting the bargains presented. Immense fortunes have been made in coal, great profits yet await those who get in on the ground floor, and no well-made investment is surer of greater safety of principal and income than coal mining. The product cannot well be stored in large quantities, which fact alone prevents any great overproduction, while the independent competition in the industry prevents the maintenance of false price standards, such as have prevailed in the steel industry to the detriment of early business resumption.

How many branches of business made a better showing in 1908 than coal mining? Although the production in 1908 was only 88 per cent. of that in 1907, we mined nearly as much bituminous coal in 1908 as was produced in 1906 (a banner year), while the anthracite output in 1908 was considerably larger than in 1906. The average price received at the mines during the last decade has varied but little, and this has been true without there having been any monopolistic control of trade. The recessions have been dictated by commercial conditions, and have always resulted in stimulating rather than in upsetting business.

The production of coal is like a manufacturing business, and the industry as a whole is less speculative than many important industrial undertakings. As in other enterprises, the percentage of profit in coal mining depends on the sagacity of the investor in selecting his opportunity. It is not enough to know that the coal is of superior quality and that from every physical aspect, the venture is meritorious; it is also essential that the investor should be sure of his market. Many inferior seams show greater profits, because of their nearby markets and cheap transportation, than others which produce a superior fuel, but less favorably situated.

The disfavor with which many Eastern capitalists view coal mining is principally due to the exaggerated value placed on some properties that have recently been gathered into important consolidations. The stock of these companies has been sold at a price only justified by earnings during times of great prosperity and maximum production. Investors who have been persuaded to buy into these overcapitalized companies have naturally condemned the whole industry as unprofitable because of their own lack of understanding.

For the man whose judgment is sound and vision is keen, coal mining offers attractive opportunities. The cry of overproduction is no more serious now than it was in 1902, and along with improved methods of mining, that not only insure cheaper production, but also a greater percentage of recovery, the prices paid per ton at the mines are higher now than in 1902. It is to be admitted that labor and material now cost more, but the slight increase in them is offset by the advance in the art of mining, which now enables a recovery of 90 per cent. or more as compared with 70 or 80 per cent. a few years ago.

The Proposed New Tariff

In the bill brought in by the Ways and Means Committee on March 17 the changes of most interest to the mining industry are those affecting iron and steel, lead and spelter, and the ores of those metals. Iron ore on the free list will be of great advantage to the independent steel makers on the seaboard, which have been obtaining Cuban ore. It will enable them to produce pig iron materially cheaper, which ought to be to the advantage of consumers, without adversely affecting any domestic iron-mining enterprises of consequence. The removal of the duty on pig iron and the principal steel products will hardly lead to any increase in the importation thereof at the present time. The effect will be rather to restrain the rise of domestic prices at another boom period.

The changes proposed as to lead and zinc are likely to be disturbing. If we may judge from the range of prices during the last 10 years, lead could have been frequently imported at a payment of a duty of 1½c. per lb. At present prices it could not be profitably imported, and this will probably be always the case when lead at New York is 4 to 4½c., which is not much below the normal of the market. The chief effect of the reduction in the lead tariff also will be to restrain an excessive rise of prices. It has been erroneously reported, by ourselves included, that the tariff on lead in ore is to be reduced to 1c. per lb. It had been so reduced, but at the last minute, after Mr. Payne's statement had been given out, the old rate was restored.

The proposed change in the tariff on zinc and zinc ore will increase the cost of raw material to the smelters, while they will be deprived of part of their protection against foreign producers. The effect of this tariff will be to raise the price of spelter, which is what the advocates of the tariff on ore desire to do.

It is to be remarked that the bill before Congress at present is only a proposal, and it will be a long time to its introduction and enactment, during which many changes may be made, wherefore the final act may bear but little resemblance to that which is now proposed.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Extraction of Zinc from Mixed Ore

On account of the mixed character of the ore which I have had to smelt during the last three years, containing an average, without selecting, of about 3 per cent. copper, and 20 per cent. zinc as sulphide with considerable silver and gold (the remainder being made up of 18 per cent. heavy spar, 18 per cent. sulphur, 12 per cent. iron, 15 per cent. carbonate of lime, 8 per cent. silica and 2 per cent. lead) I have been investigating the different methods of zinc extraction from such ore and have come to the conclusion that the leaching process with ammonia in connection with carbonic acid, after the ore is roasted and reground, is the most suitable for our ore; and if so is suitable for any zinc ore containing sufficient value.

The ammonia does not seem to dissolve anything in the ore except the copper and zinc. Our chemist extracted 99 per cent. of the copper from a rich piece of chalcopyrite and about 80 per cent. of the zinc from a sample of zinc sulphide sent him from Arizona, which he did not have ground fine enough; better yet it should be slimed.

We expect to put in a suitable plant to roast the ore properly, regrind to the most suitable fineness, leach out the copper and zinc, siphon and filter off the solutions, and recover the ammonia by distillation, same as in an ice-manufacturing plant. This throws down the zinc and copper precipitate as the ammonia leaves the solution. (In this connection I may state that I precipitated the copper from the solution first with metallic zinc which would have thrown down any gold or silver at the same time if cyanide solution had been added to have extracted them; the equivalent of zinc dissolved to precipitate the copper is recovered with the remainder of the zinc).

I have extracted 73 to 80 per cent. of the zinc from a sample of our fine dust without any regrinding or preliminary preparation of any kind. After roasting and leaching out the zinc, the remaining pulp is much sweeter to smelt, but our chemist claims that the gold and silver can be extracted at the same time by adding calcium cyanide (a very cheap salt one-sixth the value of potassium cyanide) which can be practically used only in connection with ammonia. I think he is right but I have not experimented with it myself.

I have never heard of the ammonia process being tried on a large scale, except at a small plant in Nevada which I understand was a failure on account of lack of capital, and it did not have a continuous still for boiling out the ammonia. This process appeals to me for the reason that after crushing and roasting (any process to recover zinc requires this) it needs but very little power, the solvent ammonia is recovered and the product is pure, suitable for zinc white paint, or it can be reduced to metal. All the other processes require too much acid, which not only dissolves the zinc and copper but other elements at the expense of the acid, making it more difficult to produce pure zinc and too expensive.

I have spent considerable time and money with an electrician trying to produce marketable zinc at a profit with electricity in connection with different acids, and not only found that the chemicals, anodes and power were too expensive, but the zinc produced was not of first class.

The ammonia process, we estimate, will cost $6.60 per ton at a 50-ton plant 24 miles from the Southern Pacific railroad in California. This will cover drying, crushing, grinding, roasting, sliming, gas, ammonia, cyanide, lime, boiling-out still, calcining zinc oxide and producing enough metallic zinc dust to precipitate the copper and precious metals.

S. E. Bretherton.

San Francisco, Cal., March 18, 1909.

Has the Value of Gold Depreciated?

I have read with much interest the article by Mr. Ingalls in the Journal of Nov. 28, 1908, and feel convinced that there is a good deal of truth in his ideas. Nevertheless I object to his comparing the world's gold production with that of pig iron, or any other article of general use that might be chosen for the purpose. Pig iron is consumed, and gold is not, at least to a large extent it is not. I intend to say, that this year's production of iron after a few months may be considered no longer to exist; it will be consumed and practically annihilated. The loss of gold, on the other hand, is confined to the wear of currency and to the amount used in the arts, but all the rest *joins the world's treasure;* it can be used again and again and will *remain to be available for financial purposes* for centuries to come

I therefore believe, that diagram II, showing the yearly productions of gold and iron, does not fully answer its purpose, and I should like to have it completed by a third curve, in which the proper proportion of each year's gold production is added to the total amount, available at the beginning of that year. I understand quite well, that such a curve would by no means be an easy thing to plot; a suitable beginning point must be assumed and it will be necessary to find out just what amounts were coined and stored in banks each year, the remainder being used for other than financial purposes. And even if one should succeed in tracing that curve, it would not give an accurate idea about the question, since it is probable that vast amounts of coined metal continually pass out of circulation and are hoarded, especially in Asiatic countries.

I believe the truth lies in the interval between the curves plotted and the one I propose, but perhaps nearer to the latter If considered from this point of view, is not the accumulation of precious metal in circulation faster nowadays than even the growth of industry and commerce?

I should be very pleased if Mr. Ingalls would express his opinion as to this in the Journal. A. C. de Jongh.

Ma-Aman, Sumatra, Jan. 24, 1909.

It would be practically impossible, I believe, to plot such a curve as Mr. de Jongh suggests; even if it were, I do not think the result would justify the labor that would be involved. Iron does not cease to exist when it goes into use until it disappears by decay or is otherwise actually lost. Buildings, ships and many constructions are bought and sold directly, or through the stocks and bonds that represent them. They are forms of wealth and gold is the medium of exchange in the barter thereof. How would the world with its present wealth get along with the gold supply of 50 years ago? Wealth and gold supply are both cumulative, save for loss and destruction. The loss of gold and its industrial uses appear to be greater than is commonly supposed. According to Professor de Launay, in his recent book "The World's Gold," the world should have had (at the end of 1907) 2500 millions of pounds sterling of gold in hand, but certainly not more than 1200 millions was to be found in the state of coin, while between 1873 and 1904 alone more than 1360 millions of new gold money were struck. Half of the officially registered output has passed to industrial uses or has been lost. As to the general question of the effect of the recently greatly

increased gold production upon commodity prices, etc., Professor de Launay comes to substantially the same conclusion as I have done. W. R. INGALLS.

New York, March 20, 1909.

Mining and Milling Florida Phosphates

In the JOURNAL of March 6, 1909, appeared an article entitled "Mining and Milling Florida Phosphates," by C. A. Stone. The statements made therein as to costs of mining, especially as regards that of hard rock phosphate should, I feel, be corrected in justice to the producers of Florida phosphate.

The cost of mining hard-rock phosphate is stated to be from $2 to $2.50 per ton; but to anyone conversant with this class of mining, or to any engineer who had made a careful study of the work in question, the figures given are wide of the mark. The cost of mining this class of rock, at a conservative estimate, is not less than $4.50 to $5 per ton. In addition thereto a number of the mines are operated under a royalty, varying from $1 to $1.25 per ton, payable to the land owners, which must be added to the actual cost of mining. The figures given by Mr. Stone would indicate that very large profits would accrue to the miners, even at existing low prices, whereas this is not the fact of the case when the true cost of mining is arrived at.

The cost of mining pebble phosphate is placed at $1.50 to $2.25 per ton. These figures are too low, and in my opinion, from long experience in this class of mining, should be advanced to $2.25 to $3 per ton, varying in accordance with the tonnage yield per acre, yardage of overburden to be removed, general efficiency of the mining installation as to power costs, etc.

The incorrect statements made as to cost of mining tend to do serious injustice to the Florida producers of phosphate, and should be corrected. There are a number of inaccuracies in connection with what might be termed the technical portion of this article, but these are of minor importance and hardly worthy of correction.

C. G. MEMMINGER.

Lakeland, Fla., March 12, 1909.

The Jeffrey Crab Locomotive

The article describing our new crab locomotive in the JOURNAL of March 13, was erroneous in the last paragraph, where it was said that this locomotive is not practical where the rooms are driven to the rise. As a matter of fact, this is one of its most practical features.

JEFFREY MANUFACTURING COMPANY

Columbus, O., March 15, 1909.

The Lick Branch Relief Fund

I herewith inclose you a circular which evidently has been sent to mining men or mining engineers. While I think I am as ready as anyone else to help in cases of suffering, it certainly seems to me that it is a little too much to ask outsiders to contribute to matters of this kind. All mining men and companies have their widows and orphans to look out for, and I should think that pride and common decency would suggest that a mining company should look out for its dependents, even to the point of using all of its assets.

If I remember correctly, at the time of the large explosion in Utah, in which 300 lives were lost, the company paid out $300,000 and did not say a word about it. Although I have every sympathy for the Lick Branch sufferers, it certainly seems to me that the Pocahontas Consolidated Collieries Company should either by itself, or along with its neighbors, make up this relief fund in full.

J. PARKE CHANNING.

New York, March 16, 1909.

[The circular to which Mr. Channing refers is issued by the "Lick Branch Mine Relief Committee," and recites the two explosions (Dec. 29, 1908, and Jan. 12, 1909) in the Lick Branch mine of the Pocahontas Consolidated Collieries Company, by which 117 lives were lost, leaving 53 widows and 76 children under 16 years without means of support. The company has paid for the burial of the victims and has thus far provided for the maintenance of the bereaved families, besides contributing $5000 to the fund which the committee is now seeking to raise.—EDITOR.]

A Project in the Choco Region, Colombia

It has come to my attention that an attempt is being made to interest capital in an enterprise based on the beds of the rivers Condoto, San Juan and Iro, of the Choco region, Republic of Colombia.

It would be well for the readers of the JOURNAL to bear in mind that there are good and valid titles existing, which have existed for some years, to the gold and platinum gravels of the beds and bars of these streams, including the dredging rights of their banks, subject, of course, to indemnification of agricultural injury. The taxes of these claims have been paid in perpetuity, and the rights obtained by them are indisputable.

When I learned of the fact that a dredging right covering some of this section had been granted I was in Bogota and protested to an official of the government. He at once called my attention to the fact that the dredging concession given was simply subject to all prior rights, and thus *ipso facto* was null and void regarding the region to which valid titles were in existence.

A word of explanation may be interesting. Real estate and mining titles are as safe in Colombia as anywhere on earth; but owing to the great area of the country it has been impracticable as yet to make a detailed survey on which all property should be located and geographically recorded at the time of granting title. Therefore, the central government is unaware of what titles may be existing, and grants such rights as are asked for by persons who make the pretension of intending to undertake active development, but always puts in a saving clause respecting prior rights.

It is an easy matter for anyone contemplating serious development of investment in Colombia to have investigations made in the local and departmental registries, and ascertain whether or no there are any previous titles in existence regarding tracts that they desire to obtain. Where the object, however, is not personal investment, but simply a stock-selling scheme, regarding which the promoter knows there is no legal basis, it is well for intending investors to be on their guard. I therefore give this word of warning.

HENRY G. GRANGER.

New York, March 16, 1909.

A Monument to John W. Powel

The sundry civil act for the fiscal year 1910, passed March 3, appropriates $5000 for a monument or memorial to John Wesley Powell, former director of the Geological Survey, to be erected on the brink of the Grand Cañon of the Colorado in the Grand Cañon Forest Reserve in Arizona, "in recognition of his distinguished public services as a soldier, explorer, and administrator of Government scientific work." The site for this proposed monument was suggested by Powell's memorable trips down the Grand cañon in 1869 and 1872—exploits of perilous venture that naturally appeal to men's sense of the hazardous and the heroic. The language of the act, however, recognizes the fact that Powell's more substantial achievements—his long directorship of the Geological Survey and his persistent championship of irrigation in the arid West when the cause of irrigation seemed hopeless—entitle him to the larger recognition due to the broad-minded scientific prophet working for great ends with courage and zeal to overcome not only popular indifference but narrow-minded opposition. Standing on the edge of the mighty chasm he first explored, his monument should recall not only the venturesome daring of the explorer, but the patient courage of the man of affairs who resolutely sets out, in spite of all obstacles, to achieve a great public work whose results shall endure through all time.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

MANUFACTURE—Improvements in the Manufacture of Aluminum. Henri Herrenschmidt, Paris. (Brit. No. 433 of 1908.)

BAUXITE

MANUFACTURE—Improved Process of Manufacturing Products for Refractory Ceramic or Abrasive Uses from Bauxite or Other Aluminous Earths. Erich von Seemen, Paris. (Brit. No. 702 of 1908.)

CALCIUM

MANUFACTURE—Improvements in the Manufacture of Metallic Calcium. Sherard O. Cowper-Coles, Westminster, Eng. (Brit. No. 24,396 of 1907.)

CEMENT

CEMENT CLINKER Process of and Apparatus for Making Cement Clinker. Carleton Ellis, Larchmont, N. Y., assignor to Ellis-Foster Company, a Corporation of New Jersey. (U. S. No. 910,121; Jan. 19, 1909.)

HYDRAULIC CEMENTS—Art of Making Hydraulic Cements, etc. William H. Harding, Philadelphia, Penn. (U. S. Nos. 908,092; 908,093; 908,094; Dec. 29, 1908.)

KILNS—Improvements in or Relating to Rotary Kilns for Burning Cement. Friedrich J. Poths, Hamburg, Germany. (Brit. No. 13,440 of 1908.)

MANUFACTURE—Process for the Manufacture of Cement. Willoughby E. Synder, Nazareth, Penn. (Brit. No. 15,625 of 1908.)

COAL AND COKE

BRIQUET-MACHINE. Frank Burnes, St. Louis, Mo., assignor to American Fuel Company, St. Louis, Mo., a Corporation of Arizona. (U. S. No. 915,332; March 16, 1909.)

BRIQUETTING—Process of Briquetting Coal and the Waste Materials Thereof. George B. Damon, Glenside, Penn. (U. S. No. 914,248; March 2, 1909.)

BRIQUETTING—Process of Producing Bituminous Binders and Compositions. Walter S. Wilkinson, Wytheville, Va. (U. S. No. 915,260; March 16, 1909.)

COKE - OVEN — Horizontal Coke-Oven. Francis J. Collin, Dortmund, Germany. (U. S. No. 915,660; March 16, 1909.)

COKE-OVEN. William B. Smith, Sr., Pittsburg, Penn. (U. S. No. 915,630; March 16, 1909.)

COKE - OVENS — Improvements in Portable Coke-Ovens, and Gas Producers, with Portable Base Pieces or Hearths, Applicable for Use as Furnaces or Kilns. Thomas Smith, Newcastle-on Tyne, Eng. (Brit. No. 839 of 1908.)

SAFETY LAMPS or the Like, Especially Suitable for Use in the Underground Workings of Mines and in Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 1979 of 1908.)

SAFETY LAMPS—Improvements in and Relating to Apparatus for Igniting Miners' Safety Lamps in Underground and Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 25,597 of 1908.)

SAFETY LAMPS—Improvements in, and Relating to Miners' Safety Lamps. Thomas Phillips, Rhondda, Glamorganshire, Wales. (Brit. No. 22,001 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Electrically Igniting Miners' Safety Lamps or the Like. Ernest A. Hallwood, Morley, Eng. (Brit. No. 28,255 of 1907.)

GOLD AND SILVER

ASSAYING—Process of Assaying. Joseph C. Hames, Goldfield, Nev. (U. S. No. 913,129; Feb. 23, 1909.)

CONCENTRATION Gold - Concentrating Apparatus. John H. Montgomery, South Omaha, Neb., assignor of three-eighths to Adam Kundert, Omaha, Neb., and five sixteenths to Martha Montgomery, South Omaha, Neb. (U. S. No. 913,905; March 2, 1909.)

CYANIDE PROCESS—Improvements in the Cyanide Process for Extracting Precious Metals from Their Ores and in Apparatus for Carrying Out Such Process. Communicated from the Just Mining and Extraction Company, Syracuse, N. Y. (Brit. No. 1582 of 1908.)

IRON AND STEEL

ALLOYED STEELS—Improvements in Art of Producing Alloyed Steels. James Churchward, Mount Vernon, N. Y. (Brit. No. 12,383 of 1908.)

BLAST-FURNACE. Samuel H. Hine and William R. Phibbs, Girard, Ohio. (U. S. No. 915,601; March 16, 1909.)

ELECTRIC SMELTING—Method of Operating Electric Furnaces. Paul L. T. Héroult, La Praz, France, assignor to Société Electro-Metallurgique Francaise, Froges, Isère, France. (U. S. No. 914,346; March 2, 1909.)

ELECTRIC FURNACE. Paul L. T. Héroult, La Praz, France, assignor to Société Electro-Metallurgique Francaise, Froges, Isère, France. (U. S. No. 913,888; March 2, 1909.)

EXTRACTING IRON—Method of Extracting Iron from a Pulverized Charge. Carl G. P. de Laval, Stockholm, Sweden. (U. S. No. 913,405; Feb. 13, 1909.)

ORE-SMELTING FURNACE. John T. Jones, Iron Mountain, Mich., assignor, by direct and mesne assignments, to Jones Step-Process Company, a Corporation of Minnesota. (U. S. No. 12,928; March 16, 1909.)

REFINING—Improvements in, and Relating to the Refining of Steel in Electric Furnaces. Compagnie Bismarckhütte, Bismarckhütte, Germany. (Brit. No. 6029 of 1908.)

TITANIFEROUS IRON ORES—Improvements in or Relating to the Treatment of Titaniferous Iron Ores. Alf Sinding-Larsen, Christiania, Norway. (Brit. No. 27,282 of 1907.)

TIN

DETINNING—Process of Detinning. Harry M. Fernberger, Dollar Bay, Mich., and William M. Murray, Philadelphia, Penn. (U. S. No. 913,275; Feb. 23, 1909.)

DETINNING—Method of Detinning Tin-Scrap. Meredith Leitch, Springfield, Mass., assignor to Metal Process Company, New York, N. Y., a Corporation of New York. (U. S. No. 907,061; December 15, 1908.)

ZINC

CHARGING RETORTS—Improvements in Means for Charging the Retorts of Zinc and Other Analogous Furnaces. Emil Derdelaitre, Dorpleln, Holland. (Brit. No. 13,822 of 1908.)

EXTRACTION PROCESS—An Improved Continuous Process and Apparatus for the Extraction of Zinc from Its Sulphide. Thomas J. Heskett, Surrey Hills, Victoria, Aust. (Brit. No. 1761 of 1908.)

MINING—GENERAL

DRILLING—Water Attachment for Drill-Steels. James H. Sinclair and Guy D. Neill, Denver, Colo. (U. S. No. 915,230; March 16, 1909.)

MINE PROPS—Improvements in Mine Props. Frederick Nellen, Essen-on-the-Ruhr, Germany. (Brit. No. 21,446 of 1908.)

REMOVING DUST AND GASES—Method of Removing Loose Materials, Dust and Gases from Mines. Frank T. Byers, Mount Pleasant, Penn. (U. S. No. 12,923; reissue Feb. 23, 1909.)

ORE DRESSING

ATMOSPHERIC STAMP. Charles H. Krause, Keweenaw Bay, Mich. (U. S. No. 916,362; March 16, 1909.)

GRINDING MILLS — Improvements in Drum Mills for Grinding or Crushing. Gerhard Zarniko, Hildesheim, Germany. (Brit. No. 16,724 of 1908.)

ORE SEPARATOR. Alexander S. Campbell, Orionville, Minn. (U. S. No. 913,258; March 2, 1909.)

PULVERIZING—An improved Method of and Apparatus for Pulverizing Materials. Joseph de Miniszewski, Kwasow, Poland, and Frank A. Vernon and John C. Vernon, London. (Brit. No. 19,927 of 1908.)

SEPARATING METALS IN SOLUTION—Process of Separating Metals in Solution. Herbert H. Dow, Midland, Mich., and Walter S. Gates, Worthington, Ontario, Canada, assignors to the Ontario Nickel Company, Ltd., Worthington, Canada, a Corporation. (U. S. Nos. 913,708 and 913,709; March 2, 1909.)

METALLURGY—GENERAL

ELECTROLYTIC PRECIPITATION—Method of Precipitating Metals Electrolytically. Arthur Ramén, Helsingborg, Sweden, assignor to Helsingborgs Kopparverks Aktiebolag, Helsingborg, Sweden. (U. S. No. 913,430; Feb. 23, 1909.)

EXTRACTION—Process of Extracting Gold, Platinum, Silver, Nickel, Copper, etc., from Ores. Adolphe Seigle, Lyon, France. (U. S. No. 915,705; March 16, 1909.)

SMELTING—Method of Smelting Ores. James T. Carrick, Johannesburg, Transvaal, assignor of one-half to Basil Stuart Pattison, Johannesburg, Transvaal. (U. S. No. 913,655; Feb. 23, 1909.)

SMELTING-FURNACE—Oil-Heated Smelting-Furnace. August Koch, Hanover-List, Germany. (U. S. No. 915,192; March 16, 1909.)

MINING MACHINERY AND APPARATUS

CARTRIDGE for Mining Purposes. Edward Purcell and Samuel Purcell, Pontefract, England. (U. S. No. 910,722; Jan. 26, 1909.)

DEEP-BORING APPARATUS. Wilhelm Schott, Erkelenz, Germany, assignor to the firm of Internationale Bohrgesellschaft, A. G., Erkelenz, Germany. (U. S. No. 909,234; Jan. 12, 1909.)

ROCK-DRILLING ENGINE—Gasolene-Operating Rock-Drilling Engine. Rolland S. Trott, Denver, Colo. (U. S. No. 915,320; March 16, 1909.)

ROCK-DRILLING MACHINES—Improvements in Rock-Drilling Machines. Communicated from the Ingersoll-Rand Company, New York City. (Brit. No. 13,872 of 1908.)

ROCK-DRILLING MACHINES—An Improvement in Rock-Drilling Machines. Frederick A. Parnell and Albert L. Underwood, Cheapside, London. (Brit. No. 14,529 of 1908.)

ROCK-DRILLS—Improvements in or Relating to Air-Operated Rock-Drills. Joseph Knight, Holyhead, Anglesey and Richard S. S. Bellamy, Liverpool. (Brit. No. 3827 of 1908.)

ROCK-DRILL. John A. Traylor, Denver, Colo. (U. S. No. 913,928; March 2, 1909.)

TUNNEL-BORING DEVICE. Reginald H. Keays, New York, N. Y. (U. S. No. 912,575; Feb. 16, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

CHARGING BLAST FURNACES—Apparatus for Charging and Distributing the Stock in Blast-Furnaces, etc. William C. Mitchell, Chesterfield, England. (U. S. No. 908,594; Jan. 5, 1909.)

ELECTRIC FURNACES—Improvements in or Relating to Electric Furnaces. Albert Le Roy Marsh, Lake Bluff, Ill. (Brit. No. 19,265 of 1908.)

ELECTRIC FURNACES—Improvements Relating to Electric Furnaces. Hugo Helberger, Munchen, Germany. (Brit. No. 13,257 of 1908.)

ELECTRIC FURNACES—Improvements in Electric Furnaces. Jean Ronneau, Paris. (Brit. No. 8904 of 1908.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

R. Gilman Brown, who is now in London, expects to go to Manchuria soon.

W. E. Simpson is now manager of the San Francisco del Oro mine, Chihuahua, Mexico.

F. C. Greene, Cleveland, Ohio, is designing equipment for a coal plant in Alberta, Canada.

Henry Krumb is directing developments at the Inspiration mine, near Globe, Arizona.

Edward L. Dufourcq has returned to New York from a trip to Mexico and California.

A. F. Kuehn has returned to the United States from Chile where he had been for four months.

Ralph Nichols, who is now operating at Gilmore, Idaho, was a visitor in New York last week.

Edwin A. Austin has returned from Colombia to San Francisco and will soon start for the Yukon.

Hermann A. Keller, who has been spending the winter in Europe, expects to return to New York early in April.

Edwin E. Chase recently returned to Denver, Colo., from Juneau, Alaska, and has now gone to Oaxaca, Mexico.

W. J. Olcott, now vice-president, will succeed Thomas F. Cole as president of the Oliver Iron Mining Company.

W. S. Keith, of Seattle, is making an examination of a deposit of chrome ore on Fidalgo island, Skagit county, Washington.

Prof. Dr. George Lunge, of Zürich, Switzerland, has been elected an honorary member of the Chemical Society of London.

H. Foster Bain, recently State geologist of Illinois, has become associate editor of the *Mining and Scientific Press*, of San Francisco.

Henry F. Lefevre recently returned to New Orleans from Panama, and sailed for Nicaragua on March 17, to be gone about three months.

A. H. Wethey, who has been spending the winter in Europe, returned to New York last week, and after spending a few days here proceeded to Butte.

James Epperson has been appointed State mine inspector of Indiana for another term, by State Geologist Blatchley, with whom the appointment rests.

Percy E. Barbour has returned from Mexico. After a much needed rest and some professional work in Nevada and California, he will go to Mexico again.

John T. Judd, treasurer of the Tehuantepec Silver Mines Company, has returned to Boston from an inspection of the company's mines at Taviche, Oaxaca, Mexico.

George Crerar has resigned as general superintendent of the Takilma Smelting Company, on account of the death of Charles L. Tutt and the closing down of the company's works.

Frederick H. Morley, Denver, Colo., announces that on account of a largely increased practice in Mexico he has now associated with him the firm of Dominian & Smith, mining engineers, of Mexico city.

Robert Thurston Kent has resigned as engineering editor of the *Iron Trade Review*, Cleveland, Ohio, to become managing editor of *Industrial Engineering*, Pittsburg, a new paper devoted to mechanical-engineering subjects.

T. Ohashi, mining engineer and instructor in the Kumamoto technical high school in Japan, has been in New York. He intends to visit a number of mines in the United States for the purpose of studying mining methods and conditions.

George E. Collins is about to retire from the active management of the Argo Mining, Drainage, Transportation and Tunnel Company at Idaho Springs, Colo., and will be succeeded by Roscoe B. Morton. Mr. Collins will remain associated with the company as consulting engineer.

Thomas F. Cole, who has been president of the Oliver Iron Mining Company—the company managing the mining interests of the Steel Corporation in the Lake Superior region—since its organization, has resigned his position in order to devote his time to his other mining and smelting interests.

Cyrus Robinson, consulting engineer, New York, returned home March 17, having extended his visit to Europe into a trip around the world. While in Japan he paid a visit to the copper works at Osaka. He says that while he was prepared to find that the Japanese had uptodate plants, he was surprised to note their completeness in every detail, comparing favorably with any plants that we have in this country.

Obituary

Henry Biermann died at Monterey, Mexico, March 1, aged 64 years. He was born in Germany, but had been for over 20 years engaged in mining in the northern part of Mexico, and was well known throughout that section. He was president and general manager of the Tamaulipeca Mining Company at Ciudad Victoria.

John Henry Van Dyke, a leader in the early development of Wisconsin mining, pioneer lawyer, and one of the best known public men of the city, died at his home in Milwaukee March 9 at the age of 86 years. Mr. Van Dyke was successively director and vice-president of the Menominee Mining Company, the pioneer of the Menominee range in Wisconsin and the upper peninsula. In 1887 he was elected president of the Chapin Mining Company, and in the same year, the Pewabic Company was organized with Mr. Van Dyke as vice-president.

William Connell died at Scranton, Penn., March 21, aged 81 years. He was born in Cape Breton, Nova Scotia, and when quite young moved with his parents to Hazleton, Penn. When still a boy he began work in a coal mine, and gradually rose to be mine foreman and superintendent of a local colliery. In 1856 he was placed in charge of the mines of the Susquehanna & Wyoming Valley Railroad and Coal Company, with offices at Scranton. In 1870, when the charter of that corporation lapsed he was enabled to purchase the plant and reorganized under the firm name of William Connell & Co. From this beginning he developed into the largest individual coal operator in the Wyoming region, and later organized and practically owned the Connell Coal Company, which he soon developed into a great coal operating company and later sold out to the Lehigh Valley Coal Company. He accumulated a considerable fortune and was interested in many local enterprises. He was accepted as an authority on coal-trade matters and was often consulted by both miners and operators. He acted as sole arbitrator for the Lehigh Valley Company in settling the claims arising from the Mud Run disaster of Oct. 10, 1888, when 63 persons were killed and 120 injured. Only one case went to court. Mr. Connell was also active as a mediator in the attempted settlement of coal strikes and other local industrial disputes.

Societies and Technical Schools

Mining and Metallurgical Institute of Mexico—A meeting to organize this society has been called, to be held in the city of Mexico in July next. The movement to form the society originated with the Cyanide Club of Durango, and is supported by a number of prominent mining engineers in Mexico. Bernard McDonald is in active charge of the proposed arrangements.

Geological Society of London—At the anniversary meeting Feb. 19, the officers were appointed as follows: President, Prof. W. J. Sollas; vice-presidents, G. W. Lamplugh, H. W. Monckton, Dr. J. J. H. Teall and Prof. W. W. Watts; secretaries, Prof. E. J. Garwood and Dr. A. Smith Woodward; foreign secretary, Sir Archibald Geikie; treasurer, Dr. Aubrey Strahan. The following awards of medals and funds were made: Wollaston medal, H. B. Woodward; Murchison medal, Prof. G. A. J. Cole; Lyell medal, Prof. P. F. Kendall; Bigsby medal, Dr. J. S. Fleet; Prestwich medal, Lady Evans; Wollaston fund, A. J. C. Molyneux; Murchison fund, J. V. Elsden.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Goldfield and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 19—At a meeting of the creditors of the Northern California Gold Mines Company before the referee in bankruptcy in Marysville last week, it was developed that the concern had debts amounting to $132,563 and did not even own the Herman mine which it was operating. This mine is at Westville, Placer county, and is still owned by the Herman Mining Company. A. F. Sawhill, of Pittsburg, Penn., president of the bankrupt company said that the stockholders in Pittsburg had no idea that the company had such debts as appeared from the testimony. They had contributed money as called for to meet expenses and the debt in this State had been contracted by those in charge of the mine. In fact the stockholders in Pittsburg were preparing to put up money to pay all the debts when the proceedings were interrupted by the creditors forcing the company into bankruptcy. Expensive machinery had been purchased and the mine was well equipped. It seems that an agent of the company, when offering stock for sale, represented that the company owned the Herman mine and it is hinted that fraud charges may be made before the proceedings are concluded. No trustee in bankruptcy has yet been named as they are waiting for the books to be brought from Pittsburg.

About 300,000 acres have been added to the Tahoe National Forest, contrary to the wishes of numerous mining companies interested in lands now covered by the reserve. It is not yet known in California exactly where the new boundaries are. As originally drawn the new additions to the Tahoe reservation took in old mining ground in Nevada county down to within a few miles of Nevada City. The miners vigorously protested through their Congressional representative, but it is not known definitely whether or not their protests availed.

The new mining camp in Inyo county on the west side of the Argus range, north and east of Mohave and south of Darwin, now has some 300 residents, and numbers of parties are passing through Mohave on their way in. Ballarat is being deserted for the new goldfield. A number of claims have been located and some specimen ore is being shown. A townsite has been platted and a stage line started. The place is called Custer and the stages are running there from siding No. 18. Very little development work has been done thus far, but the ore found on the surface is very promising.

A matter of great moment and great disappointment to the mineowners and managers, of California, is the final passage of the bill regulating the hours of labor in mines, mills, smelting works, etc. The new law provides that the period for employment for all persons in underground mines in search of minerals, whether base or precious, or who are engaged in such underground mines for other purposes, or who are engaged in underground workings for the purpose of tunneling, making excavations, etc., or who are employed in smelters and other institutions for the reduction or refining of ores or metals, shall not exceed eight hours within 24 hours, and the hours of employment in such work shall be consecutive, excluding, however, any intermission of time for meals; provided that in case of emergency where life or property is in imminent danger the period may be for a longer time during the continuance of the emergency.

The law also provides that any person who shall violate any provision of the act, who, as foreman, manager, director, or officer of a corporation, or as the employer or superior officer of any person, small command, persuade or allow any person to violate any provision of the act, shall be guilty of a misdemeanor, and on conviction shall be punished by a fine of not less than $50 nor more than $300, or by imprisonment of not more than three months. And the court is given discretion to impose both fine and imprisonment.

In cases where there are strong miner's unions, as in Nevada and Shasta counties, an eight-hour rule prevails already, but in most parts of the State 10 hours' labor is the rule. This new law changes all that as may be noted from the provisions quoted. In smelting works, quartz mills, etc., the change will be particularly noticeable, as it will materially increase present costs of ore reduction. In the Mother Lode section of the State, especially where the mines are being worked on very narrow margins, owing to the low grade of the ore, the effect of this new law will doubtless be the closing down of certain properties. Where high-grade ore is the rule, as in Nevada county, the mines can stand the advance in costs of mining and milling, but in other parts of the State hardship will be worked on mineowners undoubtedly. There have already been increased costs for lumber, supplies, etc. With smaller mines throughout the State the impending changes will be quite radical and probably a number will cease work altogether.

Another bill which has become a law of the State is more favorable to mineowners. It provides that every person who carries on the business of a pawnbroker or who purchases gold bars, gold quartz, or gold bullion, or mineral containing gold, and who fails to keep a record in a register of the date, duration, amount, etc., of every loan made by him, or an accurate description of the property pledged, or estimated value of the property purchased or the name of residence of the pledgor or seller, or to keep an account of all sales made by him, is guilty of a misdemeanor.

The law also provides that every pawnbroker or person who purchases gold bullion, gold bars, gold quartz, or mineral containing gold, who fails or refuses to produce for inspection, his register or account of sales to any officer holding a warrant, authorizing him to search for personal property, or the order of a committing magistrate directing an officer to inspect such register or account of sale is guilty of a misdemeanor. This law was framed in the interest of mineowners to protect them from "high grading." It is thought they will be better able now to trace specimens, bullion, amalgam, etc., than has been the case. In some mining towns where rich ore is being mined, there have sprung up places where it is easy to dispose of stolen ore, specimen rock, bullion, etc. This law will make it much more difficult for dishonest men to dispose of such stolen property, and make it easier to trace them if they do.

Salt Lake City

March 20—During the week ending March 13 Tintic mines shipped in 20-ton cars: Swansea, 6; Brooklyn, 12; Beck Tunnel, 5; Black Jack, 4; Dragon Iron, 35; Iron Blossom, 15; Colorado, 23. The following mines shipped in 50-ton cars: Centennial Eureka, 45; Eureka Hill, 5; Sioux Consolidated, 14; Ajax, 3; Yankee, 2; Bullion Beck (leasers), 3; Eagle and Blue Bell, 3; May Day, 2; total, 177 cars.

The Park City ore shipments for the week ending March 13 were: Silver King, 903 tons; Daly-West, 362 tons; Daly-Judge, 334 tons; total, 1,680 tons.

Western mining operators are organizing for a strong fight to prevent the proposed reduction in the tariff on the lead contents of ores, from 1½ cents to 1 cent

per pound, as recommended by the Ways and Means committee. A meeting of Colorado, Utah and Idaho operators has been held at Salt Lake City for the purpose of appointing a committee and raising a fund to establish headquarters at Washington where the committee will sit during this session of Congress and plead the cause of the lead industry. [The above meeting was evidently called under a misapprehension. No change in the tariff on the lead content of ores was provided in the proposed bill.]

Butte

March 19—With the recent decline in the price of the copper, there has been no apparent curtailment in the Butte copper production. The Amalgamated mines, with perhaps the exception of the Anaconda, are all sending their regular tonnage to the smelters. Operations at the Anaconda have been somewhat retarded of late by gas, due to fires in the old stopes, on the upper levels.

The number of miners employed today is about two-thirds the number employed two years ago, while the number of tons produced is nearly as large. The shafts have all been sunk to greater depths. The High Ore shaft, through which the water from the Anaconda, Parrot, and North Butte companies, is pumped, has reached a depth of 2800 ft. The Diamond shaft is now also being sunk to that level, and connection will be made with the High Ore shaft.

Denver

March 19—The Livingstone mine, formerly known as the "Potato Patch," at the base of Sugar Loaf hill, in Boulder county, has been reopened after having been idle for three years, and has recovered the rich shoot which made the mine famous when it was discovered about 10 years ago. In addition to a good body of smelting ore, there is a 5-in. streak of sylvanite. The ore is found in the Nyanza, a cross-vein to the main Livingstone dike, near the point of intersection, and in a contact between granite and schist. The first discovery was made in tilling the ground for a potato crop, and from the decomposed outcrop of the vein $35,000 was recovered with a plough and scraper. The extension of the Nyanza vein is the Ragged Top, and in the lower workings of this group, ore has been struck which is believed to be a continuation of the Nyanza shoot, which, if it maintains its pitch, must enter the Ragged Top ground with depth.

The old Gilpin county camps of Central City and Black Hawk are looking better than for some time past. Several companies are starting up again on company account, and the leasers are doing well. The Newhouse drainage and transportation tunnel will drain and open much new ground under the old mines. The Fifty Mines Company, now owning the Bobtail, Gregory-Fisk and other great producers of the early day is sending out big reports, and the outlook is promising for a good year.

Goldfield, Nevada

March 16—It is reported that as a result of recent examinations of the mines and prospects of Eldorado cañon, Lincoln county, a custom mill of 30-ton capacity will be erected this spring.

John H. Doyle, special examiner of the U. S. Land Department will take evidence at Reno in land cases in the Olinghouse and other mining districts where it is claimed the Southern Pacific Railroad Company obtained patents to mineral lands by fraudulent methods.

Reports are being circulated of a new district recently discovered north of Lodi and near the Churchill-Nye county line. The district is about one mile wide and six miles long. The formation is porphyry surrounded by granite. As yet the deepest shaft is 100 ft. The ore contains gold.

It is now generally believed that General Manager Mackenzie, of the Goldfield Consolidated, will give up the management of the property, in accordance with an agreement made, when he first assumed charge, that he be allowed to drop the more active duties of management upon the completion of the mill, the opening up of the various orebodies and systematizing the operating department. Mr. Mackenzie will retain the general direction of the property, but will devote the greater portion of his time to the Coalinga oilfields of California, in which he is interested.

The output of the Goldfield district for the week ending March 13 was 6000 tons with an estimated value of $220,000. Production of the Tonopah mines for week ending March 13 was: Tonopah Mining, 3100 tons; Montana, 780 tons; Belmont, 850 tons; MacNamara, 250 tons; Jim Butler, 200 tons; West End, 135 tons, and Midway, 100 tons; estimated total value, $140,000.

Despatches from Reno state that orders have been given to have the railroad from Goldfield to Ely surveyed at once. The road may follow the west side of Hot Creek valley, touch Tybo, Helena, Bellehelen and pass close to Revielle, opening up a large territory to the north and east of Tonopah and Goldfield. It is hoped that the road will be completed early in 1910. The project is financed by "Borax" Smith and associates.

A hearing has been set for March 29 by the Interstate Commerce Commission on the question of making Reno a terminal point for freight and passenger service. At present all freight shipments from the East billed to Nevada points in the southern part of the State pay freight to Sacremento and back to Reno again, although the goods are carried no farther than Reno. Should Reno be made a terminal point it will mean the saving of thousands of dollars a year to mining camps in the State.

Paris

March 8—The Société des Mines d'Or d'Adieu-Vat et de Bonne-Aventure (French Guiana) has lately published results of the fiscal year ended June 30, 1908. This company is one of the few which work gold lodes in French Guiana. The ore was mainly extracted from the Rocher and Madame lodes and crushed in a 10-stamp mill. Owing to the difficulty of finding labor and also to the bad climatic conditions which prevailed in 1907-8, it was not able to put up the cyanide plant, nor to get sufficient ore to supply 20 stamps. The monthly mill output was 85 metric tons from the Rocher lode averaging 38.2 grams of gold, and 417 metric tons from the Madame lode averaging 15.72 grams of gold. Since July last conditions have improved both as regards the output and the richness of the ore. From July to October the monthly mill output was 160 metric tons from the Rocher lode averaging 60.6 grams of gold, as against 38.2; and 658 metric tons from the Madame lode averaging 16.15 grams. The monthly gold production in this last period was 20,912 grams of gold, worth over $12,000. Under these conditions the company has been able to meet all expenses with the gold produced. It must be noted it is the first time such a thing has occurred in French Guiana in a deep-mining enterprise.

The Compagnie Coloniale de Dragages Aurifères and the Société Anonyme du Sparwin (Maroni) report that the 5-cu.ft. gold dredges they sent to French Guiana have safely arrived, and that they are now under erection.

A lead and zinc mine is now being developed in France by a company organized in 1908 under the name of Société Minière et Métallurgique de Villemagne, with a capital of 1,500,000 fr., or $300,000. A concession had been granted a long time ago for an area of 13,000 hectares; but the first owners worked various lodes at the same time and did not obtain satisfactory financial results. The new company will concentrate all its efforts on one lode, where over 40,000 tons of galena ore is now blocked out. A concentrating plant is to be erected with a capacity of 50,000 tons of ore per year. The board includes several leading mining engineers.

The Société Minière et Métallurgique de Penarroya has lately placed a contract for a water-jacket lead furnace. It is the first attempt of this important company to use water-jacket furnaces in place of the old Pertusola type. This water-jacket will measure 44x156 in. at the tuyere level. It will be fitted with 20 tuyeres and be 24 ft. 6 in. high from the ground to the charging platform. Charges will be elevated to the mouth of the furnace by means of skips. Blast will be supplied by a Rateau turbo-blower. The company expects to smelt about 200 metric tons of ore per day in this new furnace.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Calumet & Arizona—The production in February was 2,393,000 lb., compared to 2,380,000 lb. in January.

Superior & Pittsburg—Production in February was 1,900,000 lb., compared to 2,000,000 lb. in January.

GILA COUNTY

Gibson—This mine at Globe is reported to have been sold to a Boston syndicate.

California

BUTTE COUNTY

Mammoth Channel Gold Mining Company—This company near Magalia has installed a new hoist and is enlarging its shaft to two compartments.

Oro Light and Water Company—The temporary dam built to fill in the break in the Miocene ditch dam, has proved too weak to hold the water and went out the day of completion. A second barrier is to be built. The dam is the intake of the power plants for mines below Magalia.

San Francisco—This mine, near Wyandotte, will shortly be provided with a 10-stamp mill.

EL DORADO COUNTY

Bean Hill—A quantity of mining machinery is being hauled to this mine near Grizzly Flats. Mr. Caldwell is superintendent.

Big Cañon—The unwatering of the mine is nearly completed.

Prevolcanic—The 700-ft. tunnel is being driven to the gravel channel but work has been interfered with by the rains and seepage water. The development of other gravel claims in the vicinity will depend upon the results obtained in this mine.

KERN COUNTY

Ferris—J. B. Ferris has lately discovered, near Caliente cañon, a deposit containing both tungsten and yellow ocher. Arrangements are being made to work the deposits.

Golden Group—J. B. Ferris, owner, has found tungsten ore of high grade in what he supposed to be worthless material.

MARIPOSA COUNTY

Mount Gaines Consolidated—The 20-stamp mill is in operation. A. R. Maines, of Los Angeles, has become general manager, and W. R. Wardner, of the same place superintendent.

1909 Mining Company—This company, operating the Enterprise mine, near Hornitos is installing a new air compressor. Good ore is being taken from the mine. Fred H. McCall is superintendent.

MONO COUNTY

Masonic District—The snow is impeding operations in this section but some men are working in the Pittsburg-Liberty and work will soon commence on the Tipton.

Standard Consolidated—The working force at this mine, Bodie, is being increased by superintendent W. H. Landers. Mr. Albert Fries has been elected president of the company.

MONTEREY COUNTY

Shamrock—This company is at work developing molybdenite claims in Stonewall cañon, between Soledad and the Pinnacles. It has also located other claims in Bryan cañon.

NEVADA COUNTY

Central Consolidated—At this mine, eight miles from Grass Valley, operations have been resumed and the 20-stamp mill started. The plant has received an entire overhauling.

Lecompton—The work of unwatering this mine at Nevada City has been commenced under Superintendent Colt. The mine is owned by A. M. Gilbert, of Santa Barbara. It will take four weeks to drain the mine.

Oustomah—E. H. Wilson, of Nevada City, who is operating several mines in Sierra county, has secured a bond on this property. The mine is already well equipped but some few changes will be made and deep sinking carried on while drifting is being done. Frank M. Evans will be manager of the property.

Ben Franklin—White Brothers, owners, near Grass Valley, continue to take out good ore.

Champion—Tributers are working in virgin ground in some of this company's mines at Nevada City and are taking out good paying ore.

Union Hill—In the Greek ledge, near Grass Valley "jewelry" rock is being mined at present. The ore is being blasted out on the lower levels.

PLACER COUNTY

Rawhide—This quartz property, six miles from Towle, has been sold through F. L. Bryson to Eastern men. New stamps will be added to the mill and other improvements made. A wagon road will be built, and packing over trails given up.

PLUMAS COUNTY

Nevada Consolidated—J. D. Murray and H. H. Hunter, of Reno, Nev., have arranged for shipment of a 30-stamp mill to this mine in Butte Valley, where they have a large body of low-grade ore.

Shoofly Copper Mine—A long development tunnel is being run on this copper property at Indian Falls under superintendence of G. H. Goodhue. The lode is wide. This property is owned by Seattle and Tacoma people.

SHASTA COUNTY

Western Exploitation Company—A new hoist is being installed at the Milkmaid mine, French Gulch and the shaft will be sunk deeper.

SISKIYOU COUNTY

It is expected that the dredge at Garvey Bar will be remodeled and set at work again. This is 12 miles below Hornbrook. At the Northern California Mining Company's property, Croy's Bar, a dredge will soon be used, the ground having prospected favorably. At Hamburg Bar, on the Klamath, a dredge is being built and will start up in about two months.

Enterprise—In the Lone Jack tunnel a lode of high-grade ore has been struck.

Lewis & Boyer—At this group five miles from Fort Jones, owned by citizens of Colusa, a stamp mill is to be erected.

TRINITY COUNTY

Golden Jubilee—This property at Carrville, owned by Napa county men, was recently closed by attachment. Enough money has now been raised to lift all the attachments and work will be resumed when the snow is all gone.

TUOLUMNE COUNTY

United Gold Mining and Milling Company—A payment has been made on the Tarantula mine near Jacksonville. T. J. Russell is manager. More machinery is to be installed.

United Mines Corporation—The properties in the East belt are still idle, no adjustment having been made between the company and the miners as to their differences.

Colorado

Lake County—Leadville

Anona—This company is sinking a shaft on the Gypsy Carbonate claim; another 18 ft. should reach the top of the limestone.

Yak—Resurrection No. 1 has been unwatered and the breast of the tunnel is now in the Fortune territory. It is understood that the management of the tunnel intends to lease the property.

New Monarch—As soon as the sinking of the Cleveland shaft is completed it is the intention of the company to sink the New Monarch shaft several hundred feet deeper.

Granite Tunnel—This bore is now in 467 ft., and a few days ago two veins of ore were encountered. In addition to this there is a body of ore 11 ft. wide on which they have been working for a week. When snow disappears it is the intention of the company to put in machinery.

Fanny Rawlings—For the last week work on this Breece Hill property has been been carried on at the lower levels in a body of ore that was recently opened.

Penn—This property is shipping daily 200 tons of an excellent grade of iron ore; 100 tons being sent to the Arkansas valley plant and the other 100 goes to the Salida smelter. The mine is worked by leasers.

Ouray County

Camp Bird—Under date of March 9, 1909, the directors submit the following report on the working operations of the company for the quarter ending Jan. 31, 1909: Dry ore crushed, 20,301 tons; receipts from bullion sold (including cyanide products), $435,303; concentrates sold, $72,229. Working expenses (including development, transportation, and treatment of product), $152,467; surplus, $355,065. On Jan. 7, dividend No. 28, of 1s. per share (£41,000) was declared, payable Feb. 6, 1909.

Mine: Number of feet driven, 1105; number of feet in raises and winzes, 223; cubic feet stoped, 124,000.

Production: Of the ore treated during the quarter, about 70 per cent. was withdrawn from the reserves in stopes. The total dry ore broken and in the stopes on Jan. 31, 1909, amounted to 70,653 tons. Everything at the mine and mills has progressed satisfactorily, and a high state of efficiency has been maintained throughout.

Teller County

Gold King—Except during labor troubles, this mine is idle the first time in 17 years. It is understood that it will soon be started up under lease. This was the first discovery of ore in the district. It is controlled by Messrs. Lenox and Giddings, of Colorado Springs.

El Paso—The annual meeting of the stockholders was held in Colorado Springs and the old directors reëlected. President Burris' report shows that during last year about $423,000 dollars worth of ore was shipped by lessees. Announcement has been made that the leases will not be extended beyond May 1. J. W. Nichols, of Cripple Creek has been appointed superintendent of the property.

Prince Albert—The Union Leasing Company, of Cripple Creek, has leased this mine and a contract has been let to Walter Erickson for driving the tunnel 500 feet. The property is situated on the south side of Beacon hill not far from the El Paso. The lessees are also working several other leases. C. G. Jackson, of Cripple Creek, is in charge of the leasing company.

Trilby—It is understood that the mill on this property is to be remodeled. The mill was built a number of months ago and was designed to treat low-grade ores. The property is situated on Bull hill and is controlled by Pittsburg capitalists. A number of leasers are at work on the property, as well as the company. James T. Stewart, of Cripple Creek, is in charge.

Idaho

Kootenay County

Mineral Point—This mine has been added to the list of Cœur d'Alenes shippers. A car of ore sent to the Federal Mining and Smelting Company's sampling works and from there to the smelter netted $1340.

Idaho Smelting and Refining Company—John Mocine, secretary, has been appointed receiver.

Owyhee County

King-Philip—A good lode of silver ore is reported in this mine in Diamond basin.

Shoshone County

Amador Gold and Copper—A temporary injunction has benn granted restraining the sale of stock in payment of a 2c. assessment last October. It is claimed that funds have been squandered.

Southern Hercules—E. J. Hunter reports that orders have been placed for equipment to develop 12 silver-lead claims in the Cœur d'Alenes. The main shaft is down to the 200-ft. level, from the bottom of which a drift has been run 60 ft., opening a vein of carbonate ore. A 600-ft. tunnel is to be driven to a point directly under the shaft which will give a depth of 300 feet.

Indiana

Clay County

The miners of the Brazil Block district have secured the discharge of Silas Risher, mine-boss of the Rosebud mine, operated by the Vandalia Coal Company, for selling rooms to miners. Four men made affidavit to having purchased rooms from Risher at prices ranging from $10 to $20 per room.

Pike County

Notices have been posted at No. 4 mine at Avreshire that the mine will close down indefinitely on March 25. The closing is caused by overproduction. More than 250 men will be thrown out of work.

Vermilion County

Clinton Coal Company—This company, operating Crown Hill mines Nos. 1, 2 and 3, west of Clinton, claims to have made a record for steady operation. Mine No. 1 has missed only one day since Feb. 1, and the other two have missed only two days each. The three mines employ 800 men, and the pay-roll averages $25,000 every two weeks, and have averaged five days each per week since last November. Since the Deering company recently went into the hands of a receiver the Clinton company has been receiving orders for about 2000 tons of coal daily, to go to the United States Steel Corporation at Gary, which had been supplied by the Deering company. The Clinton Coal Company bought 80 acres of coal land from J. H. Bogart, of Clinton, for $8000 recently. This with 1600 acres recently optioned by the same company, adjoins its present tract.

Warrick County

The coal mines are now running from four to five days a week. Domestic trade has been light, owing to the mild winter, but the operators think that when the steam trade opens in April there will be a better demand for southern Indiana coal.

Michigan

Copper

Winona—Excavation has been begun on the site of the new stamp mill, on the banks of the Sleeping river. The mill will handle the rock from both this company and the King Phillips property.

Ojibway—Sinking close to the 800-ft. level is in progress at No. 2 shaft and as soon as sufficient depth is obtained a crosscut will be started to cut the formation. The crosscut from the level above is passing through a broken trap, indicative of the close proximity to the lode. Sinking is under way at No. 1 shaft toward the same level.

Victoria—Some very encouraging ground in the upper levels has recently been opened. A satisfactory state of mineralization continues in the drift from the 22d level.

Lake—The north drift from the 2d level has again entered the copper bearing formation. This drift passed out of the lode about 40 ft. from the shaft and after continuing it in the same direction for considerable distance again entered it. At the 3d level a crosscut is being driven

westward to cut the formation. This crosscut is now in about 60 feet.

Isle Royal—The new Southern shaft of this company and shafts Nos. 4, 5 and 6 are revealing a satisfactory state of mineralization and with the new hoisting plants in commission at No. 4 and 6 a decided increase in production will be made. President Agassiz of the Calumet & Hecla is asking shareholders for proxies to be voted at the annual meeting, April 7, for the election of a new board of directors, the majority to be chosen from the present directors of the Calumet & Hecla company.

Island—At a meeting recently held at Duluth the following officers and directors were elected: president, Thos. F. Cole; vice-president, Geo. C. Stone; secretary, Fred W. Nichols. Directors, Thos. F. Cole, Geo. C. Stone, F. W. Nichols, G. A. Tomlinson, Henry Nolte, G. G. Barnum, W. Ames, F. W. Heimick and O. J. Larson.

Oneco—Operations will in all probability be resumed during the coming summer. The gratifying results being obtained at the North Baltic Exploration company's land, hold out great encouragement. There is a shaft down 500 ft., but no work of any consequence has been done on the property for several years. The company has $30,000 in the treasury and 30,000 shares of unissued stock.

Montana

Butte District

Butte Reduction—An experimental concentrator is in course of construction. It is understood that the ore from the Elm Orlu claim owned and operated by W. A. Clark will be treated here as soon as the concentrator is completed.

Butte Superior—The 1400 level is being prospected with the hope of striking the shoot of copper ore recently opened up on the 1000 level of the Elm Orlu, which adjoins the Butte Superior on the west.

Davis-Doly—A crosscut is being driven on the 1400 level of the Colorado to intersect a body of ore which was lately discovered in diamond drilling.

Copper Eagle—Development work is being pushed on the 350 level. A 50-ton shipment of ore was recently made.

Butte Central Copper Company—This is a new organization with a capital of $2,500,000 divided into 250,000 shares par value $10 per share. The company succeeds as the bankrupt Butte Central and Boston Copper Corporation, and owns the Ophir mine in the south portion of the camp. The officers of the new company are: William H. North, president; R. W. Tufts, treasurer and William O. Burns, secretary.

British-Butte—Col. M. H. de Hora leaves for London, March 23, to make report to the stockholders of the company. The dredge which was completed Feb. 1 has been in continuous operation since that date.

Silver Bow County

Raven—It is reported that this company is to be reorganized.

Nevada

Esmeralda County—Goldfield

Consolidated Rep Top Lease—A new vein has been opened on the 300-ft. level, about 100 ft. west of the vein from which the ore is at present being extracted.

Gold Bar Extension—Work has been resumed by lessees. A hoist has been installed and a crosscut will be run at once for the Gold Bar vein, which is thought to pass within 100 ft. of the shaft.

Great Bend—A winze is being sunk in the ore recently opened on the Diadem Lease. The orebody showing in the winze averages 18 in. of shipping grade. The shaft will be sunk an additional 100 ft. and a crosscut driven to the vein at that depth.

St. Ives—A. A. Codd, president, has developed a plan of reorganization, the new company to be known as the Codd Mines Company. A group of six claims in the Walker river mining district, upon which promising surface showings are found, has been acquired, and it is here that the most extensive development work will be carried on. The new company will be capitalized for 3,000,000 shares, par value $1 each; stockholders in the leasing company will receive share for share in the new organization, though an assessment of 1c. per share will be made for the purpose of paying old debts and providing a fund for the erection of a small mill to be constructed on the Walker river property.

Goldfield Consolidated—In February the new mill treated 12,858 tons of ore, yielding an average of $40.75 per ton. The Combination mill treated 2291 tons. The total for both mills was 15,149 tons, yielding $618,315.

Esmeralda County—Mina

Blue Light Copper—A 100-h.p. gasolene hoist has been purchased for this property and is now en route from San Francisco. The shaft, now 720 ft. deep, will be sunk to water-level, which is estimated at 1000 feet.

Esmeralda County—Hawthorne

Hawthorne Lucky Boy—The lease being worked by Hubbard and associates, of Chicago, has produced upward of $200,000, and is said still to have ore blocked out above the 300-ft. level. Shipments amount to about 50 tons per day. The lease expires Aug. 1, but the shaft is now being sunk to the 500-ft. level with the expectation of extracting an extra-heavy tonnage before the expiration of the lease. The district, situated about six miles south of Hawthorne on the old Bodie road, covers an area about six by eight miles in extent, and is well mineralized, with silver and lead together with some copper.

Esmeralda County—Gold Mountain District

Mammoth Mining and Developing Company—This company, with headquarters at Goldfield, recently acquired the old French claims near Old Camp. The property is developed by a shaft 200 ft. deep and several adits. Contracts are to be let for the construction of a mill and a pipe line about three miles in length.

Esmeralda County—Silver Peak

Pittsburg Silver Peak—The following extract from the annual report shows the net earnings of the company for 1908. The stamp mill was completed in April, but was only in partial operation the first three months of the year, hence the itemized details; January to March, 1908, tons milled, 18,096; bullion receipts, $116,233; net earnings, $41,441. April to December, 1908, inclusive, tons milled, 87,574; bullion receipts, $848,713; operating expenses, $499,789, and net earnings, $348,923. The railroad extending from Coaldale to Blair, operated and owned by the company, has been equipped with a gasolene combination car to take the place of the locomotive and is now in successful operation at reduced expense.

Esmeralda County—Rawhide

Marigold Lease—Ore is being extracted from the north drift of the 130-ft. level. The last shipment to the Hazen sampler netted $198.30 per ton. More care is being taken in the sorting of the present shipment.

Mint Lease—The orebody recently encountered on the 300-ft. level shows no signs of decreasing value although drifted on 80 ft. to the north and 70 ft. south. The vein varies from 4 to 6 ft. in width.

Nye County—Round Mountain

Round Mountain Mining Company—Material for the addition to the mill is now being hauled from Tonopah to Round Mountain.

Nye County—Ione

Grand View—J. O. Kinney, president, is now in the east negotiating the purchase of a hoist and a five-stamp mill. The company owns four claims, though development work has been confined chiefly to the Grand View lode.

White Pine County

Nevada Consolidated—In the first half of March this company mined upward of 2000 tons of ore per day. Production in January was 1,451,000 lb.; February, 1,086,000.

Cumberland-Ely—January production, 1,004,218 lb.; February, 1,233,402.

New Mexico

Sierra County

County Seat—The legislature passed a bill making Cutler the county seat instead of Hillsboro. The bill also provides that that portion of Socorro county extending south along the eastern boundary of Sierra and west of Lincoln and Otero counties shall be taken into Sierra county.

Socorro County

Kelly Mine—Monthly shipments aggregate 15 to 20 cars zinc carbonate.

Graphic Group—The Sherwin-Williams Company is shipping 10 to 15 cars of ore per month. Jos. Brown, of Kelly, New Mexico, is in charge of the mine.

Mistletoe and Magdalena Tunnel—Machinery is arriving for a 50-ton dry concentrator. The ore will be sized by impact screens and concentrated on pneumatic tables. W. F. Gordon is superintendent.

Mill Cañon Copper—George Keith is manager. The company recently purchased the Wheel of Fortune group, 12 miles south of Kelly.

Old Soldier—Mike Wolf, manager and principal owner, recently shipped two cars of lead-silver-copper ore, which gave good returns.

South Dakota

For some time past there has been under consideration the building of a modern smelter in the Black hills. The first definite step in that direction was the leasing of the Hester A and Rainbow claims in Galena on March 16. The ore is refractory silicious material carrying pyrite, and is suitable for matte smelting. The lease runs for two years, with the provision that the building of the smelter shall begin within four months and that it shall be in operation within eight months from date. Negotiations have been entered upon for the Richmond ground, under lease till the latter part of this year to the Branch Mint Operating Company.

Custer County

An effort is being made to resume the mining of lithographic stone near Custer, where the Black Hills Porcelain, Clay and Marble Company holds several claims as yet unpatented.

Lawrence County

Ruby Mining Company—This company, capitalized at $1,000,000, has recently been formed to work a group of claims in the Tinton district. An 80-h.p. boiler and engine are being installed for development purposes.

Gold Eagle—Superintendent Keller is sinking a shaft to go 200 ft., near Maitland.

Golden Girl—Work has been commenced by A. M. Masters, of Jacksonville, Ill., on a wide ledge of ore.

Johnston—Sinking on Iron creek will soon be commenced by Thomas Johnston, the owner. The 40-ft. shaft will be sunk to a depth of 100 ft. New machinery is now being installed on the property.

Tinton—Superintendent Carnahan has succeeded Superintendent Noakes, of Chicago, and the mill will now undergo still further changes before operations begin this spring.

Pennington County

Balkan—This company, which has been operating a five-stamp mill in the Rochford district, is adding five more stamps to its equipment.

Utah

Juab County

Plutus—Ore of fair grade has been encountered in drifting to the north at a depth of 200 ft.

Zuma—Work will be resumed on the lower levels during the coming month.

Swansea Extension—The shaft is 140 ft. below the tunnel level. Drifting to the north and south is in progress and the shaft will be sunk an additional 100 feet.

Bullock—A crosscut is being driven west from the 210-ft. level.

Tintic Central—The shaft has a depth of 220 ft. and is in limestone. A hoisting plant has been ordered and power will be obtained from the Telluride Power Company. The property adjoins the Iron Blossom.

Mammoth—A shipment of 30 tons of high-grade ore was recently made, being consigned to Irvington, N. J.

East Tintic Consolidated—A depth of 75 ft. has now been reached by shaft.

Tintic Central—The shaft is down 235 ft. and a drift to the east will be started toward the south extension of the Iron Blossom vein.

Victor—Work is in progress on a body of copper ore on the 800-ft. level.

Murray Hill—Col. T. P. Murray, of Los Angeles, has taken an option on the East Humbug, Comstock, Knight, and Jack Fraction north of the Yankee Consolidated. The company will be called the Murray Hill Mining Company.

Tintic Empire—A contract has been let for sinking 100 ft. of double compartment shaft.

Wicklow—A tunnel is now in 427 ft and a contract will be let for additional work at once.

May Day—The shaft is now down 945 ft., and is to be continued until a depth of 1000 ft. is reached.

Iron Blossom—Jesse Knight states that dividends are to be commenced in April and claims to now have a larger body of high-grade ore than was ever exposed at one time in the Colorado. Twelve cars recently marketed assayed 40 per cent. lead, 113 oz. silver and $13 gold. The property is shipping 100 tons per day to the Tintic smelter.

Salt Lake County

Peruvian—Ore has been struck on the main level. While no assays have been made it is of a shipping grade and carries copper, lead and silver.

Cardiff—On the drain tunnel level, 18 in. of shipping ore carrying good values in copper, lead and silver has been found, besides 8 ft. of low-grade rock.

Columbus Consolidated—On the 400-ft. level, west of the shaft, the management has explored an orebody for a length of 150 ft. with a width in places of 15 to 20 ft. The rock runs well in silver and copper. One carload per day is being marketed.

Boston Consolidated—February production, 2930 tons sulphide; 129,000 lb. copper delivered; 35,000 tons wet-milled, 32,000 tons dry; 1575 tons dry concentrates, yielding 711,000 lb. copper.

Washington

Ferry County—Republic

New Republic—This mine is reported to be employing 50 men and shipping ore regularly to the Granby and Tacoma smelters. A car of new mine equipment, including a hoist, air compressor, machine drills and drill sharpener was unloaded last week.

San Poil-Republic—This newly organized smelting company proposes to begin constructing a smelter near Republic. The officers are R. J. Howard, Spokane, president; W. B. Parker, Spokane, vice-president; R. J. Leonard, Republic, secretary. The company is being financed by Spokane and Seattle capitalists.

Ferry County—Keller

Byrne—Development work has opened up a new silver-bearing vein. Dr. P. S. Byrne and J. R. Cassin, of Spokane, and R. L. Boyle, president of the Keller & Indiana Consolidated Smelting Company, are the principal owners.

Canada

British Columbia—Kamloops

Iron Mask—This mine, owned in England, has been bonded by United States operators, who have about 20 men employed in its further development. Other

mineral claims in the camp are under option to American capitalists, who are arranging to have them well prospected.

BRITISH COLUMBIA—AINSWORTH DIVISION

Wagner Group—D. C. Corbin, of Spokane, has, it is announced, bonded the Wagner group of mineral claims situated in the northern part of Ainsworth mining division, on the Duncan river slope of the Selkirk range. This has long been known as the most prominent mining property in that part of the country, but owing to its distance from transportation facilities it has not been extensively developed. It was described by W. A. Carlisle (then provincial mineralogist) in his annual report for 1897 as being "the highest mine in the province, elevation 8200 ft." It is in the "great lime dike" of the Selkirks. R. W. Brock, in the summary report of the Geological Survey of Canada for 1904, stated that the ore is cubical galena with some pyrite and gray copper. Two veins of ore have been opened on the property.

BRITISH COLUMBIA—CROW'S NEST PASS

D. C. Corbin, of Spokane, Wash., who last year constructed 14 miles of railway, from McGillivray, on the Canadian Pacific Crow's Nest branch to the Corbin Coal and Coke Company's coal mine, has obtained the necessary authority from the provincial legislature of British Columbia for the extension of his company's railway 40 miles south to the International boundary.

Queen Victoria—This mine, on which an option was held and recently relinquished by New York men, has been bonded by the Consolidated Mining and Smelting Company of Canada, Ltd., which owns other mines in Kootenay and the smelting works at Trail. The mine is situated about eight miles from Nelson and 37 miles from the Trail smelter, with which there is railway connection. There is a large body of low-grade copper ore in the mine.

BRITISH COLUMBIA—EAST KOOTENAY

R. L. Broadbent, of the Geological Survey of Canada, who was in charge of the Canadian mineral exhibits at the World's Fair, St. Louis, in 1894; at Liege, Belgium, in 1905; at Milan, Italy, in 1906, and at Christchurch, New Zealand, in 1907, has obtained, for inclusion in the British Columbia display at the Alaska-Yukon-Pacific Exposition, representative samples of coal from the Crow's Nest Pass coal mines, and specimens of lead and silver-lead ores from the North Star, Sullivan, and St. Eugene mines, all in Fort Steele mining division, East Kootenay. Samples of various grades of lead-silver concentrates have been obtained from the St. Eugene mill as well. Mr. Broadbent is continuing his work in West Kootenay.

BRITISH COLUMBIA—SLOCAN

Emily Edith—Another shoot of high-grade silver-lead ore has been found in this mine, which is being worked in conjunction with the adjoining Standard mine, under the direction of one of the owners of the latter, George H. Aylard, of New Denver, B. C. The Emily Edith has been opened by six adits and about 9000 ft. of underground development done. The Standard last year shipped 1250 tons of first-class ore, containing approximately 106,000 oz. silver and 1,600,000 lb. lead. A similar quantity of milling ore was placed on the dump to await provision of plant for concentrating.

BRITISH COLUMBIA—VICTORIA

Mr. Orr, manager of the exhibition association of Toronto, Ontario, has interviewed the provincial government with the object of inducing it to make suitable display; thoroughly representative of the mining industry of British Columbia, at the Toronto fair, which is regarded as Canada's national annual exhibition.

The Consolidated Mining and Smelting Company of Canada, Ltd., made a shipment of pig lead from its lead refinery at Trail to Australia by the steamer sailing from Victoria on Feb. 26.

The output of coal from the Coast district of British Columbia in 1908 was 1,229,328 tons.

SASKATCHEWAN

The "Annual Report of the Department of Public Works of the Province of Saskatchewan for the Financial Year 1907-08" has recently been made public. It includes the following statistics, relating to the coal-mining industry of the province: During the financial year ended Feb. 29, 1908., there were 19 coal mines in operation, which produced in the 12 months 189,428 tons. There were 232 persons employed inside the mines and 81 outside. Only one nonfatal and two fatal accidents were reported. There were seven new mines opened in the course of the year, and one mine was abandoned. In Saskatchewan, coal mining is only in its beginning; gradual development to operations on a larger scale is in progress.

ONTARIO—COBALT DISTRICT

Temiskaming—The financial statement shows that on Jan. 31 the company had cash on hand and ore in transit valued at $122,761. The output during the fiscal year was 831 tons of ore, which produced 1,026,285 oz. silver of the net value of $494,211. The cost of production was 8.4c. per oz. There were 16,000 tons on the dump of an estimated value of $250,000 to be concentrated.

ONTARIO—PORT ARTHUR DISTRICT

Hanson Consolidated—Active operations have been resumed and prospects are improved by increased railway facilities. Herbert Shear is in charge of the property and reports three carloads of silver ore ready for shipment to the smelters.

Mexico

CHIHUAHUA

Parral Output—Production for the week ending March 12 was 10,010 tons, of which 6550 tons were locally treated. Revised figures show the February output to have been approximately 38,500 tons.

Calamine Mining Company—This company was lately organized on the basis of the Seawell-Robbinson-Terrazas holdings in Los Lamentos district, reached from Ahumada on the Mexican Central railway line. G. V. B. Levings, of Parral, is president, and George B. Squire, secretary and manager. Zinc ore is being marketed in Kansas, and lead ore is shipped to the Monterrey smelter.

San Toy—The report for the year 1908 contains the following items: Sales of ore, $547,209; net returns from ore, $312,961; mining costs, $245,921; net mining profit, $67,040; surplus for year, $52,850; previous surplus, $217,412; profit and loss deficit on Dec. 31, 1908, $164,592.

Capitaneua—P. H. Cooper is manager of this and the San Diego mines at Santa Barbara, Gustave Reich having resigned.

Potosi—This Santa Eulalia company is said to be planning the erection of a dry-concentration plant for treating a large tonnage of low-grade zinc ore.

Batopilas—The February output was 300 bars of silver bullion, bringing the total of the first two months of the year to more than 500,000 pesos. The March production will probably be in excess of the previous month.

Hearst Oil Syndicate—Drilling operations have been resumed in the eastern part of the State. A third well has been started near La Mula. J. G. Fallonsbee has general charge of the company's local affairs and L. A. Smith is in direct charge of the drilling work.

Moctezuma—Promising copper properties are under exploitation in this unexplored section in the northern part of the state. The main operations are by the Chihuahua Copper Company, of which James Parker, of El Paso, is manager. Shipments of ore running 9 per cent. copper in car lots have been sent out during the past few months. The region is easy of access by wagon roads from Moctezuma station on the Mexican Central Railway.

SONORA

Greene Gold-Silver—The Humboldt Exploration Company, encouraged by the liberal response of the Greene Gold-Silver Company's stockholders to its proposal, will extend time for the exchange of stock to April 1 next.

Cieneguita Copper—A railroad company has been incorporated to construct a narrow-gage railroad from Tonichi in the Yaqui valley to the company's mines, 40 miles distant in the Sahuaripa district.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 24—The coal trade in the West has shown a little improvement, some spring demand for steam coal being noted; and many industries are apparently needing more fuel than they have for some time. Production is still restricted at many mines and supplies are being fairly well regulated to demand.

In the East the bituminous trade is improving a little, but can still be called quiet. Dealers, however, are hopeful of an early revival, if not of a rapid one.

The anthracite question is still unsolved. There are all sorts of reports about the disposition of the miners to accept the terms which the operators have offered. Nothing definite can be said until after the meeting of the miners' convention. That convention assembled last evening in Scranton, Penn., but it may be two or three days before any final action is taken. The general belief in the anthracite region is that the union men will vote for a strike, but that the majority of the non-union miners would prefer to have no change. The latest statement is that all other demands will be abandoned, provided there is full recognition of the union—that is, a surrender of the open shop.

Proposed Coke Consolidation—A plan has been proposed for the consolidation of a number of independent coke plants in the Connellsville region in Pennsylvania. It is proposed to unite in one company all the plants not controlled by the H. C. Frick Coke Company. Options are said to have been obtained on a number of properties. J. V. Boileau, of Pittsburg, represents the promoters of the scheme.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 13, short tons:

	1908.	1909.	Changes.
Anthracite	1,052,936	952,392	D. 100,544
Bituminous	6,561,256	6,850,177	I. 288,921
Coke	1,448,929	1,994,548	I. 545,619
Total	9,063,121	9,797,117	I. 733,996

Shipments of coal by water from Seattle and Tacoma, Wash., in January were 58,356 tons in 1908 and 26,829 tons in 1909; a decrease of 31,527 tons.

Coal passing through lock No. 3 on the Monongahela river in January was 778,400 tons in 1908, and 763,120 in 1909; a decrease of 15,280 tons.

Coal receipts at St. Louis in January were 666,810 tons in 1908, and 621,647 in 1909; a decrease of 45,163 tons.

Chief Mine Inspector Flynn reports coal production in Alabama in 1908 as follows: Jefferson county, 5,254,817 short tons; Walker, 2,522,862; Bibb, 1,180,228; Tuscaloosa, 714,015; Shelby, 369,344; other counties, 433,325; estimate on small mines not yet reported, 500,000; total, 10,974,591 tons. This is a decrease, as compared with 1907, of 3,443,272 tons, or 23.9 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, month of January, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	1,666,537	353,592	2,020,129
Buff., Roch. & Pitts.	460,988	35,733	496,721
Buff. & Susqueh'na	125,676	22,200	147,876
Penn. lines, N. Y. C.	703,004	8,308	711,312
Pitts. & L. Erie	562,526	344,666	907,192
Norfolk & Western	946,625	225,296	1,171,921
Total	4,465,356	989,795	5,455,151
Total, 1908	4,062,616	558,429	4,620,944

Total increase this year 834,207 tons, or 18.1 per cent. In addition to the above, the Baltimore & Ohio carried 78,452 tons of anthracite in 1908 and 90,099 in 1909; increase, 11,647 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, month of January, short tons:

	1908.	1909.	Changes.
Hocking Valley	185,576	244,945	I. 59,369
Toledo & Ohio Cent.	81,131	96,765	I. 15,634
Baltimore & Ohio	139,103	100,426	D. 38,677
Wheeling & L. Erie	181,511	212,991	I. 31,380
Cleve., Lorain & Wh.	170,549	155,138	D. 15,411
Zanesville & Western	89,267	105,261	I. 15,994
Toledo Div., Pen. Co.	133,613	162,820	I. 29,207
L. Erie, Alliance & Wh.	87,267	96,351	I. 9,084
Marietta, Col. & Clev.	6,237	3,002	D. 3,235
Total	1,074,354	1,177,699	D. 103,345

The total increase this year was 9.6 per cent.

Coal shipments coastwise from the leading Atlantic ports in January are reported as below, in long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York	1,247,202	849,900	2,097,102	62.5
Philadelphia	175,414	368,765	544,179	16.2
Baltimore	155,681	115,565	271,246	8.1
Newp't News	.....	207,693	207,693	6.2
Norfolk	.....	236,004	236,004	7.0
Total	1,578,297	1,777,927	3,356,224	100.0
Total, 1908.	1,550,128	1,928,460	3,478,588	.....

Total decrease this year was 122,364 tons, or 3.5 per cent. New York includes all the New York harbor shipping ports.

Coal receipts at Boston, two months ended Feb. 28, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	241,755	192,860	D. 48,895
Bituminous	493,503	449,332	D. 44,171
Total domestic	735,258	642,192	D. 93,066
Foreign	97,602	48,923	D. 48,679
Total	832,860	691,115	D. 141,745

The foreign coal comes chiefly from Nova Scotia. Total decrease this year, 17 per cent.

New York

Anthracite

March 24—The anthracite trade shows no material change. Domestic sizes continue quiet and strike possibilities have not had any effect, as consumers are confident of the ability of the producers to carry them over any period of suspension that is probable. Steam sizes are in demand for the same reason as noted last week. The April discount on prepared sizes is still in suspense.

The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Dealers and agents are getting from 10 to 20c. per ton advance on pea and No. 1 buckwheat.

Bituminous

The soft-coal market shows little or no change. Contract talk continues, but business is closed slowly. The far East is waking up a little and making some inquiries, while trade along the Sound is gradually improving. All-rail trade holds its own very well, but without much increase. Transportation and car supply are causing no complaints.

New York harbor is still rather irregular, but buying is not quite so unsteady as it has been. Prices continue $2.40@2.50 per ton, f.o.b. harbor ports, for good steam coal; with $2.20@2.30 for lower grades.

The Coastwise trade is still poor and some owners are talking of laying up their boats rather than to keep them at work at current rates. These rates are unchanged from last week.

Birmingham

March 22—The coal trade in Alabama is quiet. The production is to be farther reduced, if there is no improvement in the demand. There is a large quantity of coke stacked up for any emergency. Some of the larger consumers of coal are holding back and mines are only being operated to meet the demands. The railroads are feeling the falling off in business. There is a gloomy feeling in coal circles in this section.

Chicago

March 23—The coal trade continues firm, but unmarked by special features. Shipments are well held down to prospective needs and the demand has not fallen off for any kind. Steam coals continue about even; domestics are in light demand, the average consumer delaying purchases of anthracite to April and his consumption of bituminous being slack because of the weather.

The tendency is to adjustment of the market to spring conditions, lump falling off and slack coal advancing. In anthracite the small sizes are in much stronger demand. Contract making, in general, is slack, the disposition of consumers being to hold off, in hopes of favorable open-market conditions.

Illinois and Indiana bituminous bring $1.75@2.40 for lump and egg, $1,65@1.75 for run-of-mine and $1.25@1.55 for screenings.

Eastern coals are considerably stronger, demurrage coal being practically off the market. Smokeless lump and egg are not so strong as run-of-mine, which is in less supply and brings $3.05@3.15 for Pocahontas and New River. Hocking is firm at $3@3.15 and Youghiogheny also at $3.15 for ¾-in. gas. Pittsburg No. 8 is a trifle weak at $2.75@2.85 for ¾-in. lump.

Cleveland

March 23—Domestic trade is down and out for the present. Dealers are cleaning up their yards and preparing for next season. A few sales of Massillon lump at $3.25 constitute the record. Steam coals are looking up a little, especially slack, but prices are low. Lake trade has hardly started yet, and looks as if it would have a late beginning this year.

Indianapolis

March 23—At the annual meeting of the Indiana Coal Operators' Association held in Terre Haute March 20, the following officers were elected: President, J. S. Kolsem; vice-president, Hugh Shirkle; secretary, Philip Penna. The new directors elected are Homer Talley, M. M. Gould, John McFadden, Val. Martin and George Nester.

The principal topic considered at the meeting was the supposed intention upon the part of the Steel Corporation to gain control of the coalfields of Vermilion county, Ind., and Vermilion county, Ill., nearest the Gary plant. The plan is believed to be to profit by the impairment of the Deering company, which owns about 30 mines in that territory. It is the policy of the company to get hold of as much coal land as possible for the future. This mission, however, is regarded by Indiana operators with some concern. Some important deals are almost sure to be made in the securing of coal mines and coal lands in Indiana during the present year.

Pittsburg

March 23—The placing of several important contracts this week infused new life into the coal trade and the outlook is somewhat better than it has been for some time. The Crucible Steel Company of America yesterday closed with the Pittsburg Coal Company and the Monongahela River Coal and Coke Company for 500,000 tons of mine-run coal for deliveries running through the year. The Pittsburg & Westmoreland Coal Company closed contracts for 900,000 tons of coal for shipment to the northwestern markets and is among the first of the lake shippers to book orders. This company also took a contract for 100,000 tons of crushed coal for the Montreal Heat, Light and Power Company, Montreal, Canada. The coal is to be crushed at the mine in order to take advantage of the low duty of 15c. per ton.

Prices remain on the basis of $1.15 per ton for mine-run coal at the mine, and slack is quoted at 65@70c. Less than 50 per cent. of production is coming out, except at the river mines, which are running full. A number of tows of empty coal boats and barges arrived this week from lower ports and were sent up to the pools.

Connellsville Coke—Conditions in the coke trade do not show much improvement, but the outlook seems a trifle better. The Pickands-Magee Coke Company has received an order from the Hamilton Steel and Iron Company, Hamilton, Ont., to increase its regular shipments from 300 tons to 600 tons per day, and to add 10 cars daily until further notice. The same company began this week to ship an order of 4000 tons of smelter coke to Tampico, Mexico. The coke is being sent to Baltimore where it is being loaded. The current quotation for smelter coke is $1.40 per ton at ovens. Spot furnace coke continues to sell at around $1.50, and on contract at $1.60@1.75. Foundry coke is quoted at $1.90@2.15 for spot and on contract.

The *Courier* gives coke production in both regions at 252,617 tons. The shipments were 8972 cars, as follows: To Pittsburg district, 3106; to points west of Pittsburg, 5115; to points east of Connellsville, 751 cars.

Foreign Coal Trade

British Coal Production—A preliminary statement gives the production of coal in Great Britain in 1908 at 251,506,379 long tons; a decrease of 6,306,473 tons, or 2.4 per cent., from the previous year.

British Coal Exports—Exports of fuel from Great Britain, with fuel sent abroad for use of steamers in foreign trade, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Coal	9,360,445	8,688,934	D. 671,511
Coke	191,762	166,055	D. 25,707
Briquets	259,298	234,938	D. 24,360
Total	9,811,505	9,089,927	D. 721,578
Steamer coal	3,147,257	2,921,409	D. 225,848
Total	12,958,762	12,011,336	D. 947,426

This shows a total decrease of 7.3 per cent. in coal sold for use beyond the limits of the United Kingdom.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 13: Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.16; seconds, $1.92. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 24—There is some improvement in the iron and steel trades generally, with a rather better feeling and a more confident tone to the market. The proposed tariff reductions have had really very little effect, partly because they had been discounted, and partly because people generally understand that their effect will not be to bring about any considerable imports, though they may tend to limit increases in price in case of an improvement in business.

In pig iron, furnaces seem to be rather looking for business and, therefore, in accommodating mood about prices. Some orders are reported taken at rather low figures and southern makers have been shading freely, orders being reported placed on a basis of $11 for No. 2 foundry at Birmingham. Northern makers appear to be a little in doubt whether to meet these quotations, especially as no decision has been reached on the prices for Lake ore for the coming season.

In finished material orders are being placed rather freely for structural steel and a number of bridge and building contracts have been closed. It is reported that some orders have been taken as low as 1.10c. at mill for this material. The railroads are not coming forward with rail orders, although bridge contracts are coming in more freely. Two or three large contracts for trolley rails are under discussion.

The Cambria Steel Company has announced a cut of 10 per cent. in wages, and other companies are preparing to follow. The Steel Corporation, however, has made no announcement of its intentions in this respect so far.

Proposed Steel Combination—Reports have been in the air of the consolidation of a number of independent steel plants into one large company. These reports, however, have been denied by representa-

tives of the Jones & Laughlin, the Pennsylvania Steel, the Cambria Steel, the Republic Iron and Steel and other companies which have been mentioned in connection with these rumors.

Baltimore

March 23—Exports for the week included 807,283 lb. zinc dross and 2,273,700 lb. steel billets to Liverpool. Imports included 10,711 slabs of spelter and 842 tons manganese ore from Rotterdam; 3393 tons pyrites from Spain; 6400 tons iron ore from Cuba.

Birmingham

March 22—While there is some little selling of pig iron going on in the Birmingham district, it is admitted that but few, if any, of the companies are selling their make. The quotations are still weak, some of the companies selling the product under $12 per ton, No. 2 foundry, a report having it that $11.50 is not the lowest price, $11 being accepted. The make has been reduced a little lately, one or two furnaces having been blown out. The shipment of pig iron continues good, on business booked before the recent depression set in.

The Bessemer rolling mills of the Tennessee Coal, Iron and Railroad Company have resumed operation after a shutdown of a few weeks. Statements continue to be circulated that the steel plant of the Tennessee company at Ensley will be shut down for repairs and to wait an improvement in general conditions. There has been some selling of steel rails recently from this plant and shipments have been healthy. F. H. Crockard, vice-president of the company, who recently returned from a trip to New York when seen, declined to make any statement.

Chicago

March 23—Pig iron continues dull. Melters are still buying only for immediate needs; they will not contract generally for the future. In consequence, prices are weak, and $12 Birmingham ($16.35 Chicago) represents the basic price of Southern, while $11.50 is said to obtain on such few contracts as are possible. Northern No. 2 is at $16.50, with the demand steadier than for Southern.

Coke shows the pig-iron depression, the best Connellsville selling as low as $4.75. In iron and steel products there is yet no heavy buying generally, though a generally better market probably exists.

Cleveland

March 23—Movement of ore from the docks is increasing and March will record fair shipments to furnaces. More inquiries are coming in about prices for the coming season, but nothing definite has been done.

Pig iron is quiet, but some local orders have been placed at about $15.75, Cleveland, for No. 2 foundry.

In finished material a large shipbuilding order has been placed, which will require a good quantity of plates and shapes. Orders for building and bridge material are coming in quite freely.

Philadelphia

March 24—The pig-iron market is weak and dull, and little business has been done for several days. The outlook is discouraging and makers are not inclined to take a hopeful view of the possibilities for the coming 30 days. Local founders and other buyers are doing very little, but it is reported that outside consumers have taken considerable iron for early delivery. Competition of Southern makers is more keenly felt this week than for some time. Further shadings have been made in several well known brands of Southern iron, but up to this afternoon leading makers here have not followed suit. Basic iron is the only material that holds its own.

Steel Billets—Small lots for immediate use have been contracted for in this territory for early deliveries said to be at $1 per ton below prices named two weeks ago.

Bars—It is rumored that a further shading has been made by one or two mills on refined bar on a basis of 1.40 cents.

Sheets—Makers claim to be booking a fair amount of business.

Pipes and Tubes—Activity prevails in steel pipe and cast-iron pipe, the effect of which is reflected upon this market.

Plates—The rumor of curtailment has no relation to the plate mills. Two or three large orders have come to Pennsylvania mills. The outlook for the steel-plate makers is bright.

Structural Material—It is understood that structural material has been shaded once more, though the fact is not admitted by the manufacturers who claim that the base price of 1.25 to 1.30 will not be departed from.

Scrap—The scrap dealers are obliged to hold everything they have and they are slow to purchase or contract for new supplies except on very favorable terms. Railroads are refusing to sell scrap at present prices. Heavy cast scrap has been called for in small lots, and two or three lots of old car wheels have been sold. The yards are pretty full of material and will be fuller yet.

Pittsburg

March 23—Outside of sheets and tinplate little new business of consequence developed during the week. The American Sheet and Tin Plate Company has started the Greer works, at New Castle, Penn., 20 mills, La Belle works, Wheeling, W. Va., 10 mills, and the Pittsburg works, New Kensington, Penn., 8 mills, increasing the number of active mills to 202, and leaving but one of its plants, the United States at Demmler, Penn., 11 mills, idle; this plant likely will be going next week. The company also has four plants with a total of 29 mills that have not been operated for over two years and will be put on the active list only in the event of extremely prosperous conditions. The company has increased its sheet capacity to 105 mills and now has but 71 idle mills, some of which may be started during the coming week. The independent tinplate mills are operating about the same as before the stiff cut was made in prices and it is reported that most of them are getting satisfactory concessions from steel mills on tinplate bars.

The National Tube Company is operating its plants at around 60 per cent. but in the Pittsburg district the operations are close to 90 per cent. A number of large orders are pending. The Oklahoma Natural Gas Company is figuring on placing an order for 300 miles of 16-in. line pipe, the Pure Oil Company, of Illinois, for 400 miles of 8-in. pipe and the Kansas Natural Gas Company 60 miles of 16-in. pipe.

Officials of the American Steel and Wire Company and the Pittsburg Steel Company, the largest independent wire producer, declare that prices remain the same and no change is contemplated at present. They admit that orders are not coming in as freely as expected. It is rumored, however, that a general readjustment in prices must be made before the jobbers can be induced to buy.

The Carnegie Steel Company is operating its three rail mills to only 25 per cent. of capacity. The mills are busy on structural shapes, a number of important specifications having been received. In structural material it is reported that contracts have been taken as low as 1.10c. at mill.

Pig Iron—The market continues dull and low prices are still being quoted. Pig-iron quotations this week are purely nominal as follows: Standard bessemer, $14.75 @15; malleable bessemer, $14.50@14.75; basic and No. 2 foundry, $14.50, and gray forge, $13.50, all at Valley furnaces.

Steel—Considerable shading of billets is reported but the large producers are holding to $23, Pittsburg. Sheet and tinplate bars are quoted at $25.50 delivered at Youngstown, New Castle, Bellaire, Wheeling, McKeesport and adjacent points, but are said to have been sold within the past few days at a lower price. Merchant-steel bars are still quoted at 1.20c. and plates at 1.40 cents.

Sheets—The market shows considerable improvement since the cut in prices. Prices remain at 2.30c. for black and 3.30c. for galvanized sheets, No. 28 gage.

Ferro-Manganese—Prices remain at $41 @41.50, seaboard, or $43@43.50, Pittsburg.

Metal Market

New York, March 24—Changes have not been material, but there seems to be a slightly better tone to the markets in several directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended March 20: Gold, $6,850,985, principally to Argentina and London; silver, $460,985, chiefly to London. Imports: Gold, $623,594, from France and South America; silver, $55,435, from the West Indies and Mexico.

Gold—The price of bar gold continues 77s. 4d. per oz. in the open market in London; American eagles are in some demand and are quoted 1d. higher at 76s. 5d. per oz. In New York a total of $8,000,000 in gold has been taken for export during the week and the movement apparently is not yet at an end.

Platinum—Business is quiet and there has been no change in prices. Dealers quote $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our St. Petersburg correspondent reports, under date of March 4, that the market shows a stronger tendency. At Ekaterinburg quotations are 5@5.05 rubles per zolotnik, for crude platinum, 83 per cent.; at St. Petersburg, 20,300@20,500 rubles per pood. These prices are equivalent to $18.99 and $19.99 per ounce, average, respectively.

Silver—The market has remained fairly steady, with small fluctuations. Pressure from China to sell is much less, and the Indian bazars are regular buyers; but demand has not been sufficient to advance the market. No great change in prices is looked for in the immediate future.

SILVER AND STERLING EXCHANGE

Mar.	18	19	20	22	23	24
New York....	50⅛	50⅜	50¾	50⅝	50⅝	50⅜
London.....	23⅝	23⅝	23 7/16	23¼	23¼	23 3/16
Sterling Ex..	4.8825	4.8825	4.8830	4.8830	4.8825	4.8810

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 11:

	1908.	1909.	Changes.
India.....	£ 1,425,838	£ 888,000	D. £ 537,838
China.....	496,400	240,000	D. 256,400
Straits.....	78,270	82,800	I. 4,530
Total.....	£ 2,000,508	£1,210,800	D. £ 789,708

Imports for the week £3000 from Chile, £2000 from Mexico, £8000 from the West Indies and £190,000 from New York; £203,000 in all. Exports, £69,500 to India.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
18	12⅛ @12¾	12 @12¼	55¼	28⅛	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
19	12⅛ @12¾	12 @12¼	55 7/16	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
20	12⅛ @12⅞	12⅛ @12⅜	....	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
22	12¾ @12⅞	12¼ @12½	56¾	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
23	12¾ @12⅞	12¼ @12½	56 7/16	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
24	12¾ @12⅞	12¼ @12½	56¾	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The lower prices established last week led to more active interest on the part of European buyers, who were stimulated also by speculation for the rise in the standard market. Some fairly large quantities were thus sold for export. This brought out some large buying orders which had been pending from domestic manufacturers, and a firmer tendency developed in consequence. Altogether a good volume of business was done both for foreign and domestic account, both in Lake and electrolytic, but chiefly the latter. There was a good demand for casting copper in the early part of the week, which for a time sold practically on the same terms as electrolytic. Lake copper appears to be in a strong position, probably because of the centralization in the market for this quality, and some sales of fancy brands were made as high as 13c. The market closes steady at 12¾@12⅞c. for Lake; 12¼@12½c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12⅛@12⅜ cents.

Copper sheets, cold-rolled, are quoted 17.3c. per lb., large lots; and hot-rolled, 16.5c. Copper wire, 14¼c. base, carload lots at mill.

A buying movement, due largely to covering of bear accounts, made itself felt in the London standard market, beginning with Thursday of last week. The advance was gradual until Monday morning when prices opened almost £1 higher than at the close on Friday. This marked the culmination of the movement, and since then there has been a reaction, the quotations at the close being cabled at £55 15s. for spot, £56 10s for three months.

Refined and manufactured sorts we quote: English tough, £60 10s.; best selected, £59 10s.@£60 10s.; strong sheets, £71 10s.@£73 10s.

The production of the Nevada Consolidated from January 1 to March 20 is reported at 3,752,000 lb. of copper. During the same period the Cumberland-Ely reports a total output of 3,278,000 lb. copper.

Copper exports from New York and Philadelphia for the week were 5631 long tons. Our special correspondent gives the exports from Baltimore for the week at 355 tons of copper.

Imports of foreign copper into Germany in January were 11,788 tons, of which 11,125 tons were from the United States. Exports were 552 tons, leaving the net imports 11,236 tons; which is 2924 tons less than in January of last year.

Tin—A waiting attitude seems to be taken by operators in the London market, which does not show any decided tendency one way or the other. Quotations throughout the entire week fluctuated within very narrow limits, and the close is cabled at £120 2s. 6d. for spot, £130 12s. 6d. for three months.

The domestic market is very similar to that of London, and business here is confined to retail lots. Quotations are made at 28.50 cents.

Arrivals of Bolivian tin in Europe in February included 2138 tons concentrates, equivalent to 1407 tons fine tin.

The tin output of the Federated Malay States for the two months ended Feb. 28 was 9275 long tons in 1908 and 6794 in 1909; decrease, 2491 tons.

Lead—There has been a very good demand for this metal, particularly from the sheet and pipe manufacturers, and business is reported in larger volume than for some time past. However, the demand is being readily met at current prices and the close is unchanged at 3.82½@3.85 St. Louis, 3.97½@4c. New York.

The London market, after declining early in the week, showed a better tone and at the close is higher at £13 8s. 9d. for Spanish lead, £13 10s. for English lead.

Advices from Europe indicate that the plans for the European convention to control the production and price of lead are progressing.

Spelter—Business is very light and there is no change in the market, quotations at the close being 4.60@4.62½ St. Louis, 4.75@4.77½ New York. The New York quotation was 4.75@4.77½ for March 18-24, inclusive.

The London market has moved within narrow limits, and after advancing to £21 10s. for good ordinaries, closes at £21 7s. 6d. for that grade, and £21 12s. 6d. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

World's Production of Copper

The first estimate of the world's production of copper in 1908 comes from Aron Hirsch & Sohn, of Halberstadt, Germany. Substituting our own figures for North America, it appears the total production was approximately as follows:

Country.	1907.	1908.
Germany	24,300	23,300
Austria-Hungary	1,000	1,350
Italy	3,000	3,150
Russia	15,000	16,520
Sweden and Norway	11,964	12,015
Spain and Portugal	51,200	51,700
Turkey	2,600	2,400
Chile	28,000	36,580
Peru	9,500	17,000
Bolivia	2,400	2,500
Cape Colony	7,000	7,000
Australia	46,000	43,000
Newfoundland	2,000	2,000
Japan	37,500	40,000
Others	3,300	5,000
Total	244,764	263,515
United States	392,519	425,177
Mexico	56,567	37,571
Canada	20,695	23,881
Grand total	714,545	750,144

Apart from the conditions in the United States, Canada and Mexico, as to which we have previously commented, the most noteworthy features of the above statistics are the large increases in the outputs of Chile, Peru and Japan.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, two months ended Feb. 28, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	21,895	10,510	Imp.	11,385
Copper, 1908	22,538	13,265	Imp.	9,273
Tin	7,150	6,658	Imp.	492
Tin, 1908	5,666	6,402	Imp.	254
Lead	37,823	6,338	Imp.	31,485
Lead, 1908	38,353	9,589	Imp.	28,764
Spelter	16,915	1,153	Imp.	15,762
Spelter, 1908	15,897	1,096	Imp.	14,801
Quicksilver, lb.	409,157	171,796	Imp.	237,371
Quicksilver, '08	821,650	476,021	Imp.	345,629
Ores:				
Tin ore and con.	2,587	.....	Imp.	2,587
Tin ore, 1908	4,559	.....	Imp.	4,559
Pyrites	136,790	.....	Imp.	136,790
Pyrites, 1908	168,036	.....	Imp.	168,036

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 83 tons copper matte, 2980 tons fine copper and 5038 tons lead.

Other Metals

Antimony—No business is reported. In the absence of sales, prices are nominally unchanged at 8@8½c. for Cookson's; 7⅞c. for Hallett's; 7⅜@7⅝c. for ordinary brands.

Aluminum—The Aluminum Company of America quotes 24c. base for No. 1 ingots; 33@34c. base for sheets. Nothing new reported as to foreign metal.

Quicksilver—Business has been quiet. New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco prices are $44@45 for domestic sales, $42 @43 for export. London quotation £8 7s. 6d. per flask, with 1s. 3d. less named by second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Joplin, Mo., March 20—The highest price reported paid was $40.50 per ton for concentrate carrying 63 per cent. zinc sulphide on car sample assay, sold on a basis of $37.50. As high as $38 base was paid and nothing was reported sold in quantity under a $36 base. The most material advance of prices was in medium and lower-grade sulphides. Zinc silicate sold on $18 and $19 per ton of 40 per cent. zinc, selling as high as $24. The average price, all grades, was $32.50 per ton.

Lead ore was generally advanced $1 per ton, while some large sales were made at the week end, but not delivered, at a $2 gain, bringing $52.50 f.o.b. cars. Medium grades ranged between $50.50 and $51.50; all grades averaged $50.80 per ton.

The smelters now own the bulk of the stock in the bins at the mines, and will need to buy but lightly for a few weeks, which will have a tendency to offset the momentary excitement attending the report on the tariff.

SHIPMENTS, WEEK ENDED MAR. 20

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,451,110	955,100	$ 88,386
Joplin	1,659,310	353,070	40,115
Miami	370,760	542,650	19,025
Duenweg	944,570	36,610	18,409
Galena	717,160	50,060	13,885
Alba-Neck	658,740	.....	12,515
Prosperity	272,680	180,770	9,552
Carthage	485,750	.....	9,228
Spurgeon	463,820	103,450	8,997
Granby	521,050	27,700	7,570
Aurora	360,260	.....	5,098
Quapaw	231,280	.....	3,700
Sarcoxie	255,490	.....	3,513
Badger	163,380	.....	3,104
Oronogo	123,520	9,770	2,525
Zincite	110,100	3,350	2,055
Cave Springs	74,210	.....	1,410
Carl Junction	61,530	.....	1,005
Totals	10,934,820	2,262,430	$250,101
Twelve weeks	133,044,400	20,664,210	$2,913,926

Zinc value, the week, $192,562; 12 weeks, $2,387,991
Lead value, the week, 57,539; 12 weeks, 525,934

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.60
March	38.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	58.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.88	.....
Year	$38.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., March 20—The base price paid for 60 per cent. zinc ore was $38 per ton. No premium price is reported. For 80 per cent. lead ore $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 20

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	388,000	.....	209,200
Linden	305,290	.....	.....
Benton	164,350	.....	.....
Strawbridge	154,000	.....	.....
Hazel Green	151,700	56,700	.....
Galena	88,000	.....	.....
Livingston	80,000	.....	.....
Cuba City	71,150	.....	.....
Total	1,402,490	56,700	209,200
Year to Mar. 20	21,767,729	777,880	2,189,850

In addition to the above there was shipped to the American Zinc Ore Separating Company, 129,670 lb. and to the Joplin Separator Works, 482,600 lb. zinc ore. The shipment of zinc ore is still curtailed about 25 per cent. on account of the bad condition of the wagon roads; a number of outlying mines, with bins filled, are unable to get any of their stock to market.

Chemicals

New York, March 24—The market is extremely dull, but prices hold to last week's figures.

Copper Sulphate—Prices remain at $4.60 per 100 lb. for carload lots and $4.85 for smaller lots. No large sales reported.

Arsenic—Quotations on white arsenic are 3c. per lb. No trading of any moment is noted.

Nitrate of Soda—Prices remain at 2.15 @2.17c. per lb., with few sales made.

Mining Stocks

New York, March 24—Early in the week the general stock markets generally remained quiet and uncertain, but on Monday a strong upward movement developed, chiefly based on good buying in London of American securities. This strength continued and the market has been active, although today has showed a slight reaction. The anthracite-coal stocks weakened a little on strike rumors. The general tone of the market is strong.

On the Curb the leading incident in the first part of the week was a break in Ohio Copper under the influence of heavy selling. This lasted only for a couple of days, and the stock lapsed into quietness again. Toward the close the other copper

stocks showed considerable strength and were fairly active. The Cobalt stocks were generally in demand and brought good prices. The Nevada gold stocks are waking up a little, more attention being paid to them, but prices are not strong.

Boston, March 23—A dull and uninteresting market is all that can be said of the present conditions. Weak at times and then a degree of strength in certain stocks. The weakness in part is said to have been due to the liquidation of some 12,000 shares of mining stocks for Western account. Notwithstanding this, declines were of little consequence, and prices tonight are generally above those of a week ago. There was some selling of Atlantic, Lake and North Lake for exchange into East Butte.

The Tamarack company is said to have a floating indebtedness of $700,000, which was the reason that Calumet & Hecla people did not take the property over with the other Bigelow mines. The Isle Royale annual report shows a deficit of $451,211 for the year 1908. This included $309,460 spent for construction, etc.

On the Curb First National fell to $6. Ohio Copper had a bad break to $6, but is back to above $7. Ojibway has been taken from the Curb and placed on the unlisted department of the Stock Exchange. An issue of $250,000 bonds is announced by the Black Mountain Mining Company to retire a floating indebtedness and provide working capital.

STOCK QUOTATIONS

NEW YORK Mar. 24	
Name of Comp.	Clg.
Alaska Mine	.22
Amalgamated	69⅞
Anaconda	42
Balaklala	‡2⅛
British Col. Cop.	6⅛
Buffalo Mines	13
Butte Coalition	23¼
Colonial Silver	¼
Cum. Ely Mining	7¾
Davis Daly	4⅛
Dominion Cop.	1⅝
Douglas Copper	2¾
El Rayo	2⅞
Florence	3⅛
Foster Cobalt	.34
Furnace Creek	.11
Giroux	7⅞
Gold Hill	⅛
Goldfield Con	7⅛
Granby	95
Greene Gold	¼
Greene G. & S.	7
Guanajuato	1⅜
Guggen. Exp.	175
Hanapah	.15
Kerr Lake	7⅛
McKinley Dar.	.85
Miami Copper	13¼
Micmac	1⅜
Mines Co. of Am.	⅛
Mitchell Mining	⅝
Mont. Sho. C.	1½
Nev. Utah M. & S.	3
Newhouse M. & S.	3⅝
Nipissing Mines	10⅞
Old Hundred	⅜
Silver Queen	.50
Stewart	⅝
Tennessee Cop'r.	41
Tri-Bullion	1⅛
Union Copper	1
Utah Apex	6⅝
Utah Copper	41⅞
Yukon Gold	4¼

BOSTON Mar. 24	
Name of Comp.	Clg.
Adventure	7⅛
Allouez	39
Am. Zinc	23½
Arcadian	14¾
Arizona Com.	35¼
Atlantic	13¾
Boston Con	‡11⅛
Calumet & Ariz.	101
Calumet & Hecla	625
Centennial	‡29
Con. Mercur	‡.30
Copper Range	75¼
Daly-West	10⅝
East Butte	14¾
Franklin	14¼
Greene-Can.	9¼
Isle Royal	26⅝
La Salle	14⅝
Mass.	4⅝
Michigan	‡10
Mohawk	61
Nevada	17⅝
North Butte	68⅝
Old Colony	.60
Old Dominion	50
Osceola	128
Parrot	32⅛
Quincy	88
Rhode Island	14¾
Santa Fe	12⅛
Shannon	14
Superior	42⅛
Superior & Pitts.	13⅝
Tamarack	77⅝
Trinity	13⅞
United Cop., com.	13
U. S. Oil	31
U. S. Smg. & Ref.	‡40
U.S. Sm. & Re., pd.	45¼
Utah Con.	40⅝
Victoria	4⅝
Winona	5¾
Wolverine	141
Wyandotte	2⅛

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡36¾
Am. Smelt. & Ref.	86¾
Am. Sm. & Ref., pf.	103⅛
Colo. Fuel & Iron	32¼
Federal M. & S., pf.	80
National Lead	76⅞
National Lead, pf.	‡106⅝
Pittsburg Coal	‡10¼
Republic I. & S.	†29½
Republic I. & S., pf.	70⅞
Sloss-Sheffield	‡72
Standard Oil	665
U. S. Steel	44⅝
U. S. Steel, pf.	119¾
Va. Car. Chem.	42¾

BOSTON CURB	
Ahmeek	146
Black Mt.	1⅛
Chemung	18
Globe Con	7⅝
Hancock	11⅞
Helvetia	3¼
Keweenaw	‡4⅞
North Lake	‡7⅞
Ojibway	14
Superior & Bost.	15⅛

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Mar. 20		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	1.60	1.40
Cent. C. & C.	83.00	82.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON Mar. 24			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton's Ind.	0	2	9
Camp Bird	0	16	0
Esperanza	2	18	3
Tomboy	0	18	0
El Oro	1	4	0
Oroville	0	10	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 24.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.37	St. Ives	.10
Best & Belcher	‡.32	Triangle	.02
Caledonia	.12	BULLFROG STOCKS	
Chollar	.08	Gibraltar	.03
Comstock	.25	Homestake King	.05
Con. Cal. & Va.	.61	Mont. Shoshone C.	1.25
Crown Point	‡.45	Tramp Cons.	.04
Exchequer	.22	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	‡.03
Hale & Norcross	.19	Lee Gold Grotto	...
Mexican	.62	Nevada Hills	1.12½
Ophir	1.02½	Nevada Smelting	1.00
Overman	.10	Nevada Wonder	.80
Potosi	.08	Nevada-Utah	2.87½
Savage	.12	Penn-Wyoming	.03
Sierra Nevada	.24	Pittsburgh S. Pk.	.65
Union	.22	Rawhide Caol'n.	.64
Utah	.03	Round Mt. Sphinx	.07
Yellow Jacket	.54		
TONOPAH STOCKS			
Belmont	.80		
Extension	.63		
Golden Anchor	‡.01		
Jim Butler	.18		
MacNamara	.32		
Midway	.20		
Montana	.66		
North Star	.04		
Tono'h Mine of N.	6.75		
West End Con.	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.10		
Blue Bell	.03		
Booth	.16		
Columbia Mt.	.10		
Comb. Frac.	.92		
Con. Red Top	.07½		
Cracker Jack	.02		
Dia'dfield B. B. C.	.08		
Goldfield Belmont	.03		
Goldfield Daisy	.42		
Great Bend	.16		
Jumbo Extension	.10		
Kendall	.05		
Lone Star	.04		
May Queen	.03		
Oro	.08		
Red Hill	.08*		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS Mar. 19	
Name of Comp.	Clg.
Acacia	6¾
Black Bell	....
C. C. Con	‡3½
Dante	6¾
Doctor Jack Pot	9¼
Elkton	71¼
El Paso	49
Findlay	15
Gold Dollar	13
Gold Sovereign	3
Isabella	24¼
Index	....
Jennie Sample	8
Jerry Johnson	6¾
Mary McKinney	38
Pharmacist	3⅛
Portland	.90
Un. Gold Mines	5
Vindicator	74
Work	7¼

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	Mar. 10	Apr. 10	$0.05
Cedar Creek, Ida.	Mar. 3	Apr. 5	0.003
Challenge Con., Nev.	Mar. 19	Apr. 9	0.004
Comet G. & C., Ida.	Mar. 20	Apr. 20	0.001
Con. Cal. & Va., Nev.	Mar. 23	Apr. 13	0.25
Crater, Ida.	Feb. 23	Mar. 27	0.001
Gov't Gulch, Ida.	Mar. 9	Apr. 9	0.001
Hypotheek, Ida.	Mar. 11	Apr. 12	0.005
Mexican, Nev.	Apr. 8	Apr. 29	0.10
Mineral Farm, Ida.	Mar. 12	Apr. 10	0.003
North Franklin, Ida.	Mar. 15	Apr. 15	0.005
Reliance, Ida.	Mar. 23	Apr. 20	0.001
Savage, Nev.	Apr. 8	May 5	0.10
Silver Hill, Nev.	Feb. 25	Mar. 30	0.05
Spanish Ridge, Cal.	Feb. 11	Apr. 10	0.03
Union Con., Nev.	Apr. 8	Apr. 30	0.10
Western Star, Ida.	Mar. 5	Mar. 27	0.003
Yellow Jacket, Nev.	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.793	.....	24.377	.....
June	53.653	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.638	.....	4.438	.....	19.906	.....
June	4.643	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

The Engineering and Mining Journal

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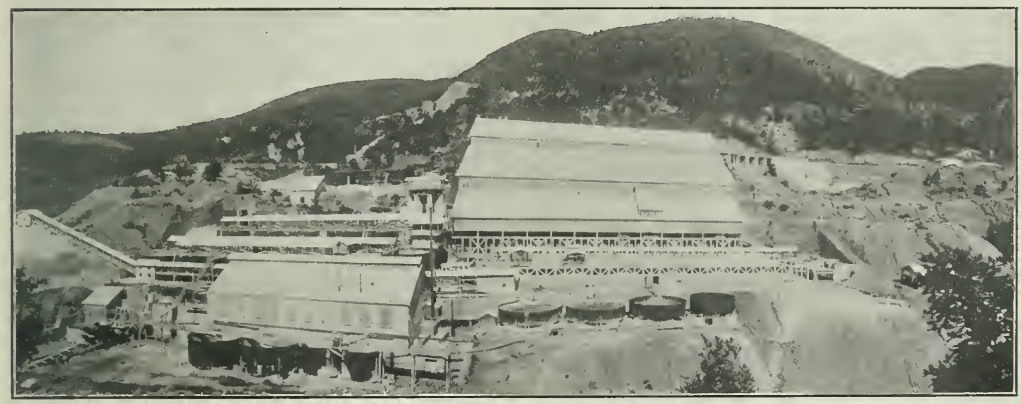
Milling and Cyaniding Practice at El Oro, Mex.

Interesting Features Are the Tailings Wheels, the Burt Filters, the Immense Cone Settler and the Continuous Agitation in Series of Tanks

BY CLAUDE T. RICE

El Oro was the pioneer district in Mexico to undertake the cyaniding of a gold ore containing much silver. Consequently it was here that much of the knowledge regarding silver cyanidation was obtained. Later Guanajuato undertook the treatment, by that process, of an ore containing considerably more silver that the El Oro ore, and finally Pachuca, emboldened by the example of Guanajuato, began to treat by cyanidation a silver ore in which the gold content is very small. Since then in other districts, the cyanidation of silver ores has been carried on successfully, but all this work owes much of its success to the early work done at El Oro.

Not only was El Oro a pioneer in cyaniding gold-silver ores, but it was the first camp in North America to adopt the tube mill for grinding on a large scale. At first the ore was crushed in water, but finally crushing in solution was adopted. In the early days (and in July, 1908, at two mills) the slime was agitated by air hose; later mechanical agitation was adopted, and now in the tailings mill of the Esperanza Mining Company which is rapidly approaching completion, the Pachuca tank is to be used for agitating the slime. The name of El Oro is also well known because of types of machinery perfected there. The early El Oro type of liner for tube mills has now been modified into a newer type at the Dos Estrellas mill.



EL CEDRO MILL, COMPANIA MINERA LAS DOS ESTRELLAS

EL ORO MILL

MEXICO MILL

Edwin Burt, cyanide superintendent for El Oro company, has invented a pressure filter which is used throughout the camp, but not content with that he is at work on a more improved type. While the Burt filter is at present the only filter used in the district the Esperanza com-

pany in its new mill is installing Merrill presses; these will be used in a new way, washing the slime cakes from the center outward. Walter Neal, superintendent of the Dos Estrellas company's cyanide plants, has erected an immense dewatering cone which is probably the largest in the world, being 35 ft. high by 34 ft. in diameter; this is used to thicken the slime pulp going to the tanks for agitation. There are many other interesting features; the Burt classifier, a modification of the Burt filter, which is used for filtering solutions before they go to the preciptation boxes; and the continuous agitation, in a series of deep, flat-bottomed tanks, which is used in giving the final wash to the slime at El Cedro mill. Finally Mr. Neal has perfected a tube-mill discharge which permits the feeding of grinders to the mill while it is running. This gives good satisfaction and is used quite generally in the district.

The South African origin of El Oro cyanide practice is well shown by the use of tailings wheels instead of centrifugal pumps or bucket elevators for elevating the sand for regrinding. These wheels at El Oro are of moderate hight, but they have succeeded so well that, while South Africa is discussing the abandonment of the tailings wheel, one has recently been built at El Cedro mill, and the Mexico, the newest mill in the district, is equipped with such a wheel. But other features of African practice are being abandoned. The El Oro and Mexican companies have adopted complete sliming and the Dos Estrellas completely slimed its ore for several months but has again returned to slime-and-sand treatment. So it will be seen that El Oro is of special interest from a metallurgical view-point.

At El Oro, most of the ore milled is oxidized but some is sulphide. In the sulphide the gold occurs in the pyrite mainly, while the main silver mineral is argentite. The gangue is highly silicious. The ore mined by the Dos Estrellas company averages 13 grams gold and 224 grams silver from the Dos Estrellas workings and 10 grams gold and 100 grams silver per ton from the Cedro workings. The ore mined by the Esperanza company averages 13 grams gold and 80 grams silver per ton from the San Rafael vein (oxidized ore) and from the sulphide vein 30 grams gold and 300 grams silver per ton. The Mexico ore averages about 17.5 grams gold and 205 grams silver per ton, while El Oro company's ore averages about 12 grams gold and 93 grams silver per ton.

BURT FILTER PLANT, EL ORO MILL

SLIME TANKS, EL ORO MILL

PRECIPITATION ROOM, MEXICO MILL

PRECIPITATION ROOM, EL ORO MILL

El Oro Company's Mills

After many changes, due to its pioneer work, El Oro company for the last year has been completely sliming its ore. In the two mills of this company there are 200 stamps, 100 weighing 1000 lb. each and 100 weighing 1140 lb. each. The ore after being broken in gyratory crushers goes to the stamps which make 102 drops, 7 in. high, per minute. The ore is crushed in solution, titrating 0.01 per cent. KCN, through 30-mesh screens; about 30 to 40 per cent. of the battery pulp will pass a 200-mesh screen.

The pulp from the two mills unites and passes through a series of classifying cones. All of these cones are fitted for using ascending currents in them, and in some an ascending current is used. The overflowing slime goes to the agitating tanks while the underflow is elevated by a sand wheel, 40 ft. 6 in. diameter, to the tube-mill feed cones. The sand goes to 7 tube mills—two Abbe and five Krupp mills. These mills are of several different sizes, but the most efficient is 4 ft. diameter by 10½ ft. long, as the shorter sizes with relatively larger diameters do not give so good results. These tube mills, owing to the high starting torque, are run by 75-h.p. Westinghouse motors and are kept a little more than half-filled with sand and grinders. The tube mills are fitted with the original Brown design of El Oro liner and with a Neal discharge,

the reverse worm being used without the baffle. This form of discharge works well and has given good satisfaction; it is described and illustrated in another part of this article.

At El Oro the tube-mill equipment is not large enough for complete sliming so that only about 80 to 85 per cent. of the tube-mill discharge passes a 200-mesh screen. The slime going to the tube mills is thickened to about 50 per cent. moisture before it enters the mills. Ore is used for grinders. There are 15 agitation tanks, 34 ft. diameter by 12 ft. deep, and 6 agitation tanks, 34x20 ft. deep, being old converted settling tanks. The agitation is effected by revolving paddles and a centrifugal pump. Aëration is effected by means of the pump, but to insure complete aëration, a small jet of air is admitted to the tank. The slime pulp enters the vats through a central perforated box extending about 15 in. below the surface of the charge and inclosed in an outer box whose sides flare upward; this construction concentrates the stream of slime entering the tank. The slime is agitated in solution titrating about 0.04 per cent. KCN at a dilution of 3 solution to 1 pulp. The strength of the solution is varied somewhat according to the amount of silver in the ore. About 250 grams of lead acetate are added to the tanks per ton of slime.

The total slime treatment lasts 52 hours. The first agitation last six hours; the second, third and fourth, one hour each. The third and fourth agitations are with barren solution; the first two with unprecipitated solution. The barren-solution washes from one agitation become the first and second washes for the next charge.

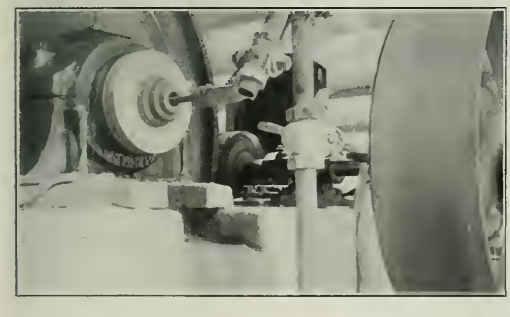
The washed slime is run to deep settling tanks, 34 ft. diameter by 20 ft. deep. About 80 per cent. of the settled slime is treated on Burt filters, while the remainder, owing to the insufficiency of the filter equipment, is discharged after settlement in only the deep tanks. There are five Burt presses[1] 42 in. diameter by 20 ft. long. These are considerably smaller than those used by the Dos Estrellas company. No washing

DOS ESTRELLAS MILL

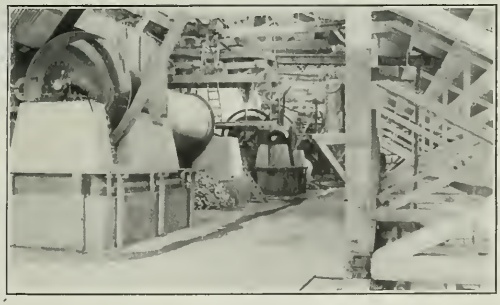
EL CEDRO MILL

SAND PLANT, EL CEDRO MILL

SLIME PLANT, EL CEDRO MILL



METHOD OF CHARGING TUBE MILLS, EL CEDRO MILL



TUBE-MILL FLOOR, EL CEDRO MILL

[1]Described in this JOURNAL, Sept. 5, 1908.

is done in the press. The filtering pressure, 40 lb. per sq.in., is obtained by gravity. It takes 35 min. to filter a charge. The cakes as discharged contain about 30 per cent. moisture.

The pregnant solutions are precipitated in ordinary precipitation boxes. The short zinc is separated by screening and is used over again so that there is no acid treatment of the zinc. The precipitate is briquetted with fluxes.

The extraction of the gold is about 93 per cent. and of the silver about 70 per cent., making the total extraction about 89 per cent. The zinc consumption is 0.9 lb. per ton and that of cyanide 0.8 lb. per ton of ore crushed. The cost of milling the ore is $0.40 per ton of ore crushed and of cyaniding is about $0.90 per ton. The ore contains about $7.90 in gold and $1.50 in silver per ton.

The Mexico Mill

The Mexico mill is the newest mill in the district and the simplest. It treats about 280 tons of ore per day. The ore from the mine contains $11.70 gold and 6.6 oz. silver per ton; as the silver content is greater than in most of the ore mined at El Oro, the treatment at the Mexico mine is correspondingly lengthened.

The ore is crushed in a jaw crusher and one set of rolls for the oversize, until all of it passes a 2-in. grizzly. This is done in a separate breaker house. The ore then goes to the mill building.

There are 40 stamps weighing 1180 lb. each and making 102 drops, 7 in. high, per minute. The ore is crushed in cyanide solution, titrating 0.02 per cent. KCN, and through 8-mesh screens. The stamp duty is about 7 tons per 24 hours. The pulp from the batteries contains about 10 to 15 per cent. that will pass a 200-mesh screen.

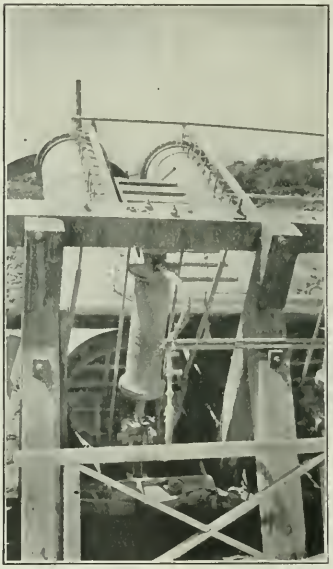
This pulp goes directly to the classifiers above the tube mills. There are six Krupp mills, 4 ft. diameter by 19½ ft. long, but only four of the tube mills are needed at present. The motors are connected by gearing to the tube mills. These mills are run at 31 r.p.m.; at the upper end the journal turns in trunnion bearing and at the lower end on two rollers.

The discharge from the tube mills goes to classifying cones. The overflow, 90 per cent. of which will pass a 200-mesh screen, goes to the agitation vats while the underflow goes to a riff-raff wheel, 40½ ft. in diameter, which returns the oversize to the tube mills. This wheel requires only about 6 h.p. to run it, and the repairs are almost nothing.

There are 12 agitation tanks, 34 ft. diameter by 12 ft. deep, but one or two of the tanks are used to receive the pulp going to the Burt filters. These tanks are similar in every respect to those used at El Oro mills. The main agitation is mechanical, but centrifugal pumps are added for transferring and aiding in agitation while a small air jet increases the aëration. The slime is agitated in cyanide solution at a dilution of 1 slime to 3 water. The total slime treatment takes four days. The first agitation lasts 24 hours and is with solution titrating 0.05 per cent. KCN. Then four agitations, lasting one hour each are given in residual solution titrating 0.03 per cent. KCN. The slimes are filtered in three Burt filters which run only about half the time. The filtered solution is passed through a Burt clarifier which is quite similar in construction to a Burt filter but is placed horizontal instead of at an angle of 45 deg. as is the filter. The clarified solution then goes to storage tanks above the precipitation house. There are nine zinc-boxes each having five compartments, 48 in. wide by 30 in. long by 20 in. deep. The zinc-room practice is quite similar to that at El Oro mill.

The cyanide consumption is a little more than 1 lb. per ton of ore crushed. The zinc consumption is about the same as at El Oro mill. The cost of milling is $0.30, of cyaniding, $1.28 and of water supply $0.02, making the total treatment cost $1.60 per ton of ore crushed. The extraction on the gold is from 94 to 95 per cent. and on the silver from 83 to 84 per cent., making a total theoretical extraction of from 91.5 to 92 per cent.

BURT FILTERS, EL CEDRO MILL



BURT FILTER, SHOWING DISCHARGE

BURT CLARIFIER, MEXICO MILL

The Dos Estrellas Mill

The Dos Estrellas mill belonging to the Compañia Minera Las Dos Estrellas is interesting, for it shows fairly clearly the gradual development in the mechanical side of the cyanide process. Starting as a pan-amalgamation mill, the plant was changed, after the cyanide process had been proved applicable to the gold-silver ores of the camp, so as to use that process. Therefore the mill lacks unity, and of

course is not comparable to the newer Cedro mill belonging to the same company.

At first this mill like the others used water in the batteries, but about a year and a half ago the scheme of treatment was changed, and the ore was crushed in weak cyanide solution. Rectangular tanks for treating the slime were first used, for that was the practice when they were erected; later cylindrical tanks and mechanical agitators were installed, and now the company is equipping the old square tanks with mechanical agitators, such as are used in the cylindrical tanks, so as to do away with air-agitation by means of movable hose. Provision is being made for separately treating the sulphide ore, and gradually the sliming capacity of the plant is being increased so that probably finally all the ore will be slimed; in fact for a few months since my visit all the ore was slimed.

The Dos Estrellas mill is at present treating 460 tons of ore per day averaging 13 grams gold and 224 grams silver per metric ton. This ore is first crushed in 15x9-in. Blake crushers, and then goes to the battery bin. Thence it is fed by Challenge feeders to the 130 stamp, 90 of which weigh 1250 lb. and the other 40 only 950 lb. Thirty of the stamps are crushing sulphide ore, while the rest are running on oxidized ore. At present the two classes of ore are cyanided together, but changes are being made so that the sulphide ore will be treated separately from the oxidized ore as it requires a longer and somewhat different treatment than the oxidized ore. The solution used in the batteries is unprecipitated solution titrating 0.1 per cent. KCN. It is the last washes from the slime and the sand tanks. The stamps crush through a 30-mesh, No. 34-wire screen, and make 106 drops, 6 in. high, per minute. The oxidized ore goes direct from the stamps to the tube-mill classifying cones, but the sulphide ore is first concentrated, the slime on Johnston and the sand on Wilfley tables, before it joins the oxidized ore. These cones remove the slime and feed a thickened pulp, containing about 60 per cent. moisture, to the tube mills. There are four Allis-Chalmers tube mills, 5x24 ft. long, having a modified El Oro lining and a Neal discharge-piece.

The Dos Estrellas type of El Oro lining is similar to the original El Oro lining, but the back of the liner is made lighter, and to strengthen this liner, where it is weakened by the holes for the bolts that hold it in place, cross webs connect the two ribs together. The liner fills with pebbles like the older type, but in the accompanying illustration the mill had just been relined and had not yet been run. This design allows a much lighter liner to be used than the original form of design permits. This is some advantage when it is desired to use the El Oro type of lining in a mill whose bearings have not been designed for such an increase in weight.

DOS ESTRELLAS TYPE OF EL ORO TUBE-MILL LINER

The Neal discharge piece, designed and patented by Walter Neal, the superintendent of the Dos Estrellas and El Cedro plants, consists of an annular, tapering baffle, made necessarily in two parts so that it can enter the mill. These two pieces bolt into the discharge of the tube mill. With this discharge piece no screen is used, for this device acts as a baffle, since the slant of both interior and exterior surface of the end projecting into the tube mill is such that any ore or pebbles striking either surface bounce back into the mill. In a tube mill having a larger discharge than the Allis-Chalmers mill a reverse-screw arrangement is added. The advantage of these discharge pieces is that it enables the mill to be charged with pebbles while it is running. At the Dos Estrellas and Cedro mills by using the Neal discharge piece the time that the tube mills are grinding is 97 per cent. of the total time, that is provided none has to be shut down to be relined.

With quartz for grinders the modified El Oro lining lasts about eight months, but with pebbles their life is increased to 12 months. The charge of grinders fills the mill a little more than half full. About two tons of quartz grinders are used per day per tube mill. Two of the tube mills run at 28 and two at 26 r.p.m.; about 60 h.p. is required to run a tube mill half-filled with quartz grinders. About six metric tons of dry ore are crushed per hour per tube mill; the heads contain 13 per cent. above 40-mesh; 41, between 40 and 80; 11, between 80 and 100; 12, between 100 and 150; 2, between 150 and 200; and 21 per cent. through 200-mesh. The discharge contains 1 per cent. on 40 mesh; 22, between 40 and 80; 11, between 80 and 100; 22, between 100 and 150; 8, between 150 and 200; and 36 per cent. through 200 mesh.

The discharge from the tube mill at present is elevated by centrifugal pumps to a second system of two large classifying cones working in series, but a bucket elevator is being installed to replace the pumps. The underflow from the first cone returns to the tube mills, and the overflow goes to the second cone; the underflow from the second cone goes to the sand-receiving tanks and the overflow to the slime-collecting tanks.

SLIME TANK, SHOWING WINGS FOR PROMOTING AGITATION

SETTLING BOX FOR USE IN CLEAN-UPS

These classifying cones, although designed to be run as hydraulic classifiers, are now used as simple cone classifiers, for with Mexican labor it is difficult to keep the water-jet pipe from plugging up. The sand going to the receiving tanks contains 1 per cent. sand on 40 mesh; 14, between 40 and 80; 14, between 80 and 100; 48, between 100 and 150; 4, between 150 and 200 and 19 per cent. through 200 mesh.

There are 12 sand-receiving tanks, 21 ft. diameter and 5½ ft. deep. The slime overflowing from these tanks is returned to the large cones that reclassify the tube-mill discharge. The sand is given a double treatment; the first in the receiving tanks, the second in the treatment tanks proper.

At the tube mills 200 grams of lead acetate per ton of total ore milled is added to the pulp, but the lime for neutralizing the acid is added to the slime in the slime-settling tanks.

In the receivers the sand is washed for five days, with cyanide solution titrating 0.15 per cent. KCN, 90 tons of solution being used. Then it is shoveled into cars and charged into the leaching tanks, 17 in number, 32 ft. diameter by 4½ ft. deep where it is given a 10-day treatment. It is leached first with 80 tons of solution titrating 0.4 per cent. KCN and then with 350 tons of 0.1 per cent. solution. The sand is discharged by shovel into cars and hauled by a Lidgerwood hoist up the slightly inclined tailing pile and dumped.

NEAL DISCHARGE FOR TUBE MILLS

Slime Treatment

The slime from the separating and thickening cones above the tube mills flows to the slime-collecting tanks which are rectangular cement tanks; at the time of my visit the pulp in these was agitated by means of air hose, but mechanical agitators were being installed. From these the slime is discharged by gravity to the circular, steel, agitation tanks fitted with mechanical agitators. For the final wash the slime is discharged to the wooden slime washers where it receives one agitation by transfer; then it is allowed to settle for as long a period as the capacity of the settlers will permit. The thinner pulp on the top is treated in the Burt presses, while owing to the fact that the capacity of the slime filters is not large enough to handle all the slime, the thicker pulp near the bottom of the tank is discharged directly to the creek.

There are two Burt filters 25 ft. long by 4½ ft. diameter, having 35 leaves each. The rated capacity of each of these filter-presses is 200 tons of dry slime per day, but, as the slime has to be charged into the filter by two 6-in. centrifugal pumps working in series, considerable trouble is caused by the pumping system owing to the rapid wearing out of the impellers and pump casing. Besides, the filters are handicapped by the fact that the capacity of the plant does not allow of sufficient settlement to feed the presses with thick slime, consequently the capacity of the presses at this mill is much lower than the rated capacity. A pressure of 40 lb. per sq.in. is used in charging the Burt filter. At the Dos Estrellas mill the cycle is 35 min.; 25 min. being the actual time of filtering, since 10 min. is consumed in handling and discharging the pulp. In these large filters a charge of 6 tons of dry slime is filtered in one operation of both presses. The entering pulp contains 70 per cent. moisture, while the discharged cakes contain 30 per cent. moisture. The cake is not given a water wash, as that makes the cycle too long.

The total time of slime treatment is four days; agitation, not including time of transferring, amounts to 17 hours. The pulp is agitated at 4 solution to 1 slime, the solution titrating 0.1 per cent. KCN. The total dilution (tons solution decanted per ton of slime) is about 6 solution to 1 slime.

The extraction on the sand is 88 per cent. of the gold and 73 per cent. of the silver. The extraction on the slime is approximately the same because the slime plant at present is purposely crowded until the extraction on the slime is the same as that on the sand. Of course normally the extraction on the slime is much better than on the sand. The cyanide consumption at the Dos Estrellas mill is 1 kg. per metric ton of ore crushed; the zinc consumption, 600 kg.; and the lime consumption, 12 kg. per ton. The average cost of crushing and cyaniding from January to June, 1908, was 2 pesos per ton.

As the zinc-room practice at the Dos Estrellas mill is almost identically the same as that at the Cedro mill, the details will be described later.

The Cedro Mill

The Cedro mill, built two and a half years ago, was designed by H. Bossuat, general manager, H. Jouanen, assistant general manager, and C. E. Rhodes, at that time superintendent of the cyanide department of the Dos Estrellas company. It is one of the best in the Republic, and, as the company expends considerable money on experimenting and tries hard to keep the mill well abreast of milling progress, this mill is indeed interesting. The practice of this mill is changing continually, and what I write about the method of milling used at present will probably be no longer true three months from now. In fact since July for several months at both the Cedro and the Dos Estrellas mills the ore was completely slimed, but as there was little difference in results, the ore is again being treated as sand and slime. In the meantime further experimenting in regard to complete sliming of the ore is being carried on.

When I was there in July they were just beginning to operate the Burt filter and were just finishing the construction of probably the largest settling cone in the world; since then the cone has been put in operation. This cone is 34x34 ft. with a vertical rim 1 ft. high, making the total vertical hight 35 ft. It is used to thicken the slime pulp before charging it into the agitation tanks. The slime at El Oro is extremely quick settling, and so by using this cone the two tanks formerly used as collecting tanks are made available for agitation. Although the discharge pulp is not as thick as had been hoped, still the pulp is sufficiently dewatered so that it can be agitated in the tanks as they are being filled, and so the cone fulfils the purpose for which it was designed. The total mill product after being ground to slime in the tube mills goes to the cone at a dilution of 8 solution to 1 slime and is thickened to a dilution of 4 to 1 when the pulp is fed so as to pass through the cone in 3 hours and 55 minutes. At present about 460 tons of slime a day are passing

through the cone. The overflow from the cone is perfectly clear and goes directly to the sand filters; thence to the precipitation boxes.

The excellent agitation and aëration obtained during the crushing, classification and re-grinding of the ore results in an extraction of 74.1 per cent. of the gold and 56.2 per cent. of the silver on the settled but unwashed samples of the underflow from the cone. This fact suggests unexpected possibilities in shortening and simplifying the treatment. But in considering this it must also be remembered that, as at the present time the mill is treating a greater proportion of ores from the upper levels, the gold and silver are more readily dissolved than if more of the less oxidized ore coming from the lower levels were being treated.

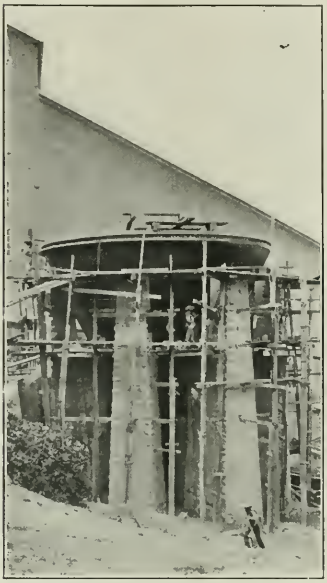
There are many other interesting features at this mill; for instance, the continuous flowing of the pulp through a series of agitation tanks in the final part of the agitation treatment; the adoption of the tailings wheel for returning to the cones above the tube mills the pulp that has passed through the tube mills; the manner of using up the short zinc; the carbon filters in the last compartment of the zinc boxes; the method of screening the precipitate, as well as several other points in the treatment. In July the mill was sliming less than half the ore, but since then, after sliming all the ore for several months, the mill has been sliming about two-thirds of the ore.

The sand plant is equipped with a complete Blaisdell system for handling the sand in the tanks and a Robins belt conveyer for taking the tailings to the dump. While, owign to the ignorance of the Mexican labor, the cost of repairs on such a system is much higher than in the United States, the fact that on a feast day two foreigners can operate the system more than offsets this disadvantage of high cost for repairs.

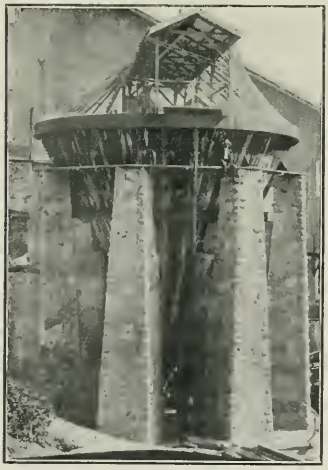
The Cedro mill is built on a side hill, but unfortunately the difference in elevation is not sufficient to permit of charging the Burt filters entirely by gravity, and so a semi-gravity system must be used The mill at present is crushing 600 metric tons per day. This ore, which assays 10 grams gold and 106 grams silver per metric ton, is mainly oxidized ore and contains little sulphide so that none of it is treated on concentrators.

The ore, brought from the mine by electric haulage, is crushed in six 15x9-in. Blake crushers to about 1½-in. size, and then goes to the battery bin which holds 9000 tons. Suspended Challenge feeders feed the ore to the 120 stamps, which weigh 1250 lb. and make 102 drops, 6 in. high, per minute. On the batteries 8-mesh, No. 18-steel-wire screens are used. The ore was formerly crushed in unprecipitated cyanide solution titrating 0.1 per cent. KCN, but now most of this is precipitated before being returned to the batteries. About 8 tons of solution are used per ton of ore.

The pulp from the stamps goes directly to the cones above the tube mills; there are five of these tube mills, each 24x5 ft.



THE LARGE SETTLING CONE BEFORE COMPLETION



THE COMPLETED SETTLING CONE, EL CEDRO MILL

diameter, made by the Allis-Chalmers Company. All are fitted with Neal discharge-pieces so that the grinders (coarse ore from the vein) are fed to the mill without stopping it. The ordinary system of three small cones is used to separate the slime and thicken the pulp going to most of the tube mills, but one mill is fed by one large cone, 7½ ft. high by 5 ft. diameter, as is the practice in South Africa. With this one cone no trouble is experienced in getting an underflow that really carries only 50 per cent. moisture—a difficult thing to do when using a series of smaller cones to feed the tube mill. Besides, there is only one cone to watch for each tube mill. The tube mills run at 26 r.p.m., and as at the Dos Estrellas mill they are lined with the modified El Oro liner. The pulp from the tube mills goes to the main system of classifying cones where the sand and the slime are separated. The sand goes to the sand plant, and the slime, after joining the slime from the cones feeding the tube mills, goes to the slime plant. In July about 45 per cent. of the pulp was treated as slime and 55 per cent. as sand.

The sand is collected in one of the 10 sand-receiving tanks, 7x22 ft. diameter. The overflowing slime and fine sand from the receivers is returned to the cones by a Byron Jackson 4-in. centrifugal pump. The sand drains 30 hours in the receiving tanks, and then is transferred to the leaching tanks by means of a Blaisdell system. There are 12 leaching tanks 36x5½ ft. deep (leaching depth 5 ft.), each holding 130 tons. In the leaching tanks the sand is given a treatment lasting 6½ days. First 48 tons of strong solution titrating 0.4 per cent. KCN and then 96 tons of weak solution titrating 0.1 per cent. KCN are used. The sand tailings contain 16 per cent. moisture when discharged and assay 1 gram gold and 48 grams silver per ton. The extraction on the gold is 90 per cent., but on the silver only 55 per cent., due to the fact that a certain amount of the silver is apparently unextractable by the cyanide. Therefore, on that account as the ore treated at the Cedro mill does not contain as much silver as that treated at the Dos Estrellas mill and as the insoluble portion is about the same in both ores, the extraction of silver at the Cedro mill is much lower.

Slime Treatment

The cyanide plant at the Cedro mill is admirably laid out, for it is so arranged that all the slime tanks and also all the sand tanks can be seen from the shift-boss' office which rises like a conning-tower among the cyaniding tanks. This is especially advantageous as it permits the man in charge to see everything that goes on and makes the overflowing of any tanks inexcusable. This overflowing is apt to occur where too much dependence is placed upon the Mexican employees.

The slime treatment at the Cedro is novel. At first the slime after being collected in two of the tanks is treated by agitation and decantation in the usual way with mechanical agitators. Then it is dis-

charged to the deep tanks, where it is given a continuous agitation as it flows from one of them to the other. There are 12 of the ordinary agitation tanks 36x10 ft. deep, and six of the continuous agitators, 36x20 ft. deep. These are connected so that the pulp flows from the bottom of one into the bottom of the next and out from the top of that tank into the top of the next tank. In these tanks two sets of agitator arms are used, one set about 20 in. above the bottom and the other set about 10 ft. above the bottom. In the tanks, 10 ft. deep, only one set of agitator arms is used.

In the tank where the agitation and decantation treatment is given, 100 grams of acetate is added per ton of total ore crushed. The slime is agitated in solution titrating 0.1 per cent. KCN, and the dilution is about 4 to 1. The total time of contact in this first agitation period is 70 hours; 16 hours of this time the slime is in agitation, and 5 to 6 agitations are given. The solutions from these agitations, as well as the overflow from the slime-collecting tanks, are precipitated. The last wash decanted from the settling tanks, and the solution from the Burt slime presses together with enough of the last washes from the 10-ft. tanks to make up the necessary amount is returned to the battery-solution storage tanks without precipitation.

In the deep tanks the slime is given a continuous agitation lasting 186 hours. From the last tank of the series the slime is discharged, part to the filter presses and part to settling tanks, 36x20 ft. deep, the same size as the continuous-agitation tanks, where it is settled and from which, finally, after the supernatant solution is decanted, it is discharged to the creek. The slime from the settlers contains about 40 per cent. moisture when discharged. The continuous-agitation tanks are transformed settlers that were made available by the use of Burt slime filters. This method of continuous agitation through a series of tanks is said to possess advantages over the method of agitating and decanting in the same tank and is being further developed.

There are two Burt filters, 25x4½ ft. diameter. Owing to the insufficiency of the head, these work on a semi-gravity system, and a 6-in. Butters centrifugal pump is required to obtain the 50-lb. pressure used in filtering. The filtered solution and that decanted from the settling tanks is returned to the stamps without precipitation. The extraction from the slimes is 92 per cent. of the gold and 65 per cent. of the silver.

The Precipitation Rooms

The solution going to the precipitation room is passed through sand filters before it enters the precipitation boxes which have six compartments, 36x36x30 in. deep. About 3000 tons of solution are precipitated each day. There are three regular precipitation boxes and one short-zinc precipitation box treating strong solution, and 23 precipitation boxes treating weak solution. The end compartment of each box is filled with charcoal that acts as a filter and increases the saving somewhat. At clean-up time the charcoal filter is washed off with a hose. After being in use for several months the charcoal is burned, and the ashes added to the precipitates for melting.

The short zinc is used in a special box in which each compartment is fitted with a set of five trays, each 5 in. high, one tray resting on the other below. On these an 8-mesh screen is used. The short zinc is laid out on these screens in a layer 1 in. thick. This method keeps the short zinc from matting and gives the cyanide solution a chance to get at all the zinc. About three-fourths of the short zinc can be consumed this way; when too much short zinc accumulates some of it is melted down with the next clean-up. The short-zinc box is used only for precipitating strong solution, and the solution after passing through the short-zinc box goes to one of the regular strong-solution boxes to insure complete precipitation.

In cleaning up, the precipitate is washed into a settling box, shown in an accompanying illustration; this is mounted on wheels, and has a small feed compartment down which the precipitate and solution passes. In this box most of the precipitate and short zinc settles so that the overflowing solution is quite clear and not until near the end of the clean-up does the 60-mesh screen, used to separate the short zinc, become clogged. Consequently the short zinc gives less trouble during clean-ups and, as the heavier precipitate is held back until the last, the speed of filtering in the press is increased. This settler makes a clean-up much easier.

In fluxing the precipitate, which contains 60 per cent. metals, slag from the assay office, amounting to 30 per cent. of the weight of dry precipitate melted, is used as part of the flux. Some lead from this slag is reduced and goes into the bullion, but that does no harm. The assay slag forms an excellent flux; unfortunately all the flux required cannot be furnished by the assay office. The first bars obtained are remelted. In pouring the pots, the top slag is poured into a cone having a clay-plugged tap hole; when near the metal, the pot is poured into the ingot molds. When a shell an inch thick has formed in the first cone, the tap hole is opened, and the interior slag run off. This slag is shipped to the smelter, but the slag shell and the slag from the ingot molds are remelted.

Cyanide consumption amounts to 0.56 kg. per ton of total ore crushed; zinc consumption amounts to 0.66 kg., and lime consumption 7.6 kg. The cost of cyaniding is 1.50 pesos.

The Mount Morgan Gold Mining Company

The report of this famous Queensland company for the half-year ending Nov. 30, 1908, states that the total revenue from all sources amounted to £507,238. The profits for the half-year, including a balance of £3421 carried forward from last account, was £135,250. The average gross price per ton obtained for copper realized was £59 3s. compared with £65 18s. for the previous half-year, irrespective of the gold values in each case. During the half-year 222,793 tons of ore were mined and treated at the works, yielding 3272 tons of blister copper and 84,037 oz. of fine gold; in addition to which 230 tons of copper precipitate were recovered. The Electrolytic Copper Refining Company, in which the Mount Morgan Company is interested, has completed the construction of its plant at Port Kembla, and will now be prepared to treat blister copper.

During the half-year two serious falls of ground occurred in the mine, causing the death of 12 men. This is the first time, since the company was formed 20 years ago that a serious accident has taken place. The first accident was due to a difficulty in supporting the roof previous to the placing in position of cribbing to form the ore way and filling. The second accident occurred through the fall from the roof of about 12,000 tons of ore, which crushed over 30 bulkheads that were under it. The square-set system of mining, which has been in use in the older parts of the mine for the last 20 years with very satisfactory results as regards safety and economy will be adopted throughout the mine in future. The flat-back stope or chamber system, which had been introduced as equally safe but more economical, will be discarded. In practice it was found that the cost of this system of mining was identical with that of the older system.

At the gold reduction works 123,675 tons were treated, averaging 6.41 dwt. or 27.22s. per ton. The total recovery was 39,717 oz. fine gold. On sulphide ore the cost of crushing, roasting and chlorinating was 13s. 7d. per ton and on the oxidized ore there costs were 10s. per ton.

At the smelting works 102,575 long tons of ore and middle products were treated, the value of the copper ore being 8.371 dwt. gold and 3.475 per cent. copper. The matte produced averaged 45 per cent. copper and went directly to the converters, which produced 3655 tons of blister copper, containing 3625 tons copper and 47,005 oz. gold.

It is said that discussion of the proposed new mining law will be resumed at the session of the Mexican Congress beginning April 1, 1909.

Geology of the Guanajuato District, Mexico

Cretaceous Shales Are the Oldest Rocks; Intrusions, Faulting and Brecciation Are Characteristic Features; Orebodies Occur along Fault Zones

BY C. W. BOTSFORD*

The Guanajuato district has come so rapidly to the front in the last few years and is becoming so well known, that it seems to me that a general geological description of the camp with some notes on the veins and ore occurrence is of interest. The accompanying plan and cross-sections should make it easier to follow the relations of the various formations. These plans are taken from work done by the Guanajuato Development Company and are largely from actual surveys.

Topography

The Sierra of Guanajuato is one of the low detached mountain ranges which rise above the central plateau of Mexico. The erosion has been so extensive that the topography of the country gives little indication of the folding and faulting of the district. The principal mines of the camp are on the western slope of the mountains, with the drainage outlet through the Silao valley. On the eastern slopes of the mountains are the smaller camps of San Felipe or Providencia San Juan de La Luz, Santa Rosa, and San Antonio. The physical conditions in these various camps are the same as at Guanajuato proper and should be considered in a discussion of the Guanajuato district.

Cretaceous Shales

The oldest exposed rocks in this whole section of the country are the Cretaceous shales. These are usually black, thinly and irregularly bedded and are calcareous. A few of the more highly calcareous beds are quarried and burned for lime, but these beds usually carry sufficient aluminous matter, to give the product weak hydraulic properties. In local areas of the district metamorphism has produced from the shales, sericite and quartz schists. These areas are, however, rather rare. Beds of impure limestone appear in the shales in increasing percentages at the extreme north end of the district. These shales have a thickness of at least 3000 ft., shown on the Valenciana. The total thickness is not known as the underlying strata have yet to be penetrated. Complex minor folding, followed by extensive erosion has affected these shales, and left a very marked unconformity between them and the overlying eruptives.

Guanajuato Conglomerates and La Luz Schists

Following these shales is a long series of andesitic breccias and tuffs covering the entire Guanajuato district. These were probably from more or less continuous explosive volcanic eruptions falling into shallow lakes or an inland sea. In large areas, a regular arrangement and bedding can be traced for miles. In other local areas, the arrangement and bedding are both irregular and the beds pinch out sharply. This formation, to my mind, could only have been formed under the shallow sea or lake conditions, the regular bedding being the portion of the formation formed in the deeper and quieter waters, and the irregular bedding being at or near the old water-levels. Parts of the area, showing the most irregularities, were probably above the water at this time. These andesitic breccias are about 3000 ft. thick in the central portion of the district. At La Luz, and to the north, this formation gets thicker, but how much is not as yet determined. These beds have been extensively metamorphosed, and lose their original characteristics entirely. The upper part of these beds has been consolidated into an agglomerate of a deep purplish-red color which is called locally the Guanajuato conglomerate.

This rock, I think, shows water-action very plainly, over the larger part of the area; this action has resulted in the rounding of the fragments and the bedding arrangement. Lower down in the formation, where the metamorphism has progressed farther, there are many varieties of schists, slates, and many unnamed, hard, indurated, close-grained rocks. Locally these are called the La Luz schists. Properly speaking, these are not true schists, but vary much in character in different portions of the area. Probably 20 per cent. of the rock mass shows more or less schistosity. These schists have their greatest development in the La Luz portion of the district, hence the name. The transition from the agglomerates into the schists is marked by no sudden change; the agglomerate first loses its original red color, then the beds show all gradations into the final schist, in which all trace of the original fragmentary structure is lost.

Granite Intrusion

In the La Luz portion of the district, there is an extensive granite intrusion, which was subsequent to some or most of the regional metamorphism of the La Luz schists. This intrusive body has been exposed by erosion over all the country from San Cayetano and Nueva Luz to the northwest for about 8 miles and as far east as the Mother lode. This granite is remarkable for the large percentage of schist inclusions. There is no regular contact between the two rocks, but the granite has intruded itself between the layers of schist, breaking and turning them up in all conceivable forms and shapes. Tongues of schist varying in thickness from a few inches to many feet and hundreds of feet long are of common occurrence. Irregular fragments of schist, included in the granite mass, are found in large percentages in nearly all parts of the intrusion. This gives to the contact a form as of interlocking fingers, mixed with innumerable fragments and boulders of schist. In only a few places that I have seen is the granite at all free from these inclusions. These probably indicate points nearer the center of the mass. Buenavista mountain seems to be the principal source of the granite because of the great thickness of the intrusion here (over 2000 ft.) The granite originally extended several miles to the west of La Luz, and, except on a few of the higher ridges, has been removed by erosion. This may have been a sill extending out from the body of the intrusion.

The granite becomes more hornblendic toward the interior of the mass. Usually at and near the contacts, there has been a strong basic differentiation resulting in diorites and quartz-diorites. In many places these dioritic differentiations seem to be broken into fragments, and slivers, showing sharp contacts with the normal granite which frequently surrounds them. This, I think, must indicate a partial solidification of the first magma and a further injection of more granite. Much contact metamorphism has taken place with the formation of much epidote and some tourmaline. Because of the mixed nature of the contact, it would seem that the intrusion must have been against great weight, only explainable by the former presence of overlying formations.

The succession of rocks above the schists is a series of andesitic and rhyolitic breccias, which were both probably needed to give the necessary weight. For this reason I have placed the age of the granite as possibly among some acid eruptions coming before the later rhyolites.

Diorite Intrusion

There is also, at La Luz, considerable evidence of a dioritic intrusion before the granite. Metamorphism has been so extensive, and weathering has so altered the exposed rocks that it is impossible to de-

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termine what many of them are. It is probable that only future developments in depth, in the mines, will settle the question of the exact character of many of the lower rocks of the La Luz formations. This part of the country was undoubtedly the center of the volcanic intrusions, which played an important part in the mineralization of the Guanajuato district.

It is impossible to give the extent and thickness of this dioritic intrusion, as it is too poorly exposed. In fact, I am led to infer the presence of an extensive diorite intrusion, more from observations at other places, as Zacatecas and Etzatlan, Jalisco, than here. At these localities the so-called Guanajuato conglomerate has been penetrated by diorites and well exposed by erosion. Near the intrusion, the phases of alteration and metamorphism have formed rocks precisely similar to many of the La Luz schists. The age of this intrusion is probably about the same as some andesitic intrusions which came before the later rhyolites, but later than all the other extensive eruptions here.

Bufa Sandstone

Overlying this andesitic agglomerate formation, and conformably is a thin bed of rhyolite tuff. This has been deposited in regular layers, showing the sorting action of water. It has been consolidated into a rock called the Bufa sandstone. This has been extensively quarried for use in the city, and for shipment, as it makes a good building stone, easily quarried and worked. This formation has a maximum thickness of about 40 ft., but pinches out to the east and north of the city of Guanajuato. It extends also about 6 miles to the south of the city and here disappears under the overlying formations. This sandstone is undoubtedly a strictly local formation. This conformity between the andesitic and rhyolitic rocks indicates a country in a quiet stage as far as folding or faulting was concerned, and probably a slowly sinking one.

Pinguico Rhyolites

Following this Bufa sandstone is a series of eruptions of rhyolitic breccias called the Pinguico rhyolites. This is an exceedingly important formation, as it is the repository of some of the largest and richest orebodies of the district; notably those of the Pinguico mine. This formation has a thickness of about 3000 ft. at the mine, but thins out rapidly to the east and north; to the south the formation is of unknown extent. The rock itself is a very acid rhyolitic breccia, which has been consolidated into a rock showing only traces of its original brecciated structure and hardly distinguishable from an original massive rhyolite. One thin bed at the extreme base of this formation is different; it looks like an eruption of volcanic bombs. Near the top of the formation the material becomes more and more tufaceous, and is not as much consolidated as the lower beds. These rhyolitic breccias are perfectly conformable with each other and with the underlying Bufa sandstone, thus proving a continuation of the quiescent period.

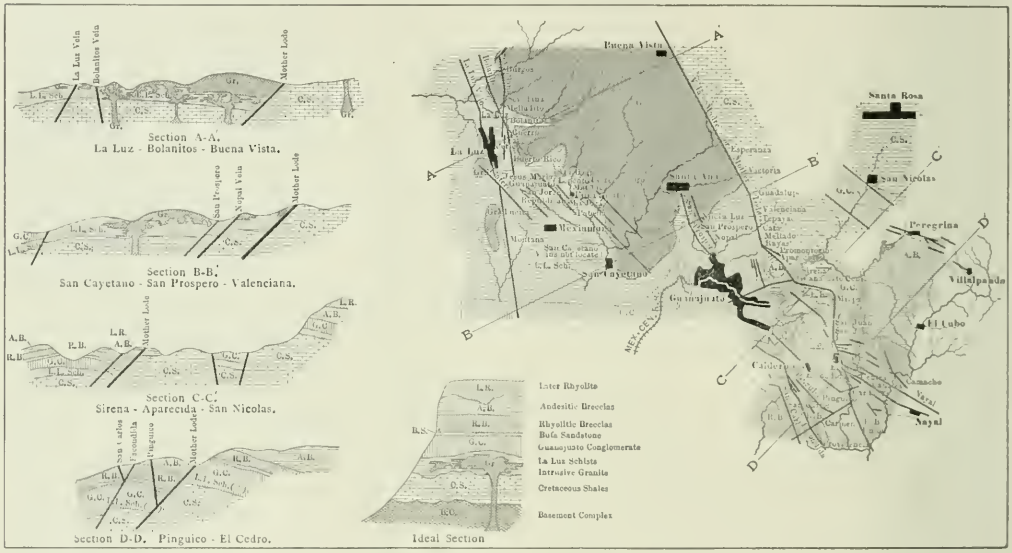
Andesitic Tuffs and Breccias

Following the Pinguico rhyolites is a series of andesitic breccias and tuffs which have overlain the country to a depth of about 3000 ft., reaching their greatest development to the south of the city of Guanajuato. This formation was made by innumerable small eruptions, or a closely continuous great eruption, as the beds are very thin and of great numbers. Among these are several tufaceous beds forming probably 10 per cent. of the formation, called the Calderones tuffs from a small town of that name in the district. These tuffs and breccias have been consolidated, but not very thoroughly, leaving a soft, porous rock which has later been very much altered by decomposition. They have not produced much ore, being as a general thing above the ore-bearing horizon, and in most of the district entirely eroded.

Between this formation and the Pinguico rhyolites is perfect conformity, except in a few local instances, where there is a sudden thinning out of beds, and a general disarrangement as though these were small local areas which were near the level of the sea. The general regularity of this formation shows the continuation of the period of quiescence, and the above local unconformities indicate, I think, the slowly sinking sea bottom with the occasional local area building up near the surface of the water.

This formation contains many intrusions of massive andesite in laccoliths and radiating sheets and dikes. These cut through the underlying formations, but their principal development has been in the andesitic breccias. These intrusives seem to have had absolutely no influence upon the ore occurrences.

Following these breccias came a period



GEOLOGICAL MAP AND CROSS-SECTIONS OF THE GUANAJUATO DISTRICT, MEXICO

of uplifting and subsequent erosion. There were two principal uplifts, one, the smaller and probably the older, which passes about through La Luz has an east and west axis. The other, or principal anticline, has a northwest and southeast axis and passes from just west of Pinguico toward and about through La Luz.

Later Rhyolites

After this uplifting came many eruptions of rhyolite tuffs and breccias and some massive flows which are called the Later rhyolites. These lie unconformably over the older eruptives. Erosion has removed practically all of this formation, the only exposure left being on the top of Chichindaro mountain. East and north of Santa Rosa, however, the formation still remains, and is several thousand feet thick. The rocks are generally normal rhyolites, but show a tendency to grade into trachytes and dacites in local areas. In some of the extreme northeastern parts of the district are a few recent, small eruptions of a black, usually cellular olivine basalt.

Faulting

The faulting in the Guanajuato district has been extensive and is complicated in sections. In a general way, there are three well defined systems of faultings, of which the first two were closely contemporaneous. The main system or Mother-lode system, probably occurred by relieving the strains caused by the settling of the uplifts already mentioned. These faults form a parallel series, with a strike of north 20 to 40 deg. west and a southwesterly dip varying from 45 to 55 deg. The movement on this series has been very extensive, probably 6000 ft. or more, of which the Mother lode has given about 3000 ft. These are all normal faults and have always moved to throw the bulk of the uplift downward. These are not simple faults, but rather zones of faulting, which, in some places on the Mother lode, are as much as 300 ft. wide, and show as many as five distinct large slips, and a multitude of smaller ones. This faulting occurred through a long period of time, during the latter part of which the mineralization was in progress.

The second system of faulting has an average strike of about north 60 deg. west, and is usually nearly vertical in dip. This, I think, occurred to relieve minor strains along the first large system of faults and is necessarily of the same age, or slightly later. They usually intersect the Mother-lode system at angles of 30 to 60 deg. In any one part of the district this system of faults is usually parallel. Of course, all these faults do not conform exactly to the above two systems, as any local conditions affecting the strains or resistances of the rock-mass would cause local variations in the faulting. The two notable exceptions to the general systems are the Bolañitos and San Carlos veins. These are parallel to the Mother-lode system, but have an opposite dip.

The third system of faults was much later than the others and displaced them both. They are of very little importance, as they are few in number and are not sufficiently mineralized to be of value. The largest known is the Cardones fault with a displacement of about 300 feet.

History of the Vein Formation

As far as it goes, a description of the faulting in this district is a description of the veins, as the ore-bearing solutions have invariably followed the lines of fracture and faulting. The ore deposits are invariably replacements of the country rock with a very little open-cavity filling. These replacements are localized along the crushed zones and the intersections of the faults, and have extended into the wall rocks where the conditions were favorable. The history of the vein formation in the district has been: (1) The formation of fault fissures with the accompanying brecciation and grinding along the walls. Without these fault fissures giving an outlet to the deep-seated solutions, the mineralization of the district would have been impossible. (2) The ascending of the mineral-bearing solutions and the deposition of mineral by replacement in the most favorable localities. (3) A further faulting, some brecciation of the vein-filling already deposited and a continuation of the ore deposition.

These lubrications show a succession of periods of comparative quiescence followed each by a resumption of the faulting and brecciation. This has been accompanied by changes in the composition of the mineral-bearing solutions. I have not worked out the succession of these changes, but in general the principal ores occur in the first; the latter are highly silicified and contain low-grade ore. Amethyst quartz and part of the calcite were among the last minerals deposited.

Ores

The ore contains gold and silver in varying proportions; the gold content is about one per cent. of the silver. The silver is almost entirely in the form of argentite and usually intimately associated with quartz. In some of the mines there is occasionally a little pyrargyrite and proustite and some of the rarer silver minerals; in some of the upper workings the chlorides and bromides are found. The gangue is quartz and calcite; other minerals occur only rarely; pyrite is quite abundant. Of copper, lead and zinc, only traces are found. The ores, except locally and near the surface, show no signs of secondary concentration or even of oxidation.

Ore Deposits and Influences of Wall-rocks

The ore deposits are found impartially in all of the formations, but vary in character according to the wall-rock. In the shales the orebodies are usually a mass of stringers or *ramaleos* running in all directions through a brecciated mass of shales which are in all stages of replacement. The principal orebodies are usually where these stringers have united and form a solid mass of vein matter. In the La Luz schists this same occurrence of *ramaleos* is very characteristic. The ore in some of the stopes seems to be merely a zone of these stringers although the principal orebodies are usually in the harder quartz. In the conglomerate the veins are harder with usually higher gold content. Replacement seems to have been slower and more difficult in this rock except where it had been thoroughly brecciated.

In the Pinguico rhyolites the solutions seem to have found a rock especially adapted to the action of replacement. The ores here are the clayey remains of the feldspar with quartz and usually high in silver and gold. In places the original walls of the vein are destroyed and the mineralization has extended into the country-rock until it is only by sampling and assaying that the limits of ore can be defined. It is in this formation that the large orebodies of the Pinguico and Carmen are found.

In the overlying andesitic tuffs and breccias very little ore has been discovered. This is due, principally, to the fact that this formation lies very high in this district and that most of the orebodies simply did not rise to this horizon.

The granite seems to have been too hard and tight to have allowed of the formation of strong veins. The diorite intrusions in other parts of Mexico have been exceedingly favorable for the formation of ore.

Genesis of the Ore Deposits

I am inclined to place the cause of the anticlinial uplifts to an extensive intrusion of a dioritic magma which had its central mass near La Luz. This probably caused some of the extensive metamorphism which has so markedly affected the La Luz district. The weight and subsequent settlement of this intrusive mass probably caused the breaks and faulting parallel to the Mother lode. The unequal temperatures of the intrusion and the surrounding rocks would tend to create a circulation of the underground waters toward the intrusion, and thence upward through the fault fissures. These waters under the great heat and pressure would take into solution, in the order of their solubility, whatever metals or minerals they came in contact with. As these solutions rose through the fissures they gradually cooled and the pressure decreased, thus lessening the solvent power of the water; the more insoluble burdens were deposited in place of the more soluble materials they came in contact with. The first solutions were highly alkaline and showed a strong tendency to replace

the quartz-bearing rocks with which they came in contact, as in the Pinguico mine, and other deposits in the rhyolites. The later silicious solutions were probably the final result of the granite intrusion, as was also the continued faulting and brecciation of the previously deposited vein matter.

In a general way, I think the above is a correct explanation of the genesis of the ore deposits here. I am led to feel very certain of the assumed dioritic intrusion from observations at other camps, mainly at Zacatecas where the Guadalupe *arroyo* has cut across both the conglomerate and the intrusion. The metamorphic products are exactly the same and the gradation rocks the same as at La Luz only on a very much smaller scale.

Several books might be written here on the details of the metamorphism, faulting, and ore-occurrences, etc., but I think the above article gives a general idea of the district without being of undue length.

The American Prospector in Mexico and His Problems

By Thorington Chase*

The same spirit that launched the overland prairie schooners upon their long western journey in 1849, somewhat modified by reason and caution, is today sending prospectors into Mexico in great numbers. The majority of these are young men fresh from the mining schools, and it is chiefly for their benefit that this article is written. A minority are older men, hardened by years of experience in the mining districts of the West, and inured to many of the hardships encountered in Mexico's mountains. As a rule, they have acquired enough Spanish to enable them to conduct their affairs without the aid of an interpreter, and to handle peon miners where necessary. Moreover, they find no difficulty in adapting themselves to the rugged conditions of Mexican life as they require no luxuries, and but few of the necessities.

A good working knowledge of the Spanish language is one of the requisites for a successful young mining engineer in Mexico. Many of the young graduates whom I have met do not possess this. The legal proceedings incident to the denouncement of mineral claims, while simple enough in themselves, will not only involve one, ignorant of the language, with cunning lawyers, but will often lay him open to extortion. A brief summary of the Mexican mining laws will show the many pitfalls for the unwary.

Mexican Mining Laws

The Mexican mining claim, or pertenencia, is 100 m. square. Five pertenencias, slightly exceeding in area the American mining claim, is usually the minimum denounced, although in the richer auriferous district, single pertenencias are held and worked. The law permits denouncements of mineral claims on either public or private domain, but in the latter case, prohibits the use of standing timber, or of other superficial resources. Reasonable ground for dump and mine bulidings may be arranged for with the land owner, at assessed value, or in case of his refusal, can be condemned for that purpose by due process of law. Building stone, oil, coal and placer ground are held as the inalienable property of the land owner, and hence cannot be denounced on private lands. Further changes in this law are looked for shortly.

Locating Claims

After locating mineral, the prospector first makes out his application. This must give the general location, stating what ground is wanted, its shape, and the direction of its boundary. This application is then filed in duplicate at the Oficina del Timbre (to be found in every mining district), and with it must be deposited $5 for each pertenencia, if the number be 25 or less. For denouncements of over this number of contiguous deposits, $3 per pertenencia is required. A 50c. stamp must be affixed to the original application, irrespective of the number of units of land applied for.

It is important that the prospector name the surveyor whom he has engaged for the subsequent survey, for in case no one is named the Government is obliged to appoint someone within eight days, and this apointee may prove unsatisfactory to the prospector, or may charge exorbitantly for his services. Forty days are allowed for the prospector to complete his survey and draw the plans for the same. Prominent and well known natural monuments, such as the highest neighboring peak, must be used in describing the survey, and all adjacent claims and "free ground" clearly shown and marked upon the plan. During this period the prospector must also publish a notice of his denouncement in the official newspaper of the state in which his claim is located.

Plans and survey records must be filed in triplicate (one copy being returned later upon grant of title), and the same remain with the local mining agent for a period of four months from the date of filing of the application, upon the expiration of which either the title is assured, or the application rejected. Upon receipt of the title the prospector is called upon to pay $1 for each pertenencia if the number be 25 or less, or 50c. per pertenencia if the number exceeds 25. A yearly tax of $5 for each pertenencia is exacted, being payable in equal instalments every four months.

The expenses incident to several denouncements, as well as the initial outlay in mining operations, are high, and the graduate, trusting to technical education to make his way as a prospector in Mexico, and thinking it easy to secure a good position in one of the numerous centers of Mexican mining industry, is liable to find himself stranded and lucky to secure a position carrying with it probably $50 gold per month. As a rule experience, rather than theory, is the qualification for the mining engineer in this country.

However, the opportunities for the young American mining engineer in Mexico are great. The vast deposits of calamine, only so recently recognized, the wealth of gold, silver, lead and copper, plentifully scattered throughout the states of the republic, are but in the infancy of their development along modern lines. The prospector, however, should be equipped with a knowledge of Spanish, and, above all, capital is required to develop any property. The prospector usually overlooks this most important point.

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Energy of the Blow in a Coal Puncher

One of the most important factors which determine the energy of the blow struck by the pick of a coal puncher is the rate of admission of air to the cylinder. In the usual type of compressed-air machine the admission of air is subject to restrictions of delivery from the various channels, such as valves, pipe or hose leading to the machine, etc. The ports must, therefore, remain open an appreciable length of time in order to permit the air to flow into the machine, and the forward stroke is accordingly retarded. The energy of the blow which is due to the speed and weight of the striking piston is expressed in mechanics as follows:

$$\textit{Energy of blow} = \frac{m\,v^2}{2\,g},$$

in which m is the weight of the moving body, v the velocity and g, 32.16.

The manufacturers of the Pneumelectric machine claim a more powerful blow than that of the ordinary compressed-air coal puncher by reason of a more rapid admission of air and a stroke of higher velocity. From an examination of the formula it will be seen that with the same weight in pistons, the energy of the blow mounts rapidly with an increase in velocity, thus the blow is 50 per cent. more powerful with only 22½ per cent. higher velocity, or 25 per cent. more powerful with 12 per cent. more velocity. This higher piston velocity with a given quantity of air, and reduction of compressed-air transmission losses are among the claims put forward by the manufacturers for the higher efficiency in the Pneumelectric machine

Cyanide Lixiviation by Agitation

By Walter M. Brodie*

After it has been established how fine an ore or product has to be ground in order to liberate the mineralized metals, the next point is how to treat the ground pulp. Generally the ground ore cannot be leached by percolation because it contains too much clay or slimes, and cannot be treated by agitation because it contains sands. It has, therefore, to be classified into sands for percolation and slimes for agitation.

Percolation is a comparatively cheap process, but it is slow and in large vats, especially when the ores are rich in silver, often gives irregular results, owing principally to the uneven distribution of the fines among the sands, which produces an uneven circulation and a lack of aëration. When, after a certain number of days or weeks, the extraction stops, almost always the assays vary in different parts of the vats, and the lower layers of the leached ore in the vat are considerably richer than those near the top. This often necessitates repeated shoveling over and re-leaching.

Agitation, as generally performed with centrifugal pumps and mechanical stirrers is expensive and not always thorough, as the coarse slimes, or rather the fine sands contained in the slimes, settle in some parts, fail to be stirred and, therefore, do not give up their gold and silver.

Now any ore which can be cyanided, either sands, slimes or concentrates, will give up its gold and silver quickest if it be well shaken up. This can be done most effectively in a revolving barrel, because there every particle of the mass is put in motion and the surfaces of each are being scrubbed clean continuously. A barrel plant, however, unless it be for concentrates or for very rich ores would be too expensive for a large tonnage. Very likely, however, in course of time when the tube mills become out of date for fine grinding, the shells of the old tube mills will be used for cyaniding concentrates.

The Pachuca Tank

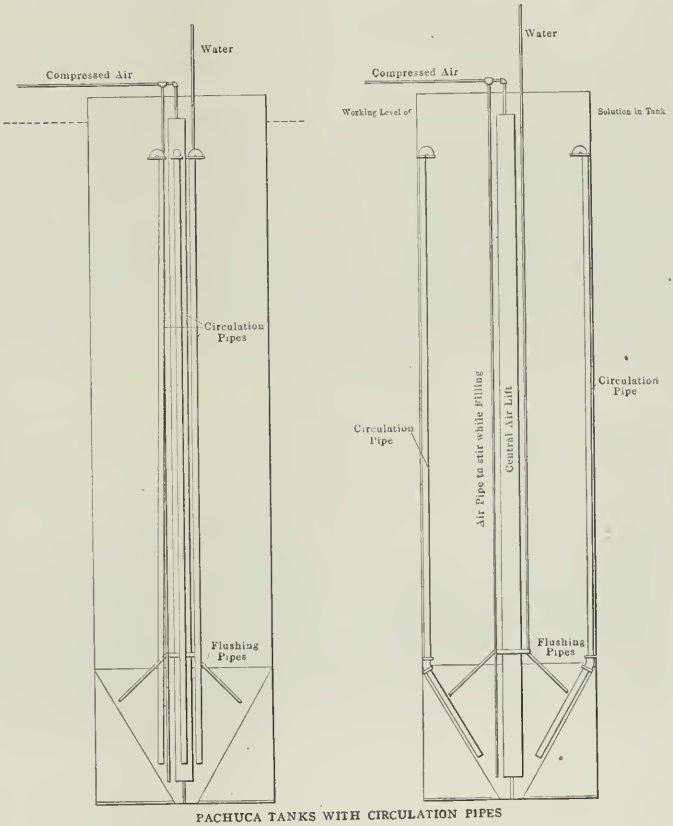
The next best mode of stirring and one which is finding favor rapidly, is the agitation by air through a central air lift in the high cone-bottomed or Brown tank, introduced in Mexico under the name of the Pachuca tank. Like any other, this process has its limitations, but on account of its simplicity, comparatively low cost and great scope it very likely will be generally adopted.

The air introduced at the bottom into the central lift tube throws up or blows out a part of the column of water contained therein and this establishes a strong upward current if the liquid on the outside of the lift pipe has free access to the bottom. When thin slimes are being worked this will generally be the case, but when the bottom of the tank is filled with anything that impedes quick filtration, say, with a heavy bed of fine concentrates, or with a settled mass of ground ore containing vein clay and sands, the circulation is apt to give trouble. To avoid this trouble the circulation pipes, shown in the sketch, may be used with great advantage. These pipes lead solution from above to within so short a distance from the entrance of the lift that the surplus pressure of the column on the outside of the central lift pipe must wash away instantly the accumulated material below their lower openings. In a tank in which the material has settled, as soon as the air is turned on, the liquid passing through them clears away everything in the apex of the inverted cone and allows the accumulations to sink down; and as the pipes furnish constantly a free supply of liquid, they regulate the quantity of the heavier accumulations. As soon as the cone is clear they stop the fast flow, ready to furnish water for flushing as soon as there is any obstruction from accumulations. With these pipes, sands can be circulated, and the circulation will keep up, even if the sands are so heavy and abundant that the cone never gets clear.

Details of the Improvement

The combined area of the circulation pipes should be about one-half of the area of the lift pipe. They can either be fastened to the lift or they can be fastened to the outside wall of the tank. The latter arrangement has some advantages.

The most effective point of discharge depends somewhat on the material, but varies from 6 to 18 in. above the entrance to the lift according to the size of the tank and the material to be treated. Three or four pipes may be used, according to the number of braces with which the lift pipe is attached to the tank. The circulation pipes bring the water from the upper part of the tank. Their upper end should be fitted with return elbows so that stuff loaded into the tanks, or the coarse settlings thrown up by the lift may not fall down the pipes. The great advantage of the circulation pipes is that a much larger proportion of sands can be stirred effectively than in any other of the customary



PACHUCA TANKS WITH CIRCULATION PIPES

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agitation vats; that even concentrates can be effectively put in motion and that starting of the movement takes much less air and much less power than when a heavy and thick mass has to be put at once into circulation.

Any cyanide expert will admit that an effective and cheap way of stirring and scrubbing sands will not only accelerate the extraction of their gold and silver, but also will save chemicals, reduce the size of the plant and cheapen the process. The tendency in cyanide practice has lately been toward sliming everything, but sliming everything is expensive. If once the sands are ground to such a size that they disclose their gold and silver, it is cheaper to wash them than to grind them fine into slimes. The extraction of silver and gold from concentrates is at present a matter of much experimenting. As a thick bed of fine concentrates does not filter, the circulation pipes in an air-lift tank may often produce the required agitation, which without them it might be impossible to maintain.

Borax in Assay Fluxes

By J. E. Clennell*

Experimental work carried on throughout a period of six months on a typical free-milling ore presenting no special features of difficulty led me to form certain conclusions regarding the use of borax in assay fluxes. The investigation was undertaken mainly on the following grounds:

(1) The fluxes previously used in assaying this particular ore had not given entirely satisfactory results.

(2) Statements had been made that the use of borax as an assay flux is liable to give rise to serious losses. It was thought worth while to test the latter point experimentally on a quartzose ore practically free from base metals except iron.

The iron was present almost exclusively as oxide, in varying amount.

The chief points noted in the course of these tests were the following:

(1) The use of a large excess of borax has a tendency to produce a hard stony slag very difficult to separate from the lead: when touched, especially with a sharp instrument, it sometimes flies to pieces with explosive violence or suddenly crystallizes in radiating needles; a film of lead almost invariably breaks off the button and adheres to the slag. This detached lead can only be recovered with much labor and some portion is probably always lost in hammering out the buttons.

(2) When no borax at all is used in the flux, the button separates absolutely clean from the slag, so that in some cases it can be cupelled direct without even hammering out. While cooling in the molds a scum rose to the surface, which on closer examination was seen to consist of a network of straw-colored crystals, evidently resulting from some constituent of the ore which remained unfused in the absence of borax.

(3) The presence of borax made the charges distinctly more fusible and gave, usually, a clear greenish slag. By using a small quantity of borax in the charge, not exceeding 5 to 10 grams per a.t. of ore, it was found that a uniform fusible slag was produced without any noticeable amount of the scum, and that the buttons could be detached from the slag by a slight blow, without any portion of lead adhering to the slag.

(4) The slag became more deliquescent as the proportion of borax was diminished. This deliquescence is a disadvantage only when hammering out is delayed for some cause or other, as when a batch of assays is left in the molds overnight.

In a series of tests, one assay of each sample was made with a flux containing no borax, and another assay with a flux as similar as possible, but containing borax. The fluxes were adjusted so that the total weight of the fusion charges and the quantities of charcoal were the same in each pair of assays.

Taking the results as a whole, it may be said that they show no marked advantage either way; they lend no support to the idea that borax carries any appreciable quantity of gold into the slag. Any losses of gold which may occur through the use of too large a proportion of borax seem to be due to mechanical causes, chiefly to the breaking off of small portions of the lead button in the process of hammering out, owing to the adhesion of the lead to the slag.

The addition of a small amount of borax seems, however, to be a slight advantage, perhaps chiefly on account of the greater fusibility which it imparts to the slag.

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Practice in Mexican Cyanide Mills

By Mark R. Lamb*

The accompanying table gives a condensed record of cyanide practice in Mexico as exemplified in the equipment of the principal metallurgical plants using this method of extraction. The data covers the operations of over 20 leading establishments, and it is interesting to note the steady advance of certain of the newer features of cyanide practice.

TABLE SHOWING MEXICAN CYANIDE PRACTICE.

Name.	In Solution.	Stamps.	Chile Mills.	Tube Mills.	Sand Concentration.	Slime Concentration.	Mechanical Agitation.	Air Agitation.	Tall Tanks.	Decantation Wash.	Vacuum Filtration.	Pressure Filters.	Authority
El Oro	X	X		X			X			X		X	Rhodes.
Dos Estrellas	X	X		X			X			X		X	Rhodes.
Mexico	X	X		X			X					X	Guthrie.
Esperanza	X	X	(c)		X			X		X			Howard.
San Rafael	X	X		X	X			X	X		X		Empson.
San Francisco	X	X	(d)		X			X	X		X		Grothe.
Loreto*	X	X	X	X	X	X				X	X		Sherrod.
Guerrero*	X	X	X	X	X	X	X			X	X		Sherrod.
Perigrina	X	X		X			X	X		X			Empson.
Pinguico	X	X	X	X		X		X			X		Empson.
Gto. Reduc. Co.	X	X		X	X		X			X	X		Van Law.
Gto. Cons	X	X			X		X			X		X	MacDonald.
La Luz	(a)	X		(a)	X			X		X	X		Adams.
La Union	X		X			X		X	X		X		Narvaez.
San Matias	X	X		X	X	X	X	X		X	X		Rhodes.
Natividad	X	X		X				X	X		X		Friberger.
Lluvia	X	(b)	(c)	X	X	X	X			X			Lamb.
Dolores	X	X											Newcomb.
Chinipas	X	X			X		X				X		Lamb.
Rio Plata	X	X	(f)		X	X		X	X		X		Lamb.
Veta Colorada	X	X		X				X	X		(g)		Allen.
Virginia & Mex.	X	X		X	X			X			X		Scobey.
El Bote	X		X					X	X		X		Pattinson.

* Cia. Minera de Real del Monte y Pachuca.
(a) Projected; (b) Nissen; (c) Huntington; (d) Boss Regrinding; (e) Lane; (f) Pans; (g) Ridgway.

The following figures on the costs of battery and cyanide work in western Australia and on the Rand are taken from the *Aust. Min. Stand.* of Dec. 9, 1908: West Australia—Golden Ridge, milling, 2s. 7.61d. per ton. Ivanhoe, milling, 2s. 11.29d. Associated Gold Mines, milling, 1s. 11.15d.; agitating and cyaniding, 1s. 6.35d. Great Boulder Proprietary, cyanide mill expenses, 3s. 1d. per ton (2000 lb.), sulphide mill expenses, 7s. 6d. Sons of Gwalia, milling, 4s. 7.19d.; cyaniding sands, 2s. 0.78d. Lake View Consols milling, 1s. 8.07d.; cyaniding concentrates, 4.74d.; cyaniding by agitation, 2s. 8.09d. Rand—"Witwatersrand," milling, 1.541s.; cyaniding, 1.632s per ton. New Riettontein Estate, milling, 1.094s.; cyaniding, 2.632s. New Unified, milling, 2.345s.; cyaniding, 1.549s. Consolidated Langlaatge, milling, 2.454s.; cyaniding, 1.250s. Van Ryn, milling, 1s. 9.503d.; cyaniding, 1s. 9.067d. Meyer and Charlton, milling, 2s. 5.469d.; cyaniding, 2s. 2.745d. Roodepoort United Main Reef, milling, 2s. 0.842d.; cyaniding, 2s. 9.218d.

Battery and Cyanide Costs

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A Trip Through Northern Durango

By C. N. Nelson*

In the spring of 1908 I had occasion to make a trip through northern Durango. The roads to Indé, Guanacevi and Magistral from Rosario are shown in the accompanying sketch map. They are all wagon roads in more or less good shape, though the road to Guanacevi is only open for wagons as far as Tule.

From Rosario it is an easy ride to Los Sauces where one can put up for the night and reach Indé early the next afternoon. A wagon with relays of mules can make the trip in one day, but with saddle animals it is unwise to attempt it. Indé proper is a quaint little town nestled in a narrow valley. It is the commercial center of the surrounding agricultural country, and is about 6 miles from the mines.

The mines of the Indé district are all situated in a ring about a great *bufa*, or butte, which rises out of the low hills like a huge monument. On the northern slope are the Terrible and Guadalupe gold deposits; to the east, Los Colorados and other silver, lead, and copper veins; to the south, the Mina de Agua and several other lead-silver mines. There is practically no known mineral ground in the surrounding country farther than 4 or 5 miles from the Bufa.

Mines of Inde

The Terrible mine of the Indé Gold Mining Company has a compact little plant, mine and cyanide mill, and treats 50 tons and upward per day. The ore occurs on a contact between porphyry and a great limestone reef which cuts across the country and can be traced for 5 or 6 miles. The ore is very silicious and is said to average at the mill about 1 oz. gold per ton. The mill saves about 85 per cent.; and the mining costs are about $2, and milling about $5 per ton.

The adjoining mill of the Guadelupe Consolidated Mining Company is an extremely simple plant with no machinery except in the crushing department, but making the same saving as the Terrible mill. The two companies have a quantity of ore blocked out, 30 ft. wide in places, said to average 0.5 oz. gold per ton.

The other mines of the district are not as far advanced as these two, but one or two look promising. Transportation difficulties are holding back the development of the camp. The Indé Reduction Company, about two miles south of the Guadelupe, has a 125-ton copper stack which is run intermittently on custom and company ores. The company ships 13-per cent. copper matte to Rosario, at a cost of $10 per ton; coke on the return trip costing $7.50 per ton freight. The coke is said to cost $35 per ton delivered; wood, $2.50 per cord, and the smelting cost comes to about $14 per ton. The scarcity of copper in the ores and the high freight costs keep the operations on a small scale.

El Oro and Guanacevi

From Indé to El Oro is about 18 miles over an old wagon road. This camp was once the center of mining in the district, but now there are no mines operating nearer than Magistral, three miles farther on. Here the Lustre Mining Company has been operating for about 25 years, owning now several mines and a 200-ton smelter. The company has three 36x168-in. furnaces with a charcoal gas-power plant. The ores are concentrated about 20 to 1, and the 15 per cent. matte, high in gold, is shipped through Rosario. The coke costs $25 per ton, which includes the wagon freight on the matte shipped out. The average price of labor here is 75c. per day. The plant was not running at full capacity.

The old Wilson wagon road between Guanacevi and Jimenez passes through

MILL, GUANACEVI COMPANY, LTD.

MINES AND MILL, SAN PEDRO, GUANACEVI

SMELTERY, MAGISTRAL, DURANGO

TERRIBLE MILL, INDE

*Mining engineer, Buffalo, N. Y.

El Oro. The trip from there to Guanacevi is made in two days, a 20-hour ride, passing the ranches of Tinaja and El Pueblo, to Zape on the present route for wagons from Guanacevi to the railroad at Tepehuanes. The country is rough and heavily wooded. The *rancheros* bring in all sorts of ore samples, a few of which look promising.

Guanacevi is an old mining camp, a monument to the faith of stockholders. Passing up the arroyo toward San Pedro, one sees the ruins of plants of almost every known process for the extraction of silver, from the patio through chlorination, pan-amalgamation, smelting and cyaniding. There must be at least 30 plants idle or in ruins, representing the outlay of an enormous capital. The boom days were in the early nineties. Guanacevi contains a great number of narrow veins; most of these consisting of a silicious vein filling with high-grade pay streaks of argentite, ruby silver, and a little native silver. Some of the veins are wider and contain zinc and lead sulphides, running lower in silver. A few small shipments have been made running as high as 1500 oz. silver, and perhaps 20 oz. gold per ton, but such are rare, and from 150 to 300 oz. silver is the usual assay of the shipped ore. All below 30 oz. is generally left on the dump.

The Guanacevi Company, Ltd., is operating some of the former good producers, and is employing about 250 men. The company has modified the old mill and is running it with the cyanide process, on heads of about 30 oz. silver.

Other Mines in the District

About five miles northwest of Guanacevi is San Pedro, a level valley where the Mexican Consolidated Mining and Smelting Company has its mines and mill. A 100-ton concentrating plant has been running more than a year, shipping high-grade concentrates and impounding the tailings. After considerable experimenting, a 200-ton cyanide mill has been erected to re-treat the big tailings dump with a certain proportion of fresh ore. The plant is modern in every particular. Everything is to be slimed through tube mills.

Two or three small mines are running successfully under Mexican ownership, and some of the old producers are working in a small way under lease. Several of the larger mines are almost hopelessly tied up in litigation, and others by disagreement among the stockholders.

One or two small mills are buying custom ore, charging $10 per ton treatment, and paying for 70 per cent. of the silver and 50 per cent. of the gold. They probably save about 80 per cent. of the silver and most of the gold. Until the start of work in San Pedro, the camp averaged for a number of years, perhaps 20 tons of mill ore daily and $250,000 of shipping ore a year. The charges on shipping ore run about as follows: smelter, $8 to $10 per ton; wagon freight, $12.50; and railroad freight $7.50; a total of $30 per ton. Labor costs from 75c. to $1 per day. The camp is really a high-grade one with consequent low tonnage.

Returning by direct route to Rosario, one travels over a wagon road which could be repaired at small cost. Tule is the half-way stop, near which the road to Carmen branches off. This camp was once active, but is dead at present. Guadelupe y Calvo and Topia are west of Guanacevi, and are still too far from a railroad to be very active.

Railroads to enter the district are possible from two sides of both Indé and Guanacevi. The most likely to reach Indé is one from Las Cruces, giving a direct line to Torreon; while the International is likely to build up from Tepehuanes, or the Parral & Durango down from Mesa Zandia.

SKETCH MAP, NORTHERN DURANGO, MEXICO

In *Dingler's Polytechnisches Journal* for Sept. 15, Professor Freytag, of Chemnitz, expresses the opinion, as abstracted by the *Min. Journ.*, that turbo-compressors are superior to piston machines in point of oil consumption and simplicity of attention, and also because there are no moving parts except the vane shaft, and no shock or reversal of the direction of force, all valves and valve gear being also dispensed with. An automatic circulation of lubricating oil prevents waste; and since no oil can find its way into the casing, the machine furnishes air uncontaminated with oil. The space occupied is small, and the working speed and the volume and pressure of air can be varied between wide limits.

Mexican Producer Plants

The general adoption of producer gas in Mexican mining operations is well illustrated by the plant of the Capuzaya Mining Company, Parral, Mexico. Here a 300-h.p. Westinghouse gas engine generating unit was put in operation in February of the present year, operating on power gas generated from charcoal. This plant was installed to serve a large group of mining properties at Parral. The National Iron and Steel Company, Mexico City, has also operated a producer gas engine plant for light and power service, and the Cia. Industrial Jabonera at Laguna, Mexico, installed a similar plant in 1906. Another important plant in Mexican territory may be mentioned, that of the Potosina Electric Company, San Luis Potosi, Mexico. This was one of the earliest and the largest installations in this part of the country, the first engines being installed in 1902. Another is that of the Empress Electricita Duraguena, Durango, Mexico, in whose plant is installed 320 h.p. in suction producers.

The *Queensland Gov. Min. Journ.* for Jan. 15, 1909, publishes a formula for a protective coating for cyanide tanks which may, it states, be relied upon. It is made by heating 80 lb. of tar in a water bath at 160 deg. F. until all water is evaporated, and then adding, with constant stirring, 80 lb. of natural cement hydraulic lime. The mixture should remain fluid and be applied hot. No quicklime should be used.

Mining in the Alamos and Arteaga Districts

Review of a Rich Section of Northwestern Mexico where Production Will Soon Be Stimulated by the Operation of New Lines of Railroads

BY GEORGE M. BLOOMER*

The Alamos is the oldest producer, yet withal the least known district in the State of Sonora. It is the southernmost district of the State and is bounded on the west by the Gulf of California, on the north by the Yaqui river, by the Arteaga district on the east, and on the south by Fuerte district of Sinaloa. For 250 years Alamos has been a producer, and the church and mint records credit it with a production of over $500,000,000 in silver and gold—chiefly silver up to 1895. About nine-tenths of the production was made prior to the French occupation in 1864. In 1800 Alamos had 84 producers of record, but the location of only 15 of these *antiguas* is known today. With reference to the silver deposits, it is a question if modern practice and methods together with the recently acquired transportation facilities would not more than compensate for the depreciation of the white metal since these old silver producers were active.

Twenty-six years ago Alamos was 300 miles from a railroad. Two years ago it was 200 miles away with a wagon trail. Up to eight months ago it had an Indian problem—the serious one of the Yaquis. Last year President Diaz called into council the chief of the Yaquis and certain other State officials and in his summary way practically settled the Yaqui question. The district has today a railroad penetrating the heart of the country—Harriman's Cananea, Rio Yaqui & Pacific—putting it in rail touch with the smelting and supply centers of Arizona and Texas, and water communication with San Francisco and supply centers of the west coast.

Divisions of the Alamos District

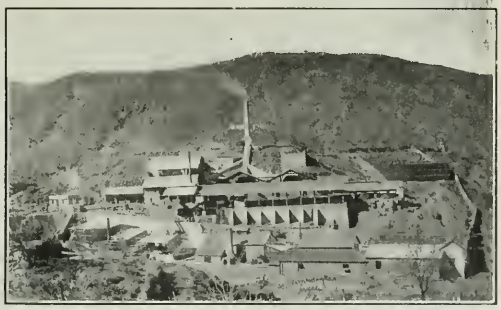
The mineral district of Alamos may be sub-divided into three great belts or contacts running approximately north and south. What I shall call contact No. 1 is the most westerly of these and consists of an intrusive porphyry dike about 35 miles long and from ¾ to 3½ miles wide with the greatest width at Minas Nuevas, 4½ miles west from the city of Alamos, the metropolis of the district. Here is located the famous Zambona mine of which John Hays Hammond was in charge during the earlier period of his career. The Zambona is the most northerly of a group of famous *antiguas* of which the Zambona and Quintera are the only ones under actual operation today. The old mines on the contact, beginning at the southern end, are the Balvaneria, the Promontorio, the Quintera, the Paloma, the Santo Domingo, El Pulpito and lastly the Zambona. The Teresa, a promising prospect, is the north extension of the Zambona.

The Balvaneria has a well defined vein or ledge about 25 ft. wide apparently carrying commercial ore from wall to wall. A crosscut at the 225-ft. level, giving about 150 ft. of backs, shows an 8x8-ft. face carrying a good grade of copper ore with silver as high as 100 oz. and some gold. A crosscut below this which should give 700 ft. of backs is now in about 100 ft. There is no machinery at this mine and the ore taken out was treated at the Quintera plant.

Two miles north of the Balvaneria is the famous old Promontorio mine which was a continuous producer for over 150 years, with a mint record of 46,000,000 oz. of refined silver. Work was suspended on this property in 1895. The American company which bought the Mexican concern in 1905 is now installing a $100,000 plant. The deepest working of this mine is only 750 feet.

Adjoining the Promontorio on the north is the Quintera mine which has been frequently described. A view of the smelter and the mine are shown in the accompanying illustrations. The next mines of importance are the Santo Domingo with workings 400 ft. deep and El Pulpito, with an 800-ft. tunnel from which ore running as high as 5000 oz. in silver has been produced. The Zambona workings are 1050 ft. deep and it is supposed to have produced upward of $10,000,000.

These properties are all situated on the east side of an intrusive porphyry dike at the contact with the granite. There are many old silver-lead mines on the west side of the mountain, among the most important of which are La Paloma and the San Jose which are about one mile west of Promontorio. From the description it will be seen that practically the whole top, both the east and west slopes, of the Alamos mountain is thoroughly mineralized.



QUINTERA MINE AND SMELTER, ALAMOS DISTRICT

Properties on the No. 2 Contact

The No. 2 contact is also an intrusion of porphyry through granite with andesite, rhyolite, dolorite and other igneous rocks appearing at intervals the entire length, a distance of approximately 100 miles. It is about 20 miles east from contact No. 1 and extends from the Fuerte river—near Agua Caliente de Boca—through the foothills of the Sierra Madres, crossing the Mayo river at the Solitral ranch and the Yaqui at Los Hornos. For the entire length one will find hot springs recurring at intervals accompanied by indications of geyser action.

Beginning at the south, there are the following mines in the order named: Jacolitas, with a 20-stamp mill and cya-

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nide plant now in process of construction, the Vaughn placer, El Cobre, Cobre Grande, Sabino Solo, Dulces Nombres and Cerro Colorado—all south of the Mayo river. Continuing north there are the gold diggings at Sobia, copper camps at Baucari and Mojari, near which are the mines of the Douglas Copper Company. Then come the gold mines at Quiriego, where there is a 50-ton cyanide plant, *antiguas* at Balamote, gold mines at La Dura and the Golfo Del Oro.

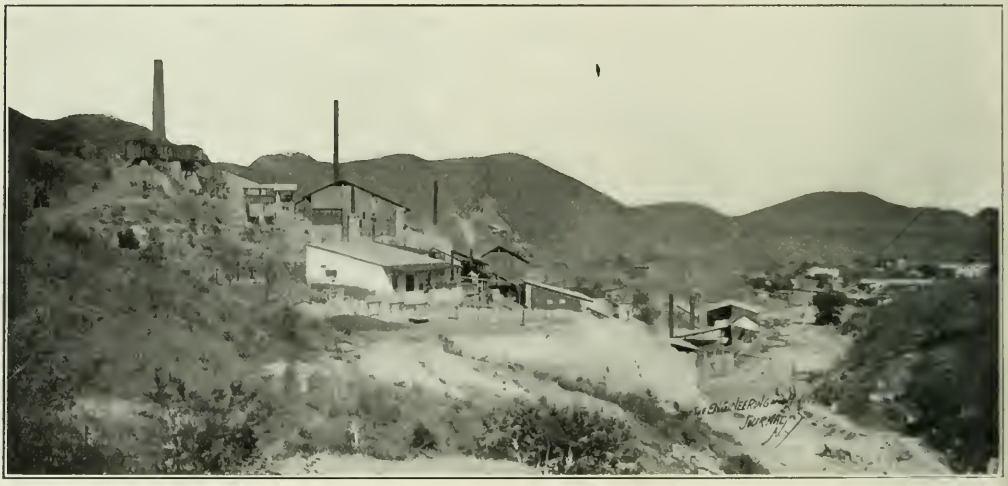
Contact No. 3

Approximately 20 miles east of the No. 2 contact is contact No. 3 which lies just below the crest of the western range of the Sierra Madres and extends the entire length of the Alamos district. It is hidden and broken here and there by overflows of lava and intersections of tufa ledges. Veins are found on this contact embracing a wide variety of commercial metals. At Cerro de la Rosa on the south are outcrops of tin. A little farther north are a series of old mines where are over 100 "townies," or arrastres, and 5 adobe smelters. The western slope of the mountains for 50 miles is a continuous series of old workings with a network of veins as yet practically untouched.

The gold placers at Baboyahui are yielding the operators good returns. From this point north to Muerto on the San Rafael ranch is "tierra incognita," but from San Rafael north to Cienega, as far as I have followed the contact, the outcroppings are noteworthy. Near Cienega lies La Luz where outcrops of cobalt and nickel have attracted attention. There are numerous copper deposits, among which are the Don Juan and others. The mule trail that crosses the Mayo at San Bernardo and follows the general course of the river to the northeast is on low-grade copper ore for two days. Silver and lead ore are found in the San Jose and gold ore in the Yaqui Indian, the Duraznos, and the Jay-Bush Bonanza.

The Duraznos company is now putting in a 20-stamp mill on the Chihuahua side of the mountain and large operations will soon commence at the La Luz, the ore from which will be shipped to Swansea. Like every district having high-grade ore, there are several "lost mines" in this country, among which are the "Tayopa" and the "San Andreas del Oro."

Supplemented by the railroad, the natural facilities for economic mining in the Alamos district should cause a renewal of activities here. Wood and water are everywhere and water-power opportunities are innumerable; for labor they have the Yaqui, the Mayos and the natives of Sinaloa. Between its mineralized mountains and within a radius of 75 miles, it has a soil which will grow bumper crops of almost any man or animal foodstuffs.



ZAMBONA MINE AND REDUCTION WORKS, ALAMOS DISTRICT, SONORA, MEXICO

The Arteaga District, Chihuahua

This district is situated on the east side of Duraznos and Santa Rosa mountains and is drained by the headwaters of the Chinipas, Fuerte, Choix and Setentrion rivers. It will be bisected by the "Stilwell," road, the Kansas City, Mexico & Orient, which lacks about 125 miles of completion through this section. The road is now operated from Topolobampo on the gulf coast northeast to Fuerte, and track is laid to a point near Choix, Sinaloa, near the three corners of Sonora, Chihuahua and Sinaloa. On the east the road is being operated from the city of Chihuahua to Minaca, and rails are being laid for 100 miles farther southwest. The connections will probably be made within a year, opening to the prospector and investor one of the most generally mineralized sections of the Republic.

The work of "Boss" Shepherd at Batopilas has often been described and is already familiar to the readers of the Journal. The producers of Arteaga past and present have a history of over 250 years. Among the prominent ones, are the Palmarejo, Guazapares, Millionaria, Montezuma, Zapote, Rincon la Republica and La Mejicana. In this district there are many mill sites where electrical power might be developed at all times of the year and there is abundant water for milling purposes in the dryest seasons.

About 22 years ago when the nearest railroad was 300 miles away, an English syndicate came to the Arteaga country, a narrow-gage railroad with accessory equipment was packed by mountain trail and wagon road to the Chinipas river and a railroad was constructed from the river to their mines 16 miles back in the mountains at Palmarejo. The power line was run along the river for a distance of 20 miles to furnish the power for the mills. Large dividends were paid and the plant extended from time to time, so that it is today the largest operation in this section. Among the other active properties in the district is the White Chief, which is operating a 15-stamp mill and is to add 20 stamps this year; the Duraznos and Guazapares are each putting in new mills, and it is expected that operations will be resumed in the near future at La Mejicana, and at La Republica. When the Stilwell road becomes operative this will doubtless be a busy district.

The Cananea Consolidated Copper Co. in 1908

Ores and Concentrates Treated and Fine Copper Produced Showed Slight Decrease as Compared with 1907; Cost of Mining $2.13 per Ton

BY L. D. RICKETTS*

The following report of operations of the Cananea Consolidated Copper Company covers the calendar and fiscal year 1908. The figures of production are for the period beginning July 11, 1908, when operations were resumed, to the close of the calendar year:

ORE TREATED AND METAL PRODUCED.

	Tons Wet.
Domestic ore treated	295,554
Custom ore treated	72,088
Total	367,642
Ratio of concentration, domestic ore milled	3.12 tons into 1
Ratio of concentration, custom ore milled	4.02 tons into 1
	Pounds.
Returnable fine copper in domestic bullion	15,679,685
Returnable fine copper in bullion from custom ore	2,939,924
Total fine copper	18,619,609
	Ounces.
Silver in domestic bullion	272,651.24
Silver in bullion from custom ore	175,011.99
Total silver	447,663.23
Gold in domestic bullion	1700.683
Gold in bullion from custom ore	1178.150
Total gold	2878.833

Recovery from domestic ore and other material treated was as follows: Copper, 2.652 per cent.; silver, 0.923 oz.; gold, 0.00575 oz. The value of precious metals per ton of domestic copper produced amounted to $21.09.

The following development work was done during 1908: Shafts, 412.5 ft.; winzes and raises, 3550.5 ft.; tunnels, drifts and crosscuts, 9388 ft.; total, 13351 feet.

The Mines

The following statement covers the tonnages and costs of mining at the various mines:

	Wet Tons.	Total Cost.	Cost per Wet Ton.
Puertocitos	18,465	$41,550	$2.250
Elisa	40,581	71,580	1.764
Capote	15,923	82,089	5.155
Oversight	142,825	272,767	1.910
Veta Grande	91,901	191,992	2.089
Total	309,696	$659,997	$2.131

Puertocitos—No underground work is being done at the present time. The mining at Puertocitos is entirely quarry work, and is done without the use of machines. The face of the mountain is broken down and broken up by hand, and about 30 per cent. of the total rock broken is sent to the smelter and 70 per cent. of practically barren rock is thrown over the dump. The output of this mine has been a little over 3000 tons per month, and has averaged 3.16 per cent. copper, 3.86 oz. silver, and 0.028 oz. gold. It is a nearly neutral ore. We expect to increase the tonnage during the coming year.

Elisa—Owing to the very desirable nature of the Elisa ore and the greatly decreased costs of mining and smelting, we have lowered the grade of ore from this mine and largely increased the tonnage. We are working not only in the lower levels, but also in a quarry and in the old levels and are finding much old filling that is profitable, and a large amount of good ore in place in the old stopes. Upon the whole, the development as far as it has gone at Elisa has been satisfactory and there is every promise of an equal or increased tonnage from this mine. The steam plant has been entirely abandoned and the power is furnished by electric current from our smelter power house.

Capote—During the shut-down an effort was made to put out the fire which has been burning here for several years. We succeeded in putting out most of the fire by filling the mine up to nearly the third level. On allowing the water to subside and starting to reopen the mine, however, we found one small area of fire above the third level which got the better of us and drove us out of the mine for a time. The gases were finally controlled and turned out through No. 9 shaft. It was then found that the old workings were badly settled and new extraction drifts had to be opened in many instances; it was four months before the mine could be got into shape for production. Almost the entire output was made in the last two months of the year, but the cost of mining includes the large amount of dead work we were obliged to do during the four months that the mine did not produce. For the month of December the mining cost was $2.11 per ton. We find that a very large portion of the old filling is profitable, and this is being drawn between the third and second levels. We are also finding large bodies of ore in place which we are working profitably.

Oversight—We have spent a great deal of money in opening up the old upper workings, which had not been worked for the past five years. This portion of the mine has made very little production on account of the difficulty in getting an outlet, but a satisfactory showing has been made in the way of blocking out ore, and in the coming year these old workings will produce a notable output, chiefly of smelting ore. Connections have been made with the main Oversight workings and thence directly by inclined winze to Veta No. 9 tunnel. Through the workings of the mine the grade of the ore has been satisfactory, and we have in the proven ground opened up fully as much ore as we have extracted. We have also opened up new ore in no great quantity but of very satisfactory grade between the third and second levels in the southeasterly workings in block 17.

Veta No. 9 tunnel has been driven ahead several hundred feet and has run into mineralized ground, and connections have been made from near the face of the tunnel with the old workings of the Oversight, as mentioned. We have also found on the Veta No. 9 level a body of ore averaging about 5 ft. in width, which goes direct to the smelting works.

Veta Grande—The Veta Grande is maintaining its normal output of ore both in tonnage and grade. The ore is so silicious that almost all of it goes to the concentrator, but blocks along the footwall are sent to the smelter. This ore is the best concentrating ore that we have at the present time, having a high ratio of concentration and making the highest grade concentrates. We have made extensive developments on the third, fifth and sixth levels. So far the developments on the sixth level have cut no ore. The work on the third and fifth levels has not yet progressed far enough to determine the value of the ground we are prospecting.

Kirk Workings—Nothing was done until the very end of the year, but this mine is now being opened up; shipments were resumed in January, 1909. It is proposed to do a great deal of development work in this locality during the coming year and we expect that the ore already opened will more than pay for this extensive work.

Development Work

Our policy has been to be exceedingly severe in charging the mines with every expense attributable to them, and the mining costs include every expense incurred by the mines, even construction work as well, of course, as development and extraction. For this reason and from the fact that the reopening of the mines required a great deal of attention from the foremen, we did not do a great deal of development work during the first few

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NOTE—Abstract from report of the Greene Consolidated Copper Company for the year ending Dec. 31, 1908.

months, but this work has been notably increased and during the coming year we expect to develop very extensively. This work will be carried on not only within the known limits of orebodies, but we also propose to develop extensively in our great outlying territory which has hitherto received little attention.

During the year S. F. Emmons, of the U. S. Geological Survey, assisted by J. M. Boutwell, L. C. Graton, W. H. Emmons, and other engineers, completed a valuable geological survey of the camp and gave us many valuable data which we will use in future development in new territory.

During the year we attacked four new outcrops that we deemed promising. The first of these is at Pavo Real, about one mile northwest of Elisa. Exposed on the surface are blowouts of copper-stained rock with bunches of high-grade ore scattered through it that contains a trifle over an ounce of silver to 20 lb. of copper. We have started a crosscut tunnel to strike under this outcrop 260 ft. below the surface, and have run about 200 ft. out of a total of 460 ft. necessary to get underneath the outcrop. At the same time we are running an adit tunnel from the Henrietta mine to prospect the ground between the Henrietta and the Pavo Real. In case this very promising territory develops the latter tunnel will come into Pavo Real 160 ft. below the Pavo Real tunnel.

We have on the southeast end of the Capote and the northwest end of the Oversight, as far as developed, highly altered mineral-bearing porphyry that is too lean to work, and we are now prosecuting development work to test the large area of undeveloped territory between these two mines. It also seems probable that the main fault of the Capote passes back of the Oversight, and we are running a number of crosscuts from the Capote and Oversight workings to the southwest to test this ground. Six of these crosscuts have been started on various levels, and the distance horizontally between the farthest of these is about 2000 ft. It is our purpose to carry some of these crosscuts nearly through the mountain for, aside from the possibility of the Capote zone extending back of the Oversight, we know that beyond the hard core of the mountain there is an immense area of soft mineralized porphyry, and it will be necessary to prospect the contact between these two classes of rock.

Mr. Kirk has started an adit tunnel called Veta 15, under a very large virgin outcrop lying southeast of Democrata gulch and about 1000 ft. southwest of the Kirk workings, and ultimately it will form a part of the Kirk mine. At the same time he is driving to develop the same large territory on the third and fifth levels of Veta No. 5 shaft. It is too early yet to make statements regarding this ground further than that we have reason to believe that it is exceedingly promising.

About two miles to the southeast of the Oversight there is a promising cropping on which we have been doing some tunnel work for some time. Altogether we have done over 1000 ft. of work at a nominal cost, and have found porphyry highly mineralized and similar in its nature to the ore-bearing porphyry of the camp. We have struck nothing of commercial value as the copper contents are far too low to be considered as even possible commercial ore. The prospect, however, is a promising one and deserves very much more work.

Mr. Emmons thinks the territory beyond the Elisa mine promising, as we all do. Furthermore, the deeper workings of the Elisa are now 200 ft. below the lowest adit tunnel. We have started the "combination tunnel" on the level of the Capote ore bins which will pass for 3000 ft. through the property of the Indiana-Sonora Copper and Mining Company, and thence through the Elisa mine, tapping the ore 40 ft. below the deepest level. This will give a new and cheaper outlet to the Elisa, drain the mine, and ultimately will extend back to prospect the ground beyond. While we drive this tunnel the Indiana-Sonora company pays one-half of the total cost for the 3000 ft. through its ground.

The Cost of Mining

The cost of mining for the total tonnage mined was $2.13 per wet ton. For the 15 months ending Oct. 31, 1907, it was $3.28, and for the year 1905 1906 it was $3.85. Great credit belongs to the mining department for this showing under most difficult conditions. The reasons for the decreased costs are twofold. First, the slicing and caving system has been thoroughly learned and applied to the various mines in the modified forms which the conditions demand. This has resulted in a decreased amount of timber and supplies and an increased efficiency of the men. The second reason is that the mining department has been entirely reorganized, and the average pay per employee has been decreased by this readjustment very nearly 20 per cent. We have, therefore, a decreased cost per man and an increased output per man. For the period in question the output per man has been increased from 1.2 to 1.6 tons, and this covers not only the miners but the muckers, trammers, blacksmiths, and in fact every employee of the mines up to and including the foremen. It is hard to realize the difficulties that have been encountered in accomplishing this, but it had to be done and was done.

Departing from facts and predicting for the future, I have little doubt that we will be able to maintain and improve upon these costs in spite of the tremendously increased amount of development work we propose to do and we can look to continued decreases in mining costs rather than increases for some time to come, but in saying this I am keeping in mind certain capital expenditures which are exceedingly urgent. This construction provides cheaper compressed air and more electrical power at the mines. You have authorized and we are now installing an air compressor of 6000 cu.ft. of free air per minute capacity at the power house, and will lay a pipe line to four of the mines and replace with this one machine eight uneconomical small machines. Since the reverberatory furnace is generating an average of over 600 h.p. we have a surplus of boilers at the power house and no new boilers are needed, and our power-house condenser is abundantly large to take care of this compressor. In addition to this we are now up to the limit of our electrical-generating capacity and it is essential that we should put in more power for the use of the mines. John Langton, consulting engineer, is now making a study and report on our power equipment and is preparing specifications to be submitted to you. It would appear that with an expenditure of $57,000 we can increase our capacity 1000 kw. and reduce the cost of generating power per kw.-year about 15 per cent. If this unit is put in there is no question but that other capital expenditures will be required because if we can change over our steam hoists at four of our shafts to electrically driven hoists by the addition of the proper motors we can abandon entirely four very expensive steam plants. If the program is approved and carried out it will require a total expenditure of about $120,000. In making this recommendation I have carefully considered the tremendous expenditures that we have had to make and am still keeping in mind the rule of recommending only expenditures that will pay for themselves in one year's operations.

The Concentrators

During the close-down a new and more powerful engine was installed in the old mill and the final addition to the vanner room of the second section was completed. Two new Chilean mills, designed by Mr. Cole, were added to the fine crushing department, and the worn-out rolls were replaced by Mr. Cole's improved rolls which he manufactured here. The timbers of the old mill resting on the masonry foundations had largely rotted out and extensive improvements were made by replacing these timbers and rebuilding the floors.

Since the close-down we have done no pumping from Capote and the pumping operations at the Indiana-Sonora mines have been discontinued. The removal of these two main sources of water from the concentrator was most serious and arrangements had to be made to meet the conditions. We consequently laid a

wooden pipe line from the Cananea Duluth *via* the America, and pumped the water directly from these mines to the Cobre Grande tanks whence it flows by gravity to the concentrator. This line is made up of 3935 ft. of 8-in. and 2800 ft. of 12-in. pipe. We have also developed water in the main arroyo 12,000 ft. below the concentrator and have here installed an electric pump and laid a pipe line partly of 6-in. steel pipe and partly of 8-in. wood pipe, to the tanks at the head of the concentrator. This line now delivers about 250 gal. of water per min. at a cost of about 6c. per 1000. We have also developed all the water possible in Puertocitos creek by a bedrock cut 300 ft. long and a bedrock tunnel 400 ft. long, and have installed a steel flume 5285 ft. in length to bring the water over the divide. An 8-in. wood-pipe line 12,000 ft. long will be laid from the latter flume, leading the water by gravity to the sump tanks at the foot of the concentrator. This pipe line will be completed early in March.

We have also laid an oil line from the main storage tanks to the power-house boilers and installed storage tanks across the cañon from the mills to store fuel oil and from which the amount of fuel oil consumed under the boilers is measured. The cost of all of this work has been charged currently to operations and has tended to make the cost of concentration exceedingly high.

The crusher plant was provided with a condenser and cooling system, part of which installation was made in 1907. During the past year we have designed and ordered the necessary material for a condensing system for the steam plants of both mills, and this will be installed during the coming year.

Recent practice in the southwest has shown that direct-acting pumps are far more economical than centrifugal pumps for lifting the water, and our power costs have become so high for re-pumping that the matter has become acute. We have ordered eight Aldrich triplex-plunger pumps to replace the centrifugal pumps now in use. Some of the foundations were put in toward the end of the year and we expect to have all of these pumps running in a few months.

The Cananea ore is probably the most difficult to concentrate of any copper ore in the country on account of the tremendous amount of clay, which is not only not susceptible to dressing but prevents proper settling of the fine sands. Our losses on this account are high and there are certain losses that we have proved by experiment, we can recover by collecting the fine sands from the large settling tanks below the mill and reconcentrating them. We are now installing a vanner house about 300 ft. in length on the opposite side of the cañon, and will rehandle the fine sands from the tailings over the 40 vanners and 10 Card tables that are being installed therein. In conjunction with this vanner house Mr. Cole has installed settling tanks of approved plan, and it includes, of course, appliances for conveying the concentrates to the railroad storage bins. Later on we propose to double the capacity of this plant. The preliminary installation will cost $50,000 and the additional 50 vanners will cost about $30,000 more. In all of these improvements we have followed the plan of undertaking no construction that will not pay for itself within a year.

The cost of concentration of the domestic ores was $0.94 per ton on account of the immense amount of construction charged to operations but the result will be not only an increased saving, which is badly needed, our present saving being only about 70 per cent., but we can safely see a reduction in cost to 75c. per ton or under. The same care was taken in reorganization in starting up the concentrator with what undoubtedly is very beneficial results.

As is customary with most milling plants in the United States, in past years the tailings have been largely thrown away in the gulches and carried away by floods. I have decided that in the future we will permit no more tailings to go down the gulch, and at present we are building a dam which will ultimately be about 50 ft. in hight and which will store nearly 2,000,000 tons.

The Reduction Division

Space will not permit a full description of the work done in reconstructing in this department.

Receiving, Bedding and Reclaiming—This splendid invention was in the main installed under the management of Arthur S. Dwight, and was designed and constructed under his direction with the assistance of E. H. Messiter, consulting engineer for the Robins Conveying Belt Company. The departure was an entirely new one and difficulties were found in operation. The conception of the bedding system is one of the most brilliant of which I know and the vital portion of the construction has worked to perfection. The receiving end, however, was too limited, and such difficulties were encountered with the proposed feeding device that it had to be abandoned after fair trial. During the close-down additional bins of 3000 tons capacity, with an automatic feeding device, were added to the receiving end, the sampling works were overhauled, and the crushing machinery changed, and an entirely new device for receiving the mixture above the furnaces, and feeding the furnaces was installed. With these changes this system has worked with great economy and most satisfactory results.

Smelting and Converting Departments—These two departments embracing the smelter proper are virtually new; in other words, a new smelter has been built on the old site and nothing remains but a portion of the steel structural work of the main building, which has been reinforced, and the converter runway and cranes, which have been rebuilt. All of the furnaces are new, the feeding device and feed floor are new, the five stands of converters and twenty shells are new, as are also the slag tracks, slag pots, bullion tracks, bullion dock, pumping plant, and so on through the list. In making these changes most careful attention has been paid not only to improved facilities for handling materials but for the comfort, facility and safety of the workmen, and a great amount of excavation work has been done and a great amount of material has been torn out, giving splendid air and light both for the feed floor and the tapping floor and converter bay.

McDougall and Reverberatory Furnaces—The McDougall roasters that were partially installed under the management of Mr. Dwight have been completed and run at sufficient capacity to supply enough calcines to add to the flue dust treated to bring the reverberatory up to its full capacity.

The reverberatory furnace was entirely rebuilt after obtaining fuel oil for smelting. The results obtained have been most satisfactory although we have still much to learn regarding reverberatory practice. The results have constantly improved since starting up and will continue to improve. The waste gases give 50 per cent. as much steam as all the oil would give if burned under boilers.

Power House—The boilers at the power house have been equipped with oil-burning apparatus. One man on a shift attends to the boilers in place of the 18 once employed. In the power house proper a new No. 10 rotary blower with direct-connected tandem-compound engine has been installed. The foundations of all the converter blowing engines have been rebuilt. All of the machines have been thoroughly repaired, and a condensing plant installed that is very satisfactory.

I have made the description of the changes in the reduction division brief in spite of the great sum of money we have spent in reconstruction for the reason that I think a statement of the results will be sufficient. We are running at the present time six furnaces and smelting about the same tonnage we were formerly able to smelt with eight, with two furnaces to spare.

The average daily pay-roll at the smelter, including the power house, was formerly $1823, and during the past six months it has been $763. The efficiency of blast in converting has been raised from 43 to 61 per cent., and the efficiency of blast on the furnace has been raised a corresponding amount.

The reverberatory ran 150 furnace days. It treated 30,275 tons of net dry charge at a cost of $1.83 per ton, allowing a credit of 60c. per ton for steam generated

in the reverberatory boilers. This average is high because the first few months' run was very much more costly than later on and we have recently been smelting for about $1.37 per ton, allowing credit for steam generated. The cost of power has been reduced about 40 per cent.

The accompanying table, compiled from Mr. Shelby's report, shows comparative results for the six months prior to and the six months subsequent to the shutdown, covering the total reduction division costs per ton of ore and old secondaries treated, per ton of new material treated, and per ton of fine copper produced.

COMPARISON OF PRODUCTION AND COSTS.

(Basis per Dry Ton).

	Tons Treated or Produced.		Total Costs.	
	1907.	1908.	1907.	1908.
Ores and concentrates	220,446	164,361	$6.82	$3.86
Net new material	299,620	217,177	5 02	2.93
Fine copper	11,103.288	9,295.769	135 47	68 47

The Railway Department

The railway belonging to the company has been maintained at its usual standard of excellence. It is in splendid condition both as to road bed and equipment, and for a long time to come I can see no important repairs with the exception of a few bridges between Henrietta and Puertocitos. The total mileage, including main lines, spurs and sidings, and including standard, 3-rail, and 36-in. gage tracks, amounts to 51.92 km., or a little under 32 miles.

The operating service of the narrow gage has been reorganized and in spite of the average lesser tonnage for the six months of operation, the total cost of operating has been reduced 25 per cent., and the average cost of hauling all ore has been reduced from 11.9c. to 7.26c. per ton. We are now equipping some of our engines with oil tanks and burners and find a notable increase in haulage capacity and a notable decrease in fuel costs. The equipment is largely new, ample and all in excellent repair and will last for many years.

Fuel Oil

Upon receiving the concession to import crude oil for fuel purposes it was necessary to provide storage tanks. A site was selected at which the oil could be discharged from the railway cars by gravity into storage tanks and from which the oil could be piped by gravity to the subsidiary storage tanks at smelter and concentrator, where the tanks could be placed a sufficient distance apart to insure safety to the others if one caught fire, and where if a tank exploded the burning oil could escape without doing serious damage. Three 10,000-bbl.-capacity tanks were manufactured at Cananea and erected, the necessary piping was completed and oil was got to the reverberatory furnace and to the power house in August. Since then the line has been extended from the concentrator to Veta No. 9 and Capote, and provision made for hauling oil in tank wagons to Ojo de Agua, and storage tanks have been installed at these three localities having an aggregate capacity of over 6000 bbl. At each of the main plants there have been provided two small tanks by means of which we can accurately measure the amount of oil consumed on each shift. The cost of the three large tanks and the pipe lines to the smelter and concentrator were charged to construction, but the other pipe lines and installation were charged to operating expense. A contract was let with the Texas company for fuel oil covering our entire needs for two years up to 35,000 bbl. per month, which is more than sufficient for our consumption during the next two years. We find 3 bbl. of this oil equivalent to one ton of run-of-mine coal, and the saving in labor is notable.

Mining and Beneficiating

Copper costs for six months of operation were as follows:

Gross costs, f.o.b. Cananea		$0 0992751
Freight to New York, export tax, refining, marketing, interest, etc.		0 0168642
Total cost		$0 1161393
Credit for value of precious metals	$0 0105446	
Miscellaneous revenues at Cananea	0.0075206	
		0 0180652
Total cost of fine copper sold		0 0980741
Construction not charged to operation		0 0070583
Cost including every expenditure		$0 1051324

The yield of copper per ton of ore beneficiated given at the beginning of this report is misleading in that during July we smelted a considerable tonnage of cleanings found in tearing out old ore bins and other structures. The actual net yield of the ore beneficiated was 51.25 lb. per ton as against 46.58 lb. for the 15 months ending Oct. 31, 1907. Owing to the decreased cost of smelting we have been able to send leaner ores of the Puertocitos and Elisa class to the smelter with a handsome margin of profit, and we have been able to smelt leaner ores that formerly went to the concentrator. This has resulted in increasing by nearly 50 per cent. the percentage of direct smelting ore to the total ore mined and has caused an increased yield per ton. As a matter of fact, therefore, the average gross copper contents of the ore have not increased even as much as the figures above would indicate. On the other hand, the greater percentage of ore smelted direct has tended to increase the total cost of mining and beneficiating a ton of ore, but with this increase the cost is more than paid for by the increased saving of values.

The following is the total cost of mining and beneficiating a ton of ore, including every cost until the refined products are sold:

Period.	Cost Per Ton.	Tons Beneficiated
Fiscal year 1905-1906	$10 21	947,977
Aug. 1, 1906, to Oct. 31, 1907	7 625	1,305,291
July 11 to Dec. 31, 1908	5 976	295,554

The results show a decreased cost during the six months of 1908 of $1.649 per ton over the previous period, and a decrease of $4.234 over the fiscal year 1905-1906. In other words, had we been able to mine and beneficiate the ore for the 15 months ending Oct. 31, 1907, under present conditions the cost would have been decreased by about $2,150,000 plus the value of the increased saving.

In making a careful and balanced study of the cost of mining and beneficiating ore two years ago the vital features were obvious. It was necessary to get cheaper mining costs, cheaper smelting costs, cheaper fuel, cheaper power and cheaper transportation. While we have made notable advance on the first four items we have been unable to obtain any adequate concessions in the matter of the heavy freight rates on fuel and supplies. We are virtually in the same location as our neighbors across the line when the great distance from the source of fuel, coke and supplies is considered, yet we are charged rates that in the aggregate amount to 1c. per lb. of copper in excess of the rates paid by our neighbors, and the burden is hard to carry. The question is serious, yet we think fair freight rates would mean increased tonnages that give the highest profit to all concerned.

While predictions are dangerous, and I have in this report only given figures from results actually accomplished, I have no hesitation in saying that we shall be able to continue decreasing the cost of mining and beneficiation and increasing the percentage of saving to a notable degree, although we cannot expect to make reductions corresponding to those made during the past year.

It should be remembered that we have been handling a decreased tonnage and it is true that an increased tonnage will undoubtedly lower the cost of beneficiation.

Self-sustaining Departments

The mercantile department received a hard blow on account of the close-down for the reason that it had large stocks, some of which was perishable; furthermore, the business was not well organized. The combined result has been that including losses from depreciation of stock and expenses of reorganization and construction, it has made a loss for the past year. During the fiscal year George Young, in addition to the other capacities in which he serves, assumed the management of the mercantile department. He has completely reorganized the department, and at the present time it is making a profit, and it is in healthy and good condition.

The sales from the lumber yard, including lumber, wood, coal, hay and grain, etc., have been satisfactory considering the dull

times, and this department is ably managed.

John A. Campbell, who took charge of the public service department in addition to his other duties, before the beginning of the fiscal year, has met with notable success, and the profits promise to pay in the future a fair rate of interest on the capital invested.

On the whole, all of the self-sustaining departments are now healthy and bid strong to show better results.

Federal and State Concessions

During the year we have received a valuable concession from the Federal government. There is a prohibitive duty against crude oil into Mexico for the purpose of protecting the refining industry, and consequently the Cananea Consolidated Copper Company was obliged to use high-priced coal. Upon bringing the matter to the attention of the Federal government they granted us the privilege of importing crude oil exclusively for fuel purposes into Cananea, under inspection, as long as the government believes that the native product cannot be furnished to us under competitive conditions.

In consideration of the improvements we have made at the reduction works and of the installation of additional power, the State government has canceled our original concession for 20 years dating from Dec. 4, 1899, and given us a new concession for a period of 20 years from April last, exempting us from the payment of export tax on copper bullion produced from our mines. We are under very great obligations both to the Federal and State governments for the just and considerate treatment and assistance they have given us.

In Conclusion

The staff of the Cananea Consolidated Copper Company, with some reductions, remains as it was when I took charge, and I feel that we are under great obligations to its members for the splendid courage and ability they have shown and the splendid work they have done. All the work accomplished has been the result of friendly and earnest committee work, and all steps made have been taken after the most thorough discussion and study.

Local conditions have been exceedingly satisfactory throughout the period. We have an excellent and capable municipal government and a contented community, and as far as I can see, there is no discontent or friction between the company and its employees. The latter have rendered good service and good work.

It is reported (*Mex. Min. Journ.*, Feb., 1909) that a rich discovery of gold-bearing quartz has been made on the headwaters of the Andagueda and Chirigo rivers, 125 miles above Quibdo, Colombia.

Electrolytic Precipitation

By Mark R. Lamb

This method of recovering metals from cyanide solutions was proposed early in the history of gold cyaniding in Africa. Solutions from ores containing ½ oz. gold per ton will contain about 2½ dwt. per ton where four tons of solution are treated for every ton of ore crushed. This ratio of solution to ore is not an average, since Merrill precipitates from only 0.6 tons of solution per ton of slime treated, while at places in Nevada with very high-grade ores the ratio is eight to one. Taking the ratio of four to one as a basis for calculation, the lowest-grade solution may carry 0.25 dwt. per ton, and the precipitation from this grade is quite as important as the treatment of the higher grade solutions.

Recently Mr. Lay has given results of his tests and daily working results on precipitation, and places the ratio for practically complete precipitation of clear, gold solutions at 0.03 amp. per sq.ft. of cathode surface. The quantity of metal in such solutions is so small that the area of the cathode is by far the most important factor of the precipitation. He estimates the required cathode area as 1750 sq.ft. per ton of solution per hour, and is using thin, lead-foil cathodes which remain in the boxes a month before being melted and cupelled.

The usual ratio of solution to ore in silver cyaniding is from four to six tons solution to a ton of ore. Then with an ore worth $6 per ton, such solutions would contain about 2½ oz. per ton, or 40 times the weight of metal in gold solutions of the same value. It will be seen at once that the problem of electrolytic precipitation in dealing with solutions from ores containing from 500 to 1000 grams of silver per ton is much easier to solve, and is altogether different. By comparison the solutions dealt with in this last case resemble the electroplater's bath.

The managers and foremen of the plants operated by Charles Butters & Co., Ltd., have improved on electrolytic precipitation until they are now getting good results. Their object has always been to secure as complete a precipitation as is consistent with reasonable first cost and maintainance expense. Ordinary tinned iron plates are used as cathodes and peroxidized lead plates as anodes. Acheson graphite will probably replace lead anodes finally, since the latter are expensive and short-lived. A current density of 0.50 amp. is employed, which is 16 times the density recommended by Mr. Lay. This heavy current deposits the metal loosely on the cathodes whence it is rubbed, and dropped to the bottom of the boxes.

The variable conditions of the boxes used by Mr. Hamilton at Minas Prietas in making his tests were: current density, rate of flow of solution, besides the constant slight fluctuations of alkali, cyanide and metal contents of the solution. The number of and distance separating the anodes remained constant. The accompanying table shows the conditions and results of the experiments made with solutions carrying 1.625 oz. gold and silver. With solutions containing more metal, the box will have greater capacity for the same per cent. precipitation. Experiments prove that with constant rate of flow of solution and current, the residue remains nearly the same, with varying grades of solution. Doubling cathode area increases percentage of precipitation more than does doubling current strength, but it also doubles attendance and first cost of plant.

ELECTROLYTIC PRECIPITATION AT MINAS PRIETAS.

Tons Sol. Passed Through Boxes Per 24 Hrs.	Cathode Area of Box, Sq.Ft.	Current Density, Amp.	Percentage Precipitated.
120	3500	0.3	90.0
240	3500	0.7	84.0
120	3500	0.8	88.0
240	3500	0.8	84.5

My object in writing this is to urge that a judicious combination of electrolytic and zinc precipitation will have an advantage over either alone. At one plant with which I am familiar, 80 tons of 50-oz. silver ore will be treated daily, producing approximately 4000 oz. of metal. At the lowest figure for zinc consumption this would require 270 lb. of zinc shavings per day. With an electrolytic plant precipitating 85 per cent. of the metal the zinc consumption will be reduced to 40 lb. with a very slight charge for power. In any case, the power cost is low. In this particular plant the labor required will be that of one man having extra help only at clean-up, who will attend to precipitation during the month. Then, too, in a closed-circuit plant, that is, one milling in solution and filtering, perfect precipitation is not required, since no loss is sustained if solution which is pumped to the battery supply contains more or less metal. Also in this class of plants the tonnage of solution to be precipitated is less, particularly where the entire tonnage is agitated.

The one advantage of purifying the solutions which become so foul in treating the average silver-sulphide ore, warrants the use of a high-duty electrolytic-precipitation plant. Further, a recovery or regeneration of as much as ½ lb. of cyanide per ton of ore treated has been observed. The product of the electrolytic boxes, when compared to zinc precipitate, is of lower grade if copper or other base metal is in solution and is of higher grade with clean ores and rich solutions. Such zinc as remains in solution after passing through the batteries, concentrators, and treatment plant is found in the electrolytic precipitate, but is of negligible quantity.

Traveling in Western Chihuahua, Mexico

Notes of a Trip to the Ocampo District, and Outfitting Therefor. Time Required for Securing Superior Mules Is Well Spent

BY FREDERICK H. MORLEY*

Journeys in western Chihuahua are usually made over well traveled trails on mule back and the notes given here may be of some interest and benefit to engineers going to Ocampo, Portrero or Sahuayacan. The Ocampo district is reached by trail from Miñaca or San Isidro on the Chihuahua & Pacific railroad, or by wagon road from Temosachic, the terminus of that railroad.

The wagon road was one of Colonel Greene's projects to supply transportation facilities for his mining properties at Concheño, Pinos Altos and Ocampo. It was a well constructed road, over 100 miles in length, which must have cost a small fortune to build, but after a few months of neglect it is scarcely better than the trails. It is a well known fact in the district that freighting by wagons over this road cost many times what it did to pack out on mules over the trails to San Isidro or Miñaca. Americans in Mexico generally have some expensive experiences before they learn that the crude native methods are often the cheapest.

Most Maps Inaccurate

The accompanying map and profile of the trail will give a general idea of the altitudes, distances and the names of the usual stopping places between San Isidro and Sahuayacan, going by way of Ocampo. There are no accurate maps of this region, and no two maps agree within two miles. The sketch given here was taken from a map of the Greene concessions, with some changes and additions made by my companion on the trip, E. P. Smith. The profile of the trail was made from our records of riding time and aneroid barometer readings.

"Riding time" is a very variable quantity, but under ordinary conditions means a rate of about 3½ miles per hour. As we would always make much faster time on the level than when going up or down hill the profile is somewhat inaccurate and distorted, but it will serve to indicate the general character of the country and the location of the difficult portions of the trail. Whenever possible two readings were taken at the same point, and the mean reading was used in plotting the profile, but in most cases it was only possible to get one reading, so that the altitudes given may be inaccurate by 200 ft. or more. A Keuffel & Esser 5-in. dial surveying aneroid was used.

Commissary Conditions

We started out from the Calera mine, going to San Isidro, and from there through Guerrero over the *camino real* which leads directly to Ocampo. This trail joins the one from Miñaca at La Junta, which is about nine hours' ride west of San Isidro. The Miñaca trail is said to be the better. There are numerous stopping places all along the trail, but these usually consist of poor little ranches where one can secure fodder and a corral for the animals, though meals and lodging for the travelers may be entirely lacking. Some of the houses have an extra room for travelers, but as a rule we found it

OCAMPO, ONE OF CHIHUAHUA'S INTERESTING TOWNS

CALERA MINE AND MILL

TOMÓCHIC RIVER

TOWN OF TOMÓCHIC, ALTITUDE 6000 FEET

*Mining engineer, 412 McPhee building, Denver, Colo.

more comfortable to sleep out under the portales or beside the corral.

At the time of this trip (December, 1908) it was rather difficult to buy food along the trail, although we could generally count upon a limited supply of *tortillas* at exorbitant prices. At times we were able to buy a few eggs or a chicken, so that we were able to get along quite comfortably. If the traveler will take with him plenty of good, American bacon, coffee, rice, and frijoles, he can travel light and live comfortably "on the country." It was always possible to buy sufficient corn and fodder for the mules, though prices were high.

San Isidro to Ocampo

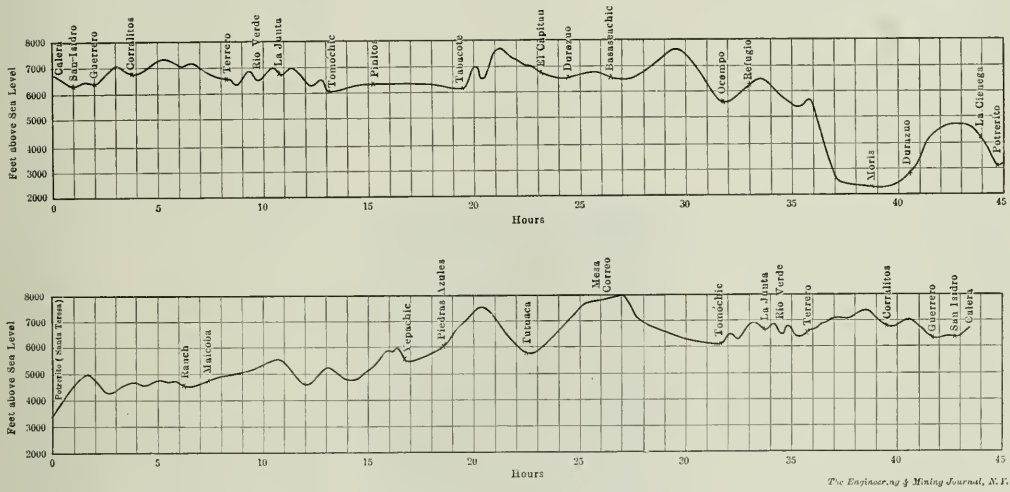
Between San Isidro and Ocampo the usual stopping places for travelers are at Corralitos, Terrero, La Junta, Tomóchic, Tabacote, Durazno and Basaseachic. Tomóchic and Basaseachic are small villages, which have one store each, but the other places enumerated are merely *ranchitos*. With good animals and fast riding it should be possible to reach Ocampo in three days from San Isidro or Miñaca, stopping at La Junta and Tabacote; or at Tomóchic and Durazno. As we were poorly mounted and the days were very short it took us four days on the trail, though three and one-half days is said to be the usual time. The distance is generally given as 90 or 100 miles.

As a whole the trail is not a bad one, although there is scarcely any level ground, as the trail seems to cross a continuous series of hills and arroyos which makes very rapid traveling almost impossible. Between Basaseachic and Ocampo there is a rapid rise, followed by a long, steep descent over a very bad trail. This part of the trail is extremely bad as it is not only steep, but also very rough and full of loose rocks. There are some rough stretches between Tabacote and Durazno, but as one gets farther into the heart of the Sierra Madre those portions of the first part of the trail which seemed steep and rough at the time are now recalled as smooth and level boulevards.

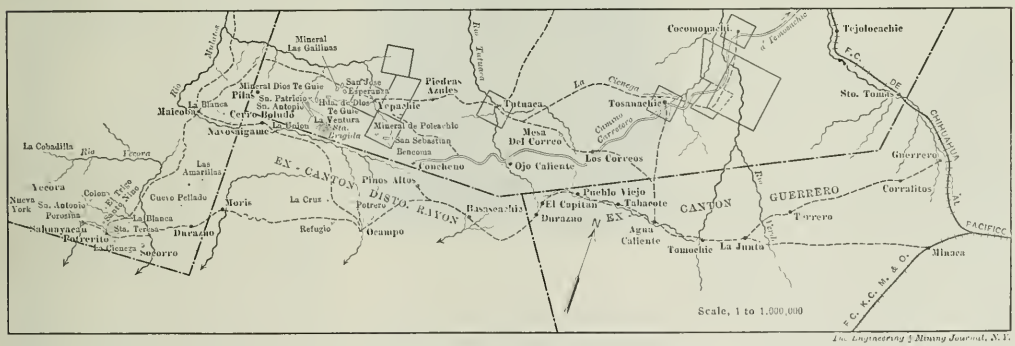
Ocampo is one of the most interesting towns in northern Mexico. It is said to be more than 100 years old, the first mine discovered being the San José in the year 1804. The only active and producing property seems to be that of the Watterson company, which is making a regular production and shipping bullion from its cyanide mill. Freight rates are so high that it is practically impossible to ship anything except bullion. The regular rate from Ocampo to San Isidro is 7.50 pesos per carga, and 5 pesos per ton from San Isidro to Chihuahua. The trip takes about 10 days, as the packers do not attempt to work their mules for more than four or five hours a day, during which time they make about 10 miles.

Rough Trail to Refugio Mine

Going west from Ocampo toward Sahuayacan the trail is steep and rough until the Refugio mine is passed, there being a rise of about 1000 ft. in the first hour and a half of riding. Beyond the Refugio the trail is good and there are no



PROFILE TRAIL FROM CALERA TO POTRERITO AND RETURN VIA YEPACHIC AND THE MESA DEL CORREO



SKETCH OF A PORTION OF WESTERN CHIHUAHUA

difficult places, as it follows along the *cumbre* for some 2½ hours.

After four hours' riding the ridge above Moris is reached. The view from that point is of surpassing grandeur. Immediately below is the valley of the Moris river and the little village of the same name, which is reached in three hours of sliding down a descent of 3300 ft. To the westward the two *pilares* stick up like giant obelisks, while range after range of rugged mountains extend indefinitely in every direction. We tried to get some photographs of this view, but they failed to give any idea of the grandeur and immensity of that vast sea of mountains. The trail down to the valley is frightfully steep and rather rough, but the mules can make it without difficulty if not too heavily loaded.

Tropical Climate at Moris

At Moris we found a tropical climate, with sugar-cane, oranges, and bananas growing in abundance. The altitude of Moris is between 2300 and 2400 ft. Instead of stopping for the night at Moris we pushed on to Durazno—a fine little ranch where they raise sugar-cane and most delicious oranges. Three and one-half hours' riding from Durazno brought us to the Cienega mine, situated almost at the foot of El Pilar. There we found an interesting gold prospect which was being developed by the American owners. It was less than an hour's ride down the mountain side from La Cienega to Potrerito, while another half hour's ride down the river brings one to the village of Sahuayacan.

This district was very active at one time, but at present it is correspondingly quiet. The Santo Niño and Santa Teresa were the principal mines at Potrerito, but neither of these properties was being operated at the time of my visit.

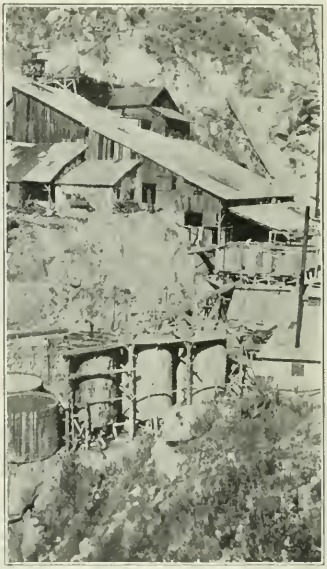
As far as could be learned the Cienega, Socorro and Republica were about the only properties in this vicinity which were in operation, and I think that the Republica was the only mine which was then shipping out bullion. This is not surprising when we consider the location of these properties and look at the profile of the trail over which everything has to be carried.

Freight to the railroad is said to cost from 13 to 15 pesos per carga for ordinary loads, while the rates for machinery are very much higher. It is evident that only mines having high-grade ores which can be reduced to bullion can be expected to make very much money in such difficultly accessible localities.

Potrerito to Calera

Returning from Potrerito to Calera we took the trail to Maicoba, going thence through Yepachic and Tutuaca to Tomóchic, where the regular Ocampo trail was again encountered. This route is probably much longer than that by way of Ocampo, but as the trail is in excellent condition, and as there is very little rough country one can make somewhat better time over the Yapachic route. This is the trail generally used by the freighters going to La Republica, Sahuayacan and Socorro.

Between Yepachic and Tutuaca there is a stiff climb, and the ascent to the Mesa Correo is long and steep, but with these exceptions the trail is an excellent one for fast traveling. One must be sure to arrange to spend the night either at Tutuaca or Tomóchic, as there are no good camping places between those towns, while on the Mesa Correo there is neither feed nor water. Yepachic is the only town which boasts of a store until Tomóchic is reached, and as there are few ranches along the trail, one cannot count upon



EL SALTO MILL—OCAMPO

obtaining many supplies along the road. We were out 4½ days from Potrerito to Calera, our riding time being 43½ hours, which is considered excellent time.

Notes on Outfitting

Traveling through this part of Chihuahua is not like riding in a Pullman, but the trips can be made very comfortably if one is accustomed to riding over mountain trails and knows how to "rough it." Most of the country is well supplied with water and wood, though nearly all grass along the trails has been cleaned off by the freight animals. Much time will be saved on the trail if care is taken in the selection of the mules available for the trip. Most of the animals usually furnished are wretched creatures which are likely to give out completely after three days' riding, so that a day or so spent in insisting upon good animals and hunting for them may save many days later on.

We found that for two of us all of our requirements were met with an outfit of two saddle mules, one pack mule and one mozo on foot. The pack consisted of two canvas panniers containing the grub and cooking utensils, a bag of clothes, a mail sack containing the sampling kit, and the blankets wrapped in a heavy canvas tarpaulin. In addition we often had to carry corn enough for all of the animals for one day, but the pack was never unduly heavy. By traveling with a light pack and a small outfit much time was saved and a great deal of trouble and annoyance avoided.

In the rainy season it would be necessary to take a tent and folding cots, but these are not essential at other times. Such trips are never easy ones, but one is well repaid for a few hardships if he can have the opportunity to see and realize the rugged grandeur of the Sierra Madre.

Exploration Company, Ltd.

At the recent annual meeting of this company, it was stated that its investments in the shares of copper-mining companies stood at £199,877, distributed in shares of the Greene-Cananea, Butte Coalition, Nevada Consolidated, Otavi Mining and Railway companies in South-west Africa and some small holdings in a few other companies. The success of the investment in El Oro mines of Mexico has inspired the company to enter upon a systematic scheme of mining exploration in Mexico. For this purpose, it is intended to form a company with a capital of £250,000, the shares of which will be subscribed for by the Exploration Company. Philip L. Foster will be on the board of the new company and its general management in Mexico will be under the direction of R. M. Raymond, who for the last six years has managed the mines at El Oro with conspicuous success. Under him will be a staff of mining engineers who will be engaged in seeking for and making preliminary examinations upon mining properties in Mexico.

A working option for two and a half years upon a large mine has already been secured.

In Mexico (*Boletin de Estadistica Fiscal*, Aug., 1908), during the fiscal year, 1007-8, titles for 91,307 pertenencias were granted to a total of 4841 persons or companies, making a total of 444,320 pertenencias held in the republic. Of these 180,850 are held for the mining of gold and silver, 105,424 for gold and silver with other minerals and 68,053 for other metals and minerals.

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Mr. Schwab on Steel Making

When Mr. Schwab testified before the Ways and Means Committee last December he was obviously uncertain of himself. He was in the position of many industrialists, who boast among themselves that in their lines of work America can beat the world in cost of production, superiority of manufactures, etc., and even exaggerate their optimism when it is a matter of floating a company, or otherwise selling a business; but are pessimists of the blackest dye when it is a question of protection against the "pauper labor" of Europe. Probably this is largely a matter of habit, or the exhibition of the business spirit which contests the relinquishment of any advantage. However, Mr. Schwab has now found himself, so to speak, and in a recent interview uttered brave and true words, as follows:

"Cut the tariff on steel or anything else all you please. American labor can stand it. I believe in a reduction. I feel just an Andrew Carnegie does on that matter. In my estimation American steel can stand all cuts in tariff that are made. American labor can make the best steel in the world, and with it we can compete with the world. I know nothing about other lines; that is, technically, but I have enough confidence in American labor to believe that cuts can be made in them without hurting business. I have been in contact with labor of all kinds for years, and I know what it can do. I know that American laborers can produce more steel in a given time than any other workmen in the world. I know that they can put out better steel than any others. We can compete with any other country. We have nothing to fear by a cut in tariff, because we have the best goods. It is true that we have to pay our workmen most; you always have to pay the most skilful workmen the highest wages. The Americans are the best workmen on earth. The highest paid labor is the cheapest to the employer. The man that understands his work thoroughly and executes it without mistakes is the man that makes money for his employer. The man that is employed at a cheap wage, and goes slowly and makes blunders, produces inferior steel or any other goods and cannot compete with the man that thoroughly understands his business and produces good material."

There is so much sound political economy in the above remarks that Mr. Schwab is to be complimented for condensing a treatise upon a tablet. The timid demur and fear dreadful things that may happen to "Labor," but the captains of industry and the engineers who assist them know that the laborer is worthy of his hire, and that if the miner at Butte is paid $3.50 for eight hours work, while the colored men in Africa may get only 50c. for 10 hours, nevertheless, the man at Butte will produce the cheapest ton of ore and is consequently the best money-maker.

Labor Efficiency and the Steel Corporation

It is well known that during the boom period of 1906-7 the cost of production of many substances increased materially owing to a large extent to decrease in the efficiency of labor. The opportunities for employment were so great that the laboring man could be independent. If he chose to relax his efforts, or be otherwise unruly, at the risk of being discharged, the chance of dismissal was entirely immaterial to him, knowing that he could immediately obtain employment elsewhere. Moreover, in many cases the most efficient men quit one kind of work in order to enter upon something else which paid better, thus illustrating the mobility of American labor. The managers of many enterprises were, therefore, obliged to content themselves, to a large extent, with an inferior class of workmen.

Since the panic conditions have been reversed. Since that time it has been jobs that have been scarce and labor that has been plentiful. This condition has enabled employers (1) to choose the best men, and (2) the men thus chosen have been inspired to work harder than formerly in order to retain their employment. The result has been a great increase in efficiency in many kinds of work and corresponding reduction in the cost of production.

However, this is by no means to be offered as a sweeping statement. There are many enterprises of long establishment and well settled character which employ the same men year in and year out with comparatively little change. Satisfied with their condition and untroubled by unionism, these men stick to their employment and bring up their families in homes around the works, in which the sons and grandsons eventually find employment. In works of that character there was prob-

ably no great decrease in efficiency in 1906-7, nor increase subsequently. Another important factor in the cost of production is the maintenance of operations at approximately the full scale. The laborer as a unit may increase in efficiency, and yet the cost of production may increase at the same time because the plant as a whole is not running at the maximum of economical capacity. The cost of some kinds of smelting, for example, will increase 5 to 10 per cent. because of the mere fact that the works is running at only three-fourths capacity.

Something of this kind appears to have been the experience of the Steel Corporation in 1908. Unfortunately its otherwise admirable report does not go into technical details. However, we can draw some general deductions. Owing to its much-discussed policy of maintaining prices, and allowing the comparatively small business offered to be taken by rival concerns, the production of the Steel Corporation showed a great falling off in 1908 as compared to 1907. Thus its production of iron ore in 1907 was 23,980,558 tons; the output in 1908 was only 16,662,715 tons. The manufacture of coke in 1908 was 8,169,931 tons as compared to 13,544,764 tons in 1907. The production of pig iron was 6,934,408 tons and 11,422,795 tons, respectively; of steel ingots, 7,838,713 tons and 13,342,092 tons, respectively. The manufacture of finished steel products in 1908 was a trifle less than 62 per cent. of the quantity in 1907.

It appears, however, that the total of salaries and wages in 1908, $120,510,829, was 75 per cent. of the total in 1907, $160,825,822. The average earnings per man decreased, being $729.40 in 1908 against $765.10 in 1907. This probably was due chiefly to shorter time worked by the men who were retained, there having been no general reduction of wages. The efficiency per man fell off materially. In the coal and coke properties, one man in 1907 produced 797 tons; in 1908 only 651 tons. One man produced 1457 tons of iron ore in 1907; in 1908 only 1,209 tons. In the manufacturing properties, applying all the men so reported to the production of steel ingots (which, of course, is not strictly correct, but, nevertheless, is illustrative), one man in 1907 produced 88 tons; in 1908 only 66 tons.

It is probable that in the cases of labor employments which are capable of a reduction to a comparable basis of labor efficiency, the Steel Corporation realized the same increase in 1908 that many other large concerns experienced. In other words, if one man shoveled 25 tons of coal or ore in 1907, it is probable that in 1908 one man shoveled 30 tons, more or less, because better men could be selected to do even so simple a kind of work. The decrease in efficiency in the whole business was undoubtedly a part of the price for running at a greatly reduced scale. The cut in prices that inspires consumption and enables a works to maintain its output by no means implies a corresponding diminution of profits.

The Anthracite Position

Seldom has there been so much uncertainty about a proposed strike as in the case of the anthracite mine workers. The agreement under which the mines are operated comes to an end March 31, the day on which this is written, and yet no settlement has been reached, operators and miners being apparently so far from an agreement as ever. Notwithstanding this, both parties are conducting their business without special reference to a strike or a lock-out and there is apparently every prospect that tomorrow, April 1, will see a quiet continuance of work at the mines.

The district conventions in the three anthracite districts, to which the strike question was referred by the central authority of the United Mine Workers, placed matters in the hands of a committee which recommended in effect that the demands of the miners be reiterated, especially with reference to the recognition of the Union as the central authority with which negotiations should be conducted. At the same time, from the tone of this report it was evident that the support of the Union miners was not altogether given to these demands. From the utterances of the district conventions it was apparent that many of the men were quite satisfied with the agreement formulated by the Anthracite Strike Commission in 1903, and renewed with very slight modifications in 1906. Under this agreement business has proceeded smoothly, as a rule, and the miners have done better perhaps than ever before in the anthracite region. To meet this sentiment the policy committee added to its recommendations another to the effect that the miners should not stop work on April 1, but should continue pending further negotiations with the operators, and that there should be no stoppage of work until further orders from the union. Apparently this will be done, and work will continue in the mines unless the coal companies should order the closing of the mines on the ground that they were unwilling to continue on such an indefinite basis. The operators, however, have taken no action of this kind and the probability is that they will not.

While making no direct answer to the action of the miners' committee—which indeed was not officially submitted to them—the coal companies have issued a statement to the public. In this they say that the United Mine Workers, as at present constituted, are not a body upon which they can rely or with which they can conduct the required negotiations. The principal reason for this is that it is a body controlled by the bituminous coal miners who are in a large majority, so that the officers of the union are not familiar with the special conditions which govern work in the anthracite region. They recall the recommendation of the Strike Commission of 1903 that a separate organization should be formed by the miners to cover the anthracite mines only, free from the control or dictation of the bituminous mine workers. In this and other respects they claim that the miners have not acted in conformance with the report of 1903. They decline, therefore, positively to recognize the union and will deal with its officers only so far as they represent their own employees.

Miners and operators, therefore, are diametrically opposed on the important point Whether it can be adjusted without an actual struggle remains to be seen. The advantage at present is clearly on the side of the operators. They have sufficient coal stored to enable them to supply their trade without interruption, even should the mines be closed for a considerable time. The season is approaching when the demand for coal is smallest Indeed it is possible that the decision of the managers of the union to continue at work is based on some vague expectation that negotiations can be protracted until the summer season is well along and the winter demand approaches This, however, they can hardly carry out. A further point is that the miners would entirely lack the support of public sentiment which was with them, at any rate in the first part of the strike of 1902-03; and this is an important point.

Mineral Production of Great Britain

The production of coal in Great Britain for the full year, from mines coming under the coal mines act, was 267,812,852 long tons in 1907, and 261,506,370 in 1908; a decrease of 6,306,482 tons, or 2.4 per cent. A few thousand tons from open-pit workings, coming under the quarries act, are still to be reported; but this quantity is too small to affect the general result.

The other minerals won from mines falling under the coal-mines act are reported as below in long tons:

	1907.	1908.
Barium (compounds)	10,297	6,217
Clay and shale	320,989	292,981
Fireclay	2,890,097	2,814,411
Igneous rocks	146	404
Iron pyrites	7,394	7,212
Ironstone	8,236,118	7,890,814
Limestone	22,366	15,416
Oil shale	2,675,779	2,891,564
Sandstone and ganister	128,103	110,513

Additions will be made to some of these figures—notably to iron ore—when the returns from metalliferous mines and quarries are published later. Most of the items show decreases last year.

The total number of persons employed in mines under the coal-mines act was as follows:

	1907.	1908.	Changes.
Underground	757,887	796,329	I. 38,442
On surface	182,731	191,484	I. 8,753
Total	940,618	987,813	I. 47,196

The number of accidents has been heretofore reported. The total quantities of all descriptions raised in 1908 were 275,534,911 tons; which gives an average of 278 tons per employee for the year.

The Mount Lyell Mining and Railway Company

Special Correspondence

The mines of this company are situated at Mount Lyell, Tasmania, and are known as the Mount Lyell and the North Mount Lyell mines. The company has also recently acquired an extensive tract of copper-bearing country in the Norfolk range, on the west coast of Tasmania, north of the Pieman river. The work done on this new area has, however, consisted only of surface trenching and sampling. The indications are promising, but the district is difficult of access.

The report of the directors for the half-year ending Sept. 30, 1908, states that during that period 134,116 tons were won from the Mount Lyell mine, having the following average assay value: Copper, 0.85 per cent.; silver, 1.84 oz.; gold, 0.063 oz. per ton. The ore won amounting to 65,446 tons from the North Mount Lyell mine was richer, containing: Copper, 6.18 per cent.; silver, 1.39 oz.; gold, 0.007 oz. per ton. At this mine an Ilgner electric hoisting plant has been installed which, so far, has given satisfaction. The main shaft at the North Lyell mine has been sunk to a depth of 1119 feet.

The ore reserves on Sept. 30, 1908, were as follows:

	Tons	Cu%	Ag oz.	Au oz.
Mount Lyell	3,382,117	0.54	1.96	0.030
North Mount Lyell	710,333	5.75	1.33	0.005

At the reduction works the usual average of four blast furnaces treated all the ores and metal-bearing fluxes, etc., supplied by the mines, in the customary manner. A new and sixth blast furnace was put into operation during the period. The tonnage treated, including metal-bearing fluxes (1562 tons) amounted to 201,697 dry tons.

The smelting results since Aug. 10, 1903, the date of incorporation of the present company, have been as follows:

Source.	Quantity, Dry Tons.	Assay. Cu, %.	Ag, Oz.	Au, Oz.
Mount Lyell mine	1,463,244	0.91	1.89	0.071
North Mt. Lyell and Lyell Tharsis	583,920	6.08	1.72	0.0052
By-products from smelting works	1,378	8.9	3.37	0.020
Total ore	2,048,542	2.39	1.84	0.052
Metal-bearing fluxes, silicious	57,614	1.49	0.38	0.0018
Cupriferous clays	98	0.50	0.35	trace
Purchased ores	3,979	....	....	.....
Total	2,110,233	....	....	.....

The converter products from this ore were as follows:

	Matte Treated, Tons.	Blister Copper Produced, Tons.	Average Assay. Cu, %	Ag, Oz.	Au, Oz.
Half year to Sept. 30, 1908	9,484	4,450	98.74	75.65	2.032
Since Aug. 10, 1903	121,066	43,377	98.79	86.16	2.667

The metal output from Aug. 10, 1903, to Sept. 30, 1908, was 42,852 tons copper, 3,737,494 oz. silver and 111,347 oz. gold.

The metal output produced by the former Mount Lyell company was 48,577 tons copper, 4,121,401 oz. silver and 155,752 oz. gold. Altogether the production from these mines—excluding that from the North Mount Lyell mine prior to Aug. 11, 1903, which is not known—has been 91,429 tons copper, 7,858,895 oz. silver and 267,099 oz. gold.

For the half-year the sales of blister copper and superphosphates, less ore purchased, realized £371,615. The railway revenue was £15,852, and the profit on working account was £192,617. After writing off sundry amounts to mine prospecting, taxes and depreciation, the profit balance for the half-year amounted to £152,157. The ninth dividend 1s. 3d. and a bonus of 6d. per share, paid June 15, 1908, absorbed £105,000, against £210,000 for the corresponding period in 1907.

The company has paid altogether since August, 1903, 18s. 9d. per share, or £1,125,000. The previous company paid £996,574, making a total distribution of £2,121,574. Mount Lyell appears to be a very wet place, the rainfall during the six months having been 59.1 in. on 138 wet days.

Lake Superior Iron Ore

In the article on this subject in the Journal of March 10, through an oversight credit was not given to the *Iron Trade Review*, of Cleveland, Ohio, for the figures there given. The *Review* has, for a series of years, collected and published these statistics of the Lake Superior iron mines, which are of great service to the trade, and are more nearly complete and reported more fully in detail than those of any other important mining region in the country.

With its issue of March 25 the *Review* sends out its usual yearly supplement, giving the production of each mine in the region yearly for 17 years, with the total output of each mine since its opening. This list includes 244 active mines, of which 110 are on the Mesabi range, 65 on the Menominee, 38 on the Marquette, 31 on the Gogebic, six on the Vermilion and three on the Baraboo range. In addition to these, total production is given for 83 mines—53 Marquette, 19 Menominee and 11 Gogebic—which have not been shippers since 1898.

In the article above referred to, a statement was given of the total shipments of iron ore up to the end of 1908. Some slight changes have been made in footing up the totals. The corrected statement is as follows:

Range:	Year Opened.	Total Ore.	Per Ct.
Marquette	1859	87,647,819	21.5
Menominee	1877	66,837,670	16.3
Gogebic	1884	56,732,446	14.0
Vermilion	1884	28,017,170	6.8
Mesabi	1892	167,527,143	41.2
Baraboo	1892	797,868	0.2
Total		407,060,116	100.0

The four mines credited with the greatest total production up to the end of 1908 were the Norrie group on the Gogebic range, 23,075,270 tons; the Cleveland Cliffs on the Marquette, 20,572,463; the Mountain Iron, on the Mesabi, 17,198,871; the Chapin, on the Menominee, 16,596,287 tons. The Jackson, the oldest mine in the region, shipped 3,874,153 tons up to the end of 1907, but was not a shipper last year.

Official figures for Western Australia given in the January, 1909, report of the Chamber of Mines, set the total sum of cash dividends distributed to Jan. 1, 1909, at £18,963,895. Dividends to the amount of £196,219 were paid last January.

The Railroad Systems of Northern Mexico

A Comprehensive Discussion of the Railroads in Operation and under Construction; Modern Map Authenticated by Personal Observations

BY H. A. HORSFALL*

The illustration for this article is a reduced sketch from a map of a part of Northern Mexico, recently published by me. This map has been about two years in course of compilation and is presumed to be correct, except as to some of the minor points on which accurate data has not been obtainable up to the present writing. The principal points, coast lines, etc., have been located by well determined astronomical observations; the minor points are from land surveys and railroad location maps, and some portions have been entirely redrawn from survey notes made by me in the field, during a residence of over a dozen years in this section of Mexico.

The lines of division between the various States are somewhat in doubt, so in places two lines are shown. The unshaded lines are those obtained from the land survey maps of the State of Chihuahua while the shaded lines represent the land claimed by adjoining States.

Southern Pacific Lines in Sonora

In the State of Sonora the principal lines of railroad have been acquired and are now being operated by the Southern Pacific Railroad Company and comprise the following:

The Sonora Railway extending south from Nogales, Arizona, to Guaymas on the Gulf of California, a distance of 260 miles.

The Cananea, Rio Yaqui & Pacific from Empalme, the junction point, five miles east of Guaymas, runs southeasterly 64 miles to Corral, the junction point of a branch now building northward, and in operation to Cumuripa on the Yaqui river, 42 miles. This branch is also being built south from Nacozari where it will make a junction with the El Paso & Southwestern Railroad extending to Douglas, Arizona; this portion is said to be nearly ready for operation. Nacozari will be the terminus of this branch for the present but it will ultimately be extended to Cananea where a branch of the Cananea, Rio Yaqui & Pacific is in operation 30 miles to Naco, Arizona.

Eight miles north of Cananea, at Del Rio a branch is also in operation. This runs northwesterly to Nogales where connection is made with the Sonora Railway. Returning for the moment to the station at Corral, Sonora, we find the road continuing in a southerly direction and at 118 miles from Empalme is the station of Navajoa, where a branch runs easterly to Alamos, 30 miles.

Southern Pacific System in Sinaloa and Jalisco

From Navajoa the line runs southeast between the coast and the foothills of high mountains and 84 miles south of Navajoa reaches San Blas in Sinaloa where it crosses the main line of the Kansas City, Mexico & Orient Railway. The road continues southward passing to the west of the mountains. It then turns more to the east and entering the foothills takes a general southeasterly direction to Culiacan in the State of Sinaloa the distance from San Blas being 136 miles and from the United States line at Nogales to Culican, Sinaloa, 493 miles.

The road is being built southeasterly from this point and the construction work has been completed as far as Mazatlan. The 34 miles from Culican to the Lorenzo river was to have been placed in operation Jan. 13, 1909, but I have not learned definitely that it has been done. From Mazatlan the road is being built southward toward Guadalajara in the State of Jalisco and construction is also being pushed rapidly northward from Guadalajara.

From the junction with the Mexican Central at Orendain station in the State of Jalisco, 34 kilometers to Tequilla have been constructed and placed in operation by the Southern Pacific Company. Additional mileage on this section is expected to be completed in March, the whole line to be in operation by the end of the year 1912.

Other Sonora Roads

The Nacozari Railroad extending south from Douglas, Arizona, to Nacozari, Sonora, is a branch of the El Paso & Southwestern Railroad and is an important mining adjunct. At a short distance north of Nacozari either from Cos or Ysabal, stations on the El Paso & Southwestern, it is proposed to construct a railroad to the east into the State of Chihuahua and connecting at Guzman with the Rio Grande, Sierra Madre & Pacific Railroad. This road will be built as soon as possible, the Mexican Government being anxious to have a railroad crossing the country south of the international boundary line. Location surveys are now being made and some other point than Guzman may be selected as the junction point, in which event the line will run further south than shown on the map.

Another short railroad called the Central Railroad of Sonora and extending 53 miles from Tonachi on the east bank of the Yaqui river to the Cieneguita mining camp, 20 miles southeast of Sahuaripa, has been in process of active construction since January 1, 1909, and is expected to be completed at an early date.

Railroads of Chihuahua

The State of Chihuahua is traversed by several railroads, the principal one being the Mexican Central, the main line of which was completed in 1885. This runs from Ciudad Juarez (Paso del Norte) southward across the State emerging near the southeast corner and crossing a small part of the State of Durango. It has a number of branches extending to various mining camps. The principal branch leaves the main line at Jimenez and runs west to the mining town of Parral and thence south to Rosario, Durango. Construction is in progress to points farther south and it will probably be extended before long to reach Indé and El Oro, mining camps in the State of Durango.

The other short lines connecting with the Mexican Central Railway run to various mining camps and are sufficiently well known not to need a special description. The Parral and Durango railroad runs from a station south of Parral, west and south to Ojitos or Laguna; it is building an extension south of these points into the mountains of Durango with an ultimate objective point at or near the prominent mining town of Guanacevi. The Mexican Northern railway runs from Escalon station on the Mexican Central to the silver-lead mines of the Sierra Mojada, a distance of about 80 miles.

The Rio Grande, Sierra Madre & Pacific railroad starts from Ciudad Juarez (Paso del Norte) and runs in a southwesterly direction to the station of Terrazas in the central part of the State. It was formerly controlled by Col. William C. Greene, who had planned to continue the construction south to Temosachic, where connection was to have been made with the Chihuahua & Pacific railroad.

Kansas City, Mexico & Orient

The Kansas City, Mexico & Orient railway crosses the Rio Grande river about five miles south of the town of Presidio del Norte and will run entirely across the State of Chihuahua and into the State of

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SKETCH MAP OF NORTHERN MEXICO, SHOWING RECENT RAILROAD EXTENSIONS

Sinaloa at its northeastern corner, thence southerly to Topolobampo bay, on the Gulf of California. There has been constructed and placed in operation up to the present time the division between Falomir and Chihuahua, a distance of 88 miles. The bridge over the Rio de Conchos has also been completed and construction is being rapidly pushed eastward toward the Rio Grande.

West from Chihuahua use is made of the railroad formerly known as the Chihuahua & Pacific Railroad extending nearly to Minaca, a distance of 122 miles. From Minaca the line proceeds in a southerly direction and is in operation to a station called Sanchez, situated on the crest of the Sierra Madre mountains at an elevation of 8054 feet, the distance from Minaca being 73 miles. Six miles east of Minaca the Chihuahua & Pacific railroad continues north to Temosachic, 54 miles, where it connects with the railroad of the Sierra Madre Lumber Company to Madera, a distance of about 35 miles.

From Sanchez in a southerly direction to Hornillas in Sinaloa, the road is under construction; about 60 of the 195 miles have been graded, but as this section of the road is the most difficult, progress during the last year has been extremely slow. From Hornillas south to Topolobampo, 73 miles, the road has been completed and is in operation. A branch of this railroad to reach the mining camps of Ocampo and Pinos Altos is in contemplation, but is not likely that the project will be carried through an early date.

Railroad Lines in Durango

The railroads in the State of Durango, other than the Mexican Central, which traverses the extreme northeastern corner, are the lines of the Mexican International, extending from the city of Durango northwesterly to Tepejuanes, 135 miles, and northeasterly 157 miles to Torreon, Coahuila, with a branch to the smelting town of Velardeña. There is also a short branch from Bermajillo on the Mexican Central to the mining town of Mapimi. This branch is owned by the Peñoles Mining Company. The Penoles company also has a railroad 11 miles in length to its Ojuela mine.

There is a short line, 30 miles in length, called the Durango Central railroad, running from Conejos station on the Mexican Central to the mining town of Descubridora. A branch also extends northwest to Azufre. It is contemplated to extend the Durango & Sinaloa railroad eastward into the State of Durango. This road now runs from Altata on the coast to Culiacan, Sinaloa. Surveys completed as far as Tamazula are being extended to the mining town of Topia, Durango. Westward from Tepejuanes, the International Railroad Company has engineers in the field making surveys for a railroad to connect with the west coast.

Mining Legislation in Congress

Special Correspondence

Although the present session of Congress was called specially to consider the revision of the tariff, several bills have been introduced relating to mining interests. They will hardly be considered at the present session.

A New Mining Bureau Bill

Representative Coudrey has introduced a new bill (H. R. 1480) to establish a bureau of mines in the Department of the Interior. The bill is somewhat different from that which was pending during the last Congress, and provides that there shall be established a bureau of mines whose duty it shall be, under the direction of the Secretary of the Interior, "to make technologic investigations on mining, extracting, and utilizing, the mineral substances of the United States and the improvement of the methods and conditions under which mines are operated with a view to the prevention of mine accidents, the waste of material, the betterment of mining conditions, and the development of the various mining industries." The director of the bureau is to receive a salary of $6000 per annum, and is to be appointed by the President and with the advice and consent of the Senate. The director is to prepare and publish for gratuitous distribution reports of the results of the inquiries and investigations conducted under the provisions of the act. He is also, with the approval of the Secretary of the Interior, to appoint for service in Washington and elsewhere such experts and other employees as may be necessary to carry out the provisions of the act. It is specified that no examinations shall be made for private persons, except where such examinations involve the question of public safety or prospecting on public lands.

Mine Experiment Station

Representative Martin, of South Dakota, has introduced a bill to establish mining-experiment stations to aid in the development of the mineral resources of the United States and for other purposes (H. R. 2189). The measure provides that there shall be established an experiment station in each of the States and Territories where there are natural deposits of the precious metals in commercial quantities whenever in the judgment of the Secretary of Commerce and Labor such action is desirable to promote the development of the mineral resources of the United States. At each station there is to be appointed an expert geologist at a salary of $3000 and a competent and experienced chemist at $2000. The sum of $5000 is to be spent each year in establishing and equipping each of the experiment stations. The stations are to analyze and assay all rock, cement, clay, or mineral-bearing material that may be deposited with them for the purpose of ascertaining the exact amount of gold, cinnabar, silver, copper, wolfram, tin, or any other mineral or metal known for its value in the arts and sciences and to furnish at a nominal charge a full analysis of each sample or specimen. The geologist in charge is to conduct mineral explorations when not otherwise engaged. The bill is parallel to one introduced for the same purpose last Congress, but which then received comparatively little attention.

A Proposed Dictionary

Representative Stephens has introduced a bill (H. R. 77) requiring the Geological Survey to publish 20,000 copies of a book to be known as a "Dictionary of the Minerals and Ores of the United States," which shall describe the various minerals and ores found in the United States or Territories, giving as far as practicable the locality where found and where possible a pictorial reproduction in their natural colors and such other information as would in the opinion of the director of the Geographical Survey be useful to citizens of the United States, and particularly of the mining States. Of this book 1000 copies are to be for the use of the Senate and 2000 copies for the members of the House of Representatives.

The European Zinc Convention

Paul Speier, Breslau, communicates the following additional information: The agreement is to remain in force for two years, commencing January 1, 1909. The output of the German group is limited to 255,700 tons for 1909 and 264,200 tons for 1910; the Franco-Belgium group to 174,500 tons for 1909 and 176,000 tons for 1910. The allotment for the English group has not yet been finally determined, but probably will be about 55,000 tons. The members of the several groups may arrange among themselves for changes in their allotments, providing that the total for the group does not exceed the quantity fixed by the Convention.

Curtailment of output will take place whenever the average price of ordinary brands of spelter has been below £19 for an uninterrupted period of six months; or if the total stock of spelter shows an increase during such a period. If any member of the Convention exceeds its allotment it will be subject to a penalty of 80 marks for every 1000 kg. of excess production. The Convention may be dissolved after one month's notice whenever smelters not belonging to the Convention, new smelters, cause an increase of spelter production amounting in the aggregate to more than 2 per cent of the estimated total production.

Mine Legislation in California

SPECIAL CORRESPONDENCE

A new State mining law has been enacted by the legislature providing for the locating and recording of mining claims, recording proofs of labor, etc. Few changes are made from the Federal mining laws, but an attempt is made to prevent relocations of claims after failure to do annual assessment work, by providing that such failure deprives the locator of the right to relocate the claim until three years have expired. It is intended by this to prevent men relocating claims year after year and holding them without doing any labor on them. The State of California owns no mineral lands, however, so this legislation relates to Federal mineral lands. This provision may, therefore, be contrary to Federal mining laws and inoperative. There will doubtless be litigation on this point. The new law provides that a record of all mining locations must be made with the county recorder of the county in which the claim is situated, the fee being $1. The boundaries of each claim are to be so defined as to be readily traced. It is also provided that after the annual assessment work is completed, within 30 days the owner must make an affidavit setting forth the value of the labor or improvements made, and record it with the county recorder. A copy of this affidavit is to be *prima facie* evidence of the performance of the labor or the making of the improvements. Copies of all records duly certified by the recorder, in whose custody such records are, may be read in evidence under such circumstances as provided by law for using copies of instruments relating to real estate, duly executed, acknowledged or proved and recorded. The provisions of the Act do not affect or abolish any mining district rules in the State, but there are now very few such districts.

These provisions about recording proofs of labor are not new in this State, but were tried and rejected. Certain mining engineers and lawyers of note found in their experience that failure to find any records of proofs of labor often prevented assurance of title to mining properties, and urged upon the legislature the passage of a law compelling record to be made of proofs of annual assessment work. A law to that effect was then passed and remained in force a few years. The miners and prospectors, however, resented the expense and annoyance to which they were put and their influence caused the law to be repealed, but it has now been reënacted. The miners contended that in the big counties like San Bernardino, Kern, Inyo, San Diego and Siskiyou, it was sometimes 100 miles to the county seat, entailing undue travel expense. In many of the little camps there were no post offices, and in others no money-order offices, so they could not send recording fees by mail. Under this new law a miner must record his proofs of labor at the county seat within 30 days after date of location. The miners and prospectors do not look on this provision as do the mining engineers and lawyers, and consider the matter a burden.

THE EIGHT-HOUR LAW

The mine-owners and managers of the State are still exercised about the eight-hour law and are not sure what course to pursue. It is conceded that it will increase mine costs, and still more the mill costs, as the act applies to smelters and other reduction works, including quartz mills. There will have to be one more shift on the mills. The owner of one large property has decided to quit the mining and milling of the low-grade ore which prevails in his property, and to mine and mill only the higher grade. Only a part of the mine will be worked and but few of the stamps run. This will greatly reduce the labor bills, as the low-grade ore will not pay on an eight-hour basis.

Progress of the Gary Plant

The report of the United States Steel Corporation gives the following statement of work done on the new plant at Gary, Indiana:

Construction work in the development and the building of the city of Gary has been carried on vigorously. Nearly all of the dwelling houses and other buildings planned to be constructed by the company have been completed and are occupied. About 10 miles of the street paving have been completed. There have also been built over 11 miles of cement sidewalk. The entire first subdivision is now being supplied with electric light, water and gas, and is equipped with a complete sewer system. The power required for furnishing these facilities is supplied from the manufacturing plant. Within the first subdivision there have been built or are in process of building 74 business blocks of substantial construction, costing in the aggregate $1,147,000. All of the buildings completed are occupied. In all 143 dwelling houses and flats have been completed in the subdivision by outside parties at an estimated cost of $486,000. At this date there are approximately 60 additional dwelling houses and flats in process of building by outside parties. At Jan. 1, 1909, there had been sold by the company a total of 449 building lots and this number was increased during the month of January, 1909, by the sale of an additional 184 lots. The sales of lots now being made are largely to employees who are purchasing for the purpose of building homes. About 130 acres of land lying immediately east of the first subdivision have been sold to the American Locomotive Company for use as a manufacturing site. It is the intention of that company to erect on this site a plant for the manufacture of locomotives which will have a capacity of 50 finished locomotives per month and will employ about 3500 men. The terminal railroad work adjacent to the plant and the city of Gary referred to in detail in the last annual report, was substantially completed during the year covered by this report.

Chronology of Mining, March, 1909

March 2—Explosion at Colliery No. 14, Pennsylvania Coal Company, Port Blanchard, Penn. Six men killed.

March 3—Eleventh annual meeting of the Canadian Mining Institute at Montreal.

March 4—Deering Coal Company, of Delaware, passes into the hands of receiver.

A round of 25 shots exploded prematurely at the bottom of a 2500-ft. shaft at the Diamond mine in the Butte district. Four men were killed.

March 5—Meeting of the anthracite district officers of the United Mine Workers of America at Wilkes-Barre, Penn., to plan for meetings with operators.

March 8—The United States loses its suit against the Standard Oil Company in the case of the $29,000,000 fine.

March 11—The Utah legislature passed a bill giving smelters right of eminent domain in counties of less than 20,000 population. This was done over the governor's veto.

The Anthracite Coal Operators and the United Mine Workers held a conference at Philadelphia, Penn.

The stock of the Phelps-Dodge company listed on the New York Stock Exchange.

March 12—Crows Nest Pass Coal Company passes into the control of the Great Northern Railroad Company and the Granby Copper Company.

March 13—The close of a five-day session of the United Mine Workers of Indiana, held at Terre Haute.

March 14—Congress assembled in extra session to revise tariff.

March 16—A stock dividend of 60 per cent. was declared by the Consolidation Coal Company of Maryland.

March 18—The appointment of a receiver for the Idaho Smelting and Refining Company.

March 20—Explosion at Sunnyside Coal Mine, Ill., caused by a windy shot. Five men were killed.

March 23—The Tri-District convention of the Anthracite miners met at Scranton to consider the Operators' proposition regarding an agreement for the ensuing year.

March 24—A joint meeting of the Mining, Civil, Electrical and Mechanical Engineers was held in New York to discuss the conservation of national resources.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Frank Mills is now manager for the Giroux Consolidated Mines Company, at Ely, Nevada.

Wm. Fleet Robertson, provincial mineralogist for British Columbia, was in Seattle, Wash., recently.

Robert R. Hedley, formerly of Nelson, B. C., is now in charge of the Long Lake mine, near Sudbury, Ontario.

John Daniels, president of the Superior & Globe Company, of Arizona, has gone to the property on an inspection tour.

Charles S. Herzig, who has been engaged in work in Nicaragua for a number of months back, expects soon to visit New York.

P. G. Lidner, of New York, has gone to Central America on professional business. He expects to be absent about six weeks.

J. E. Spurr has returned to New York after a two months' trip of inspection of the properties owned by the Guggenheim interests in Mexico.

Edmund Juessen has been appointed general manager of the Pittsburg Silver Peak Mining Company, to succeed George W. Bradley, resigned.

Albert H. Fay, of the JOURNAL staff, delivered an illustrated lecture on "Life and Travel in Alaska," on March 29, in Plymouth Church, Brooklyn.

William G. Rice, president of the Superior & Boston Company, of Arizona, has returned to his home at Houghton, Mich., after inspection of the property.

O. B. Smith, of Phoenix, B. C., superintendent of the mines of the Granby Consolidated company, is spending a vacation in California and neighboring States.

B. S. Schlessinger has resigned his position as superintendent of the Comers Mines Company, Grant county, Ore., and expects to open an office in Denver.

James MacNaughton, general manager of the Calumet & Hecla, is at Old Point Comfort, Va., where he has gone to recover after his recent operation for appendicitis.

W. R. Woodford has resigned his position as vice-president of the Pittsburg Coal Company, to become president of the River and Rail Coal Company, of Pittsburg.

E. A. Holbrook, superintendent of the Daly Reduction company's mill and cyanide plant at Hedley, Similkameen, B. C., has returned after having spent a two months in Massachusetts.

Harrison Souder, superintendent of the Cornwall Ore Bank Company at Cornwall, Penn., recently returned from Cuba, where he inspected the mines of the Spanish-American Iron Company, at Mayari and Daquiri.

J. S. Burrows, formerly engineer-in-charge of the fuel-testing division of the United States Geological Survey, has been appointed fuel expert for Castner, Curran & Bullitt, of Philadelphia.

William H. Price, chief engineer of the Meyersdale mines of the Somerset Coal Company, has been appointed assistant superintendent of the company's mines at Jenner, Penn. Eugene C. Hostetter succeeds him as chief engineer at Meyersdale.

W. A. Carlyle, consulting engineer to the Le Roi Mining Company, Ltd., has returned to London, Eng., after having spent several weeks examining the mine at Rossland, B. C. He was accompanied by A. J. McMillan, managing director of the company.

Prof. George Lunge will attain his seventieth birthday on Sept. 15, 1909, and his friends and pupils desire that the occasion should be suitably honored. An international committee has been formed to raise a sum of money which will be devoted to the formation of a "George Lunge fund," which will be handed over to Professor Lunge to dispose of as he may desire. It is further intended that a gold medal, bearing his portrait in relief be struck and presented to him on the occasion of the celebration. Subscriptions should be addressed at an early date to Prof. E. Bosshard, Eidgenössisches Chemiegebäude, Zürich, Switzerland.

Obituary

William P. Henszey died at his residence, Philadelphiia March 23, aged 76 years. He was born in Philadelphia and entered the Baldwin Locomotive Works as a draftsman in 1859. He rose gradually to be head of the designing department and finally a member of the firm of Burnham, Parry, Williams & Co., owners of the works. He was connected with many local clubs and institutions.

Dr. William Henry Wahl died in Philadelphia March 23, aged 61 years. He was born in that city and graduated from Dickinson College, later taking a course in chemistry and metallurgy at Heidelburg, Germany. He was engaged for many years as a teacher, editor and writer on technical subjects. He was best known as secretary of the Franklin Institute of Philadelphia, a position which he held from 1870 to 1874, and from 1882 to 1908, when he resigned on account of ill health. Dr. Wahl was connected with several technical journals; for two years, about 1880, he was on the staff of the ENGINEERING AND MINING JOURNAL. He was also the author of several books, chiefly on chemistry and electricity.

Waldemar Arens, general manager and financial agent for the Iron Silver Mining Company, and one of the best known mining men in Colorado, died at his home in Leadville, March 23, aged 79 years. He was born in Germany, but came to this country when a child. He was for some years in business at Detroit, Mich. In 1878 he went to Leadville as clerk and agent for Stevens & Leiter, who then owned the townsite of Leadville, and conducted the sale of lots there. Later he was made general agent for the firm, and when the Iron Silver Mining Company was organized in 1880, he was chosen secretary and financial agent. From 1885 Mr Arens, while still retaining the title of financial agent, had active charge of the Iron-Silver operations and for 20 years as the western representative of the company, had practically full control. He enjoyed to the fullest extent the confidence and esteem of the company. Several years ago he was offered an opportunity to retire on a liberal pension but declined the offer. He seemed to have a deep affection for the old mine that he had seen grow and prosper from the very beginning, and whose vicissitudes he had followed in every phase of its career. He occupied rooms in the office of the mine in California gulch, where he spent the major portion of his time. He was a great reader and a student, fond of art and music, and had an intelligent appreciation of the affairs of the great world about him. He was highly esteemed for the integrity and the thoroughness of his work, and also for his care of the interests of those under him. He never married, and left no near relatives.

Societies and Technical Schools

Museum of Safety and Sanitation—The charter members were entertained at dinner at the Engineers' Club, New York, by Philip T. Dodge, Tuesday, March 30. An organization was perfected, with Philip T. Dodge as president, Charles Kirchhoff, Richard Watson Gilder and T. C. Martin, vice-presidents, and W. H. Tolman, secretary and director.

Conservation Meeting—A joint meeting was held at the Engineering Societies building, New York, March 24, by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Dr. James Douglas presided, and addresses were made as follows: "Conservation of Water," John R. Freeman. "Conservation of Our Natural Resources by Legislation," R W. Raymond. "Waste of Natural Resources," by Charles Whiting Baker. "Electricity and the Conservation of Energy," Lewis B. Stillwell.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Goldfield and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 26—The Inyo Development Company, which is obtaining soda from the waters of Owens lake to make soda ash is in trouble about piping the water from the lake to its factory. The waters of the lake are constantly receding, so that a considerable strip of land lies uncovered between the works and the waters of the lake. Recently other people took up the land between the company's property and the lake, and complained about the pipeline passing over their ground. Thereupon an attempt was made to get the legislature to make a change in the law governing the principle of eminent domain, which would grant authority to condemn land for pipe-lines for water used for other than domestic purposes. This attempt failed because the members of the legislature thought the purpose was to settle a dispute between two corporations. The companies will now have to fight it out between themselves.

The addition to the Tahoe Forest Reserve of 300,000 acres by the presidential proclamation of March 2 took in about 80 sections in Plumas, Sierra and Nevada counties but did not affect the latter county as much as the miners feared it would. The proposition to include all the Washington and San Juan ridges in that county together with a lot of mining towns did not go through. Mr. Pinchot agreed to the change when it was shown him that the sections named were devoted chiefly to mining with little timber. Considerable land in both Butte and El Dorado counties is, however, included, together with some mining towns of small importance.

During the past week there have been some very heavy falls of snow in the mountain sections. The snow area is more widespread than in the big storm of Jan. 24. Shasta, Siskiyou and Trinity counties got a plentiful supply which will be good for the hydraulic miners.

The famous Harrison Gulch townsite case has, after 10 years' litigation, been settled by compromise. Early settlers at this mining section of Shasta county built their dwellings, stores, etc., as suited their purpose, and finally applied for a townsite. The locators of the Bonanza mining claim also applied for a patent to their mine which included the best part of the townsite. The issues were tried out in the local land office, general land office, and on to the Secretary of the Interior. The long litigation has been to settle who had the right to the surface ground. The Midas mine at Knob P. O., has long been a large producer and the Bonanza is developing rich ore, while other claims there are promising. The litigation has kept the whole place, mines and all, back for years.

The magnesite miners of California were unsuccessful in getting Congress to increase the duty on that mineral, as foreshadowed in a letter from here some months ago. The question of marketing magnesite in this country is entirely one of freight rates. California produces all the magnesite of the United States, but the largest consumption is in the East, and freight rates from California are virtually prohibitive. The Eastern consumers can get their magnesite much more cheaply by importing from Greece or Austria than they can by buying in this State. As there are less than half a dozen producers and many hundreds of consumers, it was out of the question to put on a high enough duty to permit shipments from California. The domestic output is from 4000 to 6000 tons annually, but could be largely increased.

The Dakin group of copper claims near Happy Camp, Siskiyou county, has been sold to John B. Farish, of Denver, for parties unknown. The price is said to be in excess of $100,000. Happy Camp is 75 miles down the Klamath river from Yreka on the railroad, so doubtless a branch road will be built when the mines become productive. No great amount of development work has been done, but large bodies of good ore have been found. This is the largest transaction in copper mines ever made in Siskiyou county. There are other copper deposits known there, but lack of railroad facilities has kept them from being utilized.

The Minarets section in the eastern ranges of Madera county near the Mono county line, has long been known to have extensive deposits of iron ore and some copper and tungsten. The mountain peaks in that section are from 7000 to 13,000 ft. in hight and the country has been undeveloped, owing to its isolated location and the hight of the mountains. Paul F. Mohr, of San Francisco, who has previously investigated the Minarets, has been employed to make a systematic examination of larger bodies of iron ore and for the purpose will use diamond drills.

There is quite a little stampede in the Humbug mining district of Siskiyou county, not far from Yreka. At that place J. A. Johnson found the Inyo mine in February and got out some good ore. In continuing work he has come across rich specimen rock in large quantity. In the same district others have made good finds this month and numbers of claims have been taken up.

Salt Lake City

March 26—The annual report of the Utah Consolidated Mining Company will be published in the near future. This company's contract with the American Smelting and Refining Company expires in about one year, and after that time the mine will ship to the new International smelter. A tunnel from the mine in Bingham cañon to Pine cañon on the Toocle side is projected. The mine is now in excellent condition, and of late some rich orebodies have been developed. Jesse Knight has definitely announced that the men holding an option on the Tintic smelter and the Colorado mine are representing the Cole-Ryan Syndicate. This option expired on March 20, but has been renewed. The price involved for Colorado stock is said to be about $4 per share, and that for the smelter about $1,000,000. The copper furnace at the Tintic smelter was blown in March 22 and is now running smoothly. The Grand Central, Carisa, Ajax, Mammoth and other Tintic properties will probably ship to this smelter.

For the first time since December, 1907, the Daly-West Mining Company has announced a dividend. It is dividend No. 47 for 30c. per share, or $54,000, and is payable April 10, 1909. During 1908 the Daly-West marketed 12,760 tons of crude ore and 4424 tons of concentrates. The crude ore carried 343,376 lb. of copper, 2,683,830 lb. of lead, 454,149 oz. of silver and 441.86 oz. of gold, which brought $225,780. The concentrates carried 116,346 lb. of copper, 2,305,472 lb. of lead, 211,476 oz. of silver, and 150.62 oz. gold, which brought $150,621, making a total of $376,402 for ores sold.

At the West Quincy annual meeting, G. D. B. Turner again came into control of this company. Of 270,000 shares issued 215,000 were represented. J. R. Rand was elected president; George W. Morgan, vice-president; H. C. Gaw, secretary and treasurer. J. R. Rand, H. F. Sewall, H. E. Moore, George W. Morgan, R. E. Miller, M. H. Sowles and J. R. Clawson constitute the new board of directors. The

company owns valuable ground in Park City.

The Tintic Empire Company, of Tintic, the Mountain Lake Extension Company, and the Camp Bird Company, of American Fork, the Cedar-Talisman Company, of Beaver county, and the East Tintic Gold King Company, have been listed on the Salt Lake Exchange. The Tintic Empire and Mountain Lake Extension are each incorporated for 1,000,000 shares of 10c. each; the Camp Bird and East Tintic for 1,000,000 shares of 5c. each, and the Cedar-Talisman for 1,000,000 shares of 50c. each. The Tintic Empire controls six unpatented claims, and the Mountain Lake Extension owns 14 patented and five unpatented claims. J. W. Knight is president and F. O. Frick, secretary. The Camp Bird and the East Tintic each control five unpatented claims. The Cedar-Talisman Company owns five patented and 10 unpatented claims in Beaver county. Joseph Geoghegan is president and H. Barnett, secretary and treasurer.

The Silver King Coalition Mines Company has declared a quarterly dividend of 15c. per share for $187,000, payable April 1, 1909. The Utah Consolidated has also posted a quarterly dividend of 50c. per share, payable April 15.

Butte

March 25—Since it has been concluded that the Amalgamated mines are not going to curtail their output the mining industry has taken on a more settled aspect in the Butte camp. It is reported that the Pittsmont Copper Company is about to change hand, or in other words, that the controling number of shares are under option to W. A. Paine, of Boston. The Pittsmont Copper Company succeeded the Pittsburg & Montana Copper Company, and was reorganized May 1, 1908, at which time the name was changed and the capitalization was reduced from $30,000,000, at a par value of $100 per share, to $11,000,000, with a par value of $5 per share. During the past several months a 250-ton concentrator has been completed, and many improvements made to the smelting plant. Four hundred and fifty tons daily are being mined and treated, and it is understood that new and large bodies of ore are being opened up. During the past week news of a big strike comes from the Davis Daly property. It is stated that a crosscut from the 1400 level of the Colorado has intersected and cut through a 20-ft. vein, which averages from 3½ to 4 per cent. copper, with some silver and gold.

Amalgamated is working the Poulin through the Buffalo shaft. Operations at the Anaconda are still somewhat retarded on account of the gases. The St. Lawrence and Neversweat are being worked, however, and as the levels of these three mines are all connected, the gases from the old mine fires are allowed to escape through the Anaconda shaft while the good air is supplied to the workings through the Neversweat and St. Lawrence shafts. The Anaconda company's shaft on the Right Bower claim has reached a depth of 225 ft. The Badger State shaft of the Boston & Montana has reached a depth of over 1000 ft. Boston & Montana is shipping about 3500 tons daily to Great Falls, which smelter is being enlarged and will eventually have a capacity of 5000 tons. The Brittania mine in the southwestern portion of the camp is being unwatered.

The Original and Gagnon mines have opened up better ore in the lower levels than at any other place in the mines; in fact, all of the large mines within the known copper belt, have opened up good ore in the lower levels.

The Butte Coalition company has practically made a new mine out of the Minnie Healey and has opened large bodies of ore in the recent developments. There are several development companies pushing work with much energy among which are the Butte Superior, Tuolumne, Davis Daly, Elm Orlu (the property of W. A. Clark), and the Butte Balaklava. The Anaconda company is also sinking a shaft on the Right Bower claim in Meaderville. The Boston & Montana company is sinking on the Badger State, which adjoins the Jessie claim of the North Butte company.

Denver

March 26—The Gold Dollar Consolidated Mining Company, of Cripple Creek has just issued its regular quarterly report to its stockholders, disclosing a satisfactory condition of affairs, and announcing a dividend of ½c. per share, payable April 10. Announcement is made of the granting of two important leases in the district, one on the Shurtloff, owned by the Findley company, for a period of eighteen months, to Asmussen and associates, and the other, for five years, on the entire property of the Free Coinage Gold Mining Company, to G. R. Woodin, representing, it is said, Boston capitalists. Machinery is now being installed at the Pinto shaft on this property.

From Tenderfoot hill comes the report of a strike on the fourth level of the main shaft of the Hoosier, situated about two miles northeast of the town of Cripple Creek. A group of claims between Long Hungry and Pony gulches, about eight miles south of the town, are being vigorously worked, thus showing that the circle of activity is gradually being extended beyond the recognized gold-bearing area of the Cripple Creek district.

The Vidler tunnel through Argentine Pass, above Georgetown, is being advanced at the rate, so it is reported, of seven to eight feet per day, and the breast of the Eastern portion is now 4300 ft from the portal. It is rumored that foreign capitalists have become interested in the Topeka group, one of the former large producers of Russell Gulch, and operations are soon to be resumed after an eight years' period of idleness.

A gold bar, weighing 1173 oz., and valued at over $20,000, was shipped a few days ago to the Denver mint by the Fifty Gold Mines Corporation, being the product of a 30 days' run at that company's mill, on ore produced from the Bobtail and Fisk veins at a depth of 1400 feet.

In Cripple Creek the deep drainage tunnel has now been driven 6935 ft.. The distance from the portal to the breast is 5383 ft., and the distances from the headings in the intermediate shaft are 801 and 751 ft. A strike worthy of recording is in the Doctor-Jack Pot; some leasers have exposed at a depth of 240 ft., 4 ft. of ore, the first two carloads of which ran $80 per ton.

The litigation between the Ajax and the Uinta companies, which has been pending for a number of years, preventing the working of some rich ground near Victor, Colo., has been amicably settled, and all the property is now controlled by a new company called the Ajax-Uinta Gold Mining Company. It will be worked under the lease system. A rich orebody is said to have been entered at the 1400-ft. level of the main shaft of the Vindicator. The new shoot was opened on the main Vindicator vein 260 ft. north of No. 1 shaft, and is between 3 and 4 ft. wide. The Vindicator company is maintaining a steady production of 1500 tons a month from the main workings, and lessees on the Vindicator No. 2 and Hull City shafts ship 750 to 1000 tons, averaging close to $40 per ton.

At Rico, in the San Juan region, the chief mines are now included in the United Rico Mines and the Wellington and Logan groups. The first, which has for a long time suffered under extravagant and inefficient management, is now being run under a new manager on intelligent and economical lines, with a superintendent who has had much experience in Leadville and Aspen, and who understands the somewhat puzzling formation and ore occurrences at Rico.

In the Cripple Creek district, the annual report of the El Paso Company says that during the last year, the property, which was worked under the leasing system, produced gold ore valued at $422,663.

Goldfield, Nevada

March 23—The production of the Goldfield mines for the week ending March 20 was 6500 tons valued at $332,000. The details for the consolidation of the Hibernia and Conqueror properties have been practically completed and the new organization will be known as the Conqueror Consolidated Mining Company. The new

company is incorporated under the laws of South Dakota with a capital stock of 2,000,000 shares, par value $1 each. Messrs. Wingfield, Nixon and Hennessey are heavily interested.

A reconnoissance survey of the proposed Ely-Goldfield railroad is now in progress to be followed immediately by preliminary and location surveys. Manager John Ryan, of the Tonopah and Tidewater road, states that the road will be completed and in operation by the end of the year.

By a clever ruse, the Governor caught the opposition napping, and on the night of March 16 introduced a bill abolishing the State board of assessors and creating a new commission composed of the governor, attorney general and State comptroller which has the power to assess railroads, telegraph, telephone and power companies.

The suit instituted by the Goldfield Consolidated against the Frances Mohawk Mining and Leasing Company was called on March 22 in the district court. The Consolidated asks for $125,000 damages, alleging neglect of the lessees in complying with the terms of their lease and claiming that by insufficient timbering the property was damaged to that extent. H. P. Bryant, counsel for the plaintiff and J. W. Finch, former general manager of the Consolidated, arrived in Goldfield last week to take part in the suit. As an outcome of this suit, D. Mackenzie filed a suit on the March 19 against the Mohawk Mining Company, George Wingfield and James R. Davis. Damages of $100,000 are asked against Wingfield and Davis who acted as bondsman for the Mohawk company, and $400,000 against the Mohawk company together with $2000 attorney fees. The plaintiff claims that his business was damaged greatly by the action of the defendant company in tying up the funds of the Frances Mohawk company; that the suit was of malicious origin, the Mohawk company being aware that D. Mackenzie and company were not responsible for the affairs of the Mohawk company.

Ore shipments from Tonopah for the week ending March 20 were as follows: Tonopah Mining, 3150 tons; Belmont, 700 tons; Montana Tonopah, 645 tons; MacNamara, 300 tons; Jim Butler, 160 tons; West End, 150 tons; Midway, 100 tons; total 5205 tons, worth $130,000.

Toronto

March 26—The Ontario government has disposed of 130 lots in the Gowganda townsite for the total sum of $17,664. The sale was by tender, 250 lots in all being offered of which 120 were withdrawn, the bids not being considered sufficiently high. The highest price secured for any lot sold was $412 and the lowest accepted was $25, the average figure being $136 per lot. Recently a strong deputation from northern Ontario waited on the government and urged the immediate extension of the Canadian Northern Railway from Sellwood to Gowganda and an appropriation for a permanent wagon road.

The exportation of natural gas will be discontinued at the end of March, Hon. Wm. Templeman, Canadian Minister of Mines, having decided that the present supply must be conserved for Canadian use. The only company now holding a license to export, piped, during last year, about 250,000,000 ft. to Buffalo. Its license expires at the end of March, and its renewal has been refused.

In the Ontario Legislature a bill has been introduced by Hon. Frank Cochrane, provincial minister of mines, to amend the law respecting mine accidents and the operation of mines. It is based on a report of personal investigations into mining conditions by Mine Inspector Corkill. Safeguards as to the use of explosives are made compulsory, and miners are prohibited from drilling at the bottom of old drill holes where there are frequently old charges of unexploded dynamite. The Inspector is to be in attendance at all inquests in case of mining fatalities to assist in bringing out the evidence, the lack of technical knowledge on the part of coroners sometimes resulting in the suppression of essential facts. A record must be kept of all scaling operations and crossheads must be so constructed that the bucket will stop immediately on the crosshead striking the shaft. Penalties for violations of mining regulations are considerably increased and in cases where neglect to comply with them is considered deliberate a sentence of imprisonment may be imposed.

Johannesburg

March 2—The new gold law of the Transvaal is now in force. One of its most widely applicable provisions is being advertised, so that persons affected may be fully warned. This relates to the forfeiture of claims upon which the license fees have not been duly paid. Under the old law such claims were advertised for sale by auction, and even then, as a rule, the registered holders could recover possession by paying up arrears. Under the new law, however, there will be no public sales, but the ground will revert automatically to the Crown when license payments are three months in arrears.

The duties of professor of mining in the College of Johannesburg are of rather an exacting order, but the authorities in charge have made the position attractive by fixing the salary at £1500—about the salary of the manager of a large mine—permission being given also to do consulting work in season. The position requires not only technical knowledge, but also practical experience and some familiarity with local conditions. A feature of the College is found in the night classes, in which men who are at work during the day can qualify themselves to pass the government examinations required for appointment as mine foremen, superintendents, and other responsible positions.

Paris

March 22—Debate on Ouenza affairs in the French Chambers has been put off until after Easter holidays, the reason for this delay being that the government is about to modify its first scheme and grant the Ouenza ores access to both Bizerta (Tunisia) and Bône (Algeria) harbors. It desires to facilitate the supplying of coal to Bizerta harbor by providing coal steamers with return freight. From the Ouenza-Bône railway (about 140 km.) a line would branch off to join the existing Tunisian line at Nebeur. Rates of railage would be the same for both lines. Moreover, the mining concession of Bou-Kadra, neighbor to the Ouenza concession, but independent, would have to forward all its ores through Bizerta, thus insuring a yearly ore-traffic of 700,000 or 800,000 tons.

The consortium concerned in the Ouenza had pledged itself to build the railway line from Ouenza to Bône at its own expense and to undertake large improvements in the latter harbor. The government's new scheme raises loud protests in Algeria, both from the people and the authorities, and the Chambre de Commerce of Bône has decided to suspend payment of contributing funds to the state until further orders.

Several attempts are being made in New Caledonia for treatment on nickel ore (garnierite) by the erection of blast furnaces at Duiambo Point, near Nouméa. Two other schemes contemplate turning to account hydraulic power in the island, one by fitting the Plaine des Lacs with a large dam. The other plan is to utilize the Taô falls. Gagings carried on for three years estimate the power available on the latter spot at 15,000 h.p., upon which the necessary equipment for working 2000 h.p. has just arrived. By vote of the Conseil General of New Caledonia, submitted for approval to the Conseil d'Etat, a premium of 0.10 fr. per kg. of metal will be paid to producers, up to the amount of 50,000 fr. ($10,000) for each concern.

A tornado has made great havoc on the eastern coast of New Caledonia and heavily injured the aërial wire-rope tramway of Compagnie Le Nickel, lately the subject of an illustrated article in the JOURNAL.

An Australian syndicate is boring for petroleum at Ouen-Toro on the western coast of Caledonia. A thick bed of soapstone, emitting inflammable gas, has been struck at a depth of 820 ft., and water brought up by spoon contains oil.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

Alaska Treadwell—February: 240-stamp mill crushed 35,336 tons ore; estimated value of bullion, $51,543. Saved 700 tons of sulphurets; estimated value, $33,124. Working expenses, $83,762.

Ester Creek—On Feb. 25 the first stamp mill in the Tanana began operations near Fairbanks. E. W. Griffin, mayor of Chena, says the quartz has been found in places from Ester creek to No. 8 above on Fairbanks.

Gold Bullion—This Seattle company is installing a two-stamp battery at Cook's inlet. A good shoot of gold-bearing quartz is reported.

Arizona

COCHISE COUNTY

Calumet & Arizona—The annual meeting of the stockholders will be held at Bisbee April 12.

Southern Arizona Smelting Company—This company is at present producing at the rate of about 1,250,000 lb. of copper per month.

Paradise District—The Turkey Creek Mining and Development Company was recently organized and incorporated. H. J. Freede, president, and M. J. Donahoe, secretary and treasurer. Main office is at Douglas.

GILA COUNTY

Arizona-Michigan—Work on the three-compartment shaft is progressing rapidly under Manager S. W. Clawson, formerly of the Copper Queen at Bisbee. The shaft has now reached a depth of 125 feet.

PINAL COUNTY

Ray Central—Papers have been recorded in Florence consummating a deal whereby Adolph Lewisohn, of New York, acquired the property of the Kelvin Calumet Mining Company.

YUMA COUNTY

Golden Star—The property of the company is near Polaris in the Kofa mining district, and consists of 21 mining claims and 7 placer claims. The mine has been opened by two shafts, one 130 ft., and the other is 300 ft. deep, exposing the vein the entire depth. The fourth level is now opened 150 ft. in length. The vein is 8 ft. wide, from which ore is being sent to the mill. The 50-ton cyanide mill is treating 1300 tons per month, yielding $40 to $45 per ton. Machinery is now on the ground to increase the capacity of the mill to 75 tons per day. The company is capitalized at $2,000,000, divided into 400,000 shares, par value $5.00. D. M. Hyman, president; J. L. Tilton, secretary and assistant treasurer.

Yuma Copper—This is a new company organized to develop 600 acres of mineral land. Samuel Brady, superintendent of the Michigan Copper Mining Company, is president.

California

AMADOR COUNTY

Argonaut—Some of the machinery at the shaft at Jackson is being replaced, and a larger compressor is being put in. The full milling capacity will soon be in operation.

BUTTE COUNTY

Magalia Ridge—Work is steadily prosecuted on the old Matheson mine. At the Hupp, which is now under bond, an incline is being run. At the Cole good ore is being taken out. The Mammoth Channel Gold Mining Company has installed a new hoist and is enlarging its shaft. The Atlas Mining Company will shortly begin work on its lease on the Wilson & Brown property.

CALAVERAS COUNTY

Leveggi Estate Company—The old stopes and drifts of the Newman mine are being cleaned out, preparatory to resuming operations.

EL DORADO COUNTY

Ogden—At the El Dorado mine a wide vein of good milling ore has been opened.

DEL NORTE COUNTY

Cleopatra Development Company—This new company is about to begin mining operations in the northern portion of the county.

TRINITY COUNTY

Yellow Jacket—In this district some important developments are being made, not only in the Yellow Jacket group itself, but in the mines adjoining.

TUOLUMNE COUNTY

Keltz—The shaft of this mine, Soulsbyville, is being cleaned out and, after it is retimbered, thorough development of the property will begin.

North Fork—A new 50-h.p. hoist is being installed with some other machinery at this mine.

YUBA COUNTY

Tarr—This company, which is about to work the old Blue Point or Paddy Campbell mine near Smartsville is preparing to start active operations as soon as the weather will permit.

Colorado

LAKE COUNTY—LEADVILLE

Louise—A drift on the lower level is in a body of ore 4 ft. wide. The ore is a lead sulphide, carrying gold, and was found close to the Bald mountain fault.

New Monarch—From the Cleveland and Winnie shafts the company is shipping about 1500 tons per month of different grades of ore. As the Yak tunnel has drained the country in the neighborhood of the Monarch shaft, the company has decided to resume work in the near future.

Vinnie—Another pocket of ore was opened in this Breece hill claim during the week and the company is shipping about 30 tons of ore daily. The property is worked from the Yak tunnel.

A. Y. & Minnie—From California gulch this property is shipping daily 150 tons of lead and zinc sulphides to the Western Chemical Works, Denver. The dump is being treated in the mill and a good grade of concentrates is shipped.

R. A. M.—The drift connecting this shaft with the Pyrennes has been completed and now both properties are supplied with plenty of good air, which will permit the orebodies above the water level to be worked successfully.

Matchless—A body of good ore, carrying chlorides, has been opened in one of the lower levels and shipments are now going out daily.

Progressive—Arrangements are being made to sink the shaft deeper and to install heavier machinery to handle the water

OURAY COUNTY

Camp Bird—During the month of February the mill ran 21 days, crushing 4944 tons of ore and producing 9715 oz. of bullion and 375 tons of concentrates. The expenses of the company were $43,135. During the month, 581 ft. of development work was done

Indiana

GREENE COUNTY

None of the miners in the Linton coalfield worked Tuesday, March 23, because of the local option election. A large majority of the miners voted to put the saloons out of the county. Thursday was one of the biggest pay days the miners have had for some time, the total reaching $145,000, or more.

VIGO COUNTY

The Indiana Coal Operators' Association has voted to help State Mine Inspector Epperson have Terre Haute made a station for the relief appliances which the Government has indorsed and which have been tested recently at the University of Illinois. President Van Horn, of the Indiana Mine Workers indorses the plan.

Maryland

Consolidation Coal Company—This company reports for the year 1908 receipts of $3,691,746, a decrease of $952,058 from 1907. Income from investments was $361,983, making a total of $4,053,729. Working expenses were $2,647,469; taxes and other charges, $572,000; a total of $3,219,469, and leaving a surplus of $834,260. From this dividends amounting to $820,000 were paid. The company mined 1,748,233 tons of coal in 1908, and lessees on its property 390,939 tons, a total of 2,139,172 tons. The Cumberland & Pennsylvania Railroad, owned by the company, carried 3,935,503 tons of coal during the year.

Michigan

COPPER

Keweenaw—The drift from the 13th level of the Medora shaft has encountered the west fissure vein, but there is little copper at the point of intersection. This fissure was opened at the 11th level where it was well charged with copper. The company will in all probability conduct further exploratory work on the Kearsarge lode during the coming summer. Regular shipments continue to the Phœnix stamp mill, which is treating about 100 tons daily, yielding about 16 lb. of mineral to the ton.

Isle Royal—This company continues sinking its shaft to open the Baltic lode. It is now down about 230 ft. Its further development will be awaited with interest.

Calumet & Hecla—Six additional Chilian mills have been started at this company's new regrinding mill, and others will follow as soon as they can be assembled and put in shape. This plant, when completed, will contain 48 Chilian mills and 136 Wilfley tables, all to be driven by eight 250-h.p. 2080-volt induction motors.

Franklin—The stockholders' annual meeting will be held April 21, 1909.

Elm River—The annual meeting of the stockholders will be held April 21, 1909.

IRON—MARQUETTE RANGE

Kloman—An option on this property at Republic has been taken by the Cleveland-Cliffs Iron Company, the stipulated price being $125,000. The property will be explored by drilling during the coming season.

Minnesota

IRON—CUYUNA RANGE

Arrangements have been made by Cuyler Adams, who has been for several years conducting explorations in the Cuyuna district, with the Rogers-Brown Ore Company to incorporate a company to build a railroad from Duluth to Deerwood in the center of the district. When communication is assured, steps will be taken to open one or more mines on the range.

Mississippi

LAUDERDALE COUNTY

Coal is reported to have been found near Lauderdale. The discovery is now being investigated by men from Birmingham, Ala. It is supposed to be an extension of the coal deposits in the western part of Alabama.

Montana

BUTTE DISTRICT

Tuolumne—A recent report shows that the sum of $301,110 was received from the sale of stock; total disbursements up to the present date aggregate $183,976, with a cash balance in the treasury of $117,133. The shaft has been sunk to a depth of 1200 ft., and sinking will continue until the 1400 level has been reached.

Minneapolis & Radersburg Mining and Milling Company—Articles of incorporation have been filed in Silver Bow county. The capitalization is 500,000 shares, par value $1 per share. The incorporators are W. L. Hall, Alexander Hall, and J. H. Maloney, well known Butte mining men. The property of the company is located near Radersburg, Montana.

MISSOULA COUNTY

Saltese District—This district, which has lately been opened up by the entrance of the Chicago, Milwaukee & Puget Sound railroad, is showing much mining activity. The Silver Bar Mining Company is driving a tunnel, which will cut the vein at a depth of 700 ft. The vein shows a large outcrop carrying small percentages of lead, iron carbonate and silver.

Bryan Mine—With perhaps the exception of the Monitor, this is the most thoroughly developed property in the district. The vein has been developed to a depth of over 400 ft., and a large body of silver-lead ore has been exposed.

JEFFERSON COUNTY

Corbin-Wickes Copper—A 12-in. vein of chalcopyrite is being worked on the 235-ft. level. Plans are being made to sink the shaft to the 500-ft. level.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Goldfield Consolidated—A strike remarkable both for size and richness of the orebody has been made on the Combination No. 1 claim. The orebody is just north of the Combination mill practically in the center of the claim. At present it is opened on the fourth and fifth levels and exploratory work on the sixth indicates the workings to be close to it on that level. The body is irregular in shape and varies in width from 30 to 50 ft. and as now exposed has a length of 151 ft. The same quality of ore also occurs in a raise now 35 ft. above the fourth level. Shipments are now being made to the Western Ore Purchasing Company, in carload lots, which return from 80 to 105 ounces per ton.

Consolidated Red Top—An orebody has been encountered in the crosscut on the 300-ft. level, and while penetrated 60 ft. the footwall has not yet been reached. The ore improves as the footwall is approached. The first carload shipped returned $83 per ton. The company has secured an extension of six months extending from Aug. 1, 1909, to Feb. 1, 1910.

Grizzly Bear—This lease situated on the similarly named claim of the Consolidated property has added a compressor plant to its equipment and power drills will be installed. The shaft is now 330 ft. deep and it is expected that the Clermont vein will be encountered at a depth of about 400 feet.

Gold Bar-Victor—Power drills are to be used in the Victor claim as soon as connection can be made with the Gold Bar compressor plant. Shipments are being made regularly.

Penn-Florence—A shipment of 15 tons of $60 ore was made last week. The ground which is the same as the old Zinn-Florence lease is now being worked by Capt. Thomas Hooper and associates, who are also operating the Goldfield White Rock Mining Company. The ore is being extracted from the 200-ft. level.

Little Florence Leasing Company—Exploratory work is being carried on at the 357- and 500-ft. levels where strong and well defined low-grade ledges are being followed.

ESMERALDA COUNTY—RAWHIDE

Rawhide Queen—On the Kerns No. 2 lease, the oreshoot has been found on the lower level, and shipments are regularly made to the Dayton mill. The Kerns No. 1 lease is taking out average shipping ore, and the milling ore is be-

ing thrown on the dump. A rich body of ore has lately been cut on the 130-ft. level of the Grutt Balloon Hill lease. The vein is 6 ft. wide, and this promises to be the most remarkable strike yet made in Rawhide. The Dromiac lease continues to sack ore for shipment. On the St. Ives lease drifting for the rich shoot of the Grutt Balloon Hill continues. Much work is being done, and lately several claims lying in the east Walker river country have been added to the company's holdings.

HUMBOLDT COUNTY—MAZUMA

Seven Troughs District—Three mills are operating and a fourth ten-stamp mill is now under construction by an English syndicate. Seven companies are now shipping ore. These are: Seven Troughs Mining Company, Seven Troughs Coalition, Mazuma Hills Mining Company, Wihuja lease, Harris lease, Reagan lease, and the Badger Hill. The Kindergarten mill is at present running on Harris lease ore, and the Wihuja will have a shipment as soon as the cleanup of the Harris takes place. The Mazuma Hills mill is crushing Reagan lease ore. All properties produce high-grade ore.

NYE COUNTY—TONOPAH

Montana Tonopah—During the past week 205 ft. of new ground was broken. The mill crushed 645 tons of rock from the mine and 385 tons from the MacNamara with an extraction of 90 per cent. The contract for treating the ore from the MacNamara ends this week, after which the mill will treat the company's product exclusively. The semi-monthly clean-up last week resulted in 23 bars of bullion weighing 88 lb. per bar, which together with the concentrates were shipped to the Selby smelter.

Tonopah—Sinking in the Mizpah shaft was resumed on March 11. The shaft, which is of three compartments, will be sunk at the rate of about 20 ft. per week. The new pump at the 1200-ft. level is giving satisfaction. A sump of 12,500 gal. capacity has been made on the 1200 level. It is emptied twice a day. At the mill 97 out of the 100 stamps dropped continuously last week, crushing 3100 tons of rock, averaging $23 per ton. Ninety-four bars of bullion valued at $800 each and 24 tons of concentrates worth $375 per ton were shipped, making the total production for the week $84,200.

MacNamara—The directors, at a meeting held in San Francisco, March 6, declared a second dividend of 1c. per share payable April 5.

WHITE-PINE COUNTY

Nevada Consolidated—January shipments, 1,451,000 lb. copper, February, 1,035,000 lb., March 1 to 20, 1,086,000 lb.; this is at the rate of 1,680,000 lb. per month.

Ohio

BELMONT COUNTY

Plans are under discussion for the consolidation of the Lorain Coal and Dock and the Youghiogheny & Ohio Coal companies, the combined companies to have $20,000,000 capital. The proposed new company will own 31,000 acres of land, on which seven mines are now in operation.

Ohio Coal Operators' Association—This association was organized at Columbus, Ohio, recently. The officers chosen were: President, F. M. Osborne, Cleveland; vice-president, Richard Enderlin, Chillicothe; treasurer, H. H. Heiner, Columbus; secretary, Howard Mannington, Columbus. Executive board: C. L. Cassingham, H. E. Loomis, Herbert Sternberger, J. C. Berring, H. H. Heiner, Edward Johnson, F. M. Osborne. The organization is composed of all coal operators of the State, and will deal with questions affecting the coal industry of the State as a whole, and not take up questions concerning districts as such. The State has been divided into 12 districts, each of which will have a separate but affiliated organization which will deal with all matters with which the district alone is concerned. Each district will elect one member to represent it on the executive committee of the State organization, and this body will have full charge of all rates, wages, legislation and other questions which affect the mining industry of the State.

Oklahoma

JOHNSON COUNTY

A deposit of zinc ore has been found near Ravia. The district is entirely new, and a few shallow open cuts show zinc and lead sulphides intimately associated with dolomite, flint and sandstone. The ore occurs in the vicinity of the contact between the dolomite and granite. Drilling with churn drills is to be started at once, to determine the extent of the deposit.

Oregon

LANE COUNTY

Combination—Clark Brothers, owners, are building a concentrator. Silver-gold ore is now being blocked out.

Crystal Consolidated—A suit has just been filed in the circuit court wherein the Wynne Hardware Company, of Cottage Grove, Oregon, is plaintiff, and Benjamin Lurch, Geo. M. Holland, Ben Pitcher, all of Cottage Grove, defendants. Plaintiffs claim that they were given a judgment on foreclosure proceedings against certain mining claims and mining property of the Crystal Consolidated Mining Company some time ago, and that the defendants have relocated the claims and done assessment work.

Pennsylvania

ANTHRACITE COAL

A bill said to have been originally prepared by James Roderick, chief of the State Department of Mines in Pennsylvania, has been submitted to the State Legislature for consideration. The bill takes from the electors of anthracite counties the power of chosing mine inspectors and rests this authority in the Governor. It is provided that in January 1910, and every four years thereafter, the Governor shall appoint five citizens to be known as the Mine Inspectors Examining Board. Two of the members are to be mining engineers and the three remaining committeemen are to be miners of five years' actual practice.

BITUMINOUS COAL

It is reported that J. V. Thompson, of Uniontown, who has recently purchased some large tracts of coal land in Greene and Fayette counties, is negotiating for their sale to United States Steel Corporation interests.

Somerset Coal Company—This company reports for 1908 total earnings of $1,736,797, a decrease of $632,068 from 1907. Other income was $71,903, making a total of $1,808,700. Working expenses and depreciation were $1,396,421; taxes and fixed charges, $266,365; making a total of $1,662,786, and leaving a surplus of $145,914 for the year.

South Dakota

LAWRENCE COUNTY

Branch Mint—The operating company has shut down again after operating on the Richmond dump for several months. It is evident that the operations on the scale followed proved unprofitable. It is reported that the company proposes to raise additional funds to work the mine as well as the dump.

Elliptic—This company has been prospecting its ground north of the Homestake by sinking two diamond drill holes. One from the bottom of the 600-ft. shaft has struck some free-milling ore at a depth of 1200 ft. from the surface. The second, put down 1000 ft. south, has sunk 1100 ft., but found nothing.

Gilt Edge-Maid—The mine and mill have been leased to M. E. Hiltner and A. B. Dill. The former was for a number of years superintendent of the Wasp mill and has recently been in charge of the Gilt Edge-Maid mill.

Tinton—It is reported that work will be started on the tin ores at Tinton this Spring and that machinery has been ordered to increase the capacity of the concentrating plant.

Hutchins Consolidated—Secretary M. L. Gordon, of Gillette, Wyo., is making arrangements to thoroughly open up the property in the Bear gulch. The company is newly organized and holds good ground.

Tennessee

POLK COUNTY

Ducktown Sulphur, Copper and Iron Company, Ltd.—This company, which has its headquarters in London, England, has offered for subscription in that city an issue of 48,779 ordinary shares of £1 each at the price of 25s. per share. These shares are to have a fixed preferential dividend of 10 per cent. per annum up to Dec. 31, 1909, payable on the amount from time to time called up. After Jan. 1, 1910, the shares will rank with the existing ordinary shares. The proceeds of the present issue are to be applied for completion of installation of sulphuric-acid plant.

Utah

UTAH COUNTY

Dutchman—This lease has been unable to ship owing to the bad condition of the roads, but 140 tons of high-grade ore are ready for shipment as soon as the roads become passable.

SALT LAKE COUNTY

Utah Copper Company—March production is expected to be about 4,500,000 pounds.

TOOELE COUNTY

Buffalo Consolidated—A winze has struck the extension of the rich orebody of the Lion Hill Consolidated Company. A lower tunnel now in 500 ft. will be driven a distance of 200 ft. farther to tap ore at an additional depth of 300 feet.

Rodenhouse—A drift from the 75-ft. level shows 6 ft. of good copper ore carrying some gold and silver. Four carloads of ore averaging 5 per cent. copper are now on the dump.

International Smelting and Refining—The contract has been let for the structural steel for the new smelting plant. Work on the railroad is being pushed, and it will probably be completed May 1. When the road is finished the smelter construction will be carried forward as fast as possible.

Washington

KING COUNTY—BERLIN

Apex—This mine has just shipped a car of ore to the Everett smelter. Eighteen men are at work. This force will be increased upon the completion of the surface tram connecting the mine with Berlin, a mile and a half of which remains unbuilt.

SNOHOMISH COUNTY—GRANITE FALLS

Wayside—Work continues in the encouraging vein struck a few weeks ago.

SNOHOMISH COUNTY—INDEX

Bunker Hill—Diamond-drill boring last week showed up a 29-ft. lode of chalcopyrite and marcasite, carrying about 5 per cent. copper and substantial gold and silver content. The vein encountered is the continuation of the one which was worked at a depth of 140 feet.

STEVENS COUNTY

Northport Smelter—This smelter, which is owned by Le Roi Mining Company, is to be closed early in April, owing to the lack of sufficient ore of payable grade from Le Roi mine, Rossland, B. C., to keep even one furnace regularly supplied. Custom ores have been received from about a dozen small mines, but the total receipts are not large enough to supply the needs of the works. The shutdown is not regarded as permanent—only until such time as the ore supply shall be large enough to keep at least one furnace in regular operation.

West Virginia

Fairmont Coal Company—This company reports for 1908 gross earnings of $3,401,-815, a decrease of $1,458,512 from 1907. Income from subsidiary companies was $510,398, making a total of $3,912,213. Working expenses, taxes, depreciation, etc., were $3,342,499, leaving a surplus of $569,714. Dividends paid were $240,000, leaving $329,714 to add to surplus.

CLAY COUNTY

Lackawanna Coal and Land Company—This company, organized by F. W. Tibbetts and associates, of Philadelphia and Scranton, Penn., has secured a tract of 22,500 acres in Clay county, extending into Nicholas county. The purpose is to lease tracts to coal operators on a royalty basis.

Wisconsin

ZINC-LEAD DISTRICT

Platteville—The Kohinoor Blende Company has leased its property to the Wisconsin Zinc Company; upon satisfactory examination, a mill will be erected. The property is opened up by 100 ft. of drift, showing a body of sheet zinc, and is considered one of the best prospects in the district. The Wisconsin Zinc Company is making preparations to remove the 100-ton mill from the Royal to the Mitchell Hollow. The Graham-Stevens has completed its incline shaft and is producing again. The Lyght is cementing its mill pond, breaking of which forced the company to close down soon after the mill was completed last fall. The shaft just finished on the Ellesworth farm showed 9 ft. of ore ground in sheet form. The Big Tom prospect, on the Thomas land, struck good sheet jack recently in the glass rock.

Wyoming

CARBON COUNTY

Penn-Wyoming—With the final payment of $16,831, the United Smelters, Railway and Copper Company recently took up notes and other evidence of indebtedness amounting to $1,390,789, principal and interest which were given by the Penn-Wyoming Copper Company and its subsidiary companies.

Canada

BRITISH COLUMBIA—ROSSLAND

Le Roi—A number of men who had been working at this mine have been discharged. The managing director, A. J. McMillan, who returned to Rossland from England on March 6, has made the following announcement: "The exploration work carried on for several months past in the lower levels of the mine has not, up to date, proved the extension of the rich orebodies found and opened up toward the end of last year. This is, of course, disappointing, and as it is not economical to ship ore and carry on exploration work on a small scale, it has been decided to suspend operations until arrangements are made for carrying out a large and comprehensive scheme of exploration and development, such as will thoroughly test undeveloped portions of the property, and particularly the south vein from the present 1650-ft. level to an additional depth of about 1000 feet."

BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

The Granby Consolidated Mining, Smelting and Power Company, Ltd., has bonded and made a first payment on a group of copper claims near Tasso harbor, Moresby island, of the Queen Charlotte group. Surface indications on this property and other mineral claims in the vicinity are promising, but not much development work has yet been done.

BRITISH COLUMBIA—BOUNDARY

British Columbia Copper Company—The following notice has been issued by J. E. McAllister, general manager: "Notice is hereby given that, owing to the unfavorable conditions of the copper market the mine and smelter of the British Columbia Copper Company, Limited, will close on or before April 1, 1909, for an indefinite period." This will throw some 400 men out of work. The Greenwood miners' union made a voluntary offer to the company to accept a 10-per cent. reduction in wages, but the company took no action.

Silver King—The Kootenay Development Syndicate, organized last year in London, by M. S. Davys and associates, has commenced mining at this mine, near Nelson, which was operated for years by the Hall Mining and Smelting company. Several months ago the syndicate secured the property under lease and option, and unwatering was commenced. Three levels having been pumped out, the production of ore has been commenced under the

direction of Louis Pratt, of Nelson. The ore contains values in both silver and copper; the production during eleven years to end of 1907 was 202,745 tons, averaging about 3.5 per cent. copper and 21 oz. silver per ton.

BRITISH COLUMBIA—VANCOUVER

Tyee Copper Company—February Smelter ran 19 days, treating 5250 tons of ore, producing 560 tons of matte.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending March 20 were: Buffalo, 45,350 lb.; Chambers-Ferland, 117,440; Crown Reserve, 115,520; King Edward, 44,130; La Rose, 195,000; Nipissing, 351,680; Nova Scotia, 79,420; O'Brien, 77,200; Temiskaming, 40,000; Temiskaming & Hudson Bay, 60,000; Trethewey, 56,620; total, 1,182,300 pounds.

Cobalt Lake—A new vein about 12 in. in width has been struck in the crosscut from No. 6 shaft, about 600 ft. in beneath the lake. It carries smaltite, niccolite and native silver, and the wall rock for a foot on either side is shot witih native silver. The crosscut is being run close to the McKinley Darragh property at the 135-ft. level in the hope of picking up some of its veins.

Temiskaming—No. 3 vein has widened from 8 in. on the 200-ft. to 12 in. on the 250-ft. level. In drifting at the latter level an 18-in. vein was struck, yielding rich ore.

ONTARIO—HASTINGS COUNTY

Canadian Pyrites Syndicate—Lot 9 in the 10th concession of Madoc has been secured, and a plant installed under the management of George H. Gillespie. Shipments will be made to Buffalo.

Palmer Pyrites Mine—This property in Madoc is being opened up. A 24-ft. vein of pyrites has been exposed, assays of which show from 46 to 50 per cent. sulphur with a slight trace of gold.

ONTARIO—MONTREAL RIVER DISTRICT

Moose Horn—The new plant, comprising a three-drill straight-line compressor and two 50-h.p. boilers is now being installed.

Otisse-Currie—A nine-drill compressor with boilers and other machinery has been installed.

ONTARIO—SOUTH LORRAINE DISTRICT

Lang-Hassett Syndicate—A syndicate of Cobalt capitalists, headed by Mayor Lang, has bought two groups of claims, comprising in all 20 locations in the neighborhood of Trout lake in the South Lorrain district for $75,000 cash and stock considerations. It is intended to develop the properties until shipments can be made and then to organize a company.

NOVA SCOTIA

Dominion Coal Company—The annual statement shows net profits for the year of $2,686,202, as against $2,094,539 in 1907, the balance remaining after paying interest and dividends being $1,600,162. The total surplus for the year is $4,253,471 against $2,828,308 at the close of 1907. There is cash on hand to the amount of $2,175,884. The output for 1908 was 3,555,068 tons, as compared with 3,541,253 for 1907. The demand for the company's coal for steam continues satisfactory, and the market has been maintained, in spite of competition by American operators.

YUKON—WHITEHORSE

Burwash Creek—Pay gravel has been struck on a dozen claims on which work has been done all the winter. The paystreak is 7 ft. deep and 60 ft. wide, and the dirt runs from 10 to 30c. per pan. In some places it is 30 ft. down to bedrock. Twenty men have worked on Burwash since last fall and all have located the paystreak. Jacquot Brothers, on Claim 12, above the cañon, have the best showing, their dump panning up as high as $50 per man per day. Gold-bearing gravel has also been found on other creeks in the vicinity. Freight is high, 12c. per lb. being charged from Whitehorse to Burwash.

Mexico

CHIHUAHUA

San Francisco del Oro—A reorganization was recently perfected in London and operations under the direction of James E. Hislop will be resumed about May 1.

San Toy—Regular shipments from this company's Sta Eulalia mines have been renewed, the ore coming from both the Galena and Juarez mines. The wooden terminal station, recently destroyed by fire, will probably be replaced with a steel structure.

Parral Output—The production of the Parral camp for the week ending March 19 consisted of 4050 tons of smelting ore and 5450 tons of milling ore.

Concheño—Corrigan, McKinney & Co., operating under the name of Cia Beneficiadora de Concheño, have resumed development operations on property recently forfeited by the defunct Greene Gold-Silver Company.

Zinc Mill—Lawrence Reed, representing the concern which owns the Potter process, has lately toured this and adjoining States to ascertain the ore supply and the best location for reduction works. Chihuahua or Torreon will probably be selected.

San Timateo—T. A. Ripperdan, manager, is receiving bids for a small modern concentrating plant. A reverberatory furnace is now being built. The property is in the Uruachic section in the western part of the state.

Humboldt Exploration—This lately organized New York company is said to be meeting with some financial encouragement in its efforts to assume control of the properties of the Greene Gold-Silver Company.

Hinds Consolidated—Oscar E. Slinock, managing director, is enlarging the operating department.

Rio Plata—On account of shortage of water the mill was operated only one-half its capacity during February. Net returns on shipments for the month were $30,700.

Batopilas—This company is reported to be once more in bonanza ore.

MEXICO

Esperanza—Two rich gold-bearing quartz veins are reported on the ninth level. One is 3½ ft. and the other is 5 ft. wide.

OAXACA

Tehuantepec Silver—John T. Judd, treasurer, reports that a 60-ton cyanide plant is under construction. During the year ending March 1, 1909, 787 ft. of adit work were done at a cost of $4.80 per foot. Size of adit, 6.5x9.75 feet.

SONORA

Babacanora Mine—Recent development has opened some old workings below the caved zone, in which has been found a body of silver ore blocked out in 25-ft. blocks. Alfred Tellam is superintendent.

San Lorenzo—Martin Hickinson has sold this mine to Eastern parties, who have done 200 feet of development work. John A. Rice, of El Paso, Texas, is consulting engineer.

San Agustin—This old mine, near Sinequipa, is being worked after 18 years shut-down, and is showing some high-grade silver ore.

Monte Vista—It is reported that Charles F. Hanson, of Douglas, Ariz., has raised $75,000 to put in a milling plant and build a road to the property.

Greene Cananea—Six of the eight furnaces are in blast. March production was approximately 3,800,000 lb. of copper.

TAMAULIPAS

La Esmeralda—It is reported that 250 ft of adit and drift work have been done during the last four months. Zinc-silver-lead ore has been encountered.

Africa

WEST AFRICA

Gold production, including Gold Coast and Ashanti, was 21,403 oz. bullion in February. Total for two months ended Feb. 28 was 50,108 oz. bullion in 1908, and 44,220 oz. in 1909; decrease 5978 oz. The bullion reported this year was equal to $862,070, or 41,750 oz. fine gold

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 31—The coal trade in the West shows little change since our last report. A small improvement is reported from most of the distributing centers in the demand for steam coal. Much less contracting has been done than is usual at this season of the year. This is probably due to the fact that large consumers believe that they will do better by trusting to the open market than by closing season contracts.

The bituminous coal trade in the East is also without much change. Business improves slowly so far as individuals are concerned, but shows quite an advance in the aggregate. Mines, however, are not running full time, as a rule, and there is room for considerable betterment.

The anthracite trade is in the air. There is a total lack of certainty as to strike conditions. The miners have proposed to continue work pending an adjustment, but it is not at all certain that the operators will continue to keep their mines running without an agreement. Whether April 1 will pass without a stoppage of some kind is uncertain, even at this late day. A fuller statement of the anthracite conditions will be found on another page.

The coke trade is gradually getting into shape. The overproduction of a few weeks ago is being worked off, which will leave the market on a better basis.

A report comes from Denver that the Wooten Fuel Company has closed a contract with the Navy Department for 500,000 tons of southern Colorado coal to be delivered at the Mare Island navy yard during the coming year. The report has not yet been confirmed.

Western Coal Troubles—In Salt Lake City, March 29, the United States District Court fined the Union Pacific Railroad Company, the Oregon Short Line, the Union Pacific Coal Company, and J. M. Moore, manager of the Union Pacific Coal Company, $3000 each. Everett Buckingham, division traffic manager of the Oregon Short Line, was fined $1000. The companies concerned were convicted of discrimination in refusing to haul coal bought by a Salt Lake coal firm.

In the same court the Utah Fuel Company pleaded guilty to the fraudulent acquisition of 14,040 acres of coal land, paid a fine of $8000 and $192,000 for the coal extracted, and relinquished the land.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 20, short tons:

	1908.	1909.	Changes.
Anthracite	1,138,464	1,041,375	D. 97,089
Bituminous	7,278,297	7,635,042	I. 356,745
Coke	1,588,092	2,183,632	I. 595,540
Total	10,004 853	10,860,049	I. 855,196

The total increase this year to date was 8.5 per cent.

Coal production of the State of Washington for the years named is reported as below, in short tons:

	1907.	1908.	Changes.
Shipped	3,458,276	2,745,698	D. 712,578
Local trade	135,762	103,894	D. 31,868
Used at mines	128,396	127,898	D. 498
Total	3,722,434	2,977,490	D. 744,944

The production of coke was 48,798 tons in 1907, and 37,381 in 1908; decrease, 11,417 tons.

Corrected statement of shipments by Southwestern Interstate Operators' Association for years named, short tons:

	1907.	1908.	Changes.
Missouri	2,884,471	2,370,022	D. 514,449
Kansas	6,454,419	5,122,509	D. 1,331,910
Arkansas	2,286,983	1,948,911	D. 338,072
Oklahoma	3,030,465	2,728,292	D. 302,173
Total	14,656,338	12,169,734	D. 2,486,604

The total decrease in shipments for 1908 was 19.6 per cent.

New York

Anthracite

March 31—While the trade is all at sea about the continuance of work in April, business is going on as usual and it looks as though no stop was expected. This is so much the case that the companies have issued their usual order for a discount of 50c. a ton on April sales of prepared sizes. These are in abundant supply, but there is a scarcity of steam sizes for the reasons already noted in this column. Small sizes are being held at the mines to provide fuel for pumps, etc., in case of a stoppage of work.

Prices for April are $4.25 for lump and $4.50 for egg, stove and chestnut f.o.b. New York harbor points. For small steam sizes prices are nominally unchanged as follows: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Advances ranging from 10c. per ton up are asked in many cases by commission merchants.

Bituminous

The soft-coal market still shows an irregular condition, orders coming in bunches to be followed by a period of quietness. Nevertheless, the books for March as a rule show a considerably larger total of sales than in February. Contract making continues rather slowly and up to date probably 60 per cent. of the usual contract business has been closed. Prices on this trade are as a rule from 15 to 20c. below last year.

For current trade prices are rather low; thus run-of-mine gas coal has sold on a basis of about 65@70c. per ton at mine and slack at 55@65c. The lower grades of steam coal are bringing 90c.@$1 at mine with the better grades selling up to $1.50, at mine.

Trade in all the consuming districts is about the same, New York harbor and the Sound taking coal a little more freely, while the far East is showing signs of life. All-rail trade is better than Coastwise. Transportation is fully up to schedule and cars are in abundant supply.

In the Coastwise trade, vessels are in good supply—too good in fact, as they are hunting for business. Current rates for large vessels from Philadelphia are: Boston, Saco and Portland, 70c.; Lynn, 75@80c.; Newburyport, 80c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

March 29—No improvement whatever is noted in the coal market. There is a curtailment of production; several coal mines in this district have been cut down to four days work a week and others to less. There are few sales being made. A report that the Galloway Coal Company had sold 210,000 tons of coal, delivery during the balance of the year, was confirmed by one of the owners, but with the statement that the order was just one-half of the amount that the purchasers of the same took last year. The coke production is being cut down materially.

Chicago

March 30—In general the coal trade remains firm and unchanged. The bituminous market is adjusting itself to spring conditions in which fine coals take a stronger position and lump sizes a weaker, relatively, and there is a general lull in steam consumption, owing to the waiting attitude of manufacturers. Steam trade is increasing much more slowly than was hoped for at the beginning of the year. Domestic coals are very quiet; not even the announcement of the customary 50c.

discount on anthracite for April has sufficed to book any large amounts for that month's deliveries. Contract business is not large, and shows the growing tendency of large consumers to rely on the open market.

Illinois and Indiana coals are freer from demurrage troubles than they have been for many weeks, the cause being reduced shipments to this market. Lump and egg sell at $1.75@2.40; run-of-mine, $1.65@1.75, and screenings at $1.25@1.55. Illinois operators have become watchful of the market and apparently do not intend to ship in coal that cannot be sold readily.

Eastern coals are a good deal stronger because of restricted shipments. Smokeless is stronger than it has been for several months, and Hocking shows but slight demurrage evils. For smokeless lump, Pocahontas and New River, $3.30 is obtained, and for run-of-mine from the same mines the price is $3.15. Hocking brings $2.90@3.15, with demand bettering. Gas coals are quiet, Youghiogheny selling at $3.15 for ¾-in. Anthracite sales are dull.

Cleveland

March 30—Lake trade is still uncertain, and the start will not be early. Some engagements of vessels have been made, but there is no rush. Reports of large stocks on the docks in the Northwest are not encouraging.

Local business is looking up on the steam side slowly, but is looking down on domestic coal. Prices are still low. Hocking brings $1.35 for lump at mine, and $1.10 for run-of-mine. Massillon at mine brings $2.50 for lump and $2.35 for run-of-mine.

Indianapolis

March 30—The anthracite coal situation is being watched as closely by the bituminous operators in Indiana and Illinois as by the operators in the East. The large dependence on anthracite coal in the Middle West was not fully appreciated until the strike six years ago in the anthracite field. The demand for soft coal increased until buyers flocked to the coal centers of Indiana and paid large advances to secure coal. The profits to operators were large. Many of them now think the Indiana industry was badly handicapped as a result because too many new mines were opened in the next few years. While the Indiana operators would profit by a strike in the anthracite region there is a general feeling that there will be none. President Lewis is regarded as a shrewd and long-headed man and not in favor of a strike at present.

Pittsburg

March 30—Conditions in the coal trade remain practically unchanged. A number of contracts for coal for the Northwestern markets were booked by the large Lake shippers. While the Lake season will open officially on April 1 there will be no coal for shipment and it is not known when shipments will begin. There is no iron ore to be brought down and as coal is the return cargo for the ore boats it may be late in the spring before active shipments begin. Last year no coal was shipped until about the middle of June. Operations at the railroad mines continue at something less than 50 per cent. while the river mines are still running full. Prices remain on the basis of $1.15 a ton for mine-run coal at the mine and slack is strong around 70 cents.

Connellsville Coke—There is no demand for coke and extremely low prices are named for spot shipment. Furnace coke can be had at $1.50 to $1.60 and the latter price is quoted on contracts running to July 1. Foundry coke for prompt shipment is down to $1.90 and from $2 to $2.15 is quoted on contract.

The *Courier* in its summary for the week gives the production in both regions at 251,261 tons. Shipments were 8993 cars as follows: To Pittsburg, 3172; to points west of Pittsburg, 5055; to points east of Connellsville, 766 cars.

Foreign Coal Trade

German Coal Trade—Imports and exports of fuel in Germany, month of January, metric tons:

	1908.	1909.	Changes.
Imports:			
Coal	543,960	509,153	D. 34,807
Brown coal	696,429	577,861	D. 118,568
Coke	43,351	54,784	I. 11,433
Briquets	15,821	17,051	I. 1,230
Exports:			
Coal	1,402,912	1,734,924	I. 332,012
Brown coal	1,926	2,211	I. 285
Coke	309,925	270,327	D. 39,598
Briquets	122,857	109,523	D. 13,334

Coke exports this year included 1509 tons to the United States.

German Coal Production—Coal production of German Empire, month of January, metric tons:

	1908.	1909.	Changes.
Coal	12,579,152	12,010,715	D. 568,436
Brown coal	5,702,911	5,596,415	D. 106,497
Total mined	18,282,063	17,607,130	D. 674,933
Coke made	1,858,993	1,776,373	D. 82,620
Briquets made	1,412,431	1,483,552	I. 71,121

Of the briquets reported this year 1,172,597 tons were made from brown coal, or lignite.

Russian Coal Production—Production in the Donetz basin in Russia in 1908 is reported as follows: Anthracite, 2,214,042 metric tons; bituminous, 10,352,061; coke, 1,437,286; total, 14,003,389 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 20: Best Welsh steam, $3.42; seconds, $3.30; thirds, $3.18; dry coals, $3.48; best Monmouthshire, $3.00; seconds, $2.94; best small steam, $2.16; seconds, $1.92. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 31—The iron and steel markets show signs of improvement, but in a rather irregular way. An attempt is being made in some quarters to give the impression that marked dullness still prevails, but it is evident that much of this is due to a desire to bring pressure to bear upon the tariffmakers at Washington. It is not to be denied that there is not a generally active market; but it is also true that in certain lines there is a degree of activity which points toward a more general improvement.

In pig iron there has been some business in foundry iron, although it has been in moderate quantities for early deliveries, as has been the case for some months past. Outside of foundry there is not much doing, very little basic or gray forge being sold. The hesitation on the part of the merchant furnaces and their disinclination to press sales is largely due to the fact that no action has yet been taken looking toward the fixing of prices of Lake ore for the coming season. There is an evident intention on the part of ore sellers to hold last season's prices, if it can possibly be done.

In finished material the most active market is in structural steel. Many contracts are coming forward, both small and large, and the volume of business done has been considerable. It is reported that very low prices have been made on this class of steel and persons interested in building projects are taking the opportunity. A large business has also been done in bars by brokers and agricultural-implement makers, and low prices have been made both on iron and steel bars. In some other branches of the trade, such as wire, the large makers are rather holding back and seem unwilling to make the reductions which buyers expect.

Rail orders are still held back, although several small orders have been placed amounting to a considerable total. The larger companies, however, are evidently expecting some adjustment of prices. Quite a number of orders for railroad bridges have been placed and some also for new equipment.

A London despatch of March 30 reports that a contract for rails and rail-joints for the Glasgow street railroads has been awarded to the Lorain Steel Company, Lorain, Ohio. The quantity is not stated; the price is given at £6 2s., or $27.68 per ton, delivered at dock, Glasgow harbor. The bid was £2 below English mills.

Improvements in Steel Works—The Jones & Laughlin Steel Company, of Pittsburg, has floated successfully an issue of $15,000,000 bonds, the proceeds to be used in improvements and additions to the works. The expenditures will extend over some time.

Baltimore

March 30—Exports for the week included 2001 tons steel rails to Buenos Aires. Exports included 11,250 tons iron ore from Cuba.

Birmingham

March 29—There are pessimists and optimists in the Southern iron market. There is no business being transacted now worthy of mention and as far as some of the manufacturers can see it there is no promise of any improvement in conditions in the near future. There is yet considerable iron being shipped out; it is on old orders. The cast-iron pipe interests are melting a large quantity of iron. There is to be further curtailment in production during this week. The Southern iron companies are receiving some inquiries for iron, the greater portion being for small lots. No sales are being made, however, which shows that the consumers are only testing the market. The quotations are still weak though one or two companies in this section are holding up to $12 per ton. No. 2 foundry. There is no trouble, however, in getting iron at $11.50 per ton and a lower price will not be turned down by some manufacturers.

Chicago

March 30—The pig-iron market continues depressed, and for finished materials the conditions and prospect are not much brighter. Melters are apparently waiting on general business developments and the settlement of the tariff question by Congress; everybody, high and low in the trade, is hesitating. Sales continue steady of such amounts of iron as are needed to carry along current requirements of foundrymen; for the second half of 1909 there are numerous inquiries, but they are not promising of immediate contracts. In structural materials and railroad supplies there is some activity. Here, again, there is a waiting policy.

Pig iron brings $11@11.50 Birmingham ($15.35@15.85 Chicago), for delivery within the next three months, with a possibility of a lower price on any large contract. The bottom of the market would seem to be reached by this quotation. Northern sells for $16@16.50, being in general much more stable than Southern, production of local furnaces being kept down and the demand being steadier. What a large contract would bring in the matter of prices can only be guessed; to judge from conditions the price would be very low, and delivery could be as suited the purchaser.

Philadelphia

March 31—It would be safe to omit any reference to the local pig-iron market this week. Inquiries show that very few sales have been made and those merely for piecing out purposes. A few lots of special brands have been sold and there are inquiries for additional supplies from concerns using only special makes. The tendency, if there is any discernible, is downward in prices, but this is more apparent than real. Southern foundry has been offered in this market this week at prices which would debar sales by Eastern furnaces, which fact has a depressing effect.

Plates—A fair business has been done this week for delivery in this territory.

Structural Material—A further shading has been made in structural material.

Scrap—Scrap iron is dull. Yard stock is in better demand than anything else. Heavy steel scrap is under inquiry but buyers will not pay the prices asked.

Pittsburg

March 30—Considerable new business in several finished lines has been booked by large interests and it is reported that the already low prices have been seriously shaded. Merchant-steel bars are said to have been sold by the principal producer at a cut of $2 a ton, or at 1.10c. instead of 1.20c., the recognized price. Contrary to custom and the policy of the Steel Corporation, H. P. Bope, first vice-president and general manager of sales of the Carnegie Steel Company, issued a statement denying the report and insisting that bar prices were being firmly maintained. Despite this and other denials, sales of 500-ton lots and less are said to have been closed on the low basis. Shading to the extent of $4 a ton and more in shapes also is reported and there is every evidence that someone is cutting the price. It is reported from the East that as low as 1.06c. at mill, has been done on shapes. The leading bar-iron interest has made a concession in prices in western territory. Heretofore the price for iron bars in Chicago and other points in the West was the Pittsburg base rate with the freight of 18c. per 100 lb. added, but frequently 15c. was the rate given. Now while the price is 1.40c., Pittsburg, the rate in Chicago and St. Louis is 1.30c., the iron, of course, being furnished from one of the Western mills of the company. Agricultural-implement makers are feeling the market, and it is believed will place some contracts although they usually do not buy until later in the season for the year beginning July 1. It is understood a concession in steel bars will be made on these yearly contracts, but so far no important contracts have been closed.

The National Tube Company has booked a number of small orders and several large ones. Among the latter is one calling for 30 miles of 16-in. pipe for the Philadelphia Company, and 60 miles of 16-in. pipe for the Kansas Natural Gas Company. This last-named concern is in the market for additional tonnages and may add to its purchase at any time. It is reported the Republic Iron and Steel Company will erect a large pipe plant at Youngstown and become an active competitor for the merchant-steel pipe trade. It also will make wrought-iron pipe. The plans have been practically completed but the details are not made public.

Pig Iron—The largest inquiry in the market for a long time came yesterday from the Crucible Steel Company of America. It calls for 3600 tons of chill-cast bessemer for April delivery. The contract will be placed this afternoon or tomorrow. Actual prices of pig iron cannot be given in the absence of transactions but quotations seem to be a trifle firmer this week as follows: Standard bessemer, $15@15.25; malleable bessemer and basic, $14.50@14.75; No. 2 foundry, $14.50; gray forge, $13.50; all at Valley furnaces.

Steel—No sales of billets are recorded except under sliding scale contracts. It is reported that the $23 price can be shaded. Sheet-bars and tin-bars are still quoted at $25.50, but sales are said to have been made at less. Plates remain at 1.30c. and merchant-steel bars at 1.20c., but lower prices are being made on some orders.

Sheets—New business is being booked and prices are firm, black sheets being quoted at 2.30c. and galvanized at 3.30c. for No. 28 gage.

Ferro-Manganese—There is but little demand and prices are unchanged at $43 @43.50, Pittsburg.

Metal Market

New York, March 31—The metal markets are still quiet, but rather better than they were a week ago, with some speculative tendencies.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended March 27: Gold, $9,603,250, chiefly to London; silver, $902,529 to London and Paris. Imports: Gold, $623,077, which includes $389,000 French gold in transit to Havana; silver, $199,866, from the West Indies and Mexico.

Gold and silver movement in France, month of January:

	Imports.	Exports.	Excess.
Gold.. Fr.	111,406,000 F.	4,685,000 Imp.	Fr. 106,721,000
1908...	30,588,000	2,275,000 Imp.	28,313,000
Silver...	8,507,000	4,375,000 Imp.	4,132,000
1908...	8,123,000	21,069,000 Exp.	12,946,000

Imports of nickel and copper coins, 8000 fr. in 1908, and 4000 fr. in 1909; exports, 26,000 fr. in 1908, and none this year.

Gold—The prices in the open market in London are unchanged at 77s. 4d. per oz. on bars and 76s. 5d. per oz. for American eagles. The Bank of England is taking most of the gold arriving, though some has gone to Germany. In New York the export movement has stopped for the present, but a renewal is expected.

Platinum—The business in platinum is quiet, although sales are a little better than in the early part of the month. Dealers' prices are unchanged at $23.50 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our St. Petersburg correspondent reports under date of March 18 that the market is dull and inactive, metal being offered by agents without sales. Prices quoted for crude metal, 83 per cent., are 5@5.15 rubles per zolotnik, Ekaterinburg, and 20,300@20,500 rubles per pood at St. Petersburg; equivalent to $19 and $20 per ounce, respectively. The report concerning the mines of Prince Demidoff-San Donato in the Ural is contradicted.

Silver—The recent steadiness in the silver market has been due to moderate buying by China. A shipment of £370,000 to Shanghai some two weeks ago is an indication of what has been going on this direction. Since that shipment there have been further purchases on China account.

SILVER AND STERLING EXCHANGE

Mar.	25	26	27	29	30	31
New York....	50¼	50¾	50⅝	50½	50½	50⅜
London.....	23½	23 9/16	23⅜	23⅜	23⅜	23 5/16
Sterling Ex..	4.8810	4.8800	4.8795	4.8785	4.8770	4.8770

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 18:

	1908.	1909.	Changes.
India.....	£ 1,160,238	£ 918,000	D. £ 692,238
China.....	501,400	657,000	I. 155,600
Straits.....	78,270	82,800	I. 4,530
Total., ...	£ 2,189,908	£1,657,800	D. £ 532,108

Receipts for the work, £186,000 from New York. Exports, £370,000 to China and £30,000 to India; £400,000 in all.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
25	12¾ @13	12⅛ @12⅝	56¼	28¾	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
26	12¾ @13	12⅛ @12⅝	56¾	28¾	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
27	12⅝ @13	12⅛ @12⅝	....	29	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
29	12⅞ @13	12⅜ @12⅞	56⅞	29⅛	4.10	3.92½ @3.95	4.60 @4.62½
30	12⅞ @13	12⅜ @12⅞	57	29⅛	4.10	3.92½ @3.95	4.60 @4.62½
31	12⅞ @13	12⅜ @12⅞	57	29¼	4.10	3.92½ @3.95	4.60 @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—In the week of March 25-31, there was some heavy selling for export in the early part, when certain first hands were rather aggressive. Later on domestic manufacturers entered the market to a considerable extent, and the demand for export continuing, sellers were able to realize an advance in price, and sales were made in which all of the agencies participated. All are now freely offering electrolytic copper at 12¾c., delivered, 30 days, or a little less than 12⅝c., cash, New York. Some business in Lake copper has been done through the week. Casting copper has been rather active at prices close to those realized for electrolytic.

Summarizing the week, there is a decided improvement in the general condition of the market. Consumption is slowly but surely expanding. The fears of an indefinite increase in the visible supplies are, on this account, being dissipated, and this in a measure explains the large absorption of copper that has again taken place this week, particularly before sellers raised their price, consumers both in this country and abroad having been liberal buyers. The activity has considerably subsided at the higher prices which ruled near to the close, but the tone remains firm at 12⅞@13c. for Lake copper; 12½@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12¼@12½ cents.

The standard market in London showed evidences of persistent buying throughout the week, and the advance which was established between the closing of March 26 and the opening on Monday has been fairly well sustained, quotations at the close being cabled as £57 for spot, £57 13s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £61 10s.; best selected, £60 10s.@£61 10s.; strong sheets, £72 10s.@£74 10s.

Exports of copper from the United States, two months ended Feb. 28: Metal, 79,063,640 lb.; in ores and matte, estimated, 2,517,000; total, 81,580,640 lb. Imports: In ores, 8,274,861 lb.; in matte, 2,440,346; metal, 37,223,934; total, 47,939,141 lb. The exports were 33,641,499 lb. in excess of the imports.

Visible stocks of copper in England and France are reported by Henry R. Merton & Co., London, at 52,355 long tons on March 15; an increase of 60 tons over Feb. 28. These stocks include 7475 tons afloat from Chile and Australia.

At the beginning of March there was a continuation of the large sales inaugurated during the last week of February, but these soon ceased. On March 1 sellers raised their prices, thinking that the news of the previous sales would stimulate purchasing by the manufacturers in this country, but their hopes were disappointed. During this period of activity upward of 100,000,000 lb. of copper is believed to have been sold, but the sales were to a large extent made with foreign speculators, and it gradually came to be recognized that these did not help the situation very much. From the maximum price of 12½@12⅝c. for electrolytic created in this way, the market gradually eased off under absence of buying orders and more or less pressure to sell on the part of producers, and by the middle of the month the price for electrolytic had fallen to 12⅛c. This again led to some large purchases from Europe, and afterward American manufacturers entered the market to some extent. Producers took advantage of their appearance to raise prices slightly, but the latter could not go far, the bulk of the transactions during the latter part of March being made at 12¾c. The attempt to lead manufacturers to buy largely upon a rising market thus failed, as it was bound to do, purchasers being conversant with the large accumulation of unsold metal on both sides of the Atlantic, and the probability that the supply was increasing farther during March, the exports for the month, like those in February, being at a comparatively low figure. After a lull in the trading there were some more heavy transactions in the last week of the month, certain agencies being still free sellers at about 12¾c., and in the last two days some good orders were placed at about 12.55c., while copper was freely offered by all the agencies at the equivalent of about 12.60c. The total sales for the month, during the three periods of buying activity, were without doubt in excess of the production, but their delivery is extended over April and May.

Tin—Large purchase orders which were cabled from this side toward the end of last week, supplemented by reports of comparatively small shipments from the East during the month of March, brought about an upward movement in the London market. The advance amounted to about £5 per ton, and the market closes firm at £134 5s. for spot, £135 10s. for three months.

While dealers have taken a little interest in this market, consumers have not been tempted by the advances, and continue their hand-to-mouth policy. Quotations are made at 29.75 cents.

Lead—A very brisk business has been transacted. Orders have been coming forward in larger volume from all quarters, but most noticeable is the increase in the business placed by the cable manufacturers, which has been lagging behind for some time. All offerings were

readily absorbed, and when the largest interest raised its price on Monday, the other sellers quickly followed suit, and the market is now firmly established at 4.10c., New York, 3.92½@3.95c., St. Louis.

There is a better tone in London, and the market has crept up from day to day, closing firm at £13 13s. 9d. for Spanish lead, £13 16s. 3d. for English lead.

Spelter—This metal has been an exception to the general rule. The transactions were altogether of a retail character and quotations remained unchanged through the week at 4.60@4.62½c., St. Louis, 4.75@4.77½c., New York.

The closing of the London spelter market is cabled as £21 7s. 6d. for good ordinaries, £21 12s. 6d. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

New York Metal Exchange—At the annual meeting, March 29, officers were reelected as follows: President, P. R. Jennings; vice-president, Morton B. Smith; treasurer, Robert L. Crooke; members of the board of managers, B. Hochschild, H. W. Hendricks, L. Vogelstein, G. E. Behr, Paul Koning, George W. Jacques, Emil Baerwald and A. B. Hall; arbitration committee, J. Langeloth, E. A. Caswell, E. J. Keane, Edwin Groves and H. D. Bond.

Other Metals

Antimony—Business is only of a retail order. Prices are a shade lower, 8c. per lb. being quoted for Cookson's; 7¾c. for Hallett's; 7½c. for ordinary brands.

Aluminum—The quotations here are about 22@24c. per lb. for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco, $44@45 for domestic and $2 less for export orders. London, £8 7s. 6d. per flask, with £8 6s. 3d. quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Platteville, Wis., March 27—The base price paid this week for 60 per cent. zinc ore was $37.50@38 per ton. No premium is reported. For 80 per cent. lead ore, $48 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 27

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Lindeu	526,670	.....	.....
Platteville	416,460	.....	80,000
Hazel Green	304,300	.....	.....
Benton	300,920	51,700	.....
Livingston	240,000	.....	.....
Galena	88,000	.....	.....
Cuba City	79,975	.....	.....
Rewey	54,300	.....	.....
Total	2,010,625	51,700	80,000
Year to Mar. 27	23,778,354	839,580	2,269,850

In addition to the above there was shipped to the American Zinc Ore Separating Company to a total of 318,000 lb.; to the Joplin Separator Works, 243,600 lb. zinc ore.

The shipment of zinc ore covering the first three months of the year shows an increase of 4270 tons over the corresponding period of last year. The stock now in bins approximates 7000 tons of raw concentrates. About 80 per cent. of this stock will be roasted or separated by the electrostatic method. A number of mills and roasting plants have resumed work within the past two weeks.

Joplin, Mo., March 27—Better than $41 per ton paid for the very best zinc sulphide ore, purchased on a base of $38 per ton of 60 per cent. zinc. Heavy sales were made on a base price ranging from $37 to $37.50, with a rising market at the week end. Zinc silicate lowered toward the close, practically but one buyer seeking this grade at the week end. The highest reported was $23, and the base was $17@19 per ton of 40 per cent. zinc. Average price, all grades, $35.48. Exciting rumors gained currency today relative to lead-ore prices, and though prices were materially advanced, offerings reaching $53.50, or $2 above the previous week, rumors of $55 could not be verified. The average price, all grades, is $52.22 per ton.

Another week of abbreviated shipment, with a strong output all over the district, has piled up approximately 8000 tons of reserve stock in the bins, fully 30 per cent. of which is, however, under contract.

SHIPMENTS, WEEK ENDED MAR. 27

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,896,300	845,990	$ 94,076
Joplin	1,542,260	354,770	40,193
Miami	501,990	282,680	14,821
Alba-Neck	587,140	31,240	11,966
Spurgeon	528,800	56,800	11,531
Galena	502,380	68,890	10,869
Prosperity	517,470	44,250	10,723
Duenweg	378,670	44,250	7,768
Aurora	388,440	47,870	6,736
Granby	398,200	.....	5,460
Carthage	222,460	.....	4,226
Oronogo	137,140	34,510	3,511
Sarcoxie	199,520	.....	3,115
Badger	125,550	.....	2,385
Shoalsburg	87,400	52,340	2,182
Quapaw	97,380	21,060	2,136
Cave Springs	63,070	.....	1,198
Carl Junction	49,970	1,860	1,023
Totals	10,404,200	1,885,510	$233,918
Thirteen weeks	133,448,600	22,549,720	$3,147,843

Zinc value, the week, $184,584; 13 weeks, $2,672,575
Lead value, the week, 49,334; 13 weeks, 575,268

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.66	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.06	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.65	.....	31.67	.....	59.90	.....
August	36.63	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.69	.....
October	35.96	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.76	.....	39.63	.....	49.88	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zince ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 31—There is a slight strengthening of the chemical market and, although few sales are being made, prices remain practically stationary.

Copper Sulphate—Prices are still $4.60 per 100 lb. for carload lots and $4.85 for smaller quantities. Only a moderate amount of trading is noticed.

Arsenic—The general better feeling of the market has kept prices up to 3c. per lb. for white arsenic.

Nitrate of Soda—The market is dull and prices are 2.15 for both spot and futures.

Mining Stocks

New York, March 31—In the early part of the week the general markets continued in the same quiet and irregular condition which has been noted for some time past. Later, however, a strong bull movement set in, which has sent prices up, and at the close the market must be reported active with prices firmer than they have been for some time. In part this seems to be the result of a purely professional movement, but in part also it is due to the underlying conviction of Wall Street that the tone of business is improving and that better conditions may be expected.

There was one sale of Homestake, of South Dakota, during the week, 25 shares changing hands at $92 per share.

The Curb market has been strong and active. The copper stocks were rather irregular, but the better class advanced under the leadership of Nevada Consolidated, in which there was some heavy transactions, the closing price being above that of last week. In the Nevada gold stocks the principal incident was a flurry in Goldfield Consolidated which sent the price up on the basis of heavy sales. Other Nevada stocks were also firm. The Cobalt stocks were affected by the recent declaration of large dividends by several companies, and closed firm. The present prospect is for a continuance of the bull movement for a time at least.

Boston, March 30—Although mining stocks are on a higher level, as compared with a week ago, it is due largely to professional operations. Quite a bulge ensued as the result of short covering and prices are well maintained.

Amalgamated is up some $5 to $74.62½. North Butte has been the main feature, advancing $3.87½ to $72.50, with reaction to $71. Manipulation has entered largely into these transactions, but it is believed to be mainly for the purpose of accumulating stock. There has also been activity in the so-called Amster stocks. Arizona Commercial is up $4.25 to $30.50, and Boston & Corbin has advanced $2 to $20.50. The 50c. dividend on Anaconda was as expected, and no change is anticipated in the Amalgamated dividend.

There is said to have been buying of Arcadian by a house closely affiliated with Calumet & Hecla interests. The Mohawk mining report for 1908 shows a reduction in the cost of copper of about 1c. per pound. This is one of the new companies which has earned surplus money for the period.

An issue of 200,000 shares of Alvarado Consolidated Mines Company stock is to be made at $5 to finance mill construction. This company has a 15-year lease of the Palmilla Mines of Parral, Mexico, from Peter Alvarado. The issue has been underwritten.

The Curb has been steady until today, when free offerings put prices materially lower.

STOCK QUOTATIONS

NEW YORK Mar. 31	
Name of Comp.	Clg.
Alaska Mine	.39
Amalgamated	74
Anaconda	44 ½
Balaklala	2 1/16
British Col. Cop.	7
Buffalo Mines	13
Butte Coalition	24 ¾
Colonial Silver	7/8
Cum. Ely Mining	7 7/8
Davis Daly	5 ¼
Dominion Cop.	12 ½
Douglas Copper	2 ¾
El Rayo	2 7/8
Florence	3 ½
Foster Cobalt	.34
Furnace Creek	.11
Giroux	8 ¼
Gold Hill	¼
Goldfield Con.	8 1/16
Granby	95
Greene Gold	¼
Greene G. & S.	7
Guanajuato	1 ¾
Guggen. Exp.	175
Hanapah	.15
Kerr Lake	7 7/8
McKinley Dar.	.92
Miami Copper	14 ½
Mizmac	1
Mines Co. of Am.	⅝
Mitchell Mining	⅛
Mont. Sho. C.	1 7/16
Nev. Utah M. & S.	3
Newbosse M. & S.	3 ½
Nipissing Mines	10 7/8
Old Hundred	⅜
Silver Queen	.47
Stewart	⅜
Tennessee Cop'r.	41 ¾
Tri-Bullion	1 1/16
Union Copper	1 1/16
Utah Apex	6 ½
Utah Copper	43 ½
Yukon Gold	4 7/16

BOSTON Mar. 31	
Name of Comp.	Clg.
Adventure	8
Allouez	39
Am. Zinc	‡23 ½
Arcadian	6
Arizona Com.	39
Atlantic	13 ¼
Boston Con.	11 ⅜
Calumet & Ariz.	101
Calumet & Hecla	630
Centennial	29
Con. Mercur.	‡.30
Copper Range	75 ¼
Daly-West	11
East Butte	14 7/8
Franklin	15 ¼
Greene—Can.	10 ¼
Isle Royal	25 ¾
La Salle	15
Mass.	6
Michigan	10 ¼
Mohawk	53
Nevada	19 5/8
North Butte	71
Old Colony	‡.60
Old Dominion	51 ¼
Osceola	131
Parrot	33
Quincy	88
Rhode Island	3 ¾
Santa Fe	2 ⅛
Shannon	14 ⅝
Superior	42
Superior & Pitts.	14 ¼
Tamarack	‡77
Trinity	14 ¼
United Cop., com.	13 ¼
U. S. Oil	131 ¾
U. S. Smg. & Ref.	43
U.S. Sm. & Re., pd.	46 7/8
Utah Con.	42 ⅛
Victoria	4 ½
Winona	5 7/8
Wolverine	145
Wyandotte	2 ⅜

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38
Am. Smelt. & Ref.	87 ½
Am.Sm. & Ref., pf.	103 ⅞
Colo. Fuel & Iron.	36 ¼
Federal M. & S., pf.	‡81
National Lead	81 ¼
National Lead, pf.	107
Pittsburg Coal	‡10 ¼
Republic I. & S.	22 ½
Republic I. & S., pf.	73 ¾
Sloss-Sheffield	74
Standard Oil	658
U. S. Steel	48 ¾
U. S. Steel, pf.	112 ¾
Va. Car. Chem.	44 ¼

BOSTON CURB	
Ahmeek	155
Black Mt.	1 ¼
Chemung	18
Globe Con.	4 7/8
Hancock	‡11 ⅜
Helvetia	3 ¼
Keweenaw	‡4 ¾
North Lake	‡7 ⅝
Ojibway	‡14
Superior & Bost.	‡15 ¼
Ray Con.	14 ¼

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Mar. 27		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	1.60	1.25
Cent. C. & C.	84.00	83.00
C.C. & C. pd.	81.00	79.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	21.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.19	.17
St. Joe	12.00	11.00

LONDON Mar. 31			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton's Ind.	0	2	9
Camp Bird	0	16	0
Esperanza	3	0	0
Tomboy	0	18	9
El Oro	1	5	0
Oroville	0	10	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 31.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.39
Best & Belcher	.35
Caledonia	.20
Challar	.09
Comstock	.25
Con. Cal. & Va.	.67
Crown Point	.35
Exchequer	.25
Gould & Curry	.10
Hale & Norcross	.18
Mexican	.72
Ophir	1.10
Overman	.12
Potosi	.11
Savage	.14
Sierra Nevada	.24
Union	.25
Utah	.03
Yellow Jacket	.64
TONOPAH STOCKS	
Belmont	.92
Extension	.60
Golden Anchor	...
Jim Butler	.18
MacNamara	.31
Midway	.21
Montana	.67
North Star	.03
Tono'h Mine of N.	7.25
West End Con.	.30
GOLDFI'D STOCKS	
Adams	.02
Atlanta	.12
Blue Bell	.04
Booth	.17
Columbia Mt.	.12
Comb. Frac.	1.05
Con. Red Top	.07
Cracker Jack	.03
Dia'dfield B. B. C.	.07
Goldfield Belmont	.04
Goldfield Daisy	.47
Great Bend	.17
Jumbo Extension	.17
Kendall	.06
Lone Star	.04
May Queen	.03
Oro	.09
Red Hill	.09
Roanoke	...
Sandstorm	.12

Name of Comp.	Clg.
Silver Pick	.12
St. Ives	.12
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.03
Homestake King	.03
Mont. Shoshone C.	1.37½
Tramp Cons.	.04½
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1.12½
Nevada Smelting	1.00
Nevada Wonder	.75
Nevada-Utah	2.87½
Penn-Wyoming	.02
Pittsburgh S. Pk.	.68
Rawhide Cnol't'n.	.68
Round Mt. Sphinx	.10

COLO. SPRINGS Mar. 26	
Name of Comp.	Clg.
Acacia	6¼
Black Bell	....
C. C. Con.	3⅛
Dante	5¾
Doctor Jack Pot.	9
Elkton	70¾
El Paso	48
Findlay	15
Gold Dollar	11
Gold Sovereign	3
Isabella	24⅞
Index	....
Jennie Sample	8⅝
Jerry Johnson	6¼
Mary McKinney	‡38
Pharmacist	3⅛
Portland	.86
Un. Gold Mines	4¾
Vindicator	74
Work	6⅞

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	Mar. 10	Apr. 10	$0.05
Blackjack Con., Utah	Apr. 15	May 7	0.01
Challenge Con., Nev.	Mar. 19	Apr. 9	0.00½
Comet G. & C., Ida.	Mar. 20	Apr. 20	0.001
Con. Cal. & Va., Nev.	Mar. 23	Apr. 13	0.25
Crown Point, Nev.	Apr. 18	Apr. 28	0.10
Gov't Gulch, Ida.	Mar. 9	Apr. 9	0.001
Hypothesis, Ida.	Mar. 11	Apr. 12	0.005
Imlay, Nev.	Apr. 6	Apr. 28	0.03
Mexican, Nev.	Apr. 8	Apr. 29	0.10
Mineral Farm, Ida.	Mar. 12	Apr. 10	0.003
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
North Franklin, Ida.	Mar. 15	Apr. 15	0.005
Reliance, Ida.	Mar. 23	Apr. 20	0.001
Rexall S. & C., Utah	Mar. 26	Apr. 25	0.01½
Savage, Nev.	Apr. 8	May 5	0.10
Silver King Con., Utah	Mar. 29	Apr. 14	0.10
Spanish Ridge, Cal.	Feb. 11	Apr. 10	0.03
Union Con., Nev.	Apr. 8	Apr. 30	0.10
Cedar Creek, Ida.	Mar. 3	Apr. 5	0.003
Yellow Jacket, Nev.	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.726	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Month.	New York. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	London. 1908.	London. 1909.
January	13.725	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.296	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.615	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.164	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.976	13.438
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
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July	4.485	.....	4.338	.....	19.031	.....
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September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
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Year	4.726	.....	4.578	.....	20.163	.....

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9006—CANADA—Geology of Thunder Bay—Algoma Boundary. Arthur L. Parsons. (Bureau of Mines, Vol. XVII, 1908; 41 pp.) A complete geological description of the region with 13 sketch maps indicating formations encountered.

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9012—ORE FORMATIONS—A Method for Demonstrating Ore Formation. F. C. Nicholas. (Min. Wld., Feb. 20, 1909; 1½ pp.) Geological discussion of properties of the Yankee Girl Gold Mining Company in British Columbia, showing how ore formations were demonstrated by transparent models. Illustrated. 20c.

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9019—PERU—Recursos Minerales del Departamento de Apurimac. A. Jochamowitz. (Bol. del Cuerpo de Ingenieros de Minas del Peru, No. 58, 1908; 99 pp.) Outlines the geology and mineral occurrences in parts of the provinces of Antabamba, Cotabambas and Aymaraes.

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9022—ALGERIA AND TUNIS—Mineralvorkommen in Algier und Tunis. Bruno Simmersbach. (Preus. Zeit. f. B. H. u. S., Band 56, Heft 5, 1908; 10 pp.) Enumerates in some detail the various iron, copper, lead and zinc mining operations in Northern Africa.

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American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	18.00
" No. 2	"	15.00
Extra	"	20 00@23.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
Domestic f.o.b. shipping port:		
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8 00@10 00
Ground	"	11.50@13 50
Foreign crude ex. dock	"	8 00@10 00
FULLER'S EARTH—Lump	100 lb.	.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02½@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05¼@.12
Largel ump	"	08½@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4 00@7 00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾
German	lb.	02½@.02¾
LEAD—Acetate (sugar of) brown.	lb.	.07¾@.08
Nitrate, com'l	"	.07¼@.08½
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	26 00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1 25
Sulphate (Epsom salt)	100 lb.	
foreign	"	.85@1 00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@ 01½
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16 00@32.50
MARBLE—Flour	sh. ton.	8.50@10.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
Sulphate, double	"	.06½@.08
NITRATE OF SODA—100 lb. 95% for '08		2 15
95% for 1909		2 15
95% for 1910		2 15
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.05¾@ 06
English glassmakers'	"	.08¾@ 08¾
Lithopone	"	.03¾@ 05
Metallic, brown	sh. ton.	16 50@22 00
Red	"	14 00@18 00
Ocher, Am. common	"	8.50@9.00
Best	"	16 00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01½@ 02
Paris green, pure, bulk	"	.21½
Red lead, American	"	.06¼@ 06¾
Foreign	"	.08¾@ 08¾
Turpentine, spirits bbl., per gal.		.41@ 42½
White lead, Am., dry	lb.	.05¾@.05¾
American, in oil	"	.06¼@ 06¾
Foreign, in oil	"	.10¼@ 10¾
Zinc white, Am. extra dry	"	.05¾@ 05¾
French, red seal, dry	"	06¾@ 07
French, Green seal, dry	"	07¼@ 07½
PHOSPHATES—Acid		57@60c per unit
*Fla., hard rock		8.50@9 00
land pebble 68		4 00@4 25
†Tenn., 78@80		5 00@5.50
75%		4 75@5 00
68@72		4 25@4 50
‡So. Car. dried rock		7 00@7 25
" " undried rock		5 50@5.75

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$ 08½@.09
Powdered or granulated	"	09¼@ 09½
Bicromate, Am	"	.08¾@ 08¾
Scotch	"	.10¾
Bromide	"	20
Carbonate (80@85%)	"	.03¾@ 04
Caustic, ordinary	"	.04½@ 05¾
Elect. (90%)	"	.05½@ 06
Chloride (murate), 100 lb.		1 90
Chlorate, powdered	"	.09½@ 09¾
Crystals	"	.09@ 09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	20c
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@ 10½
Prussiate, yellow	"	.13@.13½
Red	"	30@ 33
Sulphate (basis 90%)	100 lb.	2 18@2 21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported, non-arsenical, furnace size, per unit		12@.12½
Imported, arsenical, furnace size, per unit		11¾@ .12
Imported fines, arsenical, per unit.		.08½@.09
Imported fines, non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl.		72@1 13
N. Y. agricultural	sh. ton.	3 80@4 50
SALTPETER—Crude	100 lb.	4 00@4 50
Refined, crystals	"	5 50@6 00
SILICA—		
Ground quartz, ord'ry	lg. ton.	10 00@15 00
Silex, ground	"	13 00@15 00
Silex, floated	"	35 00@40.00
Lump quartz	"	5 00@6 00
Glass sand	"	2 75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—		
Acetate	lb.	.04½@.05
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1 00@1 30c.
Soda, caustic, per 100 lb., 76 60		1 75@1 85
Soda, caustic, powdered		.02¾@ 03½
Salt cake, per 100 lb., bulk		.40
Salt cake, bbl		.65@ 85
Soda, monohydrate, per lb		1 4@1 75c.
Bicromate	lb.	.06½@ 07
Bromide	"	20
Chlorate, com'l	"	08½@ 09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.	"	1 35 up
German	"	1 60@1 70
Phosphate	100 lb.	2.10@2 25
Prussiate	"	.08@ 08½
Salt soda, f.o.b. N. Y	"	60@ 70
Foreign, f.o.b. N. Y	"	80@1.00
Silicate, com'l	"	.75@ 90
Sulphate, com'l (Glauber's salt)	100 lb	60@ 75
Sulphate, com'l, calcined	"	.65@ 85
STRONTIUM—Nitrate	lb.	07½@.08
SULPHUR—		
Louisiana (prime) to New York,	lg. ton.	22 00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1 85@2 15
Flour	"	2 00@2 40
Flowers, sublimed	"	2 20@2.60
TERRA ALBA—French & Eng. 100 lb.		.80@1 00
TALC—Domestic	sh. ton	15 00@25 00
French	"	18 00@25 00
Italian, best	"	35 00@40 00
TIN—Bi-chloride, 50	lb.	.09 up
Crystals	"	.20½@ 21½
Oxide, lb	"	.32½@ 35
URANIUM—Oxide	"	3 50
ZINC—		
Chloride solution, com'l 20		02½
Chloride, granular	"	04½@.04¾
Dust	"	04¾5 05¾
Sulphate	"	02¼@ 02½

NOTE These questions are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur in which there are well established markets the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

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Cost of Pig Iron Made from Lake Superior Ores

Broad General Costs Considered; Operations of Steel Corporation Taken as Representative. Mining Less Expensive Than Transporting the Ore

BY J. R. FINLAY*

The iron ores of the Lake Superior region are the richest in the world, and it is probable that the 400,000,000 tons shipped up to the present time have averaged 60 per cent. in metallic iron per ton of dry ore. Some cargoes have run as high as 68.5 per cent. When you remember that these ores are hematite and that pure hematite is only 70 per cent. iron, you realize that they are exceptionally pure natural concentrates, indeed purer than most artificial concentrates.

When people speak of the output of metal mines in general they mean the gross selling value of the refined metals at New York. Now the value of Lake Superior iron ores is never in mass. You hear of the value of bessemer, or non-bessemer, old range or Mesabi ores at the mines or at Cleveland, but you do not hear of average values nor of gross values in pig iron.

Output of Various Mining Districts

To get a sense of proportion let us calculate the metal-selling value at New York of the annual output of some of the greatest mining districts for an average of five years: Cripple Creek, gold, $12,000,000; Transvaal, gold, $94,860,000; Butte, copper, silver and gold, $48,000,000; Cœur d'Alene, lead-silver, $13,000,000; Joplin, zinc and lead, $16,300,000; Lake Superior, iron, $290,000,000.

The business is profitable, one of the most profitable in the world, but it is not easy to give precise figures concerning it. Much has been written on the various problems involved, such as the caving system of mining, the systems of accounting, mining in open pits, blast-furnace practice, etc., but each of these is only a link in the chain. I have never found any comprehensive discussion of the subject as a whole. I have, therefore, endeavored to work out on an original basis a statement of the cost of operating this vast business. It may be interesting to explain the method.

General Costs

The first thing to decide is what to include in the cost. At present, it is not a matter of any particular interest to have details of the mere cost of extracting ore from some particular iron mine and dumping it on the surface, although before the absorption of most of the mines by the various steel and furnace corporations the local mining costs were indeed a subject of interest. There were then many companies which only mined the ore and sold it at the pit mouth.

At the present time by far the greater part of the ore is mined by concerns which use it to make pig iron and in many cases, finished manufactured steel or iron products. To describe this industry in parallel terms to those used in the case of other metals it seems to me that we should find the cost of pig iron delivered at New York. It is quite true that New York is not the greatest market for pig iron, but since I have discussed other metals on the theory of their delivery there it is reasonable to follow the same plan with iron.

The reason for stopping with the production of pig iron is simply the analogy of other metals. Pig iron is the basic commodity of iron manufacture. It bears the same relation to the making of steel rails or pocket knives, as electrolytic-copper bars bear to the making of copper wire or brass door knobs, or as pig lead bears to lead pipe or buck-shot. I have tried to show what it costs to produce from various districts copper, lead and zinc ready for manufacture so I shall try to show the cost of bringing Lake Superior iron to the same stage.

Complexities of the Problem

When we give this problem some attention we soon find it rather complex. The ore comes from scores of different mines, each producing its own particular grade at its own particular cost. But the cost of getting ore out of the mine is considerably less than that of transporting the ore from the mines to the furnaces, although the cost of transportation varies considerably according to the situation of the mine. We find that in some cases large royalties are paid to fee owners and in other cases the mining company owns the ground. These various factors are bewildering. Furthermore none of the companies gives its costs.

The United States Steel Corporation, however, issues very good reports. These and various isolated data published by the U. S. Geological Survey and such information as I could get from personal observation are the sources from which my conclusions are derived. The Steel Corporation is fully as much a manufacturing as a mining concern and even buys some of its pig iron from others. It does not stop with pig iron. It makes steel rails, sheets, wire, rods and even spelter and cement. It is the greatest of all industrial enterprises, employing more than 200,000 men. Naturally the reports of such a corporation must be condensed. As a matter of fact no operating data of any kind are given. The omission is in this case quite proper. The production, the earnings, the capital expenditures, the property holdings are all given. This information seems at first insufficient for any definite statement of costs, but it is all that can be had. On two recent trips to the Mesabi range, I saw a good deal of the mines, but I enjoyed no confidences. My inquiries were such as anyone could easily make. I make this explanation in order that no one may be under a misapprehension. The basis for the statements I am about to make is what I believe to be common sense.

Activities of the United States Steel Corporation

The operations of the Steel Corporation are undoubtedly representative of the Lake Superior iron business—far more so than those of any other concern. It mines and ships 55 per cent. of the whole product. It owns two of the three ore railroads in Minnesota and the shipments over its roads are 52 per cent. of the whole Lake Superior output. Just what proportion of the ore is transported on the lakes by the company's boats I do not know. When we come to pig iron we find that the company produces an amount equivalent to 55 per cent. of the probable content of Lake ores. It seems to have about 75 per cent. of the known ore reserves of the region.

NOTE—In this article I have assumed in regard to the United States Steel Corporation that the profits on ore hauled by others will be counterbalanced by profits earned by the corporation on ore hauled for others, so that the final result with regard to this transportation will be the same as if all the ore mined by this company were transported by the company. I have also assumed that the making of pig iron at Pittsburg is representative in cost, and that pig iron can be made at Pittsburg and sold at New York for as low a price as pig iron made at other points and shipped to New York. All tons are long tons of 2240 pounds.

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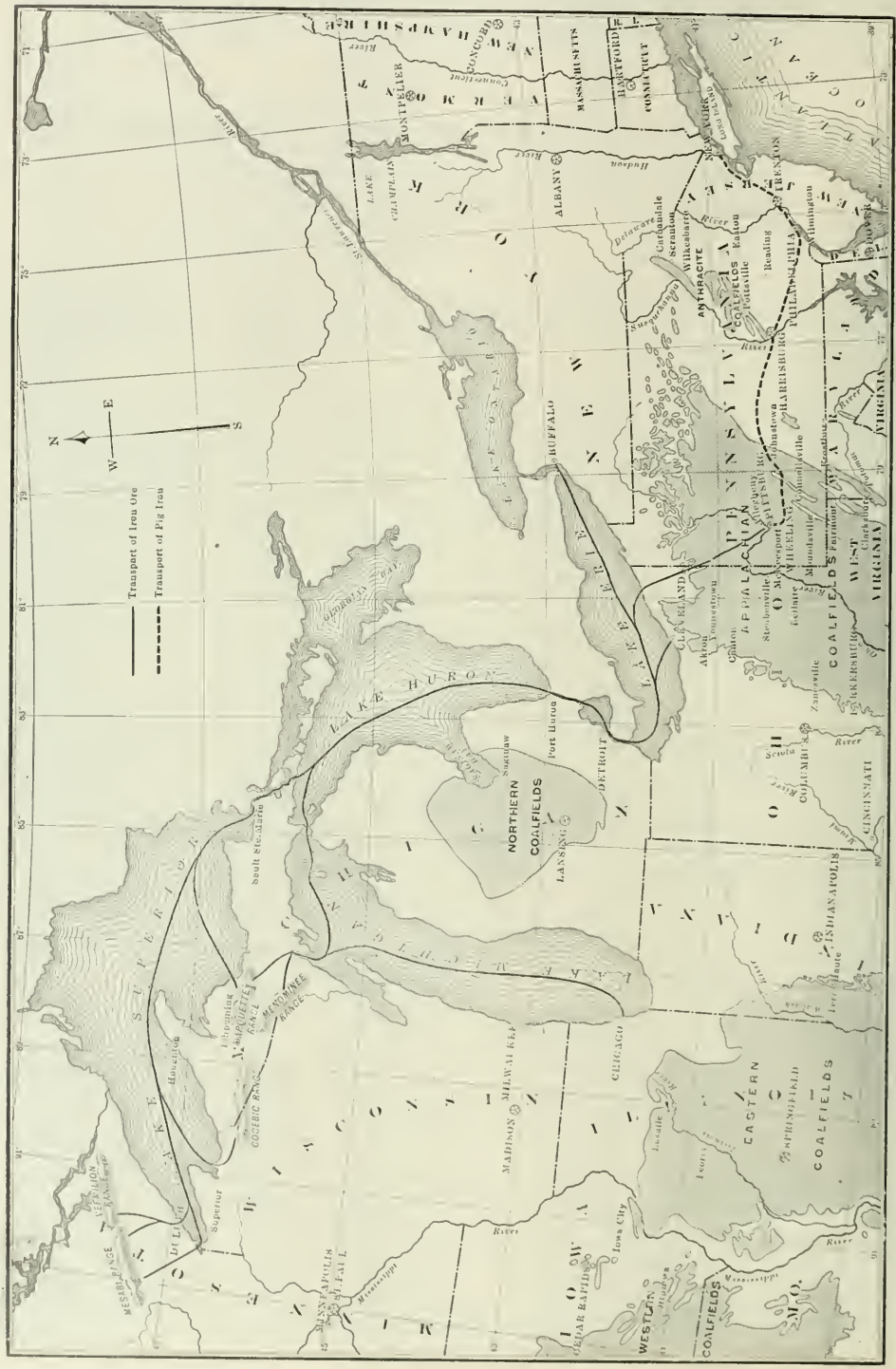

MAP SHOWING TRANSPORT OF LAKE SUPERIOR IRON TO SMELTING AND CONSUMING CENTERS

The Engineering & Mining Journal, N.Y.

We may conclude, therefore, that this company performs about 55 per cent. of the business all along the line and that its costs would be approximately the same if it did all the business.

One might argue that the costs of the Steel Corporation are radically different in some respects from those of the independents. For instance, an independent may have to pay 80c. a ton for freight that costs the Steel Corporation only 40c. It is for this very reason that the Steel Corporation is most representative. Its business is complete; that of the others, fragmentary. Just as the independents expect a profit on the ore that they own, so they must expect to pay a profit on the transportation that they do not own. It would be next to impossible to work out the real cost of pig iron if we tried to discover and weave together the obscure and disjointed costs and profits of a chain of discordant operators.

Capital Employed at Iron Mines

For the purpose of this article the capital employed is one of the most vital elements to consider. Remembering that we are to obtain our costs on pig iron and not on finished products, we must segregate the capital used in manufacturing from that used in mining and smelting. This can be done only approximately. Probably no one could make the division with absolute certainty, for it is necessary to remember that transportation, fuel and power facilities owned by the company are used for the joint purpose of manufacturing steel products and of producing pig iron. I am, therefore, compelled to make a division on my own judgment, and in order to enable the reader to estimate the legitimacy of this judgment, it is necessary to show the method of arriving at it.

The corporation owns in the Lake Superior region 72 iron mines of which 10 are on the Marquette range, 10 on the Menominee, 6 on the Gogebic, 6 on the Vermilion and 40 on the Mesabi range. Neglecting the purchase price of the properties, and considering only the actual money invested in the plants for machinery, development, etc., I make a rough guess that the total capital employed would be somewhat as follows:

Old ranges, each $2,500,000	$10,000,000
Mesabi range	25,000,000
Invested in extensive exploration and developments in the whole Lake Superior region	15,000,000
Total investment	$50,000,000

Capital Employed in Transportation

The Duluth & Iron Range railroad and the Duluth, Missabe & Northern railroad with a total of 363 miles of main line would be indispensable to the conduct of this business, even if it did not extend beyond the production of pig iron. We may calculate the value of this property at $50,000 to the mile, or in round numbers $18,000,000. The Elgin, Joilet & Eastern railroad and various small lines near the manufacturing plants with a total length of about 295 miles, may be estimated to belong half to the production of pig iron and half to manufacturing. I would charge, therefore, $7,000,000 in round numbers for these lines. The Bessemer & Lake Erie railroad with 205 miles of lines, I would charge entirely to the production of pig iron, and capitalize it at $10,000,000. This figures up a total of $35,000,000 for railroad tracks. In addition to this, we have the railroad equipment which I estimate at $52,500,000 out of which $40,000,000 would be necessary for the production of pig iron alone. We have then a total for railroads and their equipment of $75,000,000.

The marine equipment consists of 76 steamers and 29 barges. Many of these steamers are the largest and best upon the lakes, and some of them undoubtedly cost $700,000 or $800,000 each. I should say that the total equipment must be worth $40,000,000.

Capital Employed in Coal and Coke Properties

We have in the Connellsville and neighboring regions 62,253 acres of coal lands and 20,471 coke ovens. I believe it would be conservative to estimate the capital employed there at $30,000,000. In the Pocahontas district there is a lease on 65,497 acres on which are 2151 coke ovens. This property must have cost somewhere in the neighborhood of $10,000,000 for its development.

There are in addition 31,928 acres of steam-coal ground in Pennsylvania, West Virginia and Ohio. I would estimate the valuation of the plants employed on these properties to be at least $5,000,000. We have then a total of $45,000,000 for coal and coke plants. Of this I should say $35,000,000 would be necessary for the conduct of the pig-iron business of the corporation.

Capital in Blast Furnaces

The corporation owns, exclusive of its properties in the South, 100 blast furnaces, many of them the largest and best in the world. This property may be estimated at $125,000,000.

For the handling and shipping of iron ore, coke and coal, the corporation owns a large number of extensive docks, the total value of which I would guess at $20,000,000.

Capital in Inventory and Surplus

At the end of 1907, the inventory of stocks and materials used in the business was $136,000,000, and the surplus in the treasury was $122,000,000, making a total of $258,000,000 employed in the current conduct of the company's business. Of this I should say that one-half or approximately $130,000,000 would be necessary if the company's operations did not go beyond the manufacture of pig iron. As a justification of this assumption I may point out that the selling price of pig iron is about half that of steel rails and other heavy finished products which constitute the bulk of the company's sales.

Summary of Capital Used

We may summarize the capital as follows:

Iron-mine plants and developments	$50,000,000
Plants for transportation of iron ore	115,000,000
Coal, coke and quarry plants	35,000,000
Docks and dock equipment	20,000,000
Blast furnaces	125,000,000
Working capital in inventory and surplus	130,000,000
Total	$475,000,000

It is to be noted that this estimate does not include the purchase price of lands or good will, but only such capital as would be required if the opportunity to conduct this business were a free gift. Capital so employed is worth in round numbers 5 per cent. interest, plus a sinking fund calculated to retire the principal in about 40 years. Such a fund is equal to about 1 per cent. additional. We must calculate the use of this capital then at 6 per cent.; and this is not profit. It is merely the actual value of the money employed, such a return as can be secured by an investor without burdening himself with the management of an enterprise. I, therefore, calculate as an operating cost of this business 6 per cent. of $475,000,000, or $28,500,000 per year. On an output of 10,000,000 tons of pig iron a year this is $2.85 per ton.

The Iron Mines

Let us return to the source of operations and consider what iron-ore resources the company owns. According to the reports of the Minnesota Tax Commission the various properties owned by the Oliver Iron Mining Company on the Mesabi range have in sight 920,000,000 tons. This, I believe, is an estimate only of those ores which are at present merchantable. The large quantities of lower-grade ores on the western portion of the Mesabi range, which depend upon concentration for their utilization, have not, I believe, been reported. The discoveries of this kind of ore are very extensive, and as experiments have gone to the point of demonstrating the practicability of concentrating them, these ores should be considered as a resource. What the total volume of such ores may be I can only guess, but I should say that it would not fall far short of 300,000,000 tons of concentrates, making a total of probable ore on the Mesabi range of 1,220,000,000 tons.

As to the ore resources on the old ranges I have no means of making an estimate. It is to be remembered that these mines extend to great depths and that the exploration of them in advance is not easy, but on the other hand many of them are exceedingly persistent and have already been worked for a great many years with no signs of exhaustion. As-

suming that these mines may be counted on to produce as much in the future as they have in the past, we get an estimate of 114,000,000 tons for the old ranges, that is, outside of the Mesabi range. Therefore, I would estimate in round numbers, the total ore resources of the Steel Corporation in Lake Superior at 1,300,000,000 tons.

It will be seen that I have estimated for the exploration and finding of these ores, outside of cost of mining plants in operation, $15,000,000. This seems to be an extremely moderate estimate of putting in sight such enormous reserves, but as far as I can judge by the inquiries that I have made the sum is somewhere near the mark. Explorations on the Mesabi range have been extraordinarily fruitful, and the cost for drilling seems to be not much over 1c. per ton developed.

Royalties

A very large proportion of the ores controlled by the Steel Corporation are not held in fee, but under leases on which the company pays a varying rate of royalty. This royalty has shown a constant tendency to increase. Many of the earlier leases provide for a royalty of only 25c. per ton and the leases were made for periods of 20 years or more. In some cases these leases are already near termination and new leases will have to be made at an advanced royalty. Some of the latest leases provide for royalties of 85c. per ton on standard ores with provision for still further increases.

It is probable that under present conditions the company pays an average of not over 20c. per ton, because a good deal of its ores are mined from its own lands, but it is manifestly unfair to the Steel Corporation not to allow for its own land a royalty equal to that which it must pay to other owners. On this basis it is probable that the actual royalty allowable on the ore should be about 40c. per ton.

On the theory that I have adopted for these articles, royalty is not wholly an operating cost, but is in a large part a profit paid to the owners of lands out of their exploitation. Nevertheless, it must be remembered that we have not charged off to capital any of the value of these lands. A certain sum must be allowed to the owners of fees for actual expenditures in holding and developing them, and in the present case it seems more logical to charge off a certain royalty for each ton of iron ore than it is to calculate the actual cost of developing and securing the lands and then to estimate interest and amortization on the total. This latter proposition is absolutely impossible. I believe, therefore, we shall not be far from the mark if we assume a uniform cost of 40c per ton for royalty, whether the company pays this royalty to other people or pays it to itself

Cost of Ore From Various Ranges

At present about two-thirds of all the ore from Lake Superior comes from the Mesabi range, but in the case of the Steel Corporation the proportion is over 74 per cent. It is probable that we would not be far wrong if we adopted a proportion of 70 per cent. from the Mesabi range and 30 per cent. from all the others. By making the above division we may make a reasonably close estimate of the cost of mining the Lake Superior ores in general.

On the old ranges the problem is essentially uniform. That is to say, there is no great difference in mining ore on the Menominee range, or on the Vermilion range. In all cases the work is done entirely underground, usually at depths between 500 and 1500 feet. Individual mines, of course, show great variations. In some cases the ore is extremely hard and in other cases extremely soft. Some mines have one large body of soft ore; others have a number of comparatively small bodies of hard ore, but these individual differences occur about equally on all of the ranges.

The cost may be estimated as a function of the output per man per day. In the case of the hard-ore mines, the output per man is as low as 2½ tons per man, while in some of the most favorable soft-ore mines the output exceeds 5 tons per man. Now, the average wages in the Lake Superior region for all men employed may be calculated at $2.60 per day. We further estimate that wages account for approximately 60 per cent. of the cost at the mines.

It is probable that the actual operating cost may be calculated at the rate of $4.25 per man employed. On this basis if a mine gets out 2½ tons per man, its operating cost will be $1.70 per ton; if it gets out 5 tons, its cost will be 85c. I believe the actual figures on the average would fall about half way between these extremes, and that the average output for the old range mines would be somewhere near 3¾ tons per man. This would give a cost of about $1.15 at the mines, exclusive of taxes.

Costs on the Mesabi Range

The cost of mining on the Mesabi range is determined almost absolutely by the depth of the surface covering. If the orebody is thin and the overlying surface deep, it is necessary to mine the ore by underground methods. In this case the cost of mining on the Mesabi will be approximately 90c. per ton, the average output per man being 4½ tons.

Open-pit mining varies greatly in cost. This work is now done universally by means of steam shovels and the cost varies according to the proportion of overburden to ore, the texture of the ore, the proportion of boulders and tongues of country rock in the orebody, and the amount of water to be pumped. These various factors cause abrupt variations in the cost.

We may calculate that the removal of stripping costs 32c. per yard. If one yard of stripping uncovers a yard of ore we will have one yard of ore containing 2½ tons mined at a cost of removing 2 yards of material, or 64c., making the mining cost 25.6c. per ton of ore. To this cost, however, must be added the interest on capital invested in preliminary stripping and other costs of preliminary development of the mine, the cost of pumping and of certain general expenses that do not occur on the ground, so that when equal amounts of stripping and of ore are removed, I calculate that the cost will be decidedly over 30c. per ton. This estimate does not include the cost of taxes which I shall presently discuss separately.

It is evident that the proportion of stripping to the ore does not vary directly according to the relative thickness of the surface and the underlying ore; it is a function of these factors combined with several other factors. The glacial material is usually much more uniform in thickness than the orebodies underneath. The latter are usually trough-shaped with many irregularities at the sides and bottom. Furthermore, pits must have sloping sides so that in cases where the depth of the ore is equal to that of the overburden there will still be a considerably larger volume of overburden removed from the pit than there will be of ore. These considerations induce a good deal of caution on the part of operators in the question of deciding upon open-cut mining where the overburden is deep.

Open Cut *vs.* Underground Mining

When the exact proportion of stripping to ore can be worked out, it is a simple question of arithmetic to figure where it will pay to adopt underground mining instead of open pits. As the cost of underground mining is about 90c. per ton, when open-pit operations are cheaper than that, theoretically the mining should be done by the latter method. But in practice we find that a good many practical considerations come in to interfere with carrying this method to its logical limits. Among these may be pointed out the necessity of investing a large amount of money in excavating the overburden before mining can be undertaken. In the case of companies that are financially weak this is a matter of considerable importance.

In many cases where open-pit mining would have been much cheaper, the ore has been mined underground because the mine could be opened more rapidly and a certain profit more quickly realized even though the operators knew that they were not securing the best costs. This argument does not apply to the Steel Corporation, of which the capital is abundant for undertaking operations in the most comprehensive way. As a matter of fact, it is in many cases resorting to open-pit

methods at mines where formerly, under other owners, the work was done underground.

Exigencies of Open-cut Operations

At first glance it would seem as if when a yard either of ore or of waste can be dug out by steam shovels for 32c. that the cost per ton would be approximately 13c., and that, therefore, it would be as cheap to mine almost 7 tons in an open pit as it is to mine 1 ton underground. In other words, 6 tons of stripping might be removed to secure 1 ton of ore. This would be the case were there no expense involved in mining except the actual digging.

As a matter of fact, there are other expenses that amount to considerable. One of these, the interest on the money thus locked up in stripping, I have already pointed out, but a still more important cause for hesitation in adopting open-pit mining to its full apparent limit is the considerable variation in the cost of steam-shovel work in different parts of the same mine. Where the ores are soft and uniform a steam shovel will undoubtedly dig a large amount of ore. In some mines the cost of digging ore for a period may go as low as 6 or 7c. per ton, but this may be followed by another period when the costs may be several times as high.

For instance, in 1906, at the Mountain Iron mine an output of 2,560,000 tons was obtained with a force of 500 men. The bulk of the work was done in eight months, say 200 days. At an average cost of $4.25 per man per day we get for this period a total cost of about $425,000. Supposing that for the remainder of the year one-half the force was occupied, we must increase the estimated cost by about $125,000, making a total for the year of $550,000. This equals 21c. per ton. In 1907, with an output of 1,973,000 tons 1200 men were employed. This indicates a cost of more than 65c. per ton.

Open-cut Mining Costs Variable

A part of the increase was due, no doubt, to an additional volume of the stripping undertaken, but a considerable part of the increase cannot thus be explained. In the orebody itself changes were encountered that not only diminished greatly the output per steam shovel, but also greatly increased the number of men employed per shovel. Up to 1906 the total number of men required in shops, train crews, track laborers, etc., per steam shovel never exceeded 75; since then it has been 100.

The reasons for this are: (1) Ore itself has become much harder, frequently breaking into great slabs and chunks that have to be sledged to make them suitable for reduction in the blast furnace. (2) Owing to the irregularity of the bottom of the deposit it is often impossible to provide adequate working faces for the steam shovels, so that along the bottom and sides the shovels frequently have to take shallow cuts, and sometimes the shovels suddenly run into worthless bars of rock. When the last occurs the machine must be moved to a new working place. (3) Boulder-like masses of worthless country rock occur in the ore which must be removed as waste. Consequently the excavation of ore by steam shovels, after the stripping is all done, may be much more expensive than is popularly believed.

Unwatering the Open Pits

The cost of pumping must be fully as high for open-pit as for underground mining and must be kept up just as steadily. The great pits form catchment basins, often many scores of acres in extent, and in the event of heavy rains, which are far from uncommon on the Mesabi range, the volume of water is often so great as to cause work to be suspended. Fortunately the ore is porous so that the pumping may all be done from a single shaft so located as to provide for the drainage of the entire orebody for all times. The volume of water ejected from a single orebody is frequently 5000 to 6000 gal. per minute. I estimate that when 5000 gal. per minute is pumped from a depth of 300 ft. and the output is 1,500,000 tons per year, the cost of pumping will be 7 or 8c. per ton. I suppose this is about a maximum cost for the Mesabi.

Now, returning to the question of where open-pit work should end and underground mining should begin, we find that the conditions are about as follows: The actual cost of digging ore in a pit where the ore is hard and sorting is necessary may run up as high as 40 or 50c. per ton. This cost will be reached when a steam shovel with a crew of 100 men at an average cost of $4.25 per day digs 20 cars, or between 800 and 1000 tons per day. The cost will not exceed 50c. per ton, because ore can be sorted and loaded as cheaply as that by hand without any steam shovel. Let us then put 50c. per ton as a maximum cost for digging.

The cost of administration, interest on development capital (largely stripping), and of pumping, is, of course, variable. Where 500,000 or more tons are mined in a year, all these expenses combined are not likely to exceed 15c. At the worst, then, we have 65c. per ton as the cost of mining in open pits, outside of stripping. Now, as underground mining will cost 90c. per ton, we have the difference between 90c. and 65c. to invest in stripping. This 25c. will remove 2 tons of overburden.

I therefore conclude that it will pay to remove 2 tons of overburden to 1 ton of ore, under the least favorable mining conditions. Under the most favorable conditions, where both the ore and the overburden are soft and uniform, the economical proportion may rise as high as 4 or even 5 to 1.

Average Cost of Mining on the Mesabi Range

This is a point on which no one can get exact information without access to the cost statements of at least 50 different properties, but in a general way I think we can get a rough estimate that will be sufficient for practical purposes. It will appear that the actual mining cost of the ore at the mines is not, after all, one of the greatest factors in the final cost of producing pig iron.

Returning to our output per man per day as a basis for calculating costs I find that during 1907 the mines of the Steel Corporation in the Hibbing district produced approximately 9,000,000 tons of ore. This ore came largely from great open-pit properties, but some of it came from underground mines. I am informed that the total number of men employed was about 4500 with 60 steam shovels. Supposing that the whole of this force was employed for eight months, and half of it for the remaining four months of the year, and assuming that 26 working days constitute a month, we get an equivalent of 260 days with 4500 men, each costing $4.25. This gives us a total of approximately $5,000,000, or in round numbers, 55c. per ton.

This estimate is open to doubt on several points, two of which are whether the amount of stripping that was done kept pace with or exceeded the amount of ore extracted, and whether the rough figures of labor employed are actually near the truth.

As to these facts I have no means of judging except the most general impressions, but I am satisfied that at the worst, my information is not far enough astray to make the cost hopelessly inaccurate. In a general proposition of this kind no one attempts to get down to niceties, and there is no occasion for it. When I state that the average ore mined in the Hibbing district costs 55c. per ton, I may be 15 or 20 per cent. astray this year, and next year I may be right.

The mines of Hibbing undoubtedly are the most favorable on the Mesabi range for cheap costs. They have the largest, softest and most uniform orebodies, and are worked on the largest scale. It does not seem improper, therefore, that if we estimate the cost at 55c. per ton at Hibbing, we should increase this to 60c. for the whole range. I therefore estimate that the average cost of mining on the Mesabi range for both underground and surface is about 60c. per ton, exclusive of taxes.

Taxes

The laws of Minnesota tax mining properties for what ore they have in sight. The tonnage developed is reported by the mining companies to the assessor who puts a valuation upon it according to the quality and accessibility of the ore. For purposes of taxation, discovered ores are placed in five or six different grades with a minimum valuation of 8c. per ton and

a maximum of 33c. Roughly, the ore developed seems to average about 15c. per ton in valuation. This valuation is taxed just as any other assessed property is taxed, the levy being somewhere in the neighborhood of 1½ per cent.

Since the Steel Corporation has in Minnesota on the Mesabi and Vermilion ranges about 930,000,000 tons on the assessors' lists, it would appear that the total valuation would be somewhere in the neighborhood of $140,000,000 and the taxation approximately $2,000,000. On this basis we find that the company must pay on its present output of approximately 18,000,000 tons, more than 10c. per ton on its actual shipments.

This taxation is a recent development. I do not believe that the company has as yet actually paid so much, but on a basis of present and future conditions it does not seem like an excessive estimate. The fairness of this mode of taxation it is not my present purpose to discuss, but it is very evident that a company with large ore reserves and a small output may be taxed much more than a company with a large output and small ore reserves. For instance, if the Steel Corporation had only five years' ore in sight instead of 50 years its taxes in its present tonnage would be only 1c. per ton instead of 10c. For this reason there are probably vast differences in the tax rates of various companies on the Mesabi range, and I suppose the Steel Corporation undoubtedly pays more taxes per ton of output than any of the others.

Explorations and Maps

It may be interesting to digress for a moment to consider the value of combination in the operation of these mines. Since its organization the Steel Corporation has pursued a most complete, scientific and satisfactory plan of exploring and mapping its ore reserves. It has employed expert geologists and engineers for this purpose. It has secured as much land as it could for exploration and has explored them to the point of determining, before any mining is done, the situation, volume, shape and economic characteristics of the orebodies on large tracts of land.

In other words, the process of drilling and test-pitting has been carried on until the depth of surface, the quality of the ore, its probable admixture with boulders and tongues of barren rock, and its thickness have all been determined. This information is expressed on maps which show the contours not only of the surface of the land, but also of the surface of the orebody underlying the glacial drift and the contours of the bottom of the orebody.

The information permits the planning of the mining work in such a way that there shall be no duplication of effort. The drainage of an orebody can be provided for with a single shaft so situated that it reaches the bottom of the deposit. The problem of mining is solved beforehand. In other words the propriety of mining in open pits or underground is predetermined. The location of pits, of dumping grounds, of railroad tracks and of all equipment is established once for all.

Drawbacks of Individual Management

Now, suppose these same orebodies were to be mined by different companies as was, or would have been, the case 20 years ago. The orebodies are sometimes a mile or even two miles in length and quite irregular in outline. The ordinary course of the longest axis of an orebody is northeast and southwest so that it would cross the subdivisions of the land diagonally. Such an orebody would inevitably occur on several sections, quarter sections or 40-acre tracts. The land ownership is scattered and irregular. It is seldom that any tract belonging to a single owner is larger than 160 acres and many tracts are only 40 acres in area. As a matter of fact most of the great orebodies on the Mesabi range belonged originally to five or six different companies.

In such a case it is evident that each company would have its individual management, its own problem of finance and its own requirements in the way of output. The mine located on one particular 40-acre tract might find the surface only 20 ft. deep, and it would plan an open pit. Since the neighboring ground was seldom thoroughly explored, the waste from this open pit might very likely be, and indeed was in many cases, dumped on ground afterward proved to be ore-bearing.

The next mine on the same orebody might find the surface to be locally 100 ft. deep, and if the operating company were poor and in a hurry for ore, it would undoubtedly open up its mine underground. The result of this would be that large sections of the surface would be caved down into the middle of the ore, thus preventing forever the successful stripping of that part of the orebody.

Economy of Large Ownership

But if this whole orebody were in the possession of the Steel Corporation, its explorations might show that the surface averaged about 50 ft. and that it might be economical to mine all the ore by an open pit. A single pump shaft would be sufficient. No waste would be dumped on neighboring ore-bearing ground. In short, a vast amount of duplicated expense would be avoided. This is where the value of such a combination comes in.

The Steel Corporation cannot get its work done any cheaper than anybody else. If it has to sink a shaft, for instance, it cannot do it any cheaper than any one of the half dozen mines that it might replace, but it could on the average sink one shaft for one-sixth the expense that it would cost other people to sink six shafts.

It is worth remarking in this connection that the Steel Corporation has been magnificently managed. It has not striven for minute and near-sighted economies. It has not tried to outdo its rivals in points of local rivalry, but it has kept in mind the broad outline of its operations and has tried to make use of its capital and opportunities in ways that every fair-minded man would recognize as legitimate. The company can do this only as long as it is well managed, but up to the present it is only fair to say that its activities have been well directed and that its economies are such as to be certainly of no disadvantage to the public at large, but on the contrary in many ways a great benefit.

Total Cost of All Lake Superior Ores

In order to keep the proportion of things in mind, even at the expense of some repetition, we may state that the cost of mining Lake Superior iron ores is for Mesabi ores, $0.60; old range ores, $1.15 a ton. Since the Steel Corporation mines about 7 tons of ore on the Mesabi range for over 3 tons mined on the old ranges, we may calculate that the actual cost of 10 tons would be $7.65 or 76½c. To this we must add taxes which on the Mesabi range are not far short of 10c. per ton. In order to make a round figure we may state that all Lake Superior ores would cost on the ground about 85c. per ton, including taxation. To this we may add 40c. per ton for royalty, making the total cost of Lake Superior iron ores at the mines, ready for shipment, $1.25 per ton.

Transportation of Ores

The ores which are mined on both shores of Lake Superior either in northern Wisconsin and Michigan or in Minnesota, must all be transported to the region lying south of the Great Lakes for smelting. The region of iron manufacture extends from the neighborhood of Chicago and Milwaukee at the northwest, eastward in a widening belt to Pittsburg and Buffalo and thence east to the neighborhood of New York City.

The factors which dictate the production of pig iron in this region are two, namely, the presence of coal and facilities for distribution. If we take Pittsburg as the most active and central point in iron manufacture to represent average conditions we find that the ores must be transported about 1000 miles in three sections: (1) There is the land haul from the mine to Lake Superior ports; (2) the lake haul from Lake Superior to Lake Erie; (3) the land haul from Lake Erie to Pittsburg.

The first division of the work is covered by five or six different roads—three in Minnesota and the remainder in Michigan and Wisconsin. The length of

haul is variable; from Ely, Minn., on the Vermilion range to Two Harbors, the distance is about 90 miles. Most of the ore from the Mesabi range has to be hauled from 70 to 100 miles so that I suppose an average distance for the north shore roads is perhaps 80 miles. Most of the ore on the Marquette range is less than 20 miles distant, while that on the Menominee range is about 50, and from the Gogebic range the distance is only about 30 or 40 miles to the harbor.

The published rates on ore from mines in Minnesota to the lakes is uniformly 80c. per ton; from the Gogebic range to Ashland, 40c.; from the Menominee range to Escanaba, 40c., and from the Marquette range to Marquette, 25c. In the case of any company other than the Steel Corporation it would be necessary to take these rates at their face value, but in this case there is reason to believe that the transportation is the most profitable part of the business.

The company does not own any railroads on the southern shore, but its two railroads on the northern shore, namely, the Duluth & Iron Range and the Duluth, Missabe & Northern, haul about 52 per cent. of the ore produced in the entire region. The corporation also owns a fleet of boats on the lakes, probably sufficient to transport an equal amount. It also owns the Pittsburg, Bessemer & Lake Erie railroad, which hauls most of the ore to Pittsburg. I think we shall not be far wrong if we assume that so far as costs go the results are the same as they would be if the company transported all its own ore from the Minnesota mines to the furnaces.

While the freight on ores from the south shore to Pittsburg is undoubtedly less than that from Minnesota, it is also true that the Steel Corporation must pay on ore transported from those ranges a profit to independent railroad companies which it does not pay in the case of Minnesota ores. Its profits on Minnesota ores which it hauls for other companies probably more than counterbalance the amount it pays in profits to others on the Michigan ores.

Automatic Handling of Ore

Iron ore is about the most easily handled material in the world. Its specific gravity is high, so that the ton does not occupy much bulk, and it is absolutely uninjured by the roughest treatment. As a matter of fact, it is loaded directly into dump cars either by the steam shovels or directly from the mine shafts. It is made up in trains of approximately 2000 tons of net freight and hauled over roads of very slight, or no, adverse gradients to the lake docks. There it is dumped by gravity right into the hold of the ship and transported in large cargoes on waters that are generally tranquil, and unloaded by machinery at the lower lake ports to be again delivered to the dump cars and carried as before to the furnaces.

I believe the operating cost of hauling such material by rail cannot exceed ¼c. per ton per mile. On this basis transportation from the mines to Duluth would cost about 20c., and from Lake Erie to Pittsburg about 40c. per ton, making a total for rail haul of 60c. The lake freight in all probability will cost, including unloading, an average of about 40c. Thus we have a total transportation cost of $1 per ton from the mines to Pittsburg. This, of course, is merely operating cost, and does not include the necessary return on the capital invested in the transportation properties, but this item I propose to consider as a lump to be added to the cost of pig iron so that I will not discuss it here.

We have, then, ore delivered at the furnaces at Pittsburg at a total cost of $2.25 per ton, distributed as follows: Mining 85c.; royalty, 40c.; transportation, $1.

Cost of Coke

Without going into details I think it would be fair to estimate the cost of Connellsville coke to the Steel Corporation at about $1.40 per ton. This is on a basis of 70c. per ton for mining the coal and using 1½ tons of coal per ton of coke at a coking cost of 35c. The freight rate from Connellsville to blast furnaces at Pittsburg is 75c. per ton, so that we may calculate coke delivered at the furnace at $2.15.

Cost of Producing Pig Iron

It is not probable that the average Lake Superior ore of today will yield much over 50 per cent. in pig iron before moisture is deducted. Since the tendency is toward a gradual reduction in the grade of the ore, it does not seem far out of the way to assume that two tons will be required for each ton of pig iron. We may now calculate when an average output of 10,000,000 tons of pig per year is made, the cost to be as follows: Use of capital, $2.85; 2 tons iron ore at $2.25, $4.50; 1.2 tons coke at $2.15, $2.58; limestone for flux, 50c.; labor and maintenance at furnaces, $1.40; general expense, 25c.; total cost at Pittsburg, $12.08; freight from Pittsburg to New York, $2.60; total cost at New York, $14.68.

An interesting commentary on the correctness of these figures is the testimony of Judge Gary in the tariff hearings before the Ways and Means Committee of the House of Representatives. Mr. Gary gives costs for the year 1906 for all the furnaces of the United States Steel Corporation. His figures are those not of actual cost, but of market prices for iron ores, coke and transportation.

The figures are as follows: Iron ore at $4.70 per ton; cost of ore used in a ton of pig iron, $8.62; coke at furnace, $3.93 per ton; coke used in making a ton of pig iron, $4.15; limestone per ton, $1.06; limestone in pig iron, 49c.; scrap, cinder and scale, 27c.; labor and maintenance at furnaces, $1.37; depreciation of furnaces, 40c.; total cost of making a ton of pig iron, $15.30.

From these figures Mr. Gary makes the following deductions for net profits: On ores in pig iron, $2.04; on coke in pig iron, 60c.; on transportation, $1.07; total deductions, $3.71. Subtracting this amount we have by Judge Gary's estimate $11.59 per ton as the cost of pig iron at the furnaces.

There is, however, some doubt as to the exact application of the figures presented by Mr. Gary. Anyone who is familiar with testimony taken at a hearing will understand why this is so. I have gone over the evidence and put together the figures in another way. I do not know which is the most accurate.

MR. GARY'S FIGURES IN DETAIL.

Actual cost of iron mining at all mines	$0.73
Actual cost of coke at ovens	1.21
Actual cost of iron ore at furnace	2.83
Actual cost of coke at furnace	3.39
Pig Iron.	
Iron ore per ton pig	5.50
Coke per ton pig	4.07
Limestone	0.49
Cinder and scale	0.27
Operating blast furnaces	1.38
	$11.71
Depreciation of blast furnace	0.40
	$12.11

It will be noted that the sum total of Mr. Gary's figures are almost identical with those of my independent estimates. It is to be pointed out, however, that Mr. Gary's figures are for all the furnaces of the company, while mine are for Pittsburg alone. This fact will make a divergence in the details unavoidable. Furthermore, my figures are for general conditions as they are at present, while Mr. Gary's are exact statements for a single year. After giving the matter considerable thought I have decided to leave my estimates as originally made. They will at least serve to show something of the logic of calculating costs.

One mine in Australia is being operated for rutile. It is owned and worked by Francis J. Spence, and is 45 miles northeast of Adelaide in South Australia. The present production is small, but could be increased at any time, if a demand should arise for the mineral, as for instance, from the use of titanium in making steel. At present the demand is not important. Rutile is valuable chiefly for its high titanium content, and its principal uses at present are in the coloring of porcelain and of artifical teeth and in the manufacture of some forms of arc lamps.

Hitherto the deepest borehole in the world has been that near Rybnik, Upper Silesia, 2003 m. This depth has now been exceeded by a hole at Czuchow, in the same district, which has already reached 2156 m., and is to be continued to 2250 m., if possible. The hole was commenced in December, 1906, with a diameter of 16 inches.

The Mount Morgan Mine, Central Queensland

An Enormous Body of Ore Which Supports 12,000 People and Has Produced $70,000,000 of Which $37,000,000 Were Paid in Dividends

BY J. BOWIE WILSON*

Lying within the coastal edge of the hills that traverse the eastern side of Australia parallel to the coast the Mount Morgan mine, Central Queensland, has an altitude of about 800 ft. above sea level. The climate, although semi-tropical, is healthy, the extreme heat of the summer days being tempered by almost invariably cool nights. The atmosphere is dry and no tropical fevers are prevalent.

The climate is one in which white men can easily work and without apparent deterioration. A large percentage of the men now working at Mount Morgan have either been there for 20 years, or were born in the district; and it would be hard to find a body of men in better physical condition which I think tends to show that even the tropical portions of Australia, when once clear of the low-lying strip of coast country, are suitable for a white population. From the very beginning of the Mount Morgan company the whole of labor employed has been European, or the descendants of European settlers.

MILLING SYSTEM, SHOWING FUNNEL-SHAPED PITS AT SURFACE

Mount Morgan, the Town

The town of Mount Morgan, called after the mine, has been built just outside the mine works upon the banks of the Dee river, which in common with so many so-called Australian rivers contains running water only during the rainy season. The town is connected with the Queensland government railways by a short branch line 12 miles long, also built by the government, which junctions with the main central line at Kabra.

Mount Morgan has a population of 12,500, and is an uptodate mining town, having an excellent hospital, school of arts, a technical college, a local telephone exchange which is also connected with Rochhampton, and is lighted with gas supplied by a private company. The inhabitants depend wholly upon the Mount Morgan company for their support, as there is only the one producing mine in the district and the surrounding country is worthless for either agricultural or pastoral pursuits.

The fact that up to the present no payable mines have been located outside the Mount Morgan company's holdings is

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often commented upon, but when it is remembered that this company secured 750 acres in the early days and still retains them, having sold only the surface rights of a few blocks near the town, it is not surprising that they hold all the valuable portions of the ore deposit.

Water Supply

The town depends for its water supply wholly upon what each individual stores in tanks from the catchment of his dwelling; as the rains are erratic and the district must be considered a dry one, the supply of good drinking water frequently runs short. The company has built seven dams across the Dee river at different sites to supply the works with water, of which the four largest are still in use. When full these have a capacity of 370,000,000 gal., but even with this supply the works have several times been threatened with stoppage through a shortage of water. During the big drought of 1902 for seven months all the water required by the company was carried from Stanwell about 17 miles by rail. The storage capacity has since been increased, but the treatment capacity of the works has also increased, so that even today the company is not in too good a position to withstand a prolonged drought.

The Ore Deposit

The Mount Morgan deposit was discovered in 1882, quite by chance, by the Messrs. Morgan, when they were returning to Rockhampton after an unsuccessful attempt to locate a reported silver lode on Nine Mile creek, about 19 miles from Mount Morgan, and which, by the way, has never yet been located. Heavy rains falling, the creeks became flooded, and the prospectors were forced to camp in a deserted shepherd's hut on the Dee river. While waiting for the creek to fall, one of the Morgans, taking a dish and pick, went prospecting, and in passing over the hill now called Mount Morgan noticed some peculiar iron-ore boulders, pieces of which he broke off, and carrying them down to the water, crushed them and panned off. He obtained such a rich prospect that he could not believe that it was gold in the pan.

The Morgans took samples back, far away, to Rockhampton and the returns were all rich. After another trip to the locality they pegged out claims and formed a local syndicate in Rockhampton to develop their discovery. The mine was practically self-supporting from the start, only a few thousand pounds being put into the property. The syndicate worked the property until 1886. No records of their profits during this period are available, but in that year they formed themselves into a limited liability company of 1,000,000 shares of £1 each issued as paid up to 17s. 6d. per share. The flotation of the company was purely the transferring of the existing syndicate into a company as all the shares were allotted to the members of the syndicate in proportion to their holdings. The company remained in this form until 1902 when the directors made a call of 2s. 6d. per share and at the same time declared an extra dividend of 2s. 6d., thus making the shares fully paid up and taking away all liability from shareholders.

The origin of the deposit is still open to discussion but it must clearly be classified as belonging to the class of impregnations or metasomatic deposits. The

CRIBBING USED IN THE COPPER-GOLD OREBODY

country rocks around mount Morgan are of sedimentary origin belonging to the Gympie series of the Permo-Carboniferous age, but they have been greatly altered by dolerite dikes and intrusive masses of hornblendic granite and now appear as quartzites and quartz felsites.

Open-cut Mining

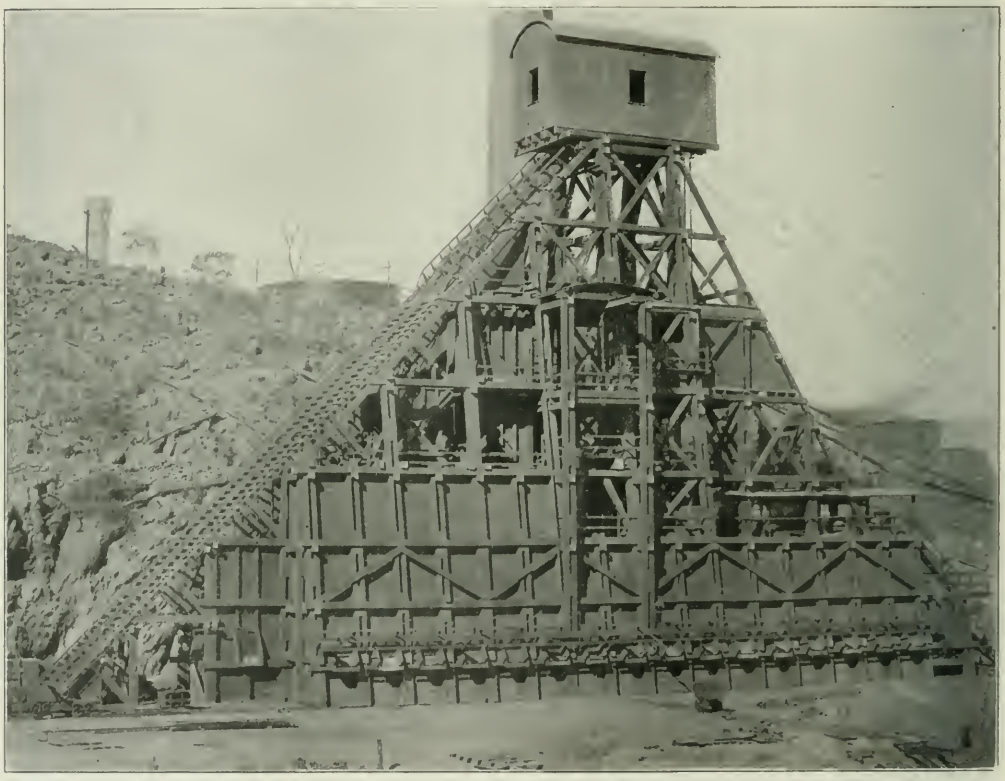
The open cut was started in the early days of the mine by benching the orebody on the top of the hill and this has developed into the present huge quarry. At first it was not realized that it would pay to remove the whole top of the hill and a lot of money was wasted by mining by the square-set system ore that should have been quarried in an open cut. For instance, on the Grantree level or floor No. 21 (315-ft. level) more than 2000 sets were mined, each set being 6x5x7 ft. 9 in. high, and now the open cut is down to the 360-ft. level.

The open cut was originally worked like an ordinary quarry in benches, the ore being shot down from the faces upon floors, shoveled into trucks and tipped into passes leading to drives upon the level of the works bins. When the west works were built upon the side of the hill, to replace the old lower works and to treat the oxidized ore, a main tunnel was driven right through the hill upon the level of the works hoppers (285-ft. level) and all the oxidized ore was passed down to this level and drawn to the hoppers, at first by two small steam locomotives and later by electric motors.

Milling System

This bench mining has now been abandoned as much as possible in favor of the milling systems in which a rise is put up, to act as an ore pass, from a drive to the surface and then the material worked out around the pass until it has the appearance of an inverted cone with the top of the pass at the apex. The milling system would be used exclusively, but for the fact that in parts of the present open cut old filled-in workings occur, and it is not always convenient to get the necessary drives and rises in the proper positions. With bench mining it is also easier to hand-pick the ore, and in places this is advisable. Where the dikes or bands of poor ore are of any size it is possible, in milling, by carefully placing the shots to shoot down ore and waste separately when the waste can go straight to the tip or to the waste passes for filling in the underground stopes.

In mining out the old filled-in stopes, the timber is recovered and, being all hardwood, iron bark and spotted gum, most of it is sound enough to be used again in the mine. As the tenons of the legs are often broken, these are either cut into caps and struts or used for double banking a weak set, or for temporary pigsties in the copper chambers for supporting a bad piece of roof.



HEADFRAME AT MAIN SHAFT

Down to the 315-ft. level practically the whole of the ore removed from the open cut was oxidized, but at about this level the ore changed to sulphide and now all the eastern side of the open cut is in unoxidized ore. The change from completely oxidized to sulphide ore is remarkably sharp taking in places only a few feet to change from the one to the other.

Economy of Open-cut Mining

The economical limit of an open cut is

reached, or course, when the cost of removing waste to allow a safe batter to the sides of the quarry, per ton of ore exposed equals the difference between open-cut and underground mining. It was estimated at Mount Morgan that this point will be reached when 450 ft. below the original summit of the hill.

To handle economically the overburden that had to be removed to allow this depth to be reached, in 1903 a 65-ton Bucyrus steam shovel was imported and erected. I believe that this was the first shovel of any size to work in Australia. It has done excellent work at Mount Morgan, its only disadvantage being that the type in use can work only on a siding as it will not clear enough room in a heading to allow a train to run beside it.

To do this work a shovel of English design, a Witaker, was imported. As this style of shovel revolves completely round, it can discharge into trucks at its rear and so can work in a heading and prepare the way for the Bucyrus shovel, but for quickness of work and cheapness it is not to be compared with the Bucyrus. Three 10-ton locomotives, of English make, running upon a 3½-ft. track, took the waste away from the steam shovels.

Although the sides are only being removed to allow a safe batter to the edge of the ore on the 450-ft. level, it will be quite possible to open-cut the center of the deposit below this level.

There is one great disadvantage in an open cut. In spite of drains, wherever possible, it acts as a catchment area for the mine and when the rainy season is on it pours a large quantity of water into the mine. This would be more serious in a locality blessed with more rain than central Queensland.

Square-set Mining

The square-set method was adopted for the gold ore when underground mining was first started and it is still in use in the older part of the mine to the east of the andesite dike. This method of timbering is safe and holds ground well, when care is taken to keep the sets filled close up to the workings, but it is undeniably expensive. Still, even in the face of the expense, I fail to see how it would have been possible to adopt a cheaper system of mining this part of the deposit, when the payable ore occurs in the midst of masses of unpayable rock and one can never be quite certain where a stope will end when starting it. The square-set system can be expanded and contracted at will without interfering with the safety of the stope and by slabbing up the outside sets before filling in, it is possible to leave the stope so that it can be worked round again if a new discovery shows this to be profitable or a reduction in treatment costs converts unpayable ore into payable.

The square-set system readily adapts itself to the keeping of accurate assay plans, as the exact position of each set can be obtained without excessive surveying. As all underground mining is done by rock drills, the sample of a set is taken by mixing some of the borings from each hole put in to mine the set. In an orebody like the Mount Morgan deposit where the gold cannot be seen and the gold is very fine and generally evenly distributed this method of obtaining samples is fairly accurate. It has frequently been checked and has always been found to give close results.

Of course in practice before mucking a set that has given a low assay return, the value of the surrounding sets is taken into consideration, and if it happens to be in good company, it is considered safe to send the material to the works hoppers if there is no time to check the sample. A set of ground equals about 20 tons on the average, and a separate assay is made for each set. Assay plans were only started in 1902, and they have been found invaluable, and the even grade of the ore sent to the works can be largely attributed to their use.

OPEN CUT, FREEHOLD LEVEL, SHOWING TIMBER IN OLD STOPES

Chamber and Filling

When the copper-gold orebody was prospected and blocked out by bore holes it was found that it would pay to mine completely a large area of the deposit. To avoid the costly timbering of the square sets it was decided to mine this body of ore in chambers. As the south dike, 20 ft. thick and practically vertical, runs through this body of payable ore and parallel with its greatest length, it was decided to run the chambers parallel with the dike, and to make use of it as a wall between the first two chambers.

These chambers are 60 ft. wide, and the length depends on the extent of the payable ore. On the 750-ft. level the chambers have an average length of 400 ft. The width of payable ore greatly exceeds the combined width of these two initial chambers, the outside walls of both being composed of ore of much the same grade as that mined; additional chambers parallel to these are opened up when required.

The width of 60 ft. was decided upon because it was not thought prudent to have a greater width of practically unsupported roof open at one time especially as the walls of the dividing dike, being partially decomposed, cannot be greatly relied upon, and if the dike is eliminated there is at present 140 ft. between the outside walls.

To start the chambers, drives were first driven down the center of each chamber and connected at the middle and ends by cross-drives which pass through the dike. By side stoping from these drives the sill cuts of the chambers were mined. While this work was proceeding winzes were sunk, about 100 ft. apart, from drives on the level above to act as passes for the waste required for filling in the stopes.

If the level below is already opened up it is best also to sink winzes to it, as it is easier to do the work at this stage than afterward from the drive kept open through the filling. These winzes are also convenient for ore passes when removing the ore broken in the second cut of the chambers and before the filling is run in.

Stoping and Filling

After the sill cut has been mined, only an occasional pillar being left in to help support the roof, the second cut is mined from the chambers by overhand stoping to raise the roof to about 20 ft. This was done by first cutting across the chambers, at the end nearest the shaft and then advancing in a breast up the chamber. The machines were rigged upon the heap of broken ore, the top of which was kept about 7 ft. from the roof.

Before firing the holes bored in the breast, sufficient ore was removed from the face of the heap to make room for the rock to be broken by the firing, and to leave room to rig up again after the roof had been worked down. To do this either a trucking way has to be kept open by timber through the heap of broken ore or the chambers have to be worked so that the shaft can be reached through the cross-drives, connecting the two chambers. This is the simplest way, but to do it one chamber has to be mined in advance of its neighbor. When laying out the work this necessity of removing ore from the face of the heap must be kept well in mind.

After the second cut has advanced sufficiently to allow some of the broken ore to be removed, still leaving sufficient upon which to rig the machines at the face, the broken ore is shoveled away. When a section of the chamber has been cleared poles are laid across the floor and slabbed over; a drive is formed of two parallel pigsties roofed over with poles covered with slabs and filling poured into the chambers and leveled off to within 5 ft. of the roof, when the third cut can be started. Pigsty chutes are built up through the filling at short intervals for passing the ore down to the drive. The filling is allowed to lie against the dike, but a pigsty is built along the outside walls of the chambers to keep the filling from the ore left there and also to keep the filling in place when the next chambers are to be mined. The flooring is laid so that the stope coming up under the chambers may be worked right up.

STEAM SHOVEL NO. 1 ON FREEHOLD LEVEL

Other Details

In filling in the chambers the waste is conveyed in side-dumping cars by an electric motor to the required pass and poured

into the chamber until the natural slope of the heap reaches the roof of the chamber and blocks the pass. Shovelers are then put on, and starting on the sides of the heap at the desired level, throw back the filling until they have filled in as much of the chamber as can be reached in this way. Just before this point is reached they stop putting waste into the top of the pass to allow the shovelers to empty it and to level off the heap under it. A rough chute is then put in the pass by running holes up the four corners and slabbing them in, when the remainder of the required filling is drawn off in cars. The filling passes were spaced 100 ft. apart, but they could have been closer with advantage.

The rock at Mount Morgan is, on the whole, excellent standing ground, or this method could not, of course, be used, but trouble occurs in the neighborhood of the small dikes, when temporary pigsties of timber have to be erected to protect the men. These can generally be completely recovered as the stope is filled, fresh ones being built up from the filling to pick up the roof. This work often requires great skill and ingenuity on the part of the underground boss.

Although to miners accustomed to small, well timbered stopes, these chambers look unsafe, up to the present there have been no accidents at Mount Morgan that can in any way be attributed to this method of mining.

Shafts

Until the beginning of 1907 all the shafts in use were small and vertical with three compartments, 10½x6 ft. in the clear. They were sunk in the orebody and none of them hauled ore directly to the surface. Their engines were underground, driven by compressed air, and they hoisted ore to tunnels upon the level of the works ore bins. All the ore was handled in cars containing on an average 18 cwt., in single-deck cages with the usual safety appliances.

In 1905 when the copper-gold orebody was being developed and the smelting works were erected, a new shaft was sunk to handle the increased output of the mine and also to replace the old shafts, and to allow the surrounding ore to be mined. This shaft, called the incline shaft, was placed upon the southern side of the hill and with its mouth outside the deposit and upon the 315-ft. contour which is the level of the mundic works hoppers, and about 70 ft. above the smelter hoppers.

It is a three-compartment shaft 17x8 ft. over all, and is sunk on an angle of 45 deg. The two hoisting compartments are each 5 ft. 6 in. wide, and in the other compartment a stairway is built. It is connected with the mine workings on the 450-, 574-, 650-, 750- and 850-ft. levels, and was in 1908 sunk to the 950-ft. level. The ore is hauled in skips running upon rails and capable of holding from 5 to 6 tons; they are filled by chutes from pockets sunk from the various levels to the roof of the shaft. The main levels have each two pockets, so that either gold ore or copper-gold ore can be drawn as required.

The skips are self-dumping and discharge into a small hopper at the top of the headgear. This hopper is kept small so that when the class of ore being hauled is changed it can be emptied in a few minutes. The ore passes next through a Gates breaker which discharges upon a belt conveyer, which runs the length of the headgear. If the ore being broken is gold ore for the mundic works the conveyer, by means of a tripper, distributes it along the hoppers which form the base of the headgear and from which it is drawn in side-dumping cars by an electric locomotive to the works hoppers. If the ore is for the copper smelters the belt delivers into one of four ore pockets which are sunk to a tunnel upon the level of the smelter bins, the ore being drawn in large hopper cars by a steam locomotive to the bins.

Incline Shaft

The incline shaft is intended for handling ore only; all men and supplies enter the mine on the 450-ft. level and are at present lowered down one of the old shafts. To free this old shaft and more economically handle the men and supplies the Linda shaft is now being sunk. This shaft is really an inclined tramway, as it is going down on a grade of 1 in 3. It starts at the mouth of the Linda tunnel (450-ft. level), and will connect with all the main working levels.

Although the cost of this shaft will exceed by about £2000 the amount for which a vertical shaft could have been sunk, clear of the deposit, it is expected that this amount will be saved in a couple of years by the decreased cost of handling the men and materials. The vertical shaft could not have been sunk from the surface; so that all steel and material would have had to be handled as at present, which is as follows: Loaded upon trucks and trucked to the shaft plat, unloaded and loaded upon the cage, lowered to the required level and unloaded from the cage on trucks again. All this handling is expensive and also hangs up the shaft a lot during the loading and unloading of the cages. With the new shaft as each level is connected with the shaft by a turnout, on a vertical curve, the material once loaded on the cars can be lowered down the shaft and shunted to the level and left there ready to be taken to the working face. Although a much greater distance has to be sunk the cost per foot is about one-third of that of sinking a vertical shaft and no expensive headgear is necessary.

OPEN CUTS AND DUMPS, LOOKING SOUTH

Breaking Ground

The rock drills in use are the Ingersoll-Rand-Sergeant auxiliary valve. All machine steel is sharpened in Ajax drill sharpeners, two machines being in constant use on three shifts with a third machine kept as a stand-by. Blasting powder is used in the jumper holes in the open cut, the holes being bulled with dynamite. Underground, Nobel's gelignite and No. 1 blasting gelatin are exclusively used, the latter in the harder ground, but sometimes only for bringing out the cut, the side holes being then fired with gelignite.

Labor Conditions

The open cut is only worked on a day shift of eight hours. Work starts at 7:30 a.m., and ends at 5 p.m., with two spells of ¼ hours each at 10 a.m. and 3 p.m., and ½ hour at noon for dinner. On Saturdays the men knock off at noon, but it counts as a full day, the extra ½ hour worked bringing it up to seven hours, so the men work only 47 hours a week, but are paid for 48 hours. All work in the open cut is done on wages.

In the gold stopes the work is cut at so much per square set erected, and in the copper chambers at so much per ton of ore delivered to the chutes. Contracts are let for a period of eight weeks, all the contracts being let upon the one day, so that all the miners have an opportunity of tendering for each job. All tenders have to be delivered at the mine office in a closed envelop, and if on opening the tenders the lowest is not considered satisfactory, the work is either done on wages or left until the next contracts are let.

Progress payments are made fortnightly, on the same days as the wage men receive pay, but 10 per cent. is withheld until the satisfactory completion of the job. Contractors supply all explosives, candles, machine oil and fuse, but the company supplies air, machines, tools (which later must be returned in good condition), and timber; the contractors must erect the timber to the satisfaction of the mine manager. The contracts are let to small parties of men (generally 12) and half of them have to be in the contract and sign the specifications.

Although the contracts average more money than can be earned on wages, still the work is done cheaper per foot and per ton than can be done by the company itself on wages work. The contract system has never given any trouble at Mount Morgan.

The Hamilton Iron and Steel Company, at Hamilton, Ont., is about to install the Gayley dry-air blast at its furnace. The contract for the refrigerating plant has been awarded to the De La Vergne Machine Company, New York. Frank C. Roberts & Co., Philadelphia, are doing the engineering work.

Aluminum Direct from Bauxite

The practice in aluminum reduction is first to purify the bauxite by one smelting operation, and then to treat the refined alumina in the reduction furnace. This is necessary from the fact that the usual impurities in bauxite are more easily reducible than the alumina, and having once found their way into the aluminum, are difficult to separate commercially. The extra expense of this procedure, arising from the larger plant required and the loss of heat, has led a German inventor (German patent No. 204,004) to propose a process whereby the purification of the alumina and the reduction of the aluminum go on more nearly together, with the liberation of a valuable by-product.

The crude bauxite is mixed with carbon and a boron compound, and treated in the electric furnace. The iron and silica go into combination with the boron, forming an exceedingly hard material which has a commercial value as an abrasive, while the pure alumina passes to another part of the same furnace, or to another furnace, if desired, for reduction into aluminum, in the usual way.

Copper in the Transvaal

Special Correspondence

The report issued by the Messina Copper Mining Company shows that, although the Transvaal's only copper producer is of small concern in comparison with the mines of other countries, it is at last assuming a permanent place among the colony's few base-metal properties of profit-making capacity. Ore reserves are now estimated at 27,782 tons containing 16.3 per cent. copper. The plant erected consists of rolls, jigs and Wilfley tables capable of treating 50 tons of ore per day. Situated in the extreme northern Transvaal, the Messina district suffers severely for lack of cheap and rapid transport. By improved roads, the $1.44 cost of mule and donkey transport has been reduced to 90c. per lb. Since the war, the government has adopted a vigorous policy of branch-line construction, but there are two regions of importance from the mining standpoint, which still urgently need practical assistance in this respect. First, the Lydenburg goldfields, which record an output worth £450,000 per annum, and second, the Zoutpansberg district, to the north of the railroad at Pietersburg. That a line will shortly be built as far as the southern part of the Lydenburg field is practically assured and it is now further reported that negotiations with the government have been satisfactorily concluded with regard to the service of the Zoutpansberg region.

Ontario Mineral Production

The Mines Department of Ontario has made a preliminary report of the production of that Province in 1908. The metallic production is reported as follows:

Gold	ounces	3,465	$60,337
Silver	"	19,424,781	9,125,903
Cobalt	tons	1,224	110,166
Nickel	"	10,175	1,866,059
Copper	"	7,561	1,071,140
Iron ore	"	199,395	537,379
Pig iron	"	271,656	4,390,839
Total value			$17,161,823

From the total value must be deducted value of 170,215 tons Ontario iron ore converted into pig iron in the Province; this was $456,176, making the net value of the metallic production $16,705,647. The valuation of all the metals was lower than in the previous year.

The silver mines of Cobalt yielded 9,000,000 oz. more than in 1907, but owing to the fall in the price of silver the value was not correspondingly greater. Shipments of ore from the silver mines amounted to 24,485 tons. A little less than a third of the total tonnage was treated in Canadian reduction works, most of the remainder going to the United States, and a small amount to Europe. The ore treated at home was largely high-grade, the lower qualities being sent mainly to smelters in the United States.

The value of the non-metallic products is reported as follows:

Arsenic, refined	tons	702	$10,373
Arsenic, crude	"	2,970	
Calcium carbide	"	2,364	147,150
Corundum	"	141	14,977
Feldspar	"	7,875	20,300
Graphite, refined	"	10	1,600
Gypsum	"	10,389	20,778
Iron pyrites	"	20,970	69,980
Mica	"	368	73,586
Natural gas	"		969,160
Peat fuel	"	200	900
Phosphate of lime	"	881	7,048
Petroleum	Imp. gal.	18,479,547	703,773
Quartz	"	44,741	52,830
Salt	"	79,112	488,330
Talc	"	1,016	3,048
Total value			$2,613,833

There was a considerable falling off in petroleum.

The output of building materials and clay products was as follows:

		Quantity	Value
Brick, tile, etc			$2,600,000
Portland cement	Bbl.	2,022,877	2,417,769
Lime	Bu.	1,850,000	357,050
Pottery			50,310
Building stone			475,000
Total value			$5,900,129

This brings the total values up to $25,210,609. Values are computed at the selling prices at the mines or works, and in the form in which the substances are produced.

On the Rand, South Africa, the Randfontein and Langlaagte mines use one tube mill to regrind the pulp from 40 stamps; the Eckstein mines, one tube mill for 56 stamps, and the Gold Fields mines one for 60 stamps.

Methods of Mining Coal in New Zealand

Detailed Description of the Westport-Stockton Colliery, where the Equipment and Prevailing Ideas Are along the Latest American Lines

BY SIDNEY FRY*

The latest addition to the coal mines of New Zealand is that of the Stockton colliery, which is situated in the heart of the bituminous coal areas of the South island.

The company which is operating this mine was floated by Mr. Munro, an enterprising citizen of Westport, and was incorporated in August, 1905, for the object of opening out and operating a coal lease of 1500 acres in area, which was afterward increased to 2000 acres. The chairman of the company is William Reece, a well known man of Canterbury, N. Z., and its engineer is G. H. Broome, who was at the time of the formation of this company, in charge of a colliery at the Crow's Nest Pass in Canada. This gentleman designed and equipped the mine on American lines, fitting it out with an electrical equipment which probably is not equalled south of the equator.

*Mining engineer, Westport, New Zealand.

Location of the Mine

The mine is situated about 20 miles northeast from the port of Westport; it is at an altitude of 2000 ft. above sea level, and back about 3 miles from the coast. The coal is delivered from the company's tram-lines and inclines into their bins, which are on the flat of the foot of the hills fronting the sea, and close beside the State railroad track. All the valleys in the neighborhood are covered with an abundant growth of red pine, black birch (*fagus fusca*, really a beech), and other useful New Zealand mining timbers.

Geology and Quality of the Coal

The geology of the coalfield is simple; the coal measures, which are of cretaceous age, repose unconformably upon the upturned edges of highly inclined strata of granwacke and argillite of Devonian and Carboniferous age which are sometimes intruded by acid eruptives; and upon granite and gneiss of probably greater age than Devonian.

The lowest member of the coal-bearing series is usually a bed about 20 ft. thick of conglomerate; this sometimes merges into a series of thin beds of shale, sandstone, conglomerate and arkose. Overlying this is the coal, the seam, varying from 10 to 20 ft. in thickness. Then follows a bed of silicious sandstone or grit 5 to 50 ft. thick. Then 20 ft. of brownish gray micaceous sandstones, covered by 1000 ft. of sandstones and marly shales.

The foregoing is the series as they appear in dip section dipping under the sea at the foot of the hills, but there has been extensive denudation, and on the hills there is only about 100 to 200 ft. of strata overlying the coal.

The operators claim to have discovered two distinct seams of coal on the property, but they will find that this is purely

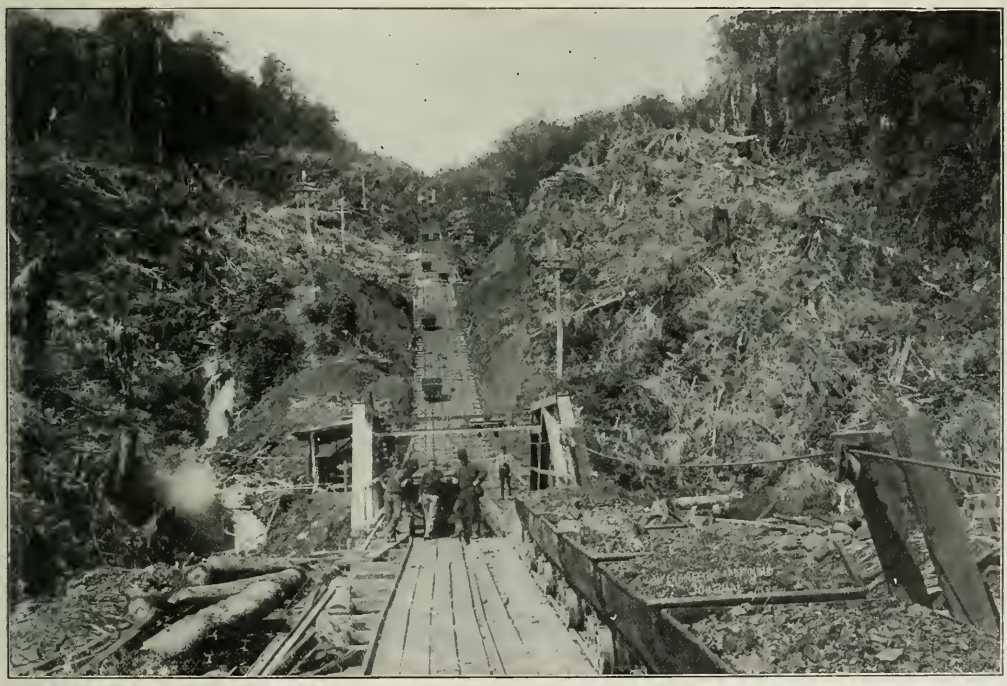


FIG. 1. SHOWING DOUBLE-TRACK ROPE INCLINE WITH CARS PLACED AT REGULAR INTERVALS ALONG THE CABLE

a local manifestation and that the two seams will soon unite, as they are simply different portions of the same main seam, and have been formed through the unequal rate of depression of a subsiding area, and of the rapid filling up of the more depressed part by sand or other sediment. Throughout the whole of the lease, the coal is lying at a very moderate angle of dip, and this together with the ample hight of the seam has warranted the adoption of large sized cars for the conveyance of the coal within the mine.

The coal is an excellent grade of bituminous fuel as will be shown by the following analysis:

Moisture at 100 deg. C.	= 1.20	per cent.
Hydrocarbons	= 36.60	" "
Fixed carbon	= 61.12	" "
Ash	= 1.08	" "
	100.00	" "

Some of the coal is comparatively soft and its structure laminated; often it is hard, compact and structureless, and stands handling well.

Method of Working

A main haulage road is being driven along the western boundary of the lease to its farthest extremity; here it will be opened out into a system of pillar-and-stall workings and the mine will be "worked home," the pillars being removed at the rear of the whole workings as early as safety and utility will permit. Like the rest of the mines in this locality, it will not be necessary to use safety lamps as the presence of inflammable gas, even a small quantity, is the exception and not the rule in these Westport mines; furthermore, the cracks caused by the settling down of the roof in the worked out areas, extend to the surface and afford ample opportunity for the escape of any free gas.

The coal is undercut by Sullivan machines; the transport of these machines from one part of the mine to another affords no difficulty on account of the moderate dip of the seam.

Ventilation

The main ventilation is effected by an electrically driven fan of improved Waddle type, actuated by a belt from an induction motor which is fed through an oil-cooled transformer taking current from a transmission line and reducing it from a potential of 6000 volts, down to 500 volts. Several electrically driven Sturtevant auxiliary fans are also in use. There will be as few stentons as possible, to avoid leakage of air and also to allow of panels being sealed off more effectively in case of fire.

Haulage Plant

The traction in the mine, and from the mine mouth down to the top of the rope incline, which is 2¼ miles from the mine mouth, will be done by electric motors. The main locomotives are 20 tons in weight and can control trains of 20 cars, each car being capable of holding 1½ tons of coal. Six-ton locomotives are used for serving the working breasts with empties and for feeding the main drawing roads with full cars. From the mine to the top of the rope incline, the gradient is in favor of the load and averages 1 in 21.2; the steepest part of this grade is 1 in 12. The formation has been made of double width, so that the present single track may be duplicated when required in the future; this plan will make it possible to transport 2000 tons of coal per day.

The sharpest curve on the tramway is 2 chains radius, and it is formed of 65-lb. steel rails laid upon ties of yellow pine (a local timber) except at curves and at points and crossings at which places imported hardwood ties are utilized. In addition to wheel brakes, the larger locomotives are fitted with Fell brakes for the operation of which each steeper gradient is provided with a center rail.

The overhead trolley system has been used both in the mine and outside, and a direct current of electricity with a voltage of 250 is employed. This involved a heavy first cost for copper, but was deemed advisable on the grounds of safety. The cars are lowered from the terminus of the electric tramway by means of endless ropes, and this is done in two stages. Both inclines are, of course, double tracked, the rails being 40 lb. to the yard. The haulage ropes are made of the best plow steel; that for the top incline being 4 in. in circumference and that for the bottom incline 4¾ in. The cars are attached to the ropes by Craven's patent screw clips and are spaced at intervals of 2 chains. Both upper and lower inclines have been carefully graded with an avoidance of sudden changes of grade; any change of grade from flatter to steeper, going down hill, being brought about by long vertical curves.

The upper incline is 40 chains in length having an average slope of 1 in. 6.7; the steepest part being 1 in 5. The lower incline is 33 chains long and has an average grade of 1 in 4 and a maximum of 1 in 3. The two inclines are separated by a short-changing level, and each incline has its haulage rope controlled by vertical 4-cylinder hydraulic brakes, and to avoid the excessive side-grinding which is a feature of Surging drums, vertical pulleys are used: these are 10 ft. in diameter; the braking pulley having 5 rope grooves, and the idler pulley 4 grooves. These brakes impart a very even movement to the rope which is given a speed of 2 miles per hour.

At the foot of the lower incline the cars

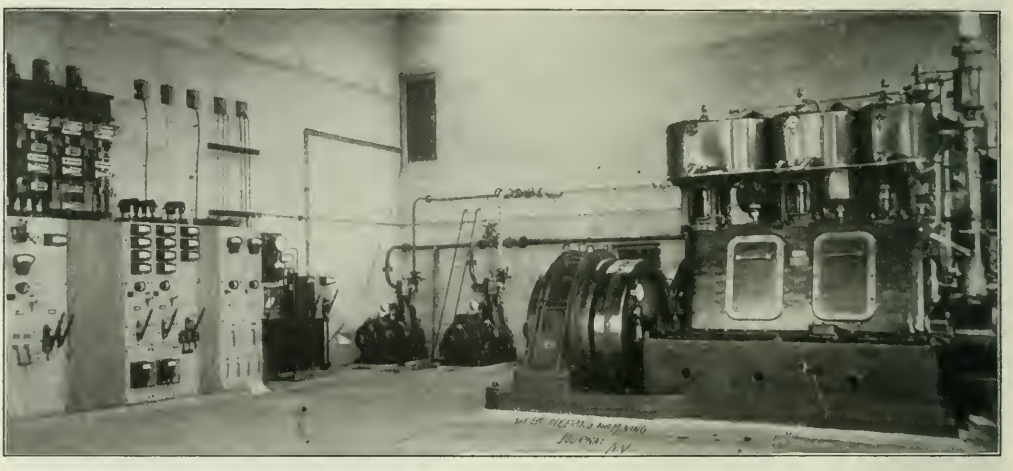


FIG. 2. SHOWING INTERIOR OF THE DYNAMO ROOM AT THE WESTPORT-STOCKTON COLLIERY

are transferred to a main-and-tail rope which draws them to the bins in trains, through a tunnel 7 chains in length, having a grade in favor of the load of 1 in 63. Through this tunnel the track is single and is formed of 40-lb. rails. The haulage power is given to the ropes by an electric hoisting engine driven by an alternating-current motor working at a potential of 220 volts; the transformer which steps the voltage down from 6600 to that of 220 is situated in the main power station.

Screening and Loading Plant

Ample siding accommodation has been made by the company, two miles of track having been laid out in shunting loops for the reception and quick despatch of the State railroad cars. On these sidings the coal bins have been erected; these latter are 50 ft. high, 100 ft. long, and in width span five railroad tracks; they are built of Australian iron bark on a pile foundation, having a total capacity of 5000 tons. They consist of three compartments, two with a capacity of 2000 tons each for the storage of unscreened coal, and one of 1000 tons capacity for the reception of nut coal.

The tipplers are large machines of the side-revolving type; the full car running in, bumps the empty one out and the latter is automatically switched back onto the empty road. In the pulling of a lever by the attendant, the tippler swings gently over and quietly deposits the coal onto a distributing jigger, and thence, in the case of No. 1 tippler, over an end-shaking screen, and a retarding conveyer belt, to the railroad car, in which the screened coal is dropped with the least amount of breakage. The nut coal from this operation is lifted to the nut bin and automatically distributed in the same way by two flight conveyers. The coal from No. 2 and No. 3 tipplers, after leaving the distributing jigger, passes onto a plate-band conveyer on which the coal is picked, and from which the unscreened bins are filled, the coal being lowered gently by means of alternate reversed chutes to save breakage.

The bottoms of the bins are provided with horizontal steel-plate sliding doors worked by means of hydraulic cylinders placed at each end of the bins, the pressure being obtained by an automatic accumulator. The plate-band conveyers, scraper conveyers, shaking screens, and distributing jiggers are all electrically driven by direct-current low-voltage motors.

The Power House

The power house is a building 174 ft. long, 50 ft. wide and 25 ft. high; walled with ferro-concrete and roofed with galvanized iron, and is divided into three rooms; the dynamo room, the condenser room, and the boiler room. The main generating engines are vertical triple-expansion steam engines having a high piston speed, and are oiled by forced lubrication. They are coupled direct to alternating-current dynamos, which generate a three-phase current at 6600 volts with a periodicity of 60 cycles per sec., at a speed of 400 revolutions per min. Each machine provides 300 kw. at 80 per cent. power factor.

The alternators are capable of 10 per cent. continuous overload, 25 per cent. for two hours, and 50 per cent. momentarily without undue heating or strain. Two of these generating sets are installed at present, and are calculated to provide sufficient power for an output of 800 tons of coal from the mine per day; however, ample room has been provided for two more sets which will bring the power sufficiently high for an output of 2000 tons per day.

Two small exciter sets are also used; these are driven by engines of the same type as the main generator engines, and are run at a speed of 600 revolutions per minute. They are used for the generation of direct current to excite the fields of the main generators.

In the dynamo room is also installed a 100-kw. motor-generator set which runs at a speed of 700 r.p.m., making current at 280 volts. This provides power for the screening and belt-conveyer machinery, also for the workshops and for lighting purposes. The switchboard is of blue-gray Vermont marble; the panels are fitted with ammeters, voltmeters, recording and indicating wattmeters, and a sensitively constructed Lyrrel regulator for automatically regulating the potential of the main generators.

All the alternating current switches are of the oil-break type and are placed in concrete cells at the back of the switchboard.

In the condenser room is a large surface condenser of Worthington make; this is fitted with an Edwards vertical-triplex air pump, and an 8-in. centrifugal circulating pump with high-speed engine. The surface in the condenser is 2600 sq.ft., and it is capable of condensing 30,000 lb. of steam per hour.

In this room there is a Worthington oil separator through which the steam passes on its way to the condenser; there is also a large hotwell, and a Webster vacuum feed-water heater which deals with the exhaust steam from the feed pumps and chain-grate-stoker engine. The boiler room contains four Babcock and Wilcox patent water-tube boilers, fitted with chain-grate mechanical stokers and with superheaters. The working pressure of the boilers is 150 lb. per sq.in., and each boiler has a heating surface of 1600 sq.ft., and a

FIG. 3. THE MAIN LOCOMOTIVES ARE 20 TONS IN WEIGHT, AND CONTROL TRAINS OF 20 CARS, EACH CAR HOLDING 1½ TONS

firegrate surface of 34 sq.ft. with an evaporative capacity of 5000 lb. of water per hour.

Provision has been made for the accommodation of more boilers when required. A Sirocco fan provides ventilation for the building, which is splendidly lighted in the day by means of large windows arched at the top and framed altogether in cast iron, the illumination at night being provided by both incandescent and by arc lamps.

Working Two Coal Seams in Close Proximity*

By Walter F. White

The following is a brief description of the method employed at present in working two coal seams which have but 3 ft. of strata between them:

The two seams have been previously worked by several methods and modifications, viz., (1) pillar and stall, (2) bottom seam first and top seam after, (3) *vice versa*, and (4) longwall—upper seam first. The two first methods resulted in great loss. The result of the last method was that when the lower seam came to be worked it was greatly deteriorated in quality and was rendered difficult to mine, especially in places that gave off water, which occurred somewhat frequently.

When a new district was required to be opened out last winter, another method, or rather another modification of longwall was introduced, by which the two seams are extracted practically by one working. The mode of procedure will now be described:

The section of the seams and their immediate strata is made up as follows: Lower seam (5 ft. thick) intersected at 3 ft. by a 6-in. band of shale, then 9 in. of inferior coal which is left and forms the roof of the lower seam. Above this is 2½ ft. of stony fireclay, on which rests the upper seam (3 ft., 6 in.) capped by 9 in. of sod or shaly clay, which generally falls with the coal. Over all this is a thick bed of not very strong metal, being full of slips and joints.

The modification of working is evident from the sketches, which show the succession of operations in the extraction of the coal.

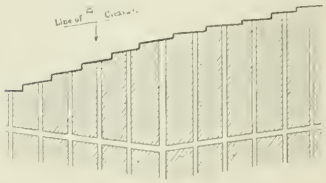


FIG. 1. Plan of Working

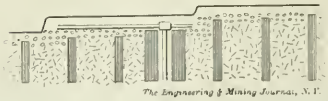


FIG. 2. PLAN SHOWING ONE GATE AND POSITION OF PACKS

There are five drawing gates on each side of the jig, stalls being about 36 yd. wide. Each stall is supported by from two to five rows of 4- to 6-in. diameter props, and a 2-yd. packwall at 6-yd. intervals. The lower seam is taken out in juds or lifts of 2½ yd. each. The packwalls are built in position immediately there is room; the three rows of props, which are farthest down in the goaf, are withdrawn; the inferior coal and fireclay then falls leaving the upper seam exposed to view, and unsupported, except by the packwalls and one or two props. We then at once climb on the fallen dirt, make it as level as practicable on its surface and set two or three rows of props to support the upper seam, placing flat pieces of wood under the props in addition to a broad cap at the head, to make them thoroughly secure.

Mining the Upper Coal

We next commence to cut down the upper coal, beginning down the pack side and cutting up to within a few inches of the sod overlying the seam. We find it much the better plan to leave 4 to 6 in. of coal and prop to it, as the sod is of a very tender nature and causes a serious loss of coal if it falls and mixes with it.

As we cut down the coal, the supporting props being drawn one by one, we of course set other props up to the roof or layer of coal that is left. As the coal falls, it is thrown down into the roadway at the face in the lower seam, or if possible it is filled into the car direct. A small portion of slack is lost by falling on the rough surface of the fallen fireclay.

At intervals of 5 or 6 yd. as we advance upward, openings are cut through the upper coal over the packwalls, to allow the ventilating current to sweep through, otherwise it becomes very hot in that portion of the face. Except where these openings are made, a rib of coal is left on the packs.

The fireclay is taken down in the gates, and when the face has advanced a short distance, the upper coal is also brought lower by the settling down of the whole strata above. The coal is then cut down in the gates, squared down by the pack sides and filled out.

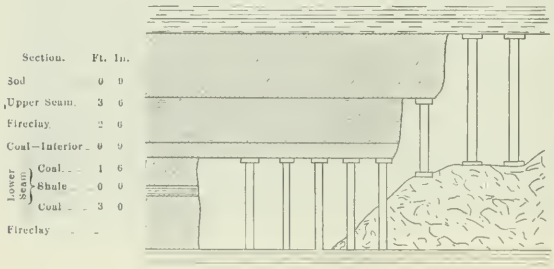


FIG. 3. SECTION SHOWING COAL FACE

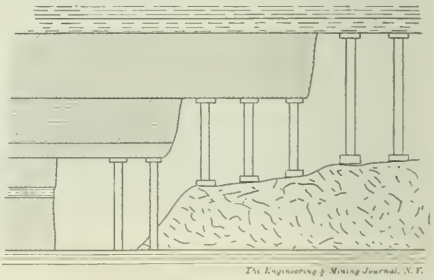


FIG. 4. SECTION OF FACE AFTER WITHDRAWAL OF BACK PROPS

When we consider the greater amount of round coal produced, however, the great saving in timber and general economy in working, it more than counterbalances the loss mentioned, and therefore has justified the change.

Compared with the method of getting the two seams by longwall in two separate workings—that is, taking out the upper seam a jig length (100 yd.) in advance of the lower—this is a wasteful method of working the upper seam, as a fairly large percentage of coal is left and lost. When we consider the greater amount of round coal produced, however, the great saving in timber and general economy in working, it more than counterbalances the loss mentioned, and therefore has justified the change.

*Abstract of an article published in *Mining Engineering*, February, 1909.

Twenty stamps to be installed at the West Rand Consolidated Company will be the heaviest on the Witwatersrand (*Aust. Min. Stand.*, Dec. 30, 1908). Each stamp will weigh 1850 lb. and have a duty of 12 tons per 24 hours.

Data on Coal-mine Ventilation

Mine ventilation is a subject which has received a great deal of attention during the last few years, largely due to the fact that mines have increased in depth and in extent far beyond the original plans.

Small mines and those worked on a minor scale, could be ventilated by natural air currents, but the air shafts for natural ventilation must be large on account of the low velocities of air. As the mines increased in extent and depth, shafts were entirely too small for natural ventilation, and it became necessary to use mechanical means; in fact, without a mechanically driven fan it is impossible to get sufficient air through the extensive workings. While there is always a certain amount of natural ventilation, probably less than 25 per cent. of the total volume of air current is due to natural flow; the rest must be furnished by the fan.

Advantages of the Small High-speed Fan

The large volumes of air require a fan of great capacity, which may be obtained by a wheel of large diameter operating at low speed or by the higher speed of a smaller wheel. The small high-speed fan possesses many advantages. With a large low-speed fan an increase in volume is obtained at a speed which is liable to be detrimental to the construction of the heavy wheel, and the large fan is expensive to run for small volume. The small high-speed fan may have the speed increased without danger, for it is built for such service, and when run at reduced speed the cost of driving is not great. Again, the parts of a small high-speed fan are of less weight, and consequently more easily handled—important factors in installation and maintenance costs.

The driving of mine fans is a matter of importance. With a very large wheel making 30 to 60 r.p.m., direct-connection to motor or engine is out of the question; however, with a smaller fan running at 175 to 350 r.p.m. a powerful reliable set is obtained, especially for water-gages up to 5 in., by driving direct-connected.

The weight and dimensions of such apparatus are very moderate, and the efficiency of the set is high, for the engine or motor may be run at its most economical speed.

The Sturtevant centrifugal fan of the multivane type, is especially applicable for the ventilation of modern mines, for it is essentially a high-speed, large-volume fan. The manufacturers claim that this machine can be run at a higher speed with safety and economy than any other fan of the same capacity. It is a thoroughly up-to-date design for handling large volumes of air against resistances up to 5- and 6-in. water-gage.

The multivane type of wheel is made up of 60 or more shallow blades which are spooned to distribute equally the air pressure within the fan, and to increase the strength and rigidity of the wheel. The shallow blades permit large inlets, which contribute to high efficiency, because the friction loss of the entering air is a minimum. With a fan wheel of but few blades, the inlets cannot be as large if the necessary blade area to give the volume is maintained.

Details of Fan Construction

The substantial cast-iron hub or hubs are strong and of sufficient size to receive and hold rigidly the steel arms of T section which are cast therein, and securely riveted at the extremities to the fan blades. For the large wheels two or more sets of arms are used to secure greater rigidity.

The shaft is extra large to support the wheel without deflection, and special attention is given the bearings so that there will be no occasion for shut-downs. The wheel is carefully balanced to eliminate vibration. Usually the fan is of the type known as ¾ or ⅞ housing to reduce the hight of the shaft above the foundation, and is built of steel plate rigidly braced with steel angles and fastened to foundations of brick or concrete, of which material the inlet housings also are made. To secure a large volume without increasing the diameter of the wheel and consequently the hight of the fan, the housing and the wheel are usually made of double width. The small diameter also makes it possible to run the wheel at a speed suited to direct connection to engines, or electric motors.

The accompanying table gives the performance of Sturtevant mine fans for use for systems where air is blown into the mine; in other words the stated resistances are the static pressures existing at the fan outlet and measured in inches of water. For exhaust systems the fans require less horsepower to maintain a static suction at the fan inlet equal to the value given, and handle less air. This is due to the fact that in the blow system no allowance is made for the conditions existing at the inlet, while in fact a suction exists there.

For a given volume of air blown into the mine, the static pressure maintained at the fan outlet is that pressure caused by the various losses due to the resistance to air flow in the circuit, whereas with an exhaust system the static suction maintained at the fan inlet is that caused by the various losses in the air circuit added to the suction which exists at the fan inlet (but not taken account of) in the blow system.

Fan No.	Maintained Resistance. 3-Inch Static Pressure. R.P.M.	Cubic Feet PerMin.	H.P.	4-Inch Static Pressure. R.P.M.	Cubic Feet PerMin.	H.P.	5-Inch Static Pressure. R.P.M.	Cubic Feet PerMin.	H.P.	Hight Above Foundation, In. ¾ Housing.	Width of Housing, Inches.	Length (at right angles to shaft), Inches.
12	398 414	126,200 136,000	172 200	448 464	138,000 148,200	244 272	500 517	154,000 165,500	338 380	74¾	80¼	112¼
13	362 377	152,800 165,000	208 244	407 422	167,400 180,000	296 328	455 471	187,000 205,000	414 458	82	88½	123½
14	332 346	182,600 197,000	252 292	373 387	199,800 215,000	352 392	416 432	223,000 240,000	492 547	88½	96½	135
15	306 319	214,200 213,200	292 344	345 357	234,400 252,200	412 460	385 398	262,000 282,000	575 643	95½	104½	146¼
16	284 296	246,000 266,800	340 396	319 331	270,800 291,000	480 532	356 369	302,100 325,000	670 744	102½	112½	157¼
17	266 277	283,000 306,600	392 456	299 310	311,000 323,000	552 612	334 346	347,000 361,000	771 855	109¾	120½	168¼
18	249 259	325,000 358,000	440 516	280 290	354,000 380,000	620 692	312 324	395,000 424,600	866 967	116	128½	179¼
20	221 231	408,000 440,000	556 652	249 258	446,000 480,000	788 876	278 288	498,000 535,200	1100 1223	130½	144½	202
22	199 207	504,000 544,000	692 804	224 232	552,000 592,000	976 1084	250 259	616,000 661,000	1364 1515	143	160½	224

When economy is not essential, or in case of emergency, these speeds may be materially increased, resulting in much greater volumes. If less volume is desired than given above, the wheel and housing may be of one-half the width, giving practically one-half the volume and requiring one-half the horsepower.

Broken Hill Proprietary Company

In the last semester the zinc concentration plant treated 135,235 tons of material, producing 29,659 tons of zinc concentrate, averaging 15 oz. of silver per ton, 9½ per cent. lead and 44 per cent. zinc. Finer grinding by means of tube mills, as compared with ball mills, increased the extraction. The Port Pirie smeltery treated 125,784 tons of ore, producing 48,350 tons of bullion. The refinery treated 48,368 tons of bullion, producing 2,589,416 oz. of silver, 1054 oz. of gold, 47,833 tons of desilverized lead and 470 tons of antimonial lead. Gas firing in connection with the roasting furnaces has given satisfaction. The first zinc distillation furnace has been completed and nine more are to be erected. Suitable clay for making the retorts has been discovered in the vicinity. It is expected that eight furnaces will be in operation by the end of 1909.

Present Position of the Steel Rail Question

The new specifications for rails issued by the larger lines include chemical requirements for open-hearth rails, and the orders are usually for as large a tonnage of this grade of steel as the mills are prepared to supply within the time limits. The growth of the open-hearth rail manufacture in the United States has been rapid. In 1903 only 45,000 tons were rolled. In 1907 the amount rolled had increased to 252,000 tons, and in 1908 to 567,000 tons. The bessemer rail production reached its maximum in 1907 when 3,380,000 tons were rolled, while in 1908 it was the smallest since 1897, less than the average for the 10 preceding years, and only 1,354,000 tons. The open-hearth rails rolled in 1908 equaled 42 per cent. of the bessemer. The present capacity of the steel works in the United States for the manufacture of open-hearth rails, including the new Indiana Steel Works just going into operation, is nearly 2,000,000 tons, or about 50 per cent. of total new-rail requirements in prosperous years.

The Pennsylvania Specification

The new Pennsylvania specification makes no change in the chemistry for bessemer rails, but adds a second classification in the chemistry of open-hearth rails. The previous specification of April, 1908, made 0.03 phosphorus and 0.80 carbon the upper limits, while the new one makes the upper limits for Classification A, phosphorus 0.03 and carbon 0.083; for Classification B, 0.04 phosphorus and 0.75 carbon. The desired carbon for the two grades is 0.75 for the lower phosphorus, and 0.70 for the higher, thus following the general law that for each 0.01 per cent. phosphorus added the carbon should be reduced 0.05 per cent. on account of the brittleness due to excessive carbon and phosphorus. The reason for making two classifications for open-hearth rails relates principally to the cost of manufacture. It was thought desirable to specify phosphorus as low as 0.03 so that high carbon could be used and the wearing quality of the rails, particularly on curves, would be materially improved. But the extra time required in the open-hearth furnace to reduce phosphorus from 0.04 to 0.03 results in some increase in the cost of manufacture, and a slight addition to normal price per ton is added for the Class A rails.

A clause has been added which excludes ingots that have been so overheated that the scale on the sides becomes liquid.

The requirements under the drop test are less rigid than those of the previous specification, and some concession has been made to the manufacturer in this particular which is not likely to insure better rails so far as the brittleness of bessemer rails is concerned. The former requirement was that "if a test piece breaks under the drop without showing physical defects all rails made from that heat shall be rejected absolutely." The present provision permits of a retest after failure of the first, allowing two more pieces from the same heat to be tested, and if neither of these fails the rails are accepted as No. 1 or No. 2, according to the deflection. If either of the second test pieces fails all rails from that heat will be rejected. The provision that drop testing shall be continued to the destruction of the specimen in case the first piece breaks without showing physical defects, is an added precaution which should result in a material benefit to the railway by reducing the number of piped rails which, in spite of the usual inspection and tests, get into the main track. This new feature in drop testing has been obtained by some concession to the railmaker, as it is agreed that if the test piece does not break under ordinary conditions, but when nicked and tested shows pipe, the top rail from each ingot will be accepted as "special" rails, and marked differently. These rails will be regarded as inferior and not used in main-line track. For open-hearth rails it is required that makers shall furnish inspectors with complete chemical analysis for each melt.

The Baltimore & Ohio Specification

The new Baltimore & Ohio specification for bessemer rails, dated Jan. 25, 1909, is similar to the Pennsylvania in chemical requirements, but for open-hearth the chemistry is somewhat different. The upper limit for phosphorus is made 0.04 for all rails made by that process. Manganese is allowed as high as 1 per cent. and carbon 0.80 per cent. This specification also allows retests. It provides that drop tests shall be made of two test pieces of rail rolled from the top of different ingots, and if either fails a third piece shall be tested. The new Pennsylvania railroad specification requires the drop-test pieces to be cut from the rail bar next to either end of the top rail. The Baltimore & Ohio also requires the drop test to be carried to destruction so that an examination can be made of the fracture and pipe or other interior defects can be detected; and acceptance of the rails is based on the clean fracture as well as the amount of deflection. The effort to enforce the discard of a certain per cent. of hight of ingot to eliminate segregation appears to have been abandoned and the new specifications now simply require that there shall be sheared from the top of the ingot sufficient discard to insure sound rails

Canadian Rails

The Canadian Pacific has prepared a new specification for rails which is interesting because it is intended to meet the severe winter conditions of Canada where the track is frozen rigid for long periods. It was prepared also with special reference to the conditions of rail manufacture in that country. Two rail mills in Canada have a capacity about equal to the ordinary requirements of Canadian railways. The Dominion Iron and Steel Company at Sidney, N. S., manufactures basic open-hearth steel only. The product of the Algoma Steel Company at Saulte Ste. Marie, Ont., is 75 per cent. acid bessemer and 25 per cent. basic open-hearth. The bessemer rails have only 0.085 phosphorus and the average carbon is 0.58 and for open-hearth steel the upper limit for phosphorus is 0.06 and the lower limit for carbon 0.60. The standard section for new rails on the Canadian Pacific is 85 lb., and this is preferred to the 100-lb. rail on account of the unfavorable experience due to square breaks with the 100-lb. rail having American Society of Civil Engineers section. This decision is based upon the fact that the 80-lb. section, having identical chemical composition under the same traffic and like climatic conditions, did not break as frequently. The Canadian Pacific has in track now 85,000 tons of the new 85-lb. rails. In their manufacture it was found that when they approached the saw they were of more even temperature in all parts of the section, the rail head being cooler than in the old section. Therefore, a finer grain of steel was produced, having better wearing qualities. The more equal distribution of material between the head and the base simplified the cold straightening to such an extent that it required 40 per cent. less work than the old section with its thin flange and thick head. The straightening of the rails under the cold press seriously impairs their strength and is one of the principal causes of fracture. If the 100-lb. rail had been given the advantage of a better balanced section it also could have been rolled with a cooler head and would have required less cold straightening and given better service.

The Canadian Pacific drop test for open-hearth rails is more severe in most of its provisions than those already mentioned. It requires that from each 50-ton heat three rail butts shall be tested, and each butt must be taken from the top end of the first, middle and last ingots cast of each heat. The supports are 4 ft. apart and the hight of drop is 20 ft. for the 85-lb. section. If two of the test pieces are not broken and show a deflection of less than 3¼ in. the heat is accepted. If two fail it is rejected. There are no retests, and less is left to chance than is in most of the rail specifications used in the United States. The practice as to discards in Canada also appears to be more definite and satisfactory than in the United States. After cutting off sufficient to square up the end, at least 12 in. more of seemingly solid steel is cut from that end of the bloom, and if the steel does not then look solid the cutting must continue until it

*Abstract of article in the *Railroad Age Gazette*, New York Chicago, March 19.

does. In the same specification the drop test for bessemer rails is 18 ft. and the minimum deflection 3¼ in. A rail butt from every third heat is taken from the top end of the first ingot. If it fails a second test is made and if that fails all rails made from that heat are rejected.

Other Specifications

The Santa Fé received last year a supply of open-hearth rails from the Bethlehem Steel Company, and they were among the first rolled by the new mill. The specification required 0.04 phosphorus and 0.60 carbon. The section is a special one having a weight of 85 lb. per yard.

The Burlington has ordered a large tonnage of open-hearth steel and adopted the 90-lb. section, Series A, recommended by the American Railway Association. Its specification requires that there shall be sheared from the end of the bloom formed from the top of the ingot 9 per cent. discard, or until sound metal shows on the end of the sheared section. "The chemical composition shall be within the following limits: Carbon, 0.55 to 0.65; manganese, 0.75 to 1; silicon, not to exceed 0.20; phosphorus, not to exceed 0.06. For every point (0.01) phosphorus is reduced below 0.06, carbon may be increased four points (0.04), the maximum carbon to be 0.80." The requirements in the drop test provide that at least two test pieces shall be selected from each heat by the inspector, and the hight of drop for the 90-lb. rail is 19 ft. If the first test piece breaks then two others from the same heat are tested and if either of these fail all the rails from that heat are rejected. If both meet the requirements, then the rails from that heat will be accepted. It is also provided that rails shall not vary throughout their entire length more than 5 in. from a straight line in any direction when delivered to the cold straightening press. Those which vary beyond that amount are classed as second-quality rails.

Piping

Inspectors using the new Pennsylvania rail specifications have discovered quite a large percentage of piping. Testing to destruction discloses such piping even in the tests that had failed to break under the drop, thus clearly indicating that there must have been a large number of piped rails delivered to the railway companies under former practice. The railmakers have been much disposed to contradict the possibility of a large percentage of piped rails existing; in fact, have in many cases taken the position that undue stress had been placed upon that defect. Some authorities, for instance, have argued that with many failed rails the defects which have been classed as pipes have really been caused by the presence of slag which, under the strain of traffic, had acted as a wedge splitting the steel. While that may have happened in some cases, many failures causing accidents have been due to pipes, and some method of inspection should be used to detect them.

General Progress Made

In conclusion, it is evident that the rail question in general is in an experimental stage, but making satisfactory progress toward improved standards. The new sections with a heavy base having a larger area than the head, have already shown important results in reducing cold straightening and in producing a finer steel structure due to cooler rolling. The open-hearth steel, with phosphorus less than half that in bessemer, will largely reduce rail breakages due to brittleness. The drop tests must be readjusted to suit the testing machine with a standard anvil and definite foundation. The one important matter which remains unsettled and indefinite is that relating to discard, segregation and the other items which affect the structure of the rail by producing pipes and similar imperfections. These will be found as frequently in open-hearth rails as in bessemer, and the best safeguard thus far proposed is testing under the drop to destruction, so that the fracture may be examined. This feature must, therefore, become an important part of a good rail specification even at an extra cost per ton.

Rhodesian Gold

Gold production in Rhodesia in February is reported at 45,744 oz. fine, a decrease of 2877 oz. from January. For the two months ended Feb. 28 the total was 94,365 oz., or $1,950,566. This is a decrease of $79,311, as compared with the corresponding period last year.

Feldspar Mining in Ontario

By Cajetan Morsack*

In various portions of the Province of Ontario there are extensive ridges of feldspathic rock. Frequent outcroppings make it possible to trace these ridges for many miles. In texture the rock ranges from a coarse-grained granite to a rock consisting of little else than pink or white feldspar intermixed with some quartz. Among these ridges are found valuable deposits of feldspar, such as are being mined at present in Frontenac county, more particularly in Laughborough, Bedford and Portland townships. For profitable mining the deposit must be large, easily mined, reasonably free from impurities, and so situated as to be readily brought to the mill.

STOPE AND HOISTING ARRANGEMENT, RICHARDSON MINE, BEDFORD TOWNSHIP, ONTARIO

Nature of the Deposits

The feldspar occurs in more or less distinct veins in the Archæan gneissoid granite, with usually a capping varying in thickness from a few inches to many feet. This capping is more often a granite or "feldspar rock," but in some instances is a hornblende or mica schist. Accompanying the feldspar there may be distinct veins of practically pure quartz which extend above the spar and may form part of the capping material. These veins of quartz are usually quite large, from 1 to 10 ft. wide, and varying in depth. The vein of feldspar varies in widths from a few feet to 40 or 50 ft., or even more in exceptional cases. Few mines have been worked to the bottom of the deposit, but a depth of 50 ft. has been attained at the Richardson mine with ore at the bottom.

*Superintendent, Verona Mining Company, Verona, Ontario.

The veins of feldspar cross the strike of the mica schists and granites in which they are found more or less obliquely. Sometimes two or more veins having different directions will intersect. Some are very irregular in outline while others run in practically a straight line for several hundred feet with sharply defined vertical walls. Usually the vein may be traced quite readily by the depression between the granite walls, since the latter almost invariably rise to a greater hight than the vein material, a natural consequence of their greater resistance to weathering.

The criterion of good feldspar is its crystallization, luster and perfect cleavage. Spar containing free silica, or what the miners call "sandy spar," must be rejected. Usual impurities are quartz, mica, hornblende, tourmaline, and pyrite. Of these pyrite usually occurs in seams in the spar or occasionally in small pockets. Mica, tourmaline and hornblende occur in well defined crystals through the spar. The last two have received from the miners the name "black jack." The veins are without doubt segregations. The mineral is usually orthoclase, or the pink soda-orthoclase perthite, consisting of interlaminated orthoclase and albite. The presence of a good body of clear flint or quartz is usually taken as a healthy indication of the absence of any great quantity of the mica, pyrite and other basic impurities.

Methods of Mining

Feldspar deposits of this region are all mined by open cut. The soil is at most not more than three or four feet deep. This is stripped off, the capping removed, and the spar mined by stopes, usually 10 or 12 ft. to a stope. At the Freeman and Bauder mines the ore is hoisted in wooden buckets and dumped upon a pile, later to be hauled by teams to the railroad. At the Richardson mine, as shown in the accompanying illustration, the ore is hoisted by means of a cable to the top of the hill, where the buckets are loaded directly upon special mine cars operating on a self-acting incline by means of which they reach barges and are towed across the lakes to the railroad.

On account of its perfect cleavage the feldspar is easily mined, as it breaks readily into nearly rectangular prisms of practically a uniform size. These are shoveled into the buckets, and usually there is one man for each bucket who picks out any refuse or impure material. Formerly the ore was "forked" but this practice has been almost wholly abandoned. Where a good body of pure white flint is encountered this is saved and sold for use as a flux.

Drilling is done almost entirely by steam. As yet no drifting has been done, and whether this is practicable where the capping is very thick is problematical on account of the ease with which the spar is shattered. This would also mean a change in power on account of the ventilation problem.

Where it pays, the impure material is cobbed, but on account of the low price of the product and the relative high cost of mining and transportation, spar which needs constant cobbing cannot be mined at a profit. Little trouble is had with water. In most cases there is scarcely more than enough to supply the boilers.

Transportation and Costs

The serious difficulty in mining feldspar deposits in this section is transportation. The distances around the lakes are so great that no attempt is made to haul in summer. In winter the frozen lakes and swamps afford a good level road for the greater part of the distance. The lakes are valuable assistants in the haulage at the Richardson mine. It may be readily seen how largely the cost of transportation enters into the total cost of production where this item alone ranges from 45 to 80c. per ton, depending on the distance. In some cases where it is feasible the ore is taken by boats across the lakes to some point on the railway, thus affording a cheaper method of transportation.

In this section the cost of mining runs from $1.10 per ton loaded on the cars at the most favorably situated mines, to as high as $2.75 per ton at smaller mines less favorably situated. It is obvious that one problem needing serious attention is that of transportation to railway points, and where the deposit is of sufficient importance to warrant it, this is being more thoroughly looked after.

Practically all the feldspar from this region is used in the pottery industry, hence the desirability of keeping out iron compounds as these produce yellow or brown spots on the finished ware.

Boston Consolidated Mining Company

The Boston Consolidated Mining Company, in its fiscal year ending Sept. 30, 1908, produced from its Sulphide mine 70,300 tons of ore containing 7447 oz. gold, 55,705 oz. silver and 3,459,911 lb. of copper. The cost of mining, including development, was $183,092; transportation to smelter, $43,613; smelting, $217,-040; freight and refining charge on bullion, $60,188; total, $504,841. There was deducted for losses in smelting and refining 249,880 lb. of copper and 6573 oz. of silver. After crediting value of gold and silver, the cost of the copper delivered at New York was 10.22c. per lb. At the Porphyry mine, the first shipment of ore mined by steam shovel to the Garfield mill was made on Jan. 15, 1908. As the shovels removed the capping they exposed an unlooked-for grade of ore, satisfactory as to copper content, but high in iron pyrites, which greatly reduced the ratio of concentration. Underground development subsequently proved that not over 16 per cent. of the payable orebody is included in this class of iron ore. Steam-shovel work was gradually suspended as the ore became available from underground working. During the year 411,175 tons of stripping were removed at a cost of 17.72c. per ton. The amount of ore mined by steam shovels and shipped to the Garfield mill was 26,647 tons. Meanwhile, underground developments were made with a view to the inauguration of mining by the caving system. In the course of this development work 128,391 tons of porphyry ore were obtained. The first section of the Garfield mill was put in operation on January 27, 1908. Only four sections were operated until September, 25, when four more were put to work. The mill recoveries ranged from 70 to 72 per cent., and milling cost was reduced from a maximum of $1 per ton experienced in the first few months of operation to 47.2c. per ton in September. The total cost of the mill to date is $1,568,604. The mill treated 143,284 tons of ore, producing 9935 tons of concentrate, containing 397 oz. of gold, 4967 oz. of silver and 2,037,599 lb. of copper.

Sidney J. Jennings, consulting engineer to the company, made a report under date of Dec. 1, 1908, in which the states that the Porphyry mine has 27,889,-000 tons developed of ore averaging 1.52 per cent. copper, besides 9,550,000 tons averaging 1.23 per cent.

He estimates that the ore will be mined by steam shovels for 31c. per ton and by the caving system for 70c. Both methods will have to be employed. The capacity of the mill is estimated at about 1,000,000 tons per annum. Ratio of concentration will be 13 to 1 and the concentrates will assay approximately 14.4 per cent. copper.

On the supposition that one-half of the ore will be mined underground and one-half by steam shovels, the cost of production will be as follows: Mining, 50.5c. per ton; transportation to mill, 28.7c.; milling, 40c.; smelting and refining charges, 70c.; general expense 10.2c.; selling commission, 3c.; interest on bonds, 10.3c; total, $2.127; this cost will decrease as the proportion mined by steam shovels increases. The recovery of copper from the average ore should be 10.5 lb. per ton, and the cost delivered at New York with allowance for gold and silver, 10.5c. per lb. Up to Sept. 30, 1908, the company had expended a total of $3,078,490.83, of which $135,107 was for porphyry developments; $488,484 for steam shovel development; $1,600,483 for Garfield mill and shops; $91,668 for steam-shovel equipment; $136,028 for steam-shovel railway; $86,800 for gravity tramway; $137,-758 for railway extension.

Delaware, Lackawanna & Western

The Delaware, Lackawanna & Western Railroad Company, besides a system of railroads extending from New York to Buffalo and Oswego, owns a large coal estate in the anthracite region in Pennsylvania. The company—unlike most of the anthracite-carrying companies — operates its coal properties directly, and not through the medium of a subsidiary corporation. The report is for the calendar year 1908.

The Coal Department statement of tonnage for the year is as follows, in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1.....	602,939	590,089	D. 12,850
Mined and bought	10,371,341	10,314,359	D. 56,982
Total.....	10,974,280	10,904,448	D. 69,832
Coal sold.....	10,384,191	9,610,127	D. 774,064
Stock, Dec. 31..	590,089	1,294,321	I. 704,232

Coal sales, with the average prices realized, were made up as follows in 1908: At mines, 101,057 (average $2.32 per ton); company's supply, 1,377,708 ($0.98); local agencies, on line of road and at tide, 5,789,685 ($3.75); foreign agencies, off line of road, 2,341,677 ($6.35); total, 9,610,127 tons, at an average of $3.97 per ton.

The income account for the year may be stated as follows:

	Tons.	Amount.	Per Ton.
Coal sales.....	9,610,127	$38,185,417	$3.97
Increase in stock...	704,232	1,413,493	2.01
Total receipts.....	10,314,359	$39,598,910	$3.84
Coal mined & bo'ght	10,314,359	$17,063,069	$1.65
Transportation, Co.'s line.....	8,388,315	14,318,780	1.71
Transportation, other lines..... ...	2,745,807	2,014,738	0.73
Handling and selling	7 933,179	1,392,212	0.17
Improvements.....	.....	252,828	0.02
Taxes.....	.....	390,500	0.04
Total expenses....	10,314,359	$35,432,117	$3.44
Net earnings.....		$ 4,166,793	$0.40

Disregarding the coal added to stock, which is credited at cost price, the profit on coal sold was 57c. per ton. The cost of coal at mines was 48.2 per cent. of expenses; transportation, 46.1; handling and selling, 3.9; mine improvements, 0.7; taxes, 1.1 per cent.

The report of the railroad shows coal carried as follows: Anthracite, 9,971,061 short tons; bituminous, 1,018,872; coke, 95,156; total, 11,085,089 tons, a decrease of 624,029 tons. Of the total earnings of the railroad 43.7 per cent. came from the transportation of coal. The average haul on coal in 1908 was 190 miles; the average rate received 0.861c. per ton-mile. The coal rate was 0.153c. per ton-mile greater than that on merchandise traffic.

The report says: "The results of the coal operations, while not equaling those of 1907, are gratifying, in view of the widespread business and industrial depression. The cost per ton of mining and preparing coal for market was higher than in 1907. As heretofore explained, this yearly increase in cost, due to physical conditions, is a feature of the industry common to all mining companies, and is a matter of importance and interest to all consumers of anthracite.

"The company's mining operations were conducted throughout the year with success and were remarkably free from accidents of a serious character, for which much credit is due to all connected with these operations. The expenditures made for improvements of an extraordinary nature were somewhat less than in recent years, but were ample to maintain the mining properties in a high state of efficiency and in condition, as to new development, to increase the output of coal from them sufficiently to meet to a reasonable extent increased market requirements.

"The total coal sold during the year was less by over 700,000 tons than during the previous one. As the tonnage produced and bought was substantially the same as in 1907, the decrease in sales is represented by the larger stocks of coal on hand at the close of the year, which about equaled the decrease in sales. Of the increased stock of coal on hand a larger percentage was of the small or steam sizes than is ordinarily the case. This was owing to the marked depression in the industrial activities of the year. The reduced quantity of anthracite coal used by the company itself also contributed to the accumulation of small sizes thereof on hand at the close of the year.

"The prices of anthracite coal established in 1902 have been generally well maintained in all markets throughout the year and the industry continues on a steady, healthy basis.

"The accumulation of stocks of coal before referred to, which is general with all the companies interested, is not considered alarming by them, in view of the fact that on March 31 the existing arrangement with the mine employees, under which wages were fixed in 1906, will expire by limitation and there is a possibility that, as in 1906, the miners may suspend work pending the outcome of future negotiations. Should there be such suspension of mining operations, it will be readily seen that the accumulated stocks of coal will be required to amply protect consumers, pending the resumption of work.

"The company's mine employees have been prosperous and apparently contented during the past year. They certainly have suffered less from the depression of general business than any other important class in the country. This fact, however, does not seem to have in the least influenced the leaders of the labor organization with which they are chiefly identified as respects the character and extent of the demands they have decided to make for increased wages and other concessions from their employers, the anthracite companies. For the most part these demands are the same as were urged before the Anthracite Strike Commission in 1902 and were, after full hearing, denied by it as being unjust and unreasonable. The conditions at present existing are not changed to any extent from what they then were, nor can there be any reasons now urged why these demands are more reasonable or just now than then, and they cannot, therefore, be seriously considered.

The important question of whether this company, in common with others similarly situated, may continue to own and operate coal properties, and mine, purchase, transport and sell coal in the future as it has during the past 50 years, although forbidden to do so by the so-called "commodity clause" of the Interstate Commerce law, is now pending before the United States Supreme Court on appeal taken and argued recently from a decree of the Circuit Court of Appeals, which in a case brought by the Government to test the legality of the act, confirmed the right of the company to continue its coal business as heretofore. It is confidently expected that the Supreme Court will affirm this decision."

Brazilian Monazite

Monazite sand from the interior of Brazil contains from 4 to 5.7 per cent. of thorium oxide, while that from the sea coast may contain as much as 7 per cent. Brazilian monazite is magnetic, which fact renders it easy to clean. It has been found in commercial quantities only in alluvial deposits in the States of Rio de Janeiro and Minas Geraes and along the coast, from Rio to Bahia. Its original occurrence is in certain felspathic rocks, pegmatite, syenite, and gneiss, in which it constitutes from 0.07 to 0.2 per cent. of the weight. The present deposits have been derived by erosion and concentration of such rocks.

The interior deposits are found in the beds of dry water courses in the form of gravel and sand containing not more than 2 per cent. monazite, together with quartz, garnet, ilmenite and other heavy minerals. The deposits sometimes lie on the surface, and sometimes under a bed of clay as much as 3 m. thick. The sand is mined and concentrated roughly, and is finished on electro-magnetic machines, which make a 95 to 96-per cent. monazite product containing, on the average, 3.7 per cent. thorium oxide.

The early development of the beach deposits by Gordon, and the subsequent retraction of his concession by the Brazilian government, which had not been aware of the value of the deposits as a source of revenue, is well known. The government has even considered the possibility of establishing a chemical manufacturing industry for the preparation of thorium nitrate within its own boundaries, and it is reported that the State of Santo has granted a mining concession to Israelsohn & Co., with this object in view.

The Coal-Mining Situation in Indiana

The national executive board of the United Mine Workers of America will convene in Indianapolis, Ind., March 24. The meeting is called to consider general conditions in the coal-producing States, including Nova Scotia. There is a probability of a clash between the Indiana operators and the miners over the 3¼-in. drill-bit law passed by the recent legislature. It is stated the operators will refuse to sign a wage scale for next year until the miners have agreed not to demand the large bits, and as a large proportion of the men desire to use bits, a stubborn controversy is likely.

It is claimed by the operators and affirmed by James Epperson, mine inspector, that the legislature by enacting the law, crippled the coal industry in Indiana more than it thought. Under the former law prohibiting the use of the large bit, the industry of the State made greater progress than at any time in its history. The reports for 1907 and 1908 show that the miners of Indiana made more money, produced more coal and had altogether better years than they had ever before experienced in the history of Indiana coal mining. There were fewer accidents and deaths from accidents than ever before, which is attributed to the use of the smaller bit and rigid enforcement of the mining laws.

The new Indiana law permitting the use of the larger bit is dangerous, and while the controversy is on, it is significant that five men were killed March 19 by a windy shot which occasioned an explosion in the Sunnyside mine near Evansville. The disaster was due to an extra large charge made possible by the use of the large drill. The operators are hopeful of inducing the men to forego the privilege of using the larger bit from both an economic and hazardous basis.

James Epperson has been reappointed State mine inspector for Indiana by State Geologist W. H. Blatchley. Mr. Epperson has already begun an agitation for an "oxygen helmet" station in Terre Haute, the most central point in the bituminous field. It is his purpose to have the operators of the field join in the purchase of six or more of the helmets, and to have the city of Terre Haute supply the station. The helmets are sold at $250 each.

Would Prevent Loss

The interest of the operators is attracted to the helmet because it is considered an economical appliance. According to the statistics in the office of the State mine inspector, scarcely a day passes that there is not a bad mine fire somewhere in the State. These fires last for weeks in most instances, always causing a cessation of work in a part, if not all, of the mine.

"As a rule," said Mr. Epperson, "the heat from these fires is not so great as to prevent the miners from going to the places where the fire is burning, but the gases generated keep them back. By means of the helmets the men could go to the seat of the fire and be able to cope with it. Thousands of dollars annually could be saved by the operators by means of the appliances."

"By establishing a substation in Terre Haute," said Mr. Epperson, "and equipping it with a half dozen or more of the helmets, we would have them within an hour's journey of all the big mines of the Indiana field. By special arrangements with the steam and electric railroads, even this time could be shortened. My plan is to construct a gas tank in the station, where the operators and miners may be shown that there is absolutely no danger connected with the use of the appliance. After these demonstrations I would have the United States Geological Survey send men to the district to instruct the mine superintendents and fire-bosses in the use of the devices."

Mr. Epperson donned one of the helmets at the Urbana station and worked in a glass tank of deadly gases for several minutes.

"A man could don one of those devices and dig coal," he said. "The only handicap is the 35 lb. of weight added."

Colliery Notes

It is a good rule to require that no holes shall be charged for a longer period than 30 min. before being fired.

It is generally advisable to have a rule forbidding the firing of any shots until the face is either sheared, mined or undercut, not less than 3 ft. deep. It is also best to prohibit the firing of any shots when the bore holes used for firing extend beyond such undercutting or open end.

Experience continues to demonstrate that 6 per cent. of the value of a coal company's plant and equipment is necessary to fully maintain its efficiency, and either replace the investment in cash, when exhausted, or in kind, in new mining territory when needed, without further capital provision being necessary; and until so used the credit remaining should continue available for working capital.

The best opinion advises against the practice of having two shafts connected together by a wooden arrangement on the surface. When the two shafts are connected, a fire in one is then easily communicated to the other shaft. It is probably true that at a majority of our coal mines, the downcast and the upcast shafts are connected on the surface by gangways of wood. Our laws do not forbid this practice; however, it is a point that should be considered by mine operators in building new plants.

For draining underground workings, located a considerable distance from the shaft, nothing is more suitable than the three-throw electric-driven ram pump; the machine should be designed to keep the velocity of the water on the suction side down to 3 ft. per sec., and the velocity in the delivery pipe should never exceed 6 ft. per second. In this connection it should be remembered that it is better to keep the plunger and valves large, and the stroke short, with a higher speed, in preference to a long stroke and a slow speed.

Before the Société de l'Industrie at Paris recently, M. Siegler stated that at a coal mine in the Loire district, France, the cost per ton of producing coal in 1855 and 1907 compared as follows:

	1855	1907	Increase
Labor underground...	$0.59	$0.95	$0.36
Labor on surface.....	0.12	0.26	0.14
Supplies	0.25	0.79	0.54
Total mining cost..	$0.96	$2.00	$1.04
General expenses.....	0.51	0.66	0.15
Total	$1.47	$2.66	$1.19

The average quantity of coal per miner per year had not changed, being about 230 tons in each year.

There are many precautions to observe when a heading is approaching old workings. Besides keeping a center bore-hole 25 or 30 ft. in advance and flank bore-holes about 15 ft. ahead, there should be preparations to deal with any water or gas that may be encountered. A good supply of dry fir plugs, 4 or 5 ft. long, should be provided and when water is tapped, one of these plugs should be driven tightly into the hole, and a post wedged up in front to prevent the water pushing it out. It is also sometimes advisable, when there are signs of water percolating through into the hole, to insert a pipe with a valve through which the boring rods may be passed and the boring continued. As soon as the water is tapped the rods may be withdrawn and the valve closed thus preventing the sudden inrush of the water.

At one of the mines in southern West Virginia, where the coal seam is situated high in the mountain, a modern aërial wire-rope tramway is used to advantage. The tramway crosses a river and runs to a loading station near the top of the mountain; it has a clear span of 1300 ft. The buckets travel at the rate of 300 ft. per minute, and make the entire distance in about 4 minutes. The difference in elevation between loading and discharging stations is 360 ft., which permits the tramway to be operated by gravity. The speed is controlled by two brakes at the loading station. The tramway handles 800 tons a day and requires the services of two men at a total cost of $4 per day; this makes the cost of transporting coal over this system ½ cent per ton for labor. It is stated that the same labor could handle practically double the present tonnage by adding more buckets.

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Production of Lead in the United States

Reports from all of the smelters and refiners show that the production of refined lead in the United States in 1908 was 413,868 tons as compared to 426,146 tons in 1907. Details of the production are given in the subjoined table, which shows the production of Missouri and Kansas lead according to groups of smelters, the single smelter in Kansas being included in "Southwest Missouri," and the two smelters in Illinois, near St. Louis, in "Southeast Missouri." The lead that is entered as "desilverized" is the production of desilverizing refiners other than those included in the two groups above mentioned. The present conditions of lead smelting in the United States do not permit of any accurate, and at the same time rational, classification.

PRODUCTION OF REFINED LEAD.

Class.	1907	1908.
Desilverized	213,383	187,759
Antimonial	9,614	*a*
Southeast Missouri	108,510	113,103
Southwest Missouri	17,833	18,014
Miscellaneous	790	.....
Total domestic	350,130	318,876
Desilverized, foreign	76,016	94,992
Grand total	426,146	413,868

(*a*) The production of antimonial lead in 1908 was 13,109 tons; in the above table it is included with the lead entered as desilverized.

The above statistics include a considerable quantity of lead refined from scrap and old metal, which is reworked by several of the refiners whose principal business is the refining of base bullion of virgin origin. There is, moreover, a considerable production of lead by smelters who make a business of reworking old metal only. To some extent they market their product as pig lead, and to some extent they refine it as an alloy, which is marketed. It is difficult to draw the line where statistical enumeration should cease in this respect. In 1907 the production of such reclaimed pig lead was 9990 tons, while the production in the form of alloys was 15,508 tons. In 1908 the production of pig lead from old material was 14,323 tons. It is probable that the reports of this industry are incomplete both for 1907 and 1908.

The statistics of lead of foreign origin as reported by the refiners do not agree exactly with the reports of imports by the Bureau of Statistics of the Department of Commerce and Labor, which in 1907 entered the importation of lead in ore and base bullion as 70,537 tons; and in 1908 as 109,286 tons. The discrepancy in 1907 is partly accounted for by the item of antimonial lead, which is recorded in the above table as wholly of domestic origin, whereas a large part of it was doubtless of foreign origin. However, discrepancies are explained anyway by metal in transit, process of refining, and accumulated stocks.

The distribution of the domestic production of virgin lead is given as nearly as possible in the second table. The total for this table does not agree with that of the first table because (1) lead derived from scrap is excluded, and (2) the figures in this table are based to a large extent upon the reports of the producers of work lead, which obviously show the origin of the metal much better than the reports of the refiners can do. Differences between the reports of smelters and refiners are, of course, explained by metal in transit, treatment, etc.

PRODUCTION OF LEAD BY STATES.

State.	1907.	1908.
Arizona	2,200	1,867
California	850	490
Colorado	47,332	26,707
Idaho	111,697	98,394
Kansas	1,800	2,400
Missouri	123,613	125,216
Montana	2,005	2,309
Nevada	3,400	3,676
New Mexico	1,900	611
Oklahoma	400	1,000
Utah	54,738	43,995
Wisconsin	3,500	3,486
Other States	1,204	600
Undistributed	.....	2,026
Zinc smelters	1,320	1,290
Total	355,959	314,067

The striking features of the statistics for 1908 are the further gain of Missouri as the premier lead-producing State and the decline in the production of nearly all of the other important lead-producing States, especially Colorado. It is probable that a large part of the lead that we have entered as "undistributed" (because we could not be sure of its source) belongs really to Colorado. The item entered under the caption of "Zinc Smelters" represents lead obtained from their residues, the origin of which it is next to impossible to trace.

Gold Production of Russia

The receipts of gold, reported in terms of the fine metal, at the government and private laboratories in 1908, were 1,279,805 oz. troy, compared to 1,166,032 oz. troy in 1907. Increasing these figures by 10 per cent. in each case, in accordance with our usual custom, in order to allow for gold clandestinely exported, or otherwise escaping official record, we estimate that the gold production of Russia in 1908

was 1,407,770 oz., compared to 1,282,635 in 1907. The increase was not altogether expected in view of the unfavorable conditions from which gold mining in Russia has been suffering, these having been the subject of general complaint. The major part of the increase in 1908 was due to the Rodaibi district in the Irkutsk Government, and the Yakutsk district, which comprise the most productive region of the Empire at present, this contributing about one-third of the total output. The Lena Gold Mining Company alone produced 273,865 oz. of fine gold in 1908, this being the most productive single undertaking in Russia. Indeed it must be in the first rank of the gold producers of the world. The Waihi mine of New Zealand in 1908 produced $4,495,847.

The Virginian Railway

An event of much importance to the West Virginia coalfields occurred this week in the formal opening for traffic of the Virginia Railway, which has been under construction for nearly three years past. This road begins at Deepwater on the Chesapeake & Ohio, extends southeasterly for some distance and then eastward, passing through Norfolk and reaching tidewater at Sewell's Point on Hampton Roads. It was planned and built as a coal road chiefly, other traffic being merely incidental, and great pains were taken in its location to secure favorable grades for the eastbound traffic which will constitute the bulk of its business. In its construction some expensive work was required to overcome the grades where it leaves the Kanawha valley and at some other points where it crosses the mountain ridges running northeast and southwest. For a considerable part of the distance traversed it parallels the Norfolk & Western railroad and it will be a competitor of that road to a certain extent for coal traffic, although it will not interfere at all with the through southwestern business, or indeed with the local trade of that line. The total length of the road from Sewell's Point to Deepwater is 436 miles and some short branches bring the total up to 450 miles of railroad. The total cost is said to have been about $40,000,000, including the extensive tidewater terminals.

The road will not be altogether a competitor of existing lines but will have, even at the start, some new trade of its own. It will interfere very little with the Chesapeake & Ohio and will leave to the Norfolk & Western practically all the trade of the Pocahontas and Tug River fields. It will open up a comparatively new district in West Virginia lying between the two older roads; in this district several large mines have already been developed or are being developed.

An unusual feature of this road is that it has been built and is owned practically by one man, H. H. Rogers of the Standard Oil Company. His purpose in building the road, it is understood, was his belief that it would be a profitable investment of capital and it is expected that he will retain its control in his own hands. At any rate no arrangements have been made to distribute its securities to the public. We can recall no other case of a railroad built in this way since Asa Packer built the original Lehigh Valley railroad—the nucleus of the present Lehigh Valley system—practically single-handed in the early fifties. That was a sufficiently large undertaking for one man in its day, but was far short of the achievement of Mr. Rogers in building the Virginian railway.

Copper Production of the World

The annual statistics of Henry R. Merton & Co., Ltd., of London, received this week, show that according to its reports the world's production of copper in 1908 was 748,625 long tons, compared to 713,865 in 1907. The figures for the principal countries are given in the following table:

	1907.	1908.
Australasia	41,250	39,500
Canada	25,615	28,570
Chile	26,685	38,315
Germany	20,490	20,200
Japan	48,935	43,000
Mexico	56,565	37,570
Peru	10,575	15,000
Russia	15,000	20,085
Spain and Portugal	49,675	52,585
United States	392,520	425,175

We have previously commented upon the statistics for the United States, Canada and Mexico. As to the statistics for the remainder of the world, the most noteworthy features for 1908 are the large increases in the production of Russia, Chile and Peru. The increase in Russia was due largely to the operations of some of the new British concerns, such as the Spassky Copper Company; the increase in Peru was due chiefly to the Cerro de Pasco company, which now appears to be getting its gait. The increase in the production of Chile is particularly interesting. Many years ago this country ranked among the most important copper producers of the world, but for nearly 20 years its output has been practically at a standstill. American and British companies are now becoming more extensively interested in the resources of that country, and their work is evidently reflected in the statistics for 1908, which show the largest production of copper in Chile since 1890. The statistics of Merton & Co. omit the production of Cuba, which amounted to 2966 metric tons in 1908, against 1388 in 1907.

A High Grade Copper Mine

It has become so much a custom to talk about copper mines that yield 1 to 2 per cent. of the metal, or translating the percentage into pounds per ton to sound better, that it is rather startling to find a copper mine producing on a large scale ore that assays about 30 per cent. copper. That is what the Poderosa Mining Company obtains at Collahuasi, Chile. This mine is also of interest by virtue of its being under the management of Robert Hawxhurst, an engineer well known in the United States. His company produces about 2000 tons of ore per month that assays about 30 per cent. copper, besides some "low-grade" ore that goes 11 per cent. copper and some "waste" that goes 4 to 5 per cent. In the six months ending June 30, 1908, the production of high-grade ore was 13,795 tons. At the beginning of that year the ore reserves were estimated at 100,000 tons, which amount was fully maintained by the developments of the semester. The production of copper in Chile in 1908 having been about 38,000 tons, it will be seen that the output of the Poderosa mines forms a respectable percentage of the total. The vein from which this ore is mined apears to be from 10 to 40 in. in width.

No strike nor lockout has taken place in the anthracite region, both sides agreeing that work shall continue under the existing agreement, at least until another conference can be held. That conference begins today (April 7), but will continue probably for two or three days. Reports, which seem well founded, are to the effect that the miners' committee will give way, insisting only upon some small points for form's sake. The position of the operators is too strong to make a contest at all hopeful just now.

North Dakota Coal Lands

The first indication of the new policy that is to govern the Land Office under President Taft and Secretary of the Interior Ballinger was afforded on March 29, when by recommendation of the secretary, President Taft revoked an executive order issued by President Roosevelt in 1906, under which 1,866,000 acres of land in North Dakota were withdrawn from entry. This land was withdrawn in consequence of a report that it contained lignite coal, and that a combination of interests were trying to get a monopoly of the supply. The restoration of these lands now permits entries to be made under the general land laws applicable to that area. A statement issued by Secretary Ballinger on this topic says that if the lands are agricultural in character they may be entered under the homestead laws; if valuable because of workable deposits of coal they may be entered under the coal-land laws. This action will relieve from suspension and pass to patent a large number of homestead entries which had been suspended for field examination because of the existing withdrawal. President Roosevelt was understood to have withdrawn this land from entry in pursuance of his conservation policy. The new President's policy, according to the statements of officials in touch with this branch of the Government's operations, is "development of natural resources." The land laws were amended at the last session of Congress so as to permit homestead entries to be made on land "chiefly valuable" for agriculture. The old law would not permit such entries, even if the mineral deposits were nearly worthless.

The Bureau of Mines Bill

Senator Dick, of Ohio, chairman of the Senate Committee on Mines and Mining, has reintroduced the Bureau of Mines bill with some minor changes and intends to press it during the present Congress, though—in view of the decision (April 1) to bar legislation other than the tariff and the census—he will not be able to act at the current session. In the form in which it has now been introduced by Senator Dick, the bill provides for the establishment of a Bureau of Mines in the Department of the Interior, which is to make such investigations as may develop greater safety and efficiency in mining, extracting and utilizing the mineral substances of the United States and the investigation of materials of construction, fuels, and other mineral materials belonging to or for the use of the Government of the United States with a view to their more efficient use. The bill follows the measure of last session in authorizing the Secretary of the Interior to transfer to the new bureau from the Geological Survey, the work of supervising the investigations of structural materials, the analyzing and testing of coals, lignites and other fuels, the investigation of the causes of mine explosions, and the inquiries into plans for the protection of the lives of miners. This work is, however, limited to the Territories of the United States, thus doing away with the objection raised against the old bill that it would give a bureau of mines power to make regulations which might interfere with the regulations of the States in regard to the same or allied subjects.

The bill further contains the following provision: "That no examinations shall be made for private parties or corporations except with the approval of the Secretary of the Interior and under such regulations as he may prescribe where such examinations involve the question of public safety, prospecting on public lands, or a serious waste of mineral resources; and in all such cases the cost of the examinations shall be charged against parties for whom the examinations are made, and the money so received shall be paid into the Treasury of the United States."

The Rio Tinto Company in 1908

The Rio Tinto Company in 1908 extracted 604,275 tons of pyrites for shipment and 1,115,610 for local treatment, a total of 1,719,885 tons. The quantity of cupreous ore invoiced to consumers in 1908 was 589,815 tons against 607,944 tons in 1907, and 632,307 tons in 1906. Of the deliveries in 1908 Germany took 300,361 tons, the United Kingdom 118,156 tons, and the United States 171,298 tons. The deliveries of sulphur ore, which were 477,843 tons in 1906, and 619,814 tons in 1907, were 688,477 tons in 1908. The copper produced in 1908 by treatment at the mines amounted to 24,256 tons, and the fine copper in pyrites shipped was 9958 tons, a total of 34,214 tons. The following quantities were marketed: Refined and blister copper, 25,093 tons; copper in pyrites, 9821 tons; total, 34,914 tons. The profit on the sale of products in 1908 was £1,446,504.

Satisfactory progress has been made with the opencasting of the San Dionisio Lode. Two of the tunnels, through which the overburden will be removed, are now complete, and progress has been made with the third or lowest outlet. The extension of the South Lode Opencast is proceeding well, and will effect a more economical extraction of the mineral in the near future. The output of mineral for 1908 was considerably reduced through the subsidences mentioned last year, but no further slips have occurred.

March Dividends

The accompanying table shows the total amount, and the amount per share, of the dividends paid during the month of March, 1909, by mining and industrial companies in the United States, and by some foreign mining companies:

U. S. Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Am. Smelters, pf., A.	U. S.	1.50	255,000
Am. Smelters, pf., B.	U. S.	1.25	375,000
Bunker Hill & Sull.	Ida.	0.20	60,000
Calumet & Arizona.	Ariz.	1.00	20,000
Calumet & Hecla.	Mich.	5.00	500,000
Colorado.	Utah	0.08	80,000
Doe Run Lead.	Mo.	1.50	94,888
Fed. M. & S. Co., pf.	Ida.	1.75	210,000
Homestake.	S. D.	0.50	109,200
MacNamara	New	0.01	7,300
North Butte.	Mont.	1.00	400,000
North Star.	Cal.	0.30	75,000
Old Dominion, M.	Ariz.	0.50	146,622
Old Dom M. & S.	Ariz.	1.00	162,000
Phelps, Dodge & Co.		0.02½	1,123,365
Quincy	Mich.	1.00	150,000
Round Mt. M. Co.	Nev.	0.04	31,933
Utah Copper	Utah	0.50	365,000
United Verde.	Ariz.	0.75	225,000

U. S. Industrials.	Location.	Amt. per Share.	Amt. Paid.
American Coal.	Md.	$1.25	62,500
Crucible Steel, pf.	Penn.	1.00	244,365
Genr'l Chem., com.	U. S.	1.00	74,103
Nat. Lead, pf.	U. S.	1.75	260,820
Sloss Sheffield	Ala.	1.25	125,000
Standard Oil	U. S.	15.00	14,550,000
U. S. Steel, com.	U. S.	0.50	2,541,512
U. S. Steel, pf.	U. S.	1.75	6,304,918

Foreign Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Crown Reserve	Ont.	$0.15	$262,500
Esperanza	Mex.	0.37	168,350
Kerr Lake	Ont.	0.20	120,000
Le Roi 2.	B. C.	0.48	57,600
Mines Co. of Am.	Mex.	0.02	40,000
Perigrina M. & M.	Mex.	3.50	350,000

International Smelting and Refining Company

The organization of this company has been perfected by the election of John D. Ryan, as president, Dennis Sheedy, as vice-president, and John W. Allen as secretary and treasurer. The board of directors consists of these, together with U. H. Broughton, Charles F. Brooker, Thomas F. Cole, Adolph Lewisohn, E. C. Converse, Thomas Morrison, C. A. Congdon, Wm. D. Thornton and Charles F. King.

The new company has taken over the Raritan copper refinery, from the United Metals Selling Company, as of Jan. 1, 1909. The new Tooele smeltery is under construction. The company is also considering the purchase of the Tintic smeltery in Utah and the Torreon smeltery in Mexico.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Electrically Driven Mine Pumps

To the interesting article by Sydney F. Walker in the JOURNAL of Feb. 20, 1909, may be added the experience of pumping by electricity in Aspen, Colo., where electrically driven mining machinery originated.

In Aspen all sorts of pumps have been used for mine pumping, from the old Cornish pump to the uptodate, highly polished and attuned electric pump. Some of the electric pumps have necessarily been freaks, on account of local conditions, and perhaps also attributable to the evolution of that class of mine machinery.

Several years ago one of the freak installations was an ordinary three throw plunger pump driven by continuous-current shunt motor and placed at the collar of a shaft in a tunnel. It was to pump water from the bottom of the shaft 80 ft. to an ejector which in turn ejected the water, with the additional mine water, up to the tunnel or level of pump. This pump and ejector did the unwatering in sinking the shaft and carrying on continuous stoping.

Another freak, also an ordinary three-throw 7-in. plunger pump was placed in the bottom of a 220-ft. shaft as a station pump and was driven by ½-in. wire-rope transmission from the 20-h.p., continuous-current, shunt motor placed at the collar of the shaft. This pump was once, during a flood, submerged under 65 ft. of water, and kept on running for two days until the mine was drained. During that time the 20-h.p. motor developed 37 h.p. intermittently and at one time continuously for eight hours without injury, the increase of power being due to obstruction of the water to the transmission gearing.

The last electrically driven pump installed is a 7x12-in., five-throw, horizontal plunger pump driven by a 90-h.p., variable-speed, continuous-current, shunt motor, working under a head of 500 ft. at a variable speed of 45 to 60 revolutions, delivering the water in the same variable ratio, 450 to 600 gal. per min., at a combined efficiency of 87 per cent. The variation of flow of water is due to the damming up and emptying of water courses and to spring thaws, and at times the water is very muddy.

This pump has been running continuously for 18 months, not losing the water once, except for 20 min. at a time for each plunger every three months when renewing packing, at which times the water is stored in an excavated sump under the pump. The cost of running the pump averages $500 per month for 500 gal. per min. against a 500-ft. lift.

This form of pump takes the water from a state of rest and delivers it to the discharge column in a continuous stream, thus only limiting the speed by the strength of pump chamber, making a possible flexibility as to capacity of several hundred per cent., and consequently rendering it an ideal mining pump.

CHARLES E. ANDERSON.

Aspen, Colo., March 15, 1909.

The Nature of High Explosives

In the JOURNAL of Feb. 6, 1909, I find under the heading "Colliery Notes" the following paragraph:

"A nitroglycerin explosive is less sensitive with a small-diameter cartridge, but an ammonium nitrate explosive is more sensitive with a small-diameter cartridge."

I wish to take exception to this paragraph, as the statement made does not conform to our understanding of the nature of high explosives. It is a well known fact that detonation "carries" better in larger cartridges of all explosives, whether they be nitroglycerin dynamite, ammonia dynamite, ammonium nitrate compounds, gelatin dynamite or blasting gelatin, than in smaller cartridges. This does not apply to the actual sensitiveness, except that in long charges, a stronger detonator is required in those of small diameter on account of the resistance offered by the charge of small diameter to the detonation wave. In a way this is similar to the friction of liquids flowing in a small pipe as compared with those flowing in pipes of large diameter. In regard to the statement concerning the ammonium nitrate explosives (through which the detonating wave does not carry so readily as through an ammonia dynamite), it has been definitely proved that these explosives cannot be used with success except when packed in cartridges of a diameter equal to or larger than 1¼ in. The only explosive of this class which has been successfully used in cartridges of as small a diameter as 1¼ in. is Monobel. This is the result of a great many careful and extended experiments made by the technical division of the Du Pont Company under all conditions of practical work.

F. H. GUNSOLUS.

Wilmington, Del., Feb. 15, 1909.

Developments in Gold Dredging in 1908

I note with interest the article on this subject, by John Power Hutchins, published in the JOURNAL of Jan. 23, 1909. I also note Mr. Hutchins' observations concerning wooden hulls and their defects and his mention of structural steel having been used in connection with the wooden hulls for the purpose of strengthening the same. I would call attention to a form of construction that I designed and incorporated in a dredge which has given excellent satisfaction during two years' use.

In this design all of the gantries were of structural steel work and were joined together by a structural steel truss. This construction formed a regular Howe truss running throughout the length of the dredge with the front and rear gantry at each end and the main gantry carrying the upper tumbler in the center, there being two of these trusses, one on each side of the well and joined throughout their length at various intervals.

The principal idea was to avoid composite construction; in other words, to avoid securing any one of the three gantries directly to the woodwork of the hull as it has been found almost impossible to secure steel work to the wooden structure in a satisfactory manner, the steel always cutting more or less into the woodwork when any strain was put upon it and thus becoming loose.

These three gantries being embodied in this steel truss-work made the whole structure a complete unit and the bottom chord of the steel truss simply rested on a sill or stringer running the entire length of the dredge, to which each of the floor beams was secured. This form of construction kept all the digging strains within the steel truss girder and at the same time this girder reinforced the hull so that there was no tendency of the hull to become distorted.

After two years successful operation of this dredge, careful observations have shown the hull and all the superstructure to be in perfect condition.

Further on in the article Mr. Hutchins speaks of steel hulls being more rigid and durable than those of wood and states that they should be used in tropical climates, but inasmuch as he states that no gold dredges with steel hulls have yet been built in the United States, one would naturally infer that this work had not been

taken up by anyone, whereas in the JOURNAL of Jan 23, 1909, it may be noted that the advertisement of the New York Engineering Company, on page 145, illustrates an all-steel dredge in which is embodied the structural steel truss girder construction for all the superstructure and gantries as described above, only this is built on the deck of a steel hull instead of resting on the floor of a wooden one.

I believe the day is near at hand for steel hulls in this country and excepting in one or two States where suitable pine is to be cut close at hand, this steel hull will not prove any more expensive than the wooden hull, and in most instances it would be cheaper on account of less labor involved in assembling the dredge.

The steel hull is readily assembled, requiring only pneumatic riveting and bolting in order to complete same, and the installation of the machinery is much more readily accomplished with the steel hull and superstructure as most all of this work is laid out and executed in the shop under favorable conditions and the assembling of the machinery on the hull in the field only requires bolting or riveting in place.

Mr. Hutchins also calls attention to the need of a small dredge for the exploitation of areas not suitable for a larger dredge. This need for a small dredge having been appreciated by me some time ago, I set about to design and build this all-steel form of dredge, advertised in the JOURNAL, especially in the smaller size having two cubic-foot buckets.

This form of construction results in a large saving in freight and transportation and labor in erecting. At the same time it provides a modern and efficient dredge at a very low cost and one that is especially designed for the exploitation of small and limited areas.

A. C. LUDLUM.

New York City, Jan. 29, 1909.

Lake Superior Iron Ore

I note in the statistics of "Lake Superior Iron Ore," in the JOURNAL of March 20, 1909, that ores from Mayville, Wis., mines are included with those from the Illinois mine of the Baraboo range. While it is advisable perhaps to include in some way the Mayville and Iron Ridge ores from Dodge county in Lake Superior statistics, yet from a geological point of view at least they should be kept separate from the ores of the Baraboo range.

The Baraboo ore is pre-Cambrian like that of the Lake Superior ranges. The Mayville and vicinity mines are in the Clinton iron-ore beds, like the Birmingham, Ala., ores. The Mayville mines have been worked for 60 years since 1849, the total production probably being between 2,000,000 and 3,000,000 tons, largely used in local furnaces. The Baraboo range has been worked since 1903.

SAMUEL WEIDMAN.

Madison, Wis., March 25, 1909.

Sharpening Drills Underground

SPECIAL CORRESPONDENCE

The topical discussions introduced into the proceedings of the South African Association of Engineers promise to be a successful feature of meetings in the future. The scheme—introduced at the last gathering—is simply to supplement the regular proceedings by the reading of brief notes on some pertinent question, for informal discussion by those present, as remarks and criticisms made cannot have received careful previous consideration, the discussion is not reported verbatim in the *Journal* of the Association, and the summarized version is submitted to speakers for correction. Members are thus encouraged to speak freely, and the truth of matters may be arrived at more speedily, if clumsily, owing to the absence of elaborate preparation of remarks, from which inadvisable, though serviceable, opinions are often omitted. At the last meeting of the association, Baron Mannerheim opened a discussion by reading notes on the advantages of sharpening drills underground—not by any particular method, though he is associated with the exploitation of an electric furnace. While the meeting was unanimously in favor of sharpening underground in deep-level mines, there was a wide divergence of opinion as to the means. W. Thomas, manager of the Jumpers Deep, reported the successful employment of Mowbray oil furnaces. These he has installed at several points in the mine so as to be near the working faces and reduce transportation of drills, where the vitiated air—apparently unimportant—can rise to old stopes or places where it cannot cause any deleterious effects.

The electricians claim that the great merit of the electric furnace is the infallible means it provides for maintaining exactly the critical temperature required to obtain the best results, from different classes of drill steel. It has been frequently urged that adequate attention is not paid to this side of the question in Rand routine practice, and that if the proper heat can be obtained by a scientific system, such as regulation in an electric furnace, the faults due to variation in coal or in oil furnaces, and to carelessness or ignorance on the part of the smith will be prevented. Working underground without centralization, which would largely neutralize the savings attributable to the scheme—the need of supervision must be greater, when furnace conditions are similar to those on surface. Mr. Thomas claims that he has used his oil furnaces underground on drill steel of all qualities and that, owing to the ease of gaging the temperature by experienced observation, there have been no complaints as to faulty tempering.

It is most probable that the whole question will be thrashed out thoroughly by some expert, able to devote his whole time to the subject, in due course, and if the informal topical discussion mentioned has influenced the movement, its practical utility will have been proved substantially. In the deep-level mines, upon which the number of shafts of over 2000 ft., vertical with independent inclines to serve the ground below, are yearly growing in number, there is not only the cost of hoisting to be considered, but also the time taken in loading and unloading the skips or cages with sharpened or blunt drills, numbering thousands per day. There is also to be considered the benefit of bringing the users of the drills—the machinemen or hand-labor supervisors—into closer contact with the sharpeners. But it is necessary to be sure that the standard of efficiency is maintained.

Metallic Chromium from Chromite

A German patent (No. 205,789) has been granted to E. Viel, of Rennes, France, for a process of extracting metallic chromium from ferro-chromes or from natural chromite. The process consists in treating the raw material, mixed with lime or clay and a calculated amount of carbon, at a high heat in an electric furnace. This forms double silicates of iron or alumina and calcium, together with such other metals as may be present, aside from the chromium. The heating must not be long continued, or the double silicates will be dissociated.

Supposing the raw material to be a ferro-chrome containing 60 to 68 per cent. chromium and 8 to 12 per cent. carbon, together with such impurities as manganese, magnesia and alumina. This is pulverized, mixed with sand and lime, or a silicate of lime, and heated for 5 min. at a temperature of at least 3500 deg. C. A double silicate of iron and calcium is formed and also one of calcium and manganese, etc., which float on the calcium carbide, which is also formed. The heavy chromium metal goes to the bottom of the furnace. The whole mass is then poured into a deep receptacle and allowed to cool, after which the several layers are broken apart.

If chromite is used for the raw material, only enough carbon is added to reduce a part of the chromic oxide, while the oxides of iron, manganese, etc., will not be reduced at all and thus enter into silicates with the lime and sand. The time and the temperature of the treatment are the same as with the ferro-chrome.

Tariff Legislation

SPECIAL CORRESPONDENCE

On April 3 the Committee on Ways and Means, after a long session, announced the amendments to the Payne bill on which they had been working for more than a week. While these amendments, as made public by the committee, numbered about 60, few of them were of general interest. The only ones affecting the metal and allied schedules appreciably were in charcoal-iron (paragraph 118), which was raised from $6 per ton to $10 per ton; in paragraph 88 where fluorspar, which had been 50c. per ton crude and $1.75 manufactured, was made dutiable at a uniform rate of $1.50 per ton; in paragraph 134 where wire over No. 16 gage was changed from 1¼c. per pound to 1¾c.; and in paragraph 89 where mica was made 10c. per pound plus 20 per cent. when manufactured; 5c. per pound and 20 per cent. when crude, instead of being taxable at 30 and 35 per cent. ad valorem, as in the original Payne bill. Copperas, which was on the free list, is made dutiable at 0.15c. per pound. Carbon electrodes were added to paragraph 93, and put at 10 per cent. ad valorem. In paragraph 182 the word "ferrophosphate" has been altered to "ferrophosphorus."

PATENT PROVISIONS

An important alteration in the bill was made by dropping out the section on providing for a retaliatory patent policy. The section was simply cut out without the insertion of any substitute. This result was arrived at in consequence, largely, of representations on the part of the State Department, which informed the committee that it had practically settled the terms of patent treaties with some of the more important European countries under which we should be relieved of the retaliatory working of the patent legislation of those countries particularly insofar as concerns the so-called "manufacturing clause." This and the urgent representations of some of the best known patent attorneys in the United States sufficed to bring about the elimination of the objectionable section. It also appeared that to adopt the section would violate important international agreements

IRON AND STEEL

One of the tariff schedules that is receiving the closest attention from the Senate Finance committee is Schedule C, which deals with metals. The portions of this schedule which relate to iron and steel were taken up for formal investigation on March 27, at which time a large delegation of iron and steel manufacturers, headed by Judge E. H. Gary, of the Steel Corporation, and Willis L. King, of the Jones & Laughlin Steel Company, appeared before the committee. In general discussion the rates fixed in the Payne tariff bill were covered, and it was made plain that the steelmakers did not consider the schedule there established to be at all feasible. The chief criticisms made upon it were based upon the apparent bad adjustment of the rates to one another and the fact that, in many cases, products which should have been highly taxed with reference to others were set at a lower rate, while in other cases products which should have been placed on a lower basis were maintained at a high point. It is understood that the criticism of the Payne tariff followed substantially the lines that were pursued by Representative Underwood, of Alabama, in his speech before the House of Representatives in which he condemned the methods followed by the Ways and Means Committee in constructing the iron and steel schedule. Particular reference was made to the Payne tariff on scrap iron, and it was suggested that this should be made identical with the duty on pig or at least approximately equal to it, in order to prevent the introduction of broken pig under the head of scrap. Severe criticism of the treatment accorded to steel billets and rails was also afforded. While it was understood that the steel and iron representatives had been given a "hearing" in the usual sense of that term, Senator Aldrich has since denied, in a speech before the Senate, that such was the case. Mr. Aldrich refers to the incident as merely a consultation or "conversation" between the Republican members of the committee and some experts who were called in for consideration of the schedules.

IRON ORE

The treatment of iron ore in the Senate now seems likely to be radically different from that accorded to this item in the House. Reduction of the duty existing in the Dingley bill by about 20 per cent., making it 32c. per ton (instead of 40c.), with a further reduction of another 20 per cent. on Cuban ores coming in under the reciprocity treaty and thus reducing the rate to 25c. per ton is probable. This disposition of the ore question has been demanded by representatives of the minor ore-producing districts who believe that the introduction of free iron ore will be injurious to the business of their particular localities. There has been a strong desire on the part of the House leaders to adhere to the Payne treatment of iron ore, as in this way some semblance of the "free raw materials" policy could be maintained. It is unlikely that the House will at the last hold out against the Senate should the latter body restore one-half or two-thirds of the original duties on iron ore. Only as a result of extreme pressure and in view of the desire to make some show of introducing a liberal tariff bill while at the same time satisfying most of the manufacturing interests did the Ways and Means Committee remove the Dingley tariff on ore, and there are several members of the committee who would welcome a chance to replace a tariff on this item in the list. The leaders have also felt quite keenly criticisms based upon the differences between their method of dealing with iron and lead and zinc ores.

COAL

Discussion of the tariff bill has developed some sharp differences of view with respect to the duty on coal. The Payne tariff provides for reciprocity in coal with Canada on a free-trade basis, and during the past week this has called forth strong protests from Western mining interests, as well as from those of Virginia and West Virginia. It has been the claim of these sections of the country that the effect of the new provision, if carried out by a mutual agreement with Canada, would be to deprive the domestic producer of a market for about 6,000,000 tons of coal in New England and to turn this market over to the Canadian producer. That the removal of the tariff of 67c. per ton on Canadian coal would not make a difference in ordinary retail prices exceeding 10c. per ton has been asserted on the floor by Representative F. W. Mondell, of Wyoming, chairman of the House Committee on Public Lands, in a set speech. It has been demanded by the coal interests that the tariff be restored at the rate of at least 45c. per ton, while they have also asked that the more favorable tariff treatment accorded to slack coal and culm in the bill be continued. Under the Dingley act, these forms of coal were dutiable at 15 per cent., but the Payne bill places them on an equality with other grades of coal. Were the duty to be restored at a flat rate of 45c. with no reciprocity provision, the new treatment of slack and culm continued, the domestic producer would consider himself in a much better position. The demand for this tariff program as regards coal has been made by Senator Elkins, of West Virginia, in conference with Senator Aldrich, of the Senate Committee on Finance.

DUTY ON LEAD

In a speech before the House on April 3 Representative Howwell, of Utah, attacked the duties on lead carried by the Payne bill and submitted a lengthy memorial from the Conference of Lead Ore Producers of Colorado, Utah, Idaho and Nevada, addressed to the Senate and House, in which they requested that the bill be improved by the addition of such a differential duty on pig lead and refined lead "as will preserve the industry." The Ore Producers Conference urges that the proposed reductions would open the market to Mexican lead, to the detriment of our own industry.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Chemical Engineer

Will the Journal please give its definition of a "chemical engineer?"

W. M.

A chemical engineer is one who has a fundamental knowledge of chemistry, and is sufficiently familiar with the principles of mechanical engineering to enable him to deal with problems of construction, operation and maintenance in connection with manufacturing processes including chemical principles.

Infusorial Earth

What is infusorial earth worth? Who deals in this material?

T. H. W.

Infusorial earth, best American ground, is quoted at 1¾c. per lb.; best German ground, 2½ to 2⅝c. per lb., f.o.b. New York. The following are dealers in infusorial earth: W. H. Whittaker, 245 Front street, New York; Hammill & Gillespie, 240 Front street, New York; T. Van Amringe, 241 Water street, New York.

Monazite Sand

What is the price of monazite sand? Is any of this material imported?

S. M. O.

The United States imports practically no monazite or other thorium-bearing minerals. About 25 tons of thorium nitrate are imported yearly. The average price for 1907 was 12c. per lb. for 90 per cent. monazite sand. The present quotations are 8c. per lb. and upward, according to quality. Prices are published in the Journal, in the chemical table which appears in the first issue of each month. The quotations given are the prices asked of the consumer by the dealer.

Monzonite

What is monzonite? Although I find this rock referred to frequently in geological literature and know that it is a variety of what miners commonly call porphyry, I have been unable to obtain a precise definition.

P. T. A.

Monzonites are rocks occupying an intermediate position between the syenites and the diorites, i.e., rocks in which plagioclase plays a greater rôle than in the syenites but not so great as in the diorites. Lindgren has proposed that rocks having alkali feldspar to the extent of more than two-thirds of the total feldspar be classed with the syenites and with less than one-third with the diorites, classifying the intermediate rocks as monzonites. This proposal has found adoption.

The Hydraulic Mining Cartridge

In the Journal of Dec. 19, 1908, I notice on page 1211, under the head of "Colliery Notes," a paragraph concerning the hydraulic mining cartridge, which is being used successfully in England, Scotland and Wales. I will be much obliged if you will give me the name of the manufacturer of this cartridge, or refer me to some party who can do so.

E. L. C.

The mining cartridge concerning which you inquire is manufactured by the Hydraulic Mining Cartridge Company, 21 Mawdsley street, Bolton, England. A full description of this cartridge was published in *The Engineering and Mining Journal*, July 14, 1906. The cartridge has been successfully introduced in Canadian coal mines, but has not been introduced to any extent in the United States.

Effect of Atmospheric Pressure on the Frenier Spiral Pump

What effect, bad or otherwise, does atmospheric pressure have on a spiral pump (Frenier's patent), and why should atmospheric pressure affect this pump? There is no vacuum formed.

T. N. W.

At each revolution of the wheel of the Frenier pump, more than half of the outside spiral coil is filled with air. This air becomes more or less intimately mixed with the sand and water which are forced up into the discharge pipe, and is compressed therein. At a high altitude, the volume of air taken in is the same as at a lower altitude, but it suffers a greater compression, and the air spaces in the discharge pipe being thus reduced, a heavier column must necessarily be lifted. The lifting power of this pump has been shown to be less by 4 in. for every increase of 1000 ft. above sea level.

Proper Size of Headframe

I wish to erect a headframe to hoist a load of 6 tons. What is the proper hight, and what dimensions should I use for front legs and backstays?

T. W.

For such information, a competent engineer should be consulted. Many factors, such as speed of hoisting, character of materials, position of backstay, etc., enter into such a consideration which, in themselves, determine the amount of the stresses. However, for an approximation the formula given below will give figures which will be amply safe even though not as economical as if the size of members was determined by a graphical or analytical study of the stresses involved:

$$S = \sqrt[3]{\frac{W H^2}{8}},$$

in which

S = Side of square section of front legs in inches;

W = Working load, on hoisting cable, in tons;

H = Hight of frame, from ground to axis of sheaves, in feet;

Backstays = 5/9 section of front legs, of rectangular section in proportion of 3 to 4.

Coal Briquetting in the United States

What is the present status of coal briquetting in the United States? I am particularly interested to learn what success has been achieved by those who have attempted to briquet Western lignite coals.

E. S. M.

This industry at the present time may be considered as in its infancy. At various times elaborate plans have been completed for the erection of modern briquetting plants, only to be later held up by the parties interested because of the great uncertainty that surrounds the successful outcome of the venture. There are waterfalls in our country that are capable of developing thousands of horsepower annually, but are so located near large coal mines where fuel is cheap, that the work of harnessing these great natural agents would at present prove unprofitable. A waterfall at Goldfield, Nev., where coal sells for $15 a ton would prove a bonanza, while the same source of power could not be profitably utilized at Pittsburg, where coal can be purchased for $1.20 a ton. The same line of reasoning is applicable to the briquet industry. Experiments are now being made in the anthracite field, where the fine coal, that is not of great commercial value, is being made into briquets. It is too early to say whether the promoters of the industry in Pennsylvania will meet with success. The briquet industry has reached its greatest state of perfection in Germany, where a large percentage of the brown-coal production is made into briquets. The principal reason for the success of the industry on the continent is due to the fact that the brown coal will not stand transportation in its raw state, and can only reach the market after it has been made transportable by briquetting. There is no question but that the briquet industry in the United States stands the greatest chance of being successfully carried on in our Western States, where good fuel is scarce and where low grades of coal or lignite that cannot be satisfactorily transported are plentiful. The question of securing a suitable binder at a reasonable cost is also a consideration of much importance. One of our greatest transcontinental railroads has attempted to engage in the briquet industry in our Northwestern country, and the success of this venture will be watched with interest. Further information can be obtained by writing to the Renfrow Briquet Machine Company, St. Louis, Missouri.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

S. W. Mudd, of Los Angeles, Cal., is visiting in New York.

C. N. Nelson is engaged in a prolonged examination of a mining property near Tucson, Arizona.

R. Britton Gottsberger has resigned his position as general manager of the Tennessee Copper Company.

Selwyn G. Blaylock, superintendent of the St. Eugene mine, East Kootenay, B. C., is back from a trip to the province of Quebec.

W. H. Aldridge, managing director of the Consolidated Mining and Smelting Company, of Canada, Ltd., was in Montreal recently.

Bruce R. Warden has returned from England to Nicola, B. C., and resumed his duties as engineer to the Nicola Valley Coal and Coke Company.

C. H. Benedict, chemist of the Calumet & Hecla stamp mills, is in the East, where he will deliver a series of lectures on the Lake Superior copper district.

R. E. Harris, president of the Nova Scotia Steel and Coal Company, has sailed for Europe in connection with the financial reorganization of the company.

H. S. Kerr, who has charge of the railroad and transportation interests of the Cerro de Pasco Mining Company in Peru, is visiting the United States on a leave of absence.

Gilbert S. Jones, district superintendent of the Temple Coal and Iron Company, at Pittston, Penn., has been suspended in consequence of the recent accident at the Mount Lookout colliery.

W. C. Seddon, of Baltimore, recently chosen chairman of the board of the Alabama Consolidated Coal and Iron Company, has been visiting the company's property in Birmingham, Ala., and vicinity.

G. A. McCarthy has resigned his position as chief engineer of the Temiskaming & Northern Ontario Railway to become superintendent of construction of a new power company, which will furnish electric power to the Cobalt mines.

Dr. B. Katsura, professor in the Technical College of the Imperial University at Tokyo, Japan, has been a visitor in New York. He will spend about five months in visiting mines and works in the United States, returning home by way of Vancouver.

C. W Purington passed through New York last week on his way from London to Siberia. He will sail from San Francisco on May 13. He goes to undertake the management of the Kolchau placer property, near the mouth of the Amur river, for the Orsk Goldfields, Limited.

W. B. Devereux, Sr., and W. G. Devereux, of the firm of W. B. Devereux & Sons, New York, have been at Rhyolite, Nev., inspecting the Pioneer lease, in which they are interested. They are now on the way to Melones, Cal., to make an examination of the Melones mine.

W. J. Olcott, of Duluth, Minn., has been elected president of the Oliver Iron Mining Company, in place of Thomas F. Cole, resigned. This promotion was generally expected. Pentecost E. Mitchell succeeds Mr. Olcott as vice-president of the company. J. H. McLean, recently assistant to Mr. Mitchell, succeeds him as general manager.

Obituary

William Frank Hall died at his residence, Brooklyn, N. Y., March 4. He was well known and highly esteemed. For some time he had been connected with the Lehigh Car, Wheel and Axle Works, of Catasauqua, Penn., as New York representative.

Neil Black, well known in the Yale-Cariboo district of British Columbia as one of the pioneers of the famous gold rush to the Fraser river 50 years ago, was recently found dead near Spuzzum, in the cañon of the Fraser, where he had for years lived a lonely life in a small cabin. The very difficult work he accomplished many years ago as foreman of construction of the wagon road the government built through the Fraser cañon and thence to Cariboo was long a cause of much wonder to engineers and others.

Jacob H. Neff, one of the best known mining men of California, died in San Francisco, March 26. He was the first president of the California Miners' Association, an office he filled for six consecutive years. He was one of the organizers of that association, having presided at the meeting in Auburn, Placer county, where it was first proposed to make an attempt to rehabilitate hydraulic mining in California, and to form an association of miners for that purpose. Mr. Neff was a pioneer of the State and had mined in many portions of it, mainly in Placer county. He was one of the owners of the Morning Star drift mine on the Iowa Hill Divide, which paid dividends for many years, and was interested in other mining properties also. Mr. Neff was widely known among the miners of the whole State, and was highly respected by them all.

Jasper R. Rand, vice-president and director of the Ingersoll-Rand Company, died of pneumonia in Salt Lake City, March 30. Mr Rand was the son of Jasper Raymond Rand, one of the founders of the Rand Drill Company, and was born in Montclair, N. J., in 1874. He was graduated from Cornell University in 1898 with the degree of mechanical engineer, and served in Porto Rico in the Spanish-American war as a member of the New York Volunteer Engineers. During 1899-1900 he was president of the Imperial Engine Company, at Painted Post, New York, leaving that position to take the presidency of the Rand Drill Company, which he held until 1905. In that year he was elected vice-president and director of the Ingersoll-Rand Company, which was his chief interest until the last. Mr. Rand was a member of the Spanish War Veterans, of the American Institute of Mining Engineers, of the American Society of Mechanical Engineers, of the Engineers' Club, of the Cornell Club, and of the Alpha Delta Phi Club, of New York. He is survived by one sister, Mrs. Henry Lang.

Capt. William Moore, one of the oldest sea captains on the north Pacific, died in Victoria, B. C., March 28. He was known as the founder of Skagway, the Alaskan port through which passes practically the whole trade of the Canadian Yukon and adjacent parts of Alaska. In the early nineties Mr. Moore, who had prospected the territory now known as the Yukon, repeatedly urged the Dominion government to build roads and trials, so that prospectors might be able to get about the country, and he was tireless in predicting discoveries of valuable goldfields. In full confidence that such would occur he occupied the site of what is now Skagway, and on the discovery of gold in the Yukon in large quantities, was instrumental in having the first large wharf built All through the period of the big stampede into the Klondike he was a leading and most active resident of the "Gateway" town. Four years ago, his health having failed, he disposed of practically all his business interests, and removed to Victoria, where he remained until his death. He frequently expressed his belief that in remote sections of the northern country, of which he had knowledge, much gold would yet be found.

Societies and Technical Schools

University of Colorado—The members of the upper classes of the College of Engineering have been visiting mines, plants and works at Pueblo, Portland, Shoshone, Glenwood Springs, Leadville and Colorado Springs, on the annual inspection trip of the College

Nova Scotia Mining Society—The officers elected at the recent annual meeting are: President, T J. Brown; first vice-president, Prof F. H. Sexton; second vice-president, G J. Partington; secretary, A A. Hayward; treasurer, H. M. Wylde; council, R Drummond, B. F. Pearson, G. W Stuart, C F. Starr, J. R. Cowan, A Dick, R H Brown, Thos Cantley, A L. McCallum.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Mexico City and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 2—The principal topic of discussion among the mining men continues to be the probable effects of the new eight-hour law for men working in deep mines and around reduction works, quartz mills, etc. Some of the mineowners think it will affect mining more than the milling, and others think the other way. In most mills the men work either 10 or 12 hours, and complying with the law of eight hours materially increases costs. One of the largest gold mines of the State in point of production is worked on the 10-hour system and the owners think the new law will increase costs of mining and milling ore from 25 to 30 per cent. Another of the large mines will quit mining its low-grade ore, hang up most of its stamps, and mine only the better grade ore and run 10 stamps to crush it. Numbers of small mines, milling their own ore, will perforce close down entirely, being unable to continue when they have to have three shifts instead of two in both mine and mill. This law applies to the quicksilver and other "underground" mines of the State as well as to gold mines. At those properties, while some skilled miners are employed, considerable unskilled labor is used in mines and about the furnaces. The principal quicksilver mine of the State is working ore containing 0.15 per cent. quicksilver and increase of expense will work a hardship. The quicksilver industry of California is in a bad way in any case, as the demand for the metal is less than the production and this additional expense will undoubtedly close down the smaller properties.

Over in Nevada where a similar law has lately gone into effect the big productive properties can stand the change, but those companies in the development stage will find it a hardship. The gypsum men are already complaining in Nevada and declare that they must close their plants on the enforcement of the law. These laws provide for the regulation of miners in the gypsum mines and plants and require that only eight hours' work must be done.

The entire equipment of the electric-power plant of the Bonanza King Mining Company, on the East Fork of the Trinity river, Trinity county, was destroyed by fire this week. The plant was only two years old and was a very fine one, costing some $70,000. It was in fact much too big for the mine and mill. These will now have to close down. Several hundred thousand dollars were spent on this mine and a 40-stamp mill put up. James Treadwell, the principal owner, was financially ruined in the failure of the California Safe Deposit Company, and 20 stamps of the mill were sold. The mine has lately been worked on a small scale, though it had one of the finest equipments of any gold mine in the State.

The Trinity River Mining Company has finished its tunnel through the point of land near Lewiston, Trinity county, and will turn the river through it when the water lowers. By diverting the stream about two miles of river bed at the horseshoe bend will be laid bare for mining. The tunnel will carry all the water of the river at the ordinary summer stage.

The Shasta Power Company and the Northern Light and Power Company have consolidated under the name of the Sacramento Valley Power Company. The Shasta Power Company has its plant on Snow creek, 28 miles east of Redding, Shasta county, and the Northern Light and Power Company has its plant on Cow creek in the same county. The merger means a branching out and extension of the power lines.

Salt Lake City

April 2—Sixty per cent. of the stock of the Pioneer Ore Sampling Company at Sandy has been sold to Ernest R. Woolley and associates. The price involved was not made public, but it is announced that no change will be made in the business management of the company, Frank Higginbotham remaining in charge of the business and L. A. Copeland continuing as superintendent at the works. The mill is situated 12 miles south of Salt Lake City between the tracks of the Rio Grande and the Salt Lake, Los Angeles & San Pedro railroads. The plant enjoys common-point rates from all directions and its location greatly favors the shippers from the Alta and American Fork districts with an even break on the ores from Big Cottonwood cañon. Mr. Woolley's "associates" are not announced.

The Boston Consolidated has announced a new issue of stock. It is understood that the receipts from the new stock will be applied to pay the floating debt and to provide for the cost of new work at the mines. It is stated that the management expects to run the mill at full capacity of 3000 tons per day after sufficient stripping has been done to provide the mill with ore of which at least one-half is mined by the steam-shovel method.

In connection with the consolidation of the Tetro and Plutus companies, stockholders of the Tetro who do not desire to receive in exchange shares of the Plutus Mining Company may accept a dividend of eight cents per share for all stock turned in. The property of the Tetro company was sold for $24,000, which amounts to approximately eight cents per share.

The Utah Fuel Company pleaded guilty in the United States Court to the charge of criminal conspiracy to unlawfully acquire 1440 acres of coal land in this State. For this act it has paid a fine of $8000 and an additional $192,000 for the coal extracted, and has relinquished the land which was acquired through "dummy" entry men as agricultural land. The agents of the Utah Fuel Company also forfeited $14,440 which had been paid for the land.

The Utah Copper Company has placed an order for two new steam shovels and four locomotives for the mine at Bingham. The new additions will give the company a total of 10 steam shovels and 21 locomotives at the porphyry mine. This additional equipment is regarded as substantial evidence of the company's faith in its steam-shovel operations and would indicate an increased tonnage to go to the concentrating mill at Garfield.

Butte

April 12—At the Belmont mine of the Amalgamated the shaft is completed to the 1000 level, and the engine, which was formerly used at the Corra mine, of the Butte Coalition company, has been set in place and is practically ready for operation. This engine is good for at least 3500 ft. The Anaconda shaft is still out of use and will probably be so for some time to come. As soon as the Belmont is connected up with the lower levels of the Anaconda it is probable that the greater portion of the ore will be hoisted through the Belmont shaft; by this means a lift of 400 ft. will be saved, as the collar of the Belmont is about 400 ft. lower than that of the Anaconda.

At the Parrot the vein has been cut on the 2000 level and the showings are said to be satisfactory. Development work is also being carried on at the 1900 level. The Little Mina shaft of the same company has reached a depth of over 1200 ft. and a station is being cut on that level. When the station is completed a crosscut will be run to the vein, which is supposed to be about 500 ft. away.

Denver

April 2—As in the base metals of the ores of Leadville, the San Juan region, Aspen, Georgetown and Red Cliff lead largely predominates, naturally the mining fraternity of this State, having a wholesome fear of the lead of Mexico and British Columbia, is wholly and strongly in favor of a protective tariff and is bringing all the guns it can muster to bear on Washington. And as zinc is largely associated with the ores of the aforementioned districts, the same desire for protection of that metal abides with us. It is stated that at the conference in Salt Lake City of lead-ore producers of Utah, Idaho, Colorado and Nevada, which has just closed there, more than 60 per cent. of these interests in the United States were represented, and the work of compiling statistics and information on the subject, which are to be forwarded to Western senators and representatives, is in the hands of the committees of the new Western Lead Ore Producers Association, which was formed as a result of the conference. So our wishes are likely to be well and strongly put, and will doubtless get an impartial judicial hearing.

In the Cripple Creek district, the output for March is given at 59,704 tons, of a gross value of $1,340,790. The deep drainage tunnel is now beginning to enter that part of the area where mineralized veins may be expected to be encountered; and at 5400 ft. from the portal a fluorine-stained vein is reported as having been intersected. The present breast of the tunnel is now in the phonolite hill known as Grouse mountain, a short distance south of Beacon hill. The Delmonico, on Bull hill, formerly owned by W. S. Stratton, is the scene of a strike reported as four feet of pay ore.

The Ferris-Haggerty and Doane Rambler copper mines, near Grand Encampment, Wyo., together with the smelter, 16-mile tramway, etc., formerly owned by the Penn-Wyoming Mining Company, have passed into the hands of the United Smelters, Railway and Copper Company, capitalized at $10,000,000. The new company is said to have $250,000 in its treasury, and will proceed to develop ore reserves in the mines. This is badly needed as adequate development was not maintained ahead of extraction.

At Georgetown, the 250-ton mill for the treatment of the Pelican dump and customs ores will be started in a few days. At Red Cliff a number of new concentration plants are under construction and will be completed this summer. The mines are busy getting out ore for treatment in these new mills.

In the San Juan region, the Revenue-Virginius of Ouray which has been closed on account of shortage of water is starting up again. The Virginius vein was first tapped by the Revenue tunnel on the Uncompahgre side of the divide, and followed through the main range to the San Miguel side, where the company is working on the Montana, its extension, which has its outcrop in Smuggler Basin. The chief values are in silver and gold.

Great interest was manifested in the Denver visit of Chief Forester Pinchot, who seemed anxious to meet the miners and hear the many complaints made against his policy, and if possible to remedy the wrongs complained of. That the practice of taking up mining claims simply for the purpose of acquiring the timber on them has been extensively carried on is well known, and this the forester very properly means to put a stop to; but that injustice has been done to a great many genuine prospectors by the subordinates of the Forest Service is also certain.

The prospector who has located his claim in good faith and done his best to develop it according to his means, should not be subject to the dictum of a $65-a-month ranger, who has no knowledge of mines or minerals, as to whether he has a valid mineral claim. The present condition of affairs, however, is unquestionably this: that owing to the misplaced zeal, sometimes arrogance and generally ignorance of the subordinates in the Forest Service, hardly any prospecting for metalliferous mines is being done on Colorado mountains which now are nearly all in the national forests. Mr. Pinchot has informed me that in future all disputes with miners and prospectors as to the validity of a claim within the forest reserves will be passed on by a thoroughly qualified mining expert.

Indianapolis

April 5—By virtue of a decree of the Federal Court, Master-in-Chancery Daniels will offer for sale at Bloomfield on May 1, the real estate, personal and mixed property, rights and franchises of the Southern Indiana Coal Company, including the Lattis Creek mine, the Greene County Coal Company mine, Tower Hill mine, Midland mine, Mammoth Vein mine, Linton Semi-Block mine and the Keystone mine; also all the coal and other minerals underlying the surface of a large acreage of lands in Greene county. The sale of this property is regarded as the largest transaction in coal lands and coal-mining property that has taken place in Indiana for some time. The indications are that the sale will attract a large number of investors.

Toronto

April 3—The Ontario government has appropriated $50,000 for the construction of a wagon road from Charlton to Gowganda. A grant of 2,000,000 acres of land will also be made to the Canadian Northern railway as an inducement to construct a line from Sellwood to Port Arthur which, in addition to opening up a fine agricultural region, will tap the Gowganda and other mineral districts. This offer is conditional on the commencement of the road within one year and its completion by the end of 1913.

Mexico

March 26—The movement for the organization of an institute of mining engineers and metallurgists for Mexico is taking definite shape. An organization committee, mostly from Mexico City and vicinity, has held several meetings to formulate the constitution and by-laws and to arrange for a general meeting to perfect the organization, to be held in June or July in Mexico City. The new society will be known as the "Instituto Mexicano de Minas y Metallurgia."

The mining interests of Mexico are still concerned about the effect of the merger of the railroads and the resulting government ownership through a control of a majority of the stock in the consolidated company. The proposed raise of ore rates has been held in abeyance by the Federal commission, because of the depressed condition of mining in the country. It is uncertain when the advance may go into effect, and this is holding back much new work. The government rate commission also has under consideration a raise in freight rates on coal from Gulf ports to protect the growing coal-mining interests of Coahuila and Nuevo Leon from the imported American coal. The smelters and mines are affected adversely by these propositions and have succeeded in securing more or less effective modifications of the proposals backed by the coal-mining interests.

A plant to demonstrate the application of the Delprat & Potter zinc-flotation process will be erected in Mexico City by an English company of which H. Lawrence Read, of Australia, is the managing director. The company controls other processes, and proposes to engage extensively in the testing of low-grade and complex ores in the Mexican field.

The zinc interests of Mexico are much concerned over the proposed zinc-tariff legislation in the United States. The 20 per cent. ad valorem duty which has been imposed during nearly two years has greatly curtailed the operations in Mexico in zinc mining. With the duty removed, the zinc miners are confronted with the arbitrary imposition of a lead-tariff tax on ore containing over 0.3 per cent. lead, with the prospect of the enactment of a new tariff on zinc ore. Some zinc ore is being shipped from Mexico to Europe and it is likely more will go to that market in the future especially if a high tariff results from the campaign in the States.

The smelters of Mexico are now, for the first time, confronted with a scarcity of silicious ores resulting from the general introduction of cyanide treatment, and the curtailing of operations in the silicious silver-ore producing camps due to the low price of silver.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

Southern Steel Company—Notwithstanding the filing of several petitions in the Federal court at Birmingham, Ala., asking for a review of the order of sale in bankruptcy of the properties of this company, there appears to be no doubt that the sale will come off on the date originally fixed, April 12. The reorganized company is prepared to make the purchase. Much litigation is still promised in this case.

CALHOUN COUNTY

Cumberland Mining Company—This company, with headquarters at Knoxville, Tenn., has bought property at Tredegar, where it will mine quartz and put up a grinding plant to turn out pure silica.

Alaska

JUNEAU

Alaska Mexicon—February: 120-stamp mill crushed 18,510 tons; estimated value of bullion, $42,308. Saved 343 tons of sulphurets; estimated value, $29,169. Working expenses, $29,177.

Alaska United—February: Ready Bullion claim 120-stamp mill and the 700-ft. claim 100-stamp mill crushed 28,165 tons; estimated value of bullion, $38,893. Saved 476 tons of sulphurets; estimated value, $26,376. Working expenses, $52,024. The 700-ft. claim mill lost several days during the month owing to lack of water, in consequence of the severe weather.

NOME

Reports from the Innoko and Candle districts give promise of satisfactory production and many new strikes have been made. Fifty new outfits are about to begin work at Center creek, in the immediate vicinity of Nome. Twenty outfits are at work on the Submarine beach. The Pioneer Mining Company, on Little creek, is working with full force. A large number of outfits are at work at Black creek on low-grade gravel.

Arizona

COCHISE COUNTY

Bowie District—An aërial tramway is being installed by Mr. Howle to transport ore from his mine to the station. The main working tunnel is now in about 300 feet. It is reported that Mr. Howle is arranging to ship 100 tons daily to the Calumet & Arizona smelter at Douglas. The ore is said to carry a fair amount of gold.

Mascot—Captain Tibbitts is in charge and is reported to be working in good copper ore.

Cowboy—Pence Brothers, owners of the Overland Gold and Copper Company, are doing some development work. The ores carry both gold and copper.

California

CALAVERAS COUNTY

Morgan—When the new air compressor, recently received at Irvine, is ready to run, quite a lot of development work will be done.

EL DORADO COUNTY

Sunshine Mining and Development Company—Final payment has been made on the claims bought of A. A. Macdonald, near Grizzly Flat. B. F. Hulings and Robert Martyr, of Sacramento, who are principally interested, will carry on active mining and install new machinery as soon as weather permits.

INYO COUNTY

The proposed purchase of the Needles smelter by the Tecopa Mining Company has fallen through.

Buckeye—The property in the Fish Spring hills consists of a quarry of low-grade ore. A double-compartment shaft is being sunk.

Harrisburg—This place has had its question of ownership cleared up, and men are grading for a new mill. This is in Skidoo district.

Inyo-Coso—The mine at Junction, 20 miles south of Darwin, is being developed and the mill has been finished.

Lane—Reynolds & Peterson, lessees, are shipping high-grade ore to the smelter at Keeler.

KERN COUNTY

Simmons—This property at Piute has been bonded to R. E. Galloway, J. A. Ross and G. E. Parker. Machinery has been purchased and work begun. The name has been changed to the Monte Carlo Mining Company.

MARIPOSA COUNTY

O. A. Harland and others, of San José, are building a new custom mill at Hornitos to handle ore from the mines of that district which have no mills. There are several dozen small mines in that locality without mills.

Sorrell—This mine, F. L. Wallingford, superintendent, has a new mill which is nearly completed.

Exchequer Mining and Power Company—At the annual meeting the price of electricity per horsepower was fixed at $7 per month for the mines at Hornitos. J. J. LeTourneau, of Duluth, Minn., was reelected president and Dr. E. S. O'Brien secretary and manager.

MODOC COUNTY

Hess—The quartz mill put up on this mine at Canby has been started. The gold is very fine, and there are doubts as to whether it can be saved by milling without a cyanide plant. This is the only quartz mill in the county.

Fort Bidwell Consolidated—George F. Atkins, secretary, states that a 6-in. streak of ore in the Mountain View claim is panning out very well; and in addition to this there are 6 ft. of ordinary milling ore in the Sugar Pine claim. A 10-stamp mill will shortly be installed.

MONO COUNTY

Lucky Boy—T. J. Hubbard, lessee, is shipping a carload of ore per day. About 70 men are at work. The whole property is being worked by leasers.

NEVADA COUNTY

Native Son—This property, owned by Wisconsin men and managed by J. Bishop, at Nevada city, is to be operated on a larger scale. A new tunnel is to be run.

Champion Mines—Thirty of the stamps are dropping on leasers' ore, and 20 more are working on ore from the Home claim. There are 54 tributers at work, and about 20 more men are working for the company.

Pittsburg-Gold Flat Mines Company—The old drain tunnel has been tapped and is being repaired. The shaft is being repaired down to the drain tunnel. The old water-power hoist has been put in order and the foundations for the new compressor are nearly finished. Excavations are being made for the new electric plant. The Pittsburg will be worked on a large scale when the water is all out.

PLACER COUNTY

Orpheum—At the Ophir, adjoining the Gold Blossom, the electric hoisting and pumping plants have been installed, and a new stamp mill will shortly be purchased.

Lewis Hill—At this property, near Newcastle, a line of operation has been laid out showing that a short extension of the workings northward will open into the pay gravel.

PLUMAS COUNTY

Seneca District—Mark Miller has struck a rich spot in his gravel mine near the old Cariboo diggings. The new quartz mill in Butte valley has had the effect of bringing a number of people into the section. Dunn Brothers have added five stamps to their five-stamp mill.

SHASTA COUNTY

Winthrop—About 70 tons of ore are being shipped daily to the Bully Hill smelter. The completion of the railroad has made it possible to make these shipments from Copper City.

Midas—The clean-up for February approximated $30,000. P. J. Harney has been elected president of the company in place of Captain Roberts, deceased.

SIERRA COUNTY

Downieville—The quartz blocked out at the Grey Eagle mine is of a satisfactory grade. Concentrators are being installed in the Papoose mill. It is expected that the York mine will soon be reopened.

Von Humboldt—Arrangements are being made to reopen this property in American Hill district. Austin & Spencer, sheepmen of the foothills country, are putting up the capital. The district is heavily timbered and well watered. There are both gravel and quartz claims.

SISKIYOU COUNTY

San Jose Ditch—This old ditch, starting about 11 miles above Scott Bar, is being cleaned out and repaired to bring water to Scott Bar mines.

TRINITY COUNTY

Yellow Jacket—J. F. Tourtelotte, one of the owners of this group in East Fork district, states that the company is driving the tunnel ahead on the pay shoot, and the 30-in. ledge is looking well. A new shaft is also about to be sunk on the ore.

TUOLUMNE COUNTY

Green Spring—J. P. Casaneve and C. E. Wilcox have purchased a half interest in this mine for $15,000, and will pay 20 per cent. of the gross output to the original owners until the last payment is made.

Ellen Winton—E. H. Truett, the new owner, has commenced the work of development.

Jupiter—This mine, near Jacksonville, has been bonded to A. F. Cook, of Alameda, and development work is under way.

Colorado

HINSDALE COUNTY

Indiana & Colorado—W. T. Moneyhun, manager, is planning to erect a concentrating mill on Henson creek, near Lake City.

LAKE COUNTY—LEADVILLE

Iron Silver—The properties of this company were closed for three days, out of respect to the memory of Waldemar Arens, who was general manager and financial agent of the company for 30 years. The mines have resumed operations and are producing about 400 tons daily of different grades of ore.

Little Evelyn—Active prospecting work is in progress in lower South Evans Gulch, through the White Cloud shaft. Several stringers of ore carrying good gold values have been encountered.

Sedalia—This property has been sold at sheriff sale to the Cribbage Mining Company for $50,100. The latter company is closely allied with the Yak Tunnel interests.

Yak Tunnel—The bore is now passing the Fortune territory and entering into Big Evans Basin. It is being driven at the rate of 350 ft. per month.

SAN JUAN COUNTY

Gold King—Between 4000 and 5000 tons of concentrates which have been tied up by the blockade on the Gladstone road, were shipped out during the month of March.

Hercules—The mill on this property is shipping concentrates at a rate of over one car per day.

Tiger—Harry Hilderman and associates, who are leasing a block of ground on this property, have made a shipment of $40 ore.

SAN MIGUEL COUNTY

Crown Point—The old Suffolk mine and other properties at Ophir are to be operated by the newly organized Crown Point Mining and Milling Company. Geo. C. Franklin, general manager. The mill is being remodeled and other improvements are being made. John Lape, superintendent.

TELLER COUNTY

Acacia—The Burns lease is now shipping ore of smelting grade from two ore shoots on the 250-ft. level. In the South Burns mine shipping ore has also been found and royalties between March 1 and March 25 have amounted to $1850. Smelting ore is being shipped from the Morning Star claim. A new shoot has been opened on the extension of the Pinnacle vein.

White City—Ore of low milling grade is being shipped from the surface workings of the Friday claims. A 3-ft vein of smelting ore has been found on the 200-ft level.

Lucky Corner—A shipment of five cars of high-grade ore has been made from this mine. The ore has heretofore been brought to the surface through the Ophelia or Moffat tunnel, but a new ore house is now being constructed at the shaft.

Delmonico—A high-grade shoot, liberally sprinkled with sylvanite, has been encountered on the 700-ft. level of this property on Bull cliff.

Ophir—Work is in progress on the new high-grade orebodies recently exposed at the 700- and 1000-ft. levels on Raven hill.

Cripple Creek—New information, charging conspiracy and obtaining money under false pretences, has been filed in the District Court against the six men recently arrested on a charge of "salting" gold ore shipped to the Golden Cycle mill from claims leased by them.

Indiana

GREENE COUNTY

As a result of a conference of mine officials and a Mine Workers' committee from the Island Valley mine near Bloomfield, and officials of the State operators and mine workers' organizations, four of 10 miners suspended for loading "dirty" coal, will be reinstated, and six will be suspended indefinitely. The dirty-coal proposition is the most serious one in the mining fields at present. The wages contract leaves the matter somewhat indefinite as to just how much dirt a miner can load.

Trouble is brewing at the Summit mine over the slate and dirty-coal question. The district officers have ordered the miners to clean up the slate and dirty coal.

Vandalia mine No. 3 near Linton has been closed. This mine is one of the old-timers of this field. The land is about worked out.

A riot occurred among the American and the Hungarian miners at the Bogle mine, three miners being killed and five injured. As a result the foreigners were driven out of the district and the mine superintendents have advertised for additional American miners.

VERMILION COUNTY

Deputy mine inspectors have filed 14 affidavits for violations of the State mining laws at Clinton. Ten of these are against miners for drilling beyond cutting and one against a miner for opening a powder keg with a pick. Three mine bosses are under charges of not conducting the ventilation of the mines properly. They had been working more than 50 persons on one air current, which is contrary to law. The mine inspectors say that there are many violations among the miners and that they have to be very vigilant to keep track of all of them. Men take chances in violating the law in order to make a part of their work easier.

The Miami Coal Mining Company, with offices in Clinton and which owns much good coal land in Vermilion county will soon begin the sinking of a shaft for a new mine near Clinton. H. V. Sherburn, is president.

Maryland

Consolidation Coal Company—The stockholders at the recent annual meeting in Baltimore, voted to increase the capital from $10,250,000 to $20,000,000. Of the new stock $6,150,000 will be issued to present stockholders as a dividend of 60 per cent., representing additions to property made out of earnings. The remaining $3,000,000 will be held in reserve, to provide for future additions.

Michigan

Copper

Keweenaw—Stamping at the Phœnix mill was discontinued after running an extensive test on the Medora shaft rock, the results being unsatisfactory. At the 11th level drift a formation known as the west fissure vein, was encountered, but upon farther opening at the 13th level it was found practically barren. Further development work will be carried on from this point, and during the summer, openings will be made on the Osceola and Kearsarge lodes. The office of the company was recently moved from New York to Hancock, with C. A. Wright, Jr., secretary and treasurer in charge.

Hancock—The crosscut which connects No. 1 and No. 2 shafts at the 13th level is completed. This will be the main working passageway through which all the rock from the levels above will be hauled to No. 2 shaft. This shaft is below the 18th level, and at that point preparations are under way to drive another crosscut to the Hancock lode. This crosscut will handle the rock between the 13th and 18th levels.

Copper Range—The improved conditions in the Trimountain property continue. The best showing is at No. 4 shaft in the drifts below the 11th level. Shafts Nos. 2 and 3 are opening better ground at the 14th level. Diamond-drill operations are in progress on sections 7 and 8, which are held under option from the St. Mary's Mineral Land Company.

Quincy—The wooden shafthouse over the Pontiac has been completed. This shaft is down about 350 ft. in encouraging copper ground.

Franklin—The Pewabic lode has been reached at the 25th level by means of the crosscut and the formation is well charged with copper. Drifting continues on this lode at the 13th and 24th levels with undiminished richness.

Arcadian—At a meeting held at Houghton reorganization was perfected. The new company is to be known as the New Arcadian, organized under the laws of Michigan with a capital of 150,000 shares, par value, $25, $10 paid in. The old officers and directors were reëlected. It was also decided to give the New Baltic Exploration Company an option on the quarter section of land in Section 16.

Victoria—Good copper-bearing ground continues to be exposed at the drift extending from the 22d level; this is the most important development at the property in a long time. The mine is operating on ore yielding about 13 lb. of copper to the ton. The hydraulic plant is being hindered in its operation by lack of sufficient water due to the continued cold weather.

Seneca—This company is drifting from the first level of its shaft at a distance of 200 ft. from surface. The formation is badly shattered with very little copper showing.

Ojibway—The crosscut from the 650-ft. level of No. 2 shaft has reached the lode. The shaft is down to the 800-ft. level. At No. 1 shaft sinking continues toward the 800-ft. level.

Ahmeek—The structural steel for this company's new stamp mill has been delivered and is being rapidly erected. Excavating is under way for the pumping station. Work at the two new shafts is being vigorously pushed. At the central crushing plant, which handles the rock from the two producing shafts, a large electric motor has been installed to drive the two 24x36-in. rock crushers.

Lake—The shaft is sinking below the third level. At the third level the crosscut is being driven westward to cut the main lode.

North Lake—Diamond-drill hole No. 3 is down over 700 ft.. The No. 4 hole is down about 225 ft. and entering the ledge. Nothing of any importance has been revealed.

Mass—A new copper-bearing lode was opened by means of a crosscut driven from the 27th level of "A" shaft. This lode is about 125 ft. from the Evergreen lode, which, together with the Knowlton, have been the main working formations of the company. The location of this lode was first revealed by a diamond-drill core.

Michigan—This company has opened an old adit and has found a very encouraging grade of stamp rock.

Tamarack—The report for the year 1908 shows a loss of $153,217 incurred by operations. Rock stamped, 654,897 tons; mineral obtained, 19,134,429 lb., containing 66.93 per cent. refined copper, or 19.6 lb. of copper per ton of rock. The total cost of the refined copper was 15.24c. per lb. Mining, smelting and other expenses were $1,870,191; construction, $32,851; exploration work, $49,537; assets, $1,791,450; liabilities, $1,314,114; balance of assets, $477,366.

Nevada

Esmeralda County—Goldfield

February Premier Lease—Fifteen men are employed. A crosscut is to be run east from the 220-ft. level.

Goldfield Consolidated—Development work on the new strike proves the extent of the orebody to be larger and richer than first reported. Eight cars of ore recently shipped to the Western Ore Purchasing Company yielded returns in excess of $150,000.

Esmeralda County—Mina

Marble Quarry—Davis Brothers, of Yerington, recently purchased the quarry, and will equip it with modern quarrying machinery. They also own 60 acres adjoining, thus making a property of about 125 acres. The marble is jet black traversed with green, gold- and copper-colored veins and takes an extremely high polish.

Esmeralda County—Hawthorne

Lucky Boy—The Alamo lease paid its first dividend March 24, amounting to $25,000, or 10c. per share. At present the mine is shipping an average of 1000 sacks of ore per day. Sixty men are now employed at the lease and 125 horses are engaged in hauling the ore to Hawthorne, six miles distant.

Humboldt County—Winnemucca

Rose Creek—Molybdenite has been found in several places by A. Zeidler on a group of claims about 10 miles west of Winnemucca. A shaft will be sunk and prospecting carried on.

Humboldt County—Seven Troughs

London Syndicate—Work is being rushed on the mill as fast as possible. The tube mill was shipped from San Francisco March 20. The sampler is being put in place and the cyanide department is nearly completed.

English George—The clean-up of a 10-days' run in the Badger Hill mill resulted in 65 lb. of amalgam valued at nearly $4000. The ore from the lease is now averaging between $15 and $20 per ton.

Reagan—The clean-up in the Mazuma Hills mill treating ore from this lease resulted in a recovery of over $6000 for 100 tons of ore treated.

Humboldt County—Chafey

Chafey Mines Company—This is a newly organized company, capitalized at $1,000,000 in $1 shares. The company will operate the Black Hole property and two additional groups of claims. Mr. Chafey is president of the company and H. C. Oastler, secretary.

Lyon County—Buckskin

Kennedy Consolidated—Work is to be resumed by Stebbins & Green who have a two-years' lease. Water has been encountered in the shaft, now 210 ft. deep, and a pump will be installed.

LYON COUNTY—YERINGTON

Nevada-Douglas—L. Humphrey, consulting engineer, in a report to this company, estimates 599,530 tons of 5.4-per cent. copper ore available. He also estimates 246,700 tons of probable ore averaging 3.69 per cent. copper.

LINCOLN COUNTY—PIOCHE

Maopa Forest—The president has signed a proclamation creating an addition of approximately 45,000 acres to the Moapa national forest reserve. This addition is at the northwest corner of the Charleston division.

Nevada-Utah—The body of silver-lead ore opened on the 700-ft. level of the Day mine is now said to show a width of 130 ft. and limits not yet reached. The same body of ore has been opened on the 600-ft. level and on the 800-ft. The ore is said to assay 10 to 15 per cent. lead and 20 to 40 oz. silver per ton.

Great Eastern—A large body of ore containing copper, nickel and platinum has been cut on the third level of this mine at Bunkerville.

Lead King—The owners of this mine have given a lease to some Goldfield operators, who expect immediately to inaugurate developments.

NYE COUNTY—BULLFROG

Montgomery Shoshone—It is estimated that the tonnage for March was in the neighborhood of 6000 tons. Eleven bars of bullion were shipped during the week.

Tramps Consolidated—A car containing 18 tons was shipped last week to Needles by three sets of leasers. The bulk of the shipment came from the Kuliachi-Vucovich lease on the fourth level.

NYE COUNTY—JOHNNIE

Johnnie Consolidated—As a result of 13 days' run at the mill a bar of bullion worth $10,000 was shipped from the property last week. About 100 tons are treated daily, by the 15 Nisson stamps. The shaft is 750 ft. deep.

WHITE PINE COUNTY

Giroux—In the report for the year ending Jan. 31, 1909, the president states that milling was commenced in November, but the crushing machinery proved inadequate. Additional Chilean mills and rolls brought the work up to estimated capacity. The ratio in concentration was about 12½:1. The Alpha shaft was continued to the 1200-ft. level, the flow of water increasing with depth. A winze sunk on the orebody showed a width of 4 to 40 ft., the high-grade ore being maintained for a distance of 130 ft. Early in January a crosscut driven to connect with this winze penetrated a body of massive copper ore. About the end of 1908 a proposition was made to purchase the property for $6,000,000, which offer was declined. This was followed by the purchase of a large interest in the company's stock by Thomas F. Cole and associates. Energies will still be directed to the development of the ground opened by the Alpha shaft, which is confidently expected to show a large deposit of high-grade carbonate and sulphide ore. Further developments will be prosecuted in the porphyry ore to permit of milling on a larger scale. A large portion of the porphyry deposit can be mined by steam shovel. At present the treasury has $1,000,000 available.

Cumberland-Ely—Production in March was 1,636,171 lb., compared to 1,233,492 in February, and 1,094,218 in January.

Nevada Consolidated—Production in March was 2,169,088 lb., compared to 1,035,000 in February, and 1,451,000 in January.

Montana

BUTTE DISTRICT

British Butte—The dredge at this property has been closed down due to the burning out of one of the motors. Operations will be resumed as soon as the necessary repairs can be made.

Butte Superior—It is stated that a zinc mill will be erected near the Black Rock shaft of this company. Large bodies of zinc ore have been opened up in recent development.

East Butte Extension—Operations have been resumed. The work is being done at a depth of 250 ft., the bottom level of the property.

Tuolumne—Work has been partially suspended while the new equipment is being put in place. The shaft has reached a depth of 1395 ft. It is expected that crosscutting for the vein on the 1400 level will be in progress before May 1.

JEFFERSON COUNTY

Corbin District—Four tunnels are being driven on the claims of the Corbin Copper Company. Stephen R. Dow, president, has charge of the work.

New Jersey

SUSSEX COUNTY

A corps of engineers and assistants has been exploring the workings of the old zinc mine at Ogdenburg, which has been closed for a number of years. This has given rise to a report that the mine will be reopened.

North Carolina

JACKSON COUNTY

Consolidated Nickel Company—Machinery is arriving and being erected at the mine and smelter, near Webster

Oregon

GRANT COUNTY

Comer—These cobalt mines were not operated during 1908. However, it is expected that work will be resumed in 1909.

LANE COUNTY

Black Butte Quicksilver—J. B. Rouse, lumberman, has begun suit against this mining company to recover money which he claims is due him.

Le Roy—The management intends to resume work when patents are secured. The mine is equipped with air drills and a compressor plant.

Pennsylvania

BITUMINOUS COAL

Isabella-Connellsville Coke Company—This new company has secured control of practically all of the coal lands recently bought by J. V. Thompson, of Uniontown, in Fayette, Greene and Washington counties. The purchase is the largest area of coking coal in Pennsylvania, outside of that owned by the H. C. Frick Coke Company. The managers of the new company include John C. Bryden, who is president; Daniel Beach, L. G. McCrum, J. R. Nutt and other well known coal and iron men of Pittsburg and Cleveland. Charles M. Schwab, of the Bethlehem Steel Company, is also said to be interested.

ANTHRACITE COAL

In the appeals of the Delaware, Lackawanna & Western and other companies from the decision of the Circuit Court, the Pennsylvania Supreme Court has reversed the decision of the lower court, and holds that there must be a reassessment of the property of the companies. The ground of the reversal is that the coal property was assessed for taxation at a higher percentage of its value than surface property. The appellants are, therefore, entitled to a reassessment on a uniform rate of valuation.

Plymouth Coal Company—This company has resumed possession and operation of the Dodson and Black Diamond collieries near Wilkes-Barre, the receiver having been discharged by the court. John C. Haddock, president of the Company, announces that the sum of 1c per ton of coal mined will hereafter be set aside as a trust for the benefit of employees who may be injured in the collieries.

Philadelphia & Reading Coal and Iron Company—This company's statement for February and the eight months of the fiscal year from July 1 to Feb. 28 is as follows:

	February	Eight Mos.
Earnings	$2,497,771	$22,803,425
Expenses	2,511,804	21,642,155
Net or deficit	Def $ 14,033	N $1,161,270

For the first time this year the expenses for the month exceeded the receipts.

South Dakota

Custer County

The Westinghouse mica mill, near Custer, has resumed after a month's shutdown. No cause for the suspension has been given out. The raw product from this mine is shipped to Denver.

Lawrence County

Elliptic—Much interest has been aroused by the discovery of free-milling ore in the Maitland district. The ore is similar to that of the Homestake and intensifies the belief that the great Homestake ledge continues northwest at an increasing depth.

Homestake—At the regrinding plant hard quartz ore from the lower workings has been substituted for imported pebbles in the tube mills.

Definite information is now available in regard to the hydroelectric plant planned by the Homestake company. Work is to commence May 1, and the plant should be in operation by November, 1910. The capacity is to be 7000 horsepower and the power is to be used in the stamp mills, regrinding plant, the two leaching plants, the slimes plant, the machine shop, foundry and pattern shop. For the stamps alone, 2500 h.p. is required, while the compressor at the Ellison hoist will use 1000 more. The entire flow will be taken from Spearfish creek, four miles below Savoy, carried about six miles through a 7x6-ft. concrete-lined conduit with a fall of 700 ft. Eight tunnels varying from 2000 to 4000 ft. will be driven, for which work eight 5-h.p. electric drills will be used. The total cost is estimated at $1,000,000.

Tennessee

Tennessee Copper—It is rumored that the directors will not declare a dividend covering the operations for the last six months. The matter of a contract for disposal of the sulphuric acid output of the company is still in the air.

Utah

Beaver County

Cedar-Talisman—Sinking and drifting on the 500-ft. level is now under way and the property will be in shape to ship ore in the near future.

Utah Gold and Copper—The main tunnel on this property has entered the second vein 15 ft. without finding the wall. The upper tunnel shows a large amount of lead ore and plans for the erection of a mill are now being made.

Beaver Combination—D. H. Ferguson of the Cedar-Talisman has been put in charge of this property also and development work is to be undertaken at once.

Juab County

Ajax—The mine is shipping about 500 tons per month, part going to the Tintic plant and part to the Salt Lake smelters. Development work is being done on the 1000-ft. level.

Opex—The shaft has reached the 2000-ft. level, and will be continued for a distance of 500 ft. before drifting is started. The company is expecting to find the extension of the Centennial-Eureka orebodies.

King William—Development work on the 500- and 1000-ft. levels is being carried on through the Eagle and Blue Bell shafts.

Centennial-Eureka—The large body of ore found on the 2000 level resulted in continuing the sinking of the shaft to a depth of 2225 ft. A station is now to be cut and sinking of the shaft discontinued until an electric pump can be installed to handle the water, after which the shaft will be sunk to the 2500 level.

Utah Consolidated—The shaft of this Tintic property has attained a depth of 300 ft., and it has been decided to sink to the 400 level. Th crosscut from the 300 level has gone a distance of 250 ft. and work is to be continued until the orebody is encountered.

Mammoth—A considerable tonnage of ore is being piled up by leasers at this mine awaiting satisfactory smelting arrangements.

Tintic Smelter—Ore is being received from outside the Tintic district from such properties as the Dalton & Lark, of Bingham, the Yellow Pine at Gene, Nev. and the Horn Silver at Frisco.

Bullock—Ore of the smelting grade has been encountered in the crosscut on the 210-ft. level.

Iron Hat—A contract has been let to Fred Wahlberg and Conrad Anderson to sink the shaft 100 feet.

Salt Lake County

Bingham-New Haven—The General Engineering Company of Salt Lake has been awarded a contract for a 100-ton concentrating mill at Bingham. The mill is to be in operation by July 1.

Bingham Central-Standard—Shipping ore has been found in the last 100 ft. in the Mountain Maid tunnel which is being worked on company account. Leasers on the Jeff Davis and Moscow tunnels are also taking out shipping ore.

Summit County

Keystone—At a depth of 150 ft. in the incline shaft from the tunnel, 8 ft. of second-class ore have been found.

Tintic-Silver Crown—M. L. Snow, manager, announces the sale of 381,000 shares of treasury stock to Eastern men, and extensive development work will be started at once on the 540 acres controlled by this company.

Tooele County

International Smelting—The contract for grading for the site of the new smelting plant in Pine cañon has been let to the Ely Construction Company.

Virginia

Tazewell County

Big Vein Pocahontas Coal Company—This company recently leased a large tract of coal land, on which are two small mines. One of these mines will be closed for the present; the other will be enlarged and provided with new machinery, increasing its capacity to 1500 tons daily. Thomas T. Boswell, Baltimore, Md., is president.

Washington

Snohomish County

Arsenic Tariff—The Everett Chamber of Commerce adopted a resolution requesting congress to secure the imposition of a tariff on arsenic to the extent of at least 1½c. a pound on the mineral in the ores, and 2c. on white arsenic. F. H. Brownell, local attorney for the American Smelters Securities Company, states that the total consumption on this continent is about 7000 tons annually, and that the maximum production of 1500 tons at the Everett plant has led to a reduction in price by European producers who pay 30 per cent. less wages and have the advantage of cheap water transportation.

Monte Cristo—This property is reported sold to the American Smelters Securities Company, a transaction which in part is verified by its attorney, F. H. Brownell.

Snohomish County—Index

Nonpareil Copper—This company will resume mining operations. Supplies are being packed up to the mine, and the drift in which a vein of copper ore was uncovered last fall will be continued.

Chewawa Lead and Smelting—At the mine on Red mountain a tunnel has been driven about 375 ft. Several orebodies have been crosscut. The outlook for the mine is very bright and the owners are greatly pleased with the progress made.

SNOHOMISH COUNTY—SILVERTON

Imperial—A strike of high-grade ore was made recently at this mine. The ore is gold-bearing.

West Virginia

KANAWHA COUNTY

Kanawha Collieries Company—This new company has bought the coal land and mine at Graham Mines, on the line of the Coal and Coke Railway. Electrical equipment and other new machinery will be installed at the mine. E. D. Leach, Moundsville, W. Va., is president of the new company.

MONONGALIA COUNTY

Arrangements are being made to open up the Millholland tract of 12,000 acres, owned by the Fairmont Coal Company.

Canada

BRITISH COLUMBIA

Crow's Nest Pass Coal Company—The coal-handling plant built by the C. O. Bartlett & Snow Company, of Cleveland, O., at the Michel mines, was started up in February, and is now handling the entire output of the mines. It is the largest plant of the kind in Canada. It is stated that this plant does the same work with 17 men in 12 hours that formerly required 68 men working 12 hours.

BRITISH COLUMBIA—ROSSLAND

Consolidated Mining and Smelting Company—A fire on the 400-ft. level of the Center Star mine did considerable damage to mine timbers before it was extinguished. A large force of men was engaged about 20 hours fighting the fire, under the supervision of W. H. Aldridge, managing director, R. H. Stewart, mine manager and M. E. Purcell, superintendent. Work has been resumed in the mine.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended March 27 were as follows: Crown Reserve, 114,540 lb.; Cobalt Central, 40,000; Chambers-Ferland, 60,000; City of Cobalt, 53,592; Kerr Lake, 62,000; La Rose, 260,000; Nipissing 258,770; Right-of-Way, 62,008; Temiskaming & Hudson Bay 46,600; total 957,510 pounds.

Beaver—The annual meeting was held in Toronto March 29, when the shareholders granted authority to the directors to increase the capital stock from $1,500,000 to $2,000,000, in order to provide funds for continuing development operations, with the proviso that the new issue should not be sold at less than 10 per cent. of its par value.

Little Nipissing—Good ore has been struck in the vein on the Peterson Lake lease in drifting at the 160-ft. level. The vein, 10 in. wide, has become rich in native silver estimated at 2500 oz. to the ton.

Temiskaming—A vein with good silver contents about 10 in. in width has been discovered at a depth of 250 ft. where the drift was continued into the Gans location.

ONTARIO—GOWGANDA DISTRICT

Bartlett—H. T. Pemberton, manager, recently brought samples of ore to Toronto from vein No. 1 on the southwest claims, weighing about 900 lb. Two specimens, weighing over 150 lb. each are almost solid calcite and silver.

NOVA SCOTIA

Dominion Coal Company—This company and the Dominion Steel Company, on March 30, entered into two agreements with a view to the settlement of the dispute over the coal contract which is involved in the pending litigation, the coal company at the same time making a payment of $2,750,000 on account of the damages claimed by the steel company. The agreements are given at length in the *Montreal Gazette* of March 31; the substance is as follows: The coal contract of Oct. 20, 1903, is declared to be in full force and effect and the steel company is permitted within 10 days to deliver to the coal company notices of its requirements of coal for April, May and June, 1909, not exceeding 80,000 tons per month.

The steel company may in the pending action recover damages suffered from Aug. 1, 1906, to date, but no damages shall be assessed therein for the unexpired term of the contract. Neither party shall be precluded from bringing action for any breach of the contract which may hereafter occur.

The steel company is to file a statement of the particulars of its claim, and within two months also a complete detailed supplementary statement of all damages caused by the short deliveries of coal by the coal company, or the partial shutting down of the steel company's works by reason thereof, the coal company to have four months (exclusive of delay caused by the steel company) to verify the particulars of the claim, and for that purpose to have the right to examine the works, books, accounts and documents of the steel company.

The payments on account shall be without prejudice to the right of the coal company to dispute any of the items of the steel company's claim.

After the conclusion of the examination an amicable settlement of the litigation is to be reached, if possible, before proceeding to assess the damages claimed before the referee appointed by the court.

YUKON—DAWSON

Much activity prevails, in connection with the opening of the mining season. Many people are coming in from "the outside," chiefly by stage or private conveyance from Whitehorse, while scores of teams are hauling supplies to the various creeks. Mining companies are hurrying their preparations for either ordinary hydraulicking or dredging. The Guggenheim interests, especially, are preparing for extensive operations throughout the ensuing season; beside putting on hundreds of men at mining, they will build 12 miles of new ditch on Bonanza creek. Other power schemes are being worked out and more dredging enterprises will be undertaken than in any previous year.

Mexico

CHIHUAHUA

Burns & Daly—A strike of good copper ore is reported about 15 miles from Ahumada. A small shipment was recently made to the El Paso smelter. This property was denounced last year by J. L. Hollister, but is now owned by Burns & Daly.

Mexicana—A good grade of zinc ore is being shipped to the Kansas smelters. The property is 20 miles west of the Burns & Daly mine.

Mexico Northwestern Railway Company of Canada—S. F. Pearson, president; E. D. Kenna, Enrique C. Creel and Walter Gow, vice-presidents. This company has lately been organized and incorporated in Canada to build and operate railroads in northern Mexico. Capital stock, $40,000,000.

MEXICO

Esperanza—February: Mill, 22 days, crushed 11,569 tons of dry ore. Concentrates and 31 tons of ore shipped to smelter. Estimated value of bullion produced, $116,809; estimated value of concentrates, $31,569; receipts from rents and other sources, $438. Total, $148,816. Less—Working expenses, including development, marketing of bullion, and freight and treatment charges on concentrates shipped to smelter, $93,989; allowance for depreciation of plant, $2500; consulting engineers' fees and New York office expenses, $2187; total, $98,667. Balance, $50,149. Estimated profit, £10,026. Of this there has been expended on construction account $2136. Feet of development work, 968. Low profit is due to smaller tonnage of ore treated, arising from the continued changing over from the old to new mill, and the short month.

SONORA

Greene-Cananea—Production in March was 4,000,000 lb., compared to 3,894,000 in February and 3,848,000 in January.

South America

BRITISH GUIANA

Exports of gold for the two months ended Feb. 28 were 7417 oz. bullion in 1908, and 8081 in 1909; an increase of 664 oz. The bullion reported this year was equal to $130,609, or 6754 oz. fine gold.

Exports of diamonds for the two months were 307 carats, of $1846 value.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 7—The anthracite labor question is still unsettled, although no strike nor lockout has taken place. The companies agreed to a continuance of work under the existing agreement for a short time, or until further negotiations could be carried out, and work is continuing at the mines as usual. It is not expected, however, that this arrangement will continue long and a decision one way or the other will undoubtedly be forced as soon as possible. A conference between representatives of the operators and those of the mine workers is being held today, but may continue for several days before any result is reached. It is undoubtedly the purpose of the mine workers to prolong the negotiations as much as possible; and it is equally the determination of the operating companies to tolerate as little delay as they can. It is not impossible that matters may be settled at the conference now in progress.

The Eastern bituminous trade continues quiet. A fair amount of business is being done, but nothing like that of 1907. The demand for steam coal increases slowly.

In the West reports are rather more cheerful, a better demand for steam coal being noted, and mines are working more steadily throughout Indiana and Illinois.

The coke market has rather suffered from overproduction, and this week the Frick Coke Company shut down 600 ovens, while independent producers banked 500 more in the Connellsville region.

Panama Contracts—The contract for 400,000 tons of coal for the Panama railroad during the coming year has been awarded to W. C. Atwater & Co. at $2.39 per ton for Pocahontas coal, f.o.b. Newport News.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 27, short tons:

	1908.	1909.	Changes.
Anthracite	1,209,280	1,164,953	D. 44,327
Bituminous	8,093,033	8,387,857	I. 294,824
Coke	1,718,252	2,37.,772	I. 657,520
Total	11,020,565	11,928,582	I. 908,017

Total increase this year to date was 8.2 per cent.

The total coal production of Ohio in 1908 is reported at 26,268,239 short tons. This compares with 32,365,949 tons in 1908, showing a decrease of 6,097,710 tons, or 18.8 per cent. Of the total last year 21,621,046 tons, or 82.3 per cent., were mined by machines.

New York

Anthracite

April 7—The market continues quiet and business is going on steadily as though there was no controversy impendent. Trade is about as usual and domestic sizes are in abundant supply. Steam sizes are still rather scarce.

Prices under the April circular are $4.25 for lump and $4.50 for egg, stove and chestnut f.o.b. New York harbor points. For small steam sizes prices are nominally unchanged as follows: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Advances from 10c. per ton up are still asked by commission merchants.

Bituminous

The soft-coal market remains quiet, with very little change from the last report. Contract making continues slowly and probably about one-half of the yearly contracts usually closed in this market have been concluded, most of them at prices a little under last year. Current business may be said to show a little improvement; that is, more coal is being sold than there was a year ago. It is noticed that orders coming in are generally accompanied by a hurry clause indicating that stocks in the hands of consumers are very low. The different consuming districts are running about even, the far East, the Sound and New York harbor being about the same. All rail trade is better than Seaboard, as it has been for some time. Transportation is good and cars are in plentiful supply. There is no stock of coal pressing on the market anywhere, as producers have fallen into the habit of shipping coal only on orders.

Prices continue low. Good grades of steam coal can be had at about $1.25@1.35 at mine; poorer grades as low as 90c.@$1 at mines. Gas coal brings from 85c.@$1.10 for ¾-in.; 75@85c. for run-of-mine and 60@65c. for slack, all at mines.

In the Coastwise trade vessels are still hunting for charters. Rates are unchanged from last week's report, although a few of the larger boats have shaded prices 5c. in order to get full cargoes.

Birmingham

April 5—The coal market in Alabama is quiet and the production is off considerably. More mines have been shut down. The starting up of a couple of batteries of coke ovens is the only encouraging feature for the week. One of the principal traffic companies in the district reports that the business has fallen off at the mines and that the greater portion of the product being handled right now is for company use.

Coke is in a little better demand than it has been and there is hope of a continuation of the improvement.

Chicago

April 5—Except on lump sizes the shipments of Illinois and Indiana coals are well regulated to demand in the Chicago market now, and prices consequently hold up well. The demand for domestic coals is small and decreasing; for steam coals it is steady and increasing slowly. Fine coals are in growing demand, but the supply is so large from Western mines that no large increase in price is probable. Screenings now bring $1.40@1.60; run-of-mine sells for $1.65@1.75, and lump or egg for $1.75@2.30.

Eastern coals in general continue strong, smokeless especially holding up close to circular prices, in contrast to the demoralization caused by overshipments a few weeks ago. Neither lump nor run-of-mine smokeless is in too great supply now, operators having generally restricted their shipments. Smokeless finds fair sale at $3.20@3.45 for lump and $3.05@3.15 for run-of-mine. Hocking is somewhat weak; too much has been received for stability of the list price of $3.15, which has been cut to as low as $2.75, most sales being made at $2.90@3. Youghiogheny is in quiet, steady movement at $3.15 for ¾-in. gas coal; Pittsburg No. 8 brings $2.65@2.75 for the same size.

Anthracite moves well under the April discount, retailers and consumers showing a disposition to lay in stocks early, and sales for immediate consumption are fairly good.

Cleveland

April 6—The coal trade is improving a little, dealers reporting a better demand for steam coal. Shipments from mines are not rushed, and there is little demurrage coal on the market.

Little is doing yet in the Lake trade, and it is evident that there will be a late opening. Reports from the Northwest are that stocks are still large.

Indianapolis

April 6—Indiana coal-mine operators say that the winter season is practically

at an end, but that manufacturers are ordering larger quantities of steam coal regularly. From this time on the operators will begin to provide for the demand that usually comes in June and August for storage supplies from dealers.

An order has been entered in the Federal court directing John K. Seifert, as receiver for the Indiana Southern Coal Company, to enter into a contract with the American Steel and Wire Company to supply that company with 250 to 300 tons of coal a day from April 1, 1909, to April 1, 1910. The contract price is 87½c. per ton.

Pittsburg

April 6—Considerable new business has been taken during the past few days at cut prices. Producers are still quoting on the basis of $1.15 for mine-run coal, but contracts have been closed at $1.10 and some as low as $1.05 a ton. On a large contract even this rate might be shaded. The most important contract of the week was taken by the Pickands-Magee Company calling for one-half of the year's fuel supply for the Grand Trunk Railroad, or 150,000 tons, deliveries to be made at Conneaut Harbor, beginning on May 1. The coal will come from the Bessemer district and will insure the steady operation of the Pickands-Magee Company's mines. Shipments to Lake ports for the northwestern markets have been begun on a small scale and several cargoes have gone out in small boats from Cleveland. The railroad mines in the Pittsburg district are not being operated to more than 60 per cent. and there is a scramble for all the business going. The river mines continue in full operation and a fairly large tonnage of coal has been accumulated in coal boats and barges.

Connellsville Coke—The coke trade is discouraging. Fully 1200 ovens have been put on the idle list within the past 10 days and others likely will go out this week. The H. C. Frick Coke Company has closed about 600 ovens. A number of blast furnaces that receive coke from the Connellsville fields have been blown out and others are scheduled to go out before May 1. Favorable progress is being made in the project to form a combination of all the coke interests outside of the big corporation. Furnace coke for spot shipment is still selling at $1.50@1.60; some concerns are holding for $1.75 on contract coke; it is believed $1.60 can easily be done for deliveries running to July 1. Foundry coke remains at $1.90 for spot and $2@2.15 on contract. The *Courier* gives the production in both fields at 237,741 tons The shipments were 8787 cars as follows. To the Pittsburg district, 3270, to points west of Pittsburg, 4641; to points east of Connellsville, 867 cars.

Foreign Coal Trade

United States Coal Imports—Imports of coal and coke into the United States, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Anthracite	11,914	3,114	D. 8,800
Bituminous	305,724	208,103	D. 97,621
Total coal	317,638	211,217	D. 106,421
Coke	31,134	28,594	D. 2,540

Canada furnished this year 166,504 tons coal and nearly all the coke; Australia, 31,474 tons coal. Imports are chiefly on the Pacific coast.

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished for the use of steamships at all ports, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Anthracite	301,267	297,096	D. 4,171
Bituminous	1,222,038	1,000,130	D. 221,908
Total exports	1,523,305	1,297,226	D. 226,079
Steamer coal	982,458	871,306	D. 111,152
Total	2,505,763	2,168,532	D. 337,231
Coke	131,016	155,917	I. 24,901

Canada took this year 879,874 tons, or 67.8 per cent. of the total coal. The coke goes chiefly to Mexico and Canada.

French Coal Production—The total coal production of France for the years named was, in metric tons:

	1907.	1908.	Changes.
Coal mined	36,930,250	36,770,211	D. 160,039
Coke made	2,107,342	1,954,760	D. 152,582
Briquets made	2,192,745	2,016,881	I. 175,864

The change in the total coal production was unimportant.

French Coal Trade—Official statement of fuel exports and imports in France, full year, metric tons:

Exports.	1907.	1908.	Changes.
Coal	1,165,400	1,092,106	D. 73,294
Coke	169,840	150,783	D. 19,057
Briquets	113,410	129,369	I. 15,959
Total	1,448,650	1,372,258	D. 76,392
Imports:			
Coal	14,868,967	14,732,530	D. 136,437
Coke	2,176,715	1,826,350	D. 349,365
Briquets	694,120	1,012,320	I. 318,200
Total	17,738,802	17,571,200	D. 167,602

Exports in 1908 included 115,697 tons coal and 53,217 tons briquets furnished to steamships in foreign trade.

Austrian Coal Production—Coal production in Austria for the full year was as follows, in metric tons:

	1907.	1908.	Changes.
Coal	13,850,420	14,091,161	I. 240,741
Brown coal	26,262,110	26,669,709	I. 407,599
Total mined	40,112,530	40,760,870	I. 648,340
Coke made	1,879,189	1,915,434	I. 36,245
Briquets made	295,145	339,686	I. 44,541

Of the briquets made in 1908 there were 191,869 tons from brown coal, or lignite.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 27: Best Welsh steam, $3.48; seconds, $3.30; thirds, $3.24; dry coals, $3.48, best Monmouthshire, $3.06; seconds, $3; best small steam, $2.22; seconds, $2.04. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, April 7—The iron and steel markets show a variable improvement; while still slow in some directions there is a manifest advance in others.

Pig iron has been rather quiet. Early in the week one or two considerable contracts were reported for basic pig for Western delivery at prices not made public. There is considerable inquiry in the East for foundry iron, but less in that line is doing in the West. Prices are rather indefinite, but those for foundry have been seriously affected by the action of Southern makers in taking contracts as low as $11 and even $10.50 Birmingham for No. 2 foundry.

In finished material there has been a great deal of activity in structural steel and in bars, while plates have sold rather freely. The structural market has been especially active and some large contracts for buildings have been placed. An improvement in the demand for nails and other minor products is reported, indicating an increase in general building throughout the country.

While new orders for rails are still scarce, the railroads are taking on a good deal of bridge material, and some orders for equipment are reported.

Bethlehem Steel Company—The report of this company for 1908 shows that the total orders received for the year were $14,458,997, a decrease of $1,156,021 from 1907. Net income was $2,192,355, a decrease of $446,602; net surplus over charges and depreciation, $386,864, a decrease of $1,231,925. The uncompleted orders on hand Dec. 31, 1908, amounted to $7,592,502, a decrease of $992,163 during the year. The number of employees at the close of 1908 was 8615, being 1168 less than at the end of the previous year.

Baltimore

April 6—Exports for the week included 776 tons of steel rails and rail fastenings to Vera Cruz. Imports included 1508 tons ferromanganese and 3 tons silico-spiegel from Liverpool; 10,500 tons iron ore from Cuba.

Birmingham

April 8—An encouraging feature in the Southern pig-iron market is the fact that inquiries are coming in. The market is quite dull. The sale of another good lot of iron for use in manufacturing cast-iron pipe is reported in this district, an Eastern pipe concern making the deal The quotations are between $11@11.50 per ton, No. 2 foundry Two or three of the larger companies are holding their iron at $11.50 per ton, and one company in particular is said to have notified some of the larger consumers in the North that there is no necessity to sacrifice the product, and that

the carrying of the same until better times would not be difficult. There has been a little accumulation of iron in this territory, but not to any alarming extent. There has been no further curtailment of production recently.

The rumors still prevail that there is to be a shutdown of the steel plant of the Tennessee company in the next few days, but nothing definite is given out at the local offices.

The cast-iron pipe plants in the Birmingham district have their hands full, and shipments are steady.

Chicago

April 5—The pig-iron market continues to wait on the laggard melter who is postponing his buying until he feels sure that the bottom of the market has been reached. Buying is in small lots for second and third quarters at $10.50@11, Birmingham ($14.85@15.35 Chicago), for Southern No. 2, and $16@16.50 for Northern No. 2. On much business $11 is obtained for Southern and on some still more, depending on conditions of delivery. For a good-sized contract on second-half delivery a very low price, doubtless, could be made. Inquiries continue numerous for second-half tonnage.

The steadiness of Northern iron compared with Southern is noteworthy. Iron from local furnaces has a fairly assured market for special purposes, as has Northern charcoal, which sells at $19.50@20 in the small lots demanded.

Iron and steel products find slightly improving conditions from week to week, railroad supplies, plates, bars and sheets being in good demand and structural material quiet. Coke is stationary, the best Connellsville bringing $4.75@4.85, Chicago.

Philadelphia

April 7—The pig-iron market is still in a depressed condition. Foundrymen will not buy much ahead, as they are still looking for bottom prices to come. The only people who seem to want much iron just now are the cast-iron pipe makers, and they want it cheap. Southern furnaces have further demoralized the trade by their hunt for orders at any price.

Steel Billets—Nothing doing, as buyers are looking for lower prices still.

Bars—Some large orders are reported placed at low prices. Store trade is much better than a month ago.

Structural Material—Business is active. Some large contracts are being talked over and will be placed soon, as low prices have been named. Small orders are coming in, making up a big total. Everybody seems to be getting ready to build.

Nails—The demand for nails and other supplies for small building is increasing fast, indicating a lot of work in that line.

Scrap—Dealers are on the hunt for customers. Most of them are pretty well loaded, and are anxious to get rid of some of the stock they are carrying. Buyers, for the most part, are in no hurry. Between the two prices are demoralized.

Pittsburg

April 6—A large volume of new business has been placed during the past few days and some important contracts are about to be closed. Orders so far have been for small tonnages only, but the aggregate has been large, and some interests have increased their production. The Republic Iron and Steel Company is operating all of its plants in the Youngstown district this week and today blew in No. 2 furnace of the Hazleton group, the other two having been in operation for several months. The company's Hannah furnace at Youngstown, is scheduled to go in blast next week. This will practically double the company's pig-iron production in the North and indicates a rapidly increasing trade in finished iron and steel products. It was intimated by the representative of a large steel interest today that several large contracts for structural steel, plates, merchant pipe and rails are to be awarded within a few days. Despite the low prices established on Feb. 19, there has been considerable shading by independents while the Steel Corporation subsidiary companies have been strictly adhering to the rates. It is now planned, according to reports, for the Corporation to go after all business, quoting below the lowest prices named by independent producers. The leading bar-iron producer has cut the price of iron bars $1 a ton and is now quoting 1.35c., Pittsburg, and is strictly observing the 1.20c. rate for merchant-steel bars. For western shipments prices are lower than heretofore quoted, but all western orders are supplied from mills in the Chicago territory. The wire concerns are not booking much new business as former prices are being quoted and jobbers and large consumers are so confident that prices will be cut that they are keeping out of the market, buying only for urgent needs. The National Tube Company continues to operate its plants in the Pittsburg district at about 80 per cent. and is still booking new business.

Pig Iron—The only new business of importance was the closing of a contract for 3600 tons of chill-cast bessemer by the Crucible Steel Company of America. The price is not given; the iron will be supplied by the Carnegie Steel Company from the Clairton furnaces. The Carnegie Steel Company blew in another Edgar Thomson blast furnace, the eighth of the group of 11, and is now operating 36 of its 59 blast furnaces. The bessemer average for March was $15.437, Valley furnaces, a decline of $0.438 from the previous month. The basic average was $14.937, Valley, a decline of 25c. Pig-iron quotations are nominal as follows: Standard bessemer, $15@15.25; malleable bessemer, $14.50@14.75; basic and No. 2 foundry, $14.50; gray forge, $13.50, all at Valley furnaces; freight to Pittsburg district, 90c. per ton.

Steel—Billet sales at the established price of $23, Pittsburg, are few and reports that this price is being shaded cannot be confirmed. Sheet-bars are quoted at $25.50, delivered, but sales have been made lower. Merchant-steel bars are still 1.20c., and plates, 1.30c.

Sheets—Prices are firm and some new business is being booked. Black sheets are 2.30c. and galvanized 3.30c. for No. 28 gage.

Ferro-Manganese—Prices are a trifle higher; $43.50@44 is quoted for prompt delivery at Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the two months ended Feb. 28 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $27,531,617 in 1908, and $21,276,547 in 1909; a decrease of $6,255,040, or 22.7 per cent. Leading items of export, in long tons:

	1908.	1909.	Changes.	
Pig Iron	4,222	5,962	I.	1,740
Billets, ingots & blooms	27,008	15,954	D.	11,054
Bars	9,499	9,889	I.	390
Rails	25,254	33,764	I.	8,510
Sheets and plates	16,480	19,891	I.	3,411
Structural steel	26,407	15,813	D.	4,594
Wire	23,300	20,115	D.	3,185
Nails and spikes	7,990	8,353	I.	363
Pipe and fittings	15,531	16,981	I.	1,450

The increases and decreases in these quantities were almost evenly divided.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States two months ended Feb. 28 were valued at $3,774,291 in 1908, and $3,628,746 in 1909; decrease, $145,545, or 3.9 per cent. Leading articles of import were, in long tons:

	1908.	1909.	Changes.	
Pig iron	23,418	20,643	D.	2,775
Scrap	1,076	1,064	D.	12
Ingots, blooms, etc.	1,107	2,018	I.	911
Bars	8,009	3,653	D.	4,356
Wire-rods	2,066	1,834	D.	232
Tinplates	10,201	7,463	D.	2,738
Sheets and plates	470	502	I.	32

The only increases this year were small ones in sheets and in ingots and blooms.

Iron Ore Movement—Imports and exports of iron ore in the United States, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.	
Imports	137,753	166,982	I.	29,229
Exports	10,984	11,799	I.	815

Of the imports this year 114,205 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore, two months ended Feb. 28, were 53,713 tons in 1908, and 35,060 in 1909; decrease, 18,653 tons.

Metal Market

New York, April 7—The metal markets show some degree of improvement, but no considerable changes for the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,843,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended April 3: Gold, $344,000, to London and Argentina; silver, $806,550, to London and Paris. Imports: Gold, $110,456, from Central and South America; silver, $78,592, from South America and Mexico.

Treasury Department estimate of the amount and kinds of money in the United States on April 1:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 192,611,628	$ 608,292,659
Gold certificates	47,661,660	796,956,209
Silver dollars	8,814,297	71,682,515
Silver certificates	6,607,037	476,757,963
Subsidiary silver	25,967,101	127,887,934
Treasury notes of 1890	11,193	4,386,807
U. S. notes	7,652,169	339,128,847
Nat. bank notes	22,816,033	661,591,582
Total	$311,931,018	$3,086,684,516
Total, April 1, 1908		3,080,450,734

Population of the United States April 1, 1909, estimated at 88,567,000; circulation per capita, $34.85. In addition to amount in Treasury the Government has $58,152,737 on deposit in National banks.

Gold—No change in prices in the open market in London is reported, quotations being 77s. 6d. per oz. for bars and 76s. 4d. for American coin. Most of the gold offered this week was taken by the Austrian government, presumably for use in its settlement with Turkey.

Platinum—Dealers quote $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap. Business is improving and sales are freer than they have been.

Silver—The market appears to have reached a period of dullness, with no special inquiry or speculative tendency in sight. It does not look as if any great fluctuation in price were liable to happen at present.

SILVER AND STERLING EXCHANGE

Apr.	1	2	3	5	6	7
New York	50½	50¾	50⅞	51	50¾	50⅞
London	23¼	23⅛	23 7/16	23⅛	23 3/16	23 5/16
Sterling Ex.	4.8750	4.8760	4.8780	4.8770	4.8770	4.8780

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 25:

	1908.	1909.	Changes.
India	£ 1,753,238	£1,083,000	D. £ 670,238
China	501,400	657,000	I. 155,600
Straits	78,270	82,800	I. 4,530
Total	£ 2,332,908	£1,822,800	D. £ 610,108

Receipts for the week, £5000 from the West Indies and £175,000 from New York; £180,000 in all. Exports, £165,000 to India.

Copper, Tin, Lead and Zinc

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
1	12⅞ @13	12½ @12⅝	57⅝	29⅝	4.10	3.95	4.60 @4.62½
2	12⅞ @13	12½ @12⅝	57¼	29⅝	4.10	3.95	4.60 @4.65
3	12⅞ @13	12½ @12⅝	....	29¾	4.10	3.95	4.60 @4.65
5	12⅞ @13	12½ @12⅝	57⅜	29¼	4.10	3.95	4.62½ @4.67½
6	12⅞ @13	12½ @12⅝	57½	29½	4.10	3.95	4.62½ @4.67½
7	12⅞ @13	12½ @12⅝	57¼	29¼	4.10	3.95	4.65 @4.67½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Although business has quieted down, the market has not lost any ground during the week. It is generally recognized that consumption the world over is slowly, but surely, increasing, and that the disparity between supply and demand is proportionately diminishing. All of the agencies are offering electrolytic freely at 12¾c., delivered, 30 days, which is equivalent to a little less than 12⅝c., cash, New York, and this price has been shaded a little on transactions. The close is steady and unchanged at 12⅞@13c. for Lake copper; 12½@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 12⅜@12½ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14¼c. base, carload lots at mill.

The London market has shown a firm undertone during the week, fluctuating within narrow limits. The close is steady at £57 5s. for spot, £57 17s. 6d. for three months standard.

Statistics for the second half of March show a decrease in the visible supplies of 1000 tons.

Refined and manufactured sorts we quote: English tough, £61 10s.; best selected, £60 10s.@61 10s.; strong sheets, £72 10s.@74 10s.

Copper exports as reported by the Bureau of Statistics for the two months ended Feb. 28 were 36,542 long tons; for March they are estimated at 21,160 tons, making a total of 57,702 tons for the three months.

Stocks of copper usually included in visible supplies were, on April 1: Great Britain, 37,930 long tons; France, 5920; afloat from Chile and Australia, 7500; total, 51,350 tons, a decrease of 1020 tons from the March 15 report.

Tin—The transactions in the London market have become smaller and the tone somewhat softer than it was during last week. Quotations have declined somewhat and close at £133 2s. 6d. for spot, £134 2s. 6d. for three months.

Some business was done in the domestic market by speculators, presumably for London account, but the demand on the part of consumers, especially for forward delivery, still leaves much to be desired. Spot metal at the close can be bought at about 29¼c. per pound.

Statistics for the month of March show an increase in the visible supplies of 100 tons.

Lead—Business continues in fair volume at 3.95c. St. Louis, 4.10c. New York.

The London market has been rather easier this week, the close being cabled at £13 8s. 9d. for Spanish lead, £13 11s. 3d. for English lead.

Spelter—There is a great deal of reluctance on the part of sellers to part with their metal at present prices, due to the proposed tariff on zinc ores. It took only a slightly better inquiry to affect prices, and though the orders placed were relatively of small volume, the market has advanced at the close to 4.80@4.82½ New York. 4.65@4.67½ St. Louis.

Quotations for spelter in New York, April 1, were 4.75@4.77½c.; 2 and 3, 4.75@4.80c.; 5 and 6, 4.77½@4.82½c.; 7, 4.80@4.82½ cents.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The London market is unchanged at £21 7s. 6d. for good ordinaries, £21 12s. 6d. for specials.

According to a newspaper report, the earnings of the Lanyon-Starr Smelting Company in 1908 were about 4 per cent. on its preferred stock of $250,000.

Other Metals

Antimony—Business continues extremely dull. In the absence of sales prices are nominally unchanged at 8c. per lb. for Cookson's, 7¾c. for Hallett's, and 7½c. for ordinary brands.

Aluminum—Quotations are unchanged at 22@24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—The market in New York is quiet and unchanged at $45@46 per flask of 75 lb. San Francisco prices are nominal at $44@45 for domestic orders, and $2 less for export. The London quotation has been reduced 5s., and is now £8 2s. 6d. per flask.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States, two months ended Feb. 28, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	36,542	21,401	Exp. 15,141
Copper, 1908....	59,352	14,312	Exp. 45,040
Tin, long tons....	56	5,938	Imp. 5,882
Tin, 1908.....	60	3,212	Imp. 3,152
Lead, short tons.	13,840	17,958	Imp. 4,118
Lead, 1908.....	17,195	18,266	Imp. 1,071
Spelter, sh. tons.	732	761	Imp. 29
Spelter, 1908....	255	34	Exp. 221
Nickel, lb.....	1,490,116	2,163,266	Imp. 673,150
Nickel, 1908....	2,182,566	2,599,997	Imp. 417,431
Antimony, lb.....	.....	1,172,524	Imp. 1,172,524
Antimony, 1908.	.....	1,574,237	Imp. 1,574,237
Platinum, oz.....	.....	21,841	Imp. 21,841
Platinum, 1908.	.....	5,124	Imp. 5,124
Quicksilver, lb...	8,878	.....	Exp. 8,878
Quicksilver, '08	31,430	.....	Exp. 31,430
Aluminum, value	$11,575	.....	Exp. $11,575
Aluminum, 1908	10,722	.....	Exp. 10,722
Ores, etc.:			
Zinc oxide, lb. ...	4,067,281	.....	Exp. 4,067,281
Zinc oxide, '08..	3,200,287	.....	Exp. 3,200,287
Zinc dross, lb....	2,259,462	.....	Exp. 2,259,462
Zinc dross, '08..	5,066,965	.....	Exp. 5,066,965
Zinc ores, lg. tons	.....	13,242	Imp. 13,242
Zinc ores, 1908.	6,067	6,285	Imp. 218
Antim'y ores, lb.	504	2,366,385	Imp. 2,365,881
Ant. ores, 1908.	.....	121,603	Imp. 121,603
Chrome ore,....	.....	6,801	Imp. 6,801
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 2929 tons calamine and 10,313 tons other ores, against 3648 and 2637 tons, respectively, last year. Chrome ore was not reported last year.

Zinc and Lead Ore Markets

Platteville, Wis., April 3—The highest price paid this week for zinc ore was $39; the base price for 60-per cent. zinc was $37.50@38 per ton. For 80-per cent. lead ore, $49 per ton was paid.

SHIPMENTS, WEEK ENDED APR. 3

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green.....	334,600	.....	.....
Linden.....	288,290	.....	.....
Benton.....	252,240	.....	.....
Livingston.....	240,000	.....	.....
Cuba City.....	175,400	.....	.....
Platteville.....	175,050	88,000	160,000
Total.....	1,463,580	88,000	160,000
Year, to Apr. 3.....	25,241,934	627,580	2,429,850

In addition to the above there was shipped to the American Zinc Ore Separating Company 273,300 lb., and to the Joplin Separator Works, 174,600 lb. zinc concentrates.

Joplin, Mo., April 3—The highest price reported was $41.50 per ton for sulphide zinc ore assaying 63.5 per cent. zinc sold on a $38 base. Additional sales were made this week on a $38 base, and the bulk of the large purchases were made on a $37.50-base price, with a less amount selling at $37@36.50 base, and but a few scattering lots on a $36 base. Zinc silicate ore was lower in price, with no competition, very nearly all the purchases being on a base of $17 per ton of 40-per cent. zinc, with a few on an $18 base. The highest reported was, however, $25 for one bin assaying 47 per cent. on an $18 base. The general high price was $20@21. The average price, all grades, was $34.58. Lead continues upward, with offerings as high as $55, an advance of $1.50 per ton. The base price was generally $54 per ton of 80-per cent. lead. The average price, all grades, was $52.82 per ton.

The week's shipment foots up the second largest total tonnage of the year, in zinc, some of the large purchases of two and three weeks ago being loaded out. The car situation has been troublesome, but is better now.

SHIPMENTS, WEEK ENDED APR. 3

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,037,380	844,910	$ 97,200
Joplin.....	1,968,320	301,340	44,255
Badger-Beacock.....	1,114,430	74,350	22,903
Galena.....	630,940	244,140	18,286
Duenweg.....	898,420	79,660	16,900
Alba-Neck.....	658,010	5,720	12,650
Aurora	566,240	.....	7,924
Spurgeon.	444,540	78,850	6,786
Granby	439,000	18,000	6,350
Prosperity.	479,630	40,400	6,273
Miami.....	370,040	.....	5,735
Zincite.....	256,380	21,750	5,329
Carthage.....	272,890	.....	5,184
Quapaw.....	234,030	20,450	4,285
Oronogo.....	258,090	.....	3,613
Sarcoxie.....	137,270	.....	2,538
Carl Junction.....	72,960	.....	1,423
Ash Grove.....	.....	45,350	1,224
Stott City.....	44,650	.....	803
Cave Springs.....	33,210	.....	631
Totals	12,916,470	1,774,920	$270,292

Fourteen weeks 156,365,070 24,324,640 $3,418,135
Zinc value, the week, $223,400; 14 weeks, $2,796,975
Lead value, the week, 46,892; 14 weeks, 622,160

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April.....	35.40	.....	34.08	.....	52.47	.....
May.....	34.19	.....	33.39	.....	56.05	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July.....	34.55	.....	31.67	.....	59.90	.....
August.....	36.53	.....	33.42	.....	60.34	.....
September..	37.63	.....	34.44	.....	54.59	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November...	39.13	.....	35.02	.....	54.53	.....
December..	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, April 6—The chemical market is exceptionally dull and inactive.

Copper Sulphate—Prices are at a standstill at $4.60 per 100 lb. in carload lots and $4.85 per 100 lb. for smaller quantities.

Arsenic—White arsenic is now quoted at 2⅞c. per lb. A dull market prevails.

Nitrate of Soda—The market is exceptionally dull and heavy. Prices are 2.15@2.17c. for both spot and futures.

The position of nitrate in the United States on April 1 is reported as follows, in long tons, by Messrs. Mortimer & Wisner, New York:

	1908.	1909.	Changes.
Stocks, Jan. 1.....	5,900	9,140	I. 3,240
Imports 3 months.....	53,300	104,800	I. 51,500
Total Supplies.....	59,200	113,940	I. 54,740
Deliveries 3 months....	51,650	99,990	I. 48,340
Stocks, Apr. 1.....	7,550	13,950	I. 6,400
Afloat for U. S....	80,000	60,000	D. 20,000

Quantities afloat include all cargoes due to arrive at United States ports before July 15 next.

Phosphates—Exports of Florida phosphates through the port of Savannah in February are reported by J. M. Lang & Co., at 5025 tons, all to Germany.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, two months ended Feb. 28, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	1,318,978	E.	1,318,778
Bleach, lb.....	12,814,773	.....	I. 12,814,773
Potash salts, lb..	69,318,942	1,108,105	I. 68,210,837
Soda salts, lb....	2,055,204	94,002	I. 1,961,202
Acetate lime, lb.	.....	16,704,200	E. 16,704,200
Nit. of soda, tons	41,254	1,035	I. 40,219
Phosphates, tons	425	119,005	E. 118,580
Sulphur, tons....	4,762	6,537	E. 1,775
Pyrites, tons.....	93,946	.....	I. 93,946

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 42,340 long tons.

Mining Stocks

New York, April 7—The general stock markets throughout the week have shown a good deal of strength and prices have advanced with only some slight reaction. The bull market seems to be pretty well established for the present.

There have been all sorts of rumors about the expected decision of the Supreme Court on the commodities clause, but these seem to have been without foundation and were doubtless circulated for the purpose of depressing certain stocks.

On the Curb the copper stocks were generally strong and in good demand, but fluctuations were not very large in amount. There were heavy sales of Nevada Consolidated and one or two other stocks at slight advances in prices. The Nevada gold stocks were only moderately

active, but held their own so far as quotations were concerned. There is a good deal of interest in the Cobalt stocks and a little boom in them is rather expected.

Boston, April 6- Sentiment continues optimistic regarding the mining-share market, although it is not accompanied to any great extent by extended market operations. Prices as a rule are higher in the week's time, but activity has been confined to a few specialties.

Activity in the share market has been speculative, and is in those stocks in which pool manipulation has entered to a large extent. Conspicuous have been Arizona Commercial and Lake. The former rose $4.25 to $43.25. This company's 6-per cent. convertible bonds realized $175, which is a new high record. Lake Copper rose over $2 to $19 on insistent buying by brokers with Michigan connections. Mass Mining sold up over $2 to $8.12½, owing to developments at the mine.

Amalgamated has advanced $3.50 to $77.50. North Butte is slightly lower for the week closing at $71. The market movements of this stock are not understood, but presumably are manipulative and for the purposes of accumulating the stock. Copper Range rose $1.50 to $78. Conspicuous declines are $1.50 for Old Dominion to $51.25, $1.25 for U. S. Smelting at $41.75, and less than $1 for Utah Consolidated to $41.75.

Curb operations have been quiet and prices are slightly lower for the week.

STOCK QUOTATIONS

NEW YORK	Apr. 7	BOSTON	Apr. 7
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.51	Adventure	8
Amalgamated	76⅛	Allouez	39½
Anaconda	44¾	Am. Zinc	25¼
Balaklala	‡2⅛	Arcadian	5
British Col. Cop.	7	Arizona Com	43½
Buffalo Mines	3¼	Atlantic	12½
Butte Coalition	25¼	Boston Con	12¾
Colonial Silver	¼	Calumet & Ariz	101¾
Cum. Ely Mining	7¾	Calumet & Hecla	625
Davis Daly	5¼	Centennial	31
Dominion Cop.	12½	Con. Mercur	‡.28
Douglas Copper	2¾	Copper Range	78
El Rayo	2½	Daly-West	10⅝
Florence	3⅞	East Butte	14¾
Foster Cobalt	.34	Franklin	16¾
Furnace Creek	.11	Greene—Can	10¼
Giroux	8½	Isle Royal	26
Gold Hill	¼	La Salle	15
Goldfield Con	8½	Mass	7¾
Granby	96	Michigan	12¾
Greene Gold	¼	Mohawk	62⅝
Greene G. & S.	7	Nevada	20¾
Guanajuato	1¾	North Butte	72¾
Guggen. Exp	175	Old Colony	.60
Hanapah	.15	Old Dominion	52½
Kerr Lake	7⅞	Osceola	131
McKinley Dar	.99	Parrot	33½
Miami Copper	14⅞	Quincy	89
Mienac	1½	Rhode Island	‡4¾
Mines Co. of Am.	⅝	Santa Fe	2½
Mitchell Mining	⅛	Shannon	11⅞
Mont. Shoe. C.	1½	Superior	42
Nev. Utah M. & S.	2½	Superior & Pitts.	13
Newhouse M. & S.	3⅛	Tamarack	77½
Nipissing Mines	10⅞	Trinity	14½
Old Hundred	⅞	United Cop., com.	‡12½
Silver Queen	.49	U. S. Oil	32¼
Stewart	¾	U. S. Smg. & Ref.	41¾
Tennessee Cop'r	40½	U. S. Sm. & Re., pd.	41⅞
Tri Bullion	1⅛	Utah Con.	41½
Union Copper	⅛	Victoria	4¾
Utah Apex	6⅛	Winona	5⅛
Utah Copper	43¼	Wolverine	145
Yukon Gold	4⅞	Wyandotte	2¾

*Ex Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	37½
Am. Smelt. & Ref.	89⅝
Am. Sm. & Ref., pf.	104⅝
Colo. Fuel & Iron	36
Federal M. & S., pf.	82½
National Lead	84½
National Lead, pf.	107½
Pittsburg Coal	‡10¼
Republic I. & S.	22½
Republic I. & S., pf.	74¾
Sloss-Sheffield	74⅛
Standard Oil	669
U. S. Steel	50⅛
U. S. Steel, pf.	113⅞
Va. Car. Chem.	44½

BOSTON CURB	Low.
Ahmeek	140
Black Mt.	97
Chemung	19
Globe Con	4½
Hancock	11
Helvetia	2¼
Keweenaw	‡4¾
North Lake	‡7⅝
Offshaw	12⅞
Ray Con	14⅛
Superior & Bost.	‡15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS		Apr. 3
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	1.60	1.30
Cent.C.&C.*	83.00	82.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Grg. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON	Apr. 7
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton's Ind.	0 2 9
Camp Bird	0 16 0
Esperanza	3 0 0
Tomboy	0 18 9
El Oro	1 5 0
Oroville	0 10 3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Apr. 7.
Furnished by Welr Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.14
Belcher	.47	St. Ives	.13
Best & Belcher	.35	Triangle	.01
Caledonia	.20	BULLFROG STOCKS	
Challar	.09	Gibraltar	.03
Comstock	.26	Homestake King.	.03
Con. Cal. & Va.	.67	Mont. Shoshone C.	1.37½
Crown Point	‡.36	Tramp Cons	.04½
Exchequer	.07	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	...
Hale & Norcross	.16	Lee Gold Grotto	...
Mexican	.57	Nevada Hills	1.25
Ophir	1.05	Nevada Smelting	1.00
Overman	‡.12	Nevada Wonder	.75
Potosi	.11	Nevada-Utah	2.81½
Savage	.12	Penn-Wyoming	.02
Sierra Nevada	.23	Pittsburgh S. Pk.	.65
Union	.11	Rawhide Coal't'n.	...
Utah	.03	Round Mt. Sphinx	.10
Yellow Jacket	‡.64		
TONOPAH STOCKS			
Belmont	.93		
Extension	.53		
Golden Anchor	...		
Jim Butler	.17		
MacNamara	.30		
Midway	.24		
Montana	.69		
North Star	.03		
Tono'h Mine of N.	6.50		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.12		
Blue Bell	.04		
Bond	.20		
Columbia Mt.	.12		
Comb. Frac	1.15		
Con. Red Top	.07		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06½		
Goldfield Belmont	.04		
Goldfield Daisy	.46½		
Great Bend	.17		
Jumbo Extension	.19		
Kendall	.06		
Lone Star	.04		
May Queen	.03		
Oro	.10		
Red Hill	.10		
Roanoke	...		
Sandstorm	.12		

COLO. SPRINGS	Apr. 2
Name of Comp.	Clg.
Acacia	.06⅛
Black Bell	...
C. C. Con	.03⅛
Dante	.06
Doctor Jack Pot	.09
Elkton	.69
El Paso	.46
Findlay	.14⅞
Gold Dollar	.13½
Gold Sovereign	‡.03
Isabella	.24
Index	....
Jennie Sample	.07⅜
Jerry Johnson	‡.06⅛
Mary McKinney	.38
Pharmacist	.03
Portland	.90
Un. Gold Mines	.04¾
Vindicator	.76
Work	.07¼

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida	Mar. 10	Apr. 10	$0.05
Blackjack Con., Utah	Apr. 15	May 7	0.01
Cedar Creek, Ida	Mar. 3	Apr. 5	0.003
Challenge Con., Nev	Mar. 19	Apr. 9	0.004
Comet G. & C., Ida	Mar. 20	Apr. 20	0.001
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crown Point, Nev	Apr. 18	Apr. 28	0.10
Gov't Gulch, Ida	Mar. 9	Apr. 9	0.001
Hypothesis, Ida	Mar. 11	Apr. 2	0.005
Imlay, Nev	Apr. 6	Apr. 28	0.03
Mexican, Nev	Apr. 8	Apr. 29	0.10
Mineral Farm, Ida	Mar. 12	Apr. 10	0.003
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Reliance, Ida	Mar. 23	Apr. 20	0.001
Rexall S. & C., Utah	Mar. 26	Apr. 25	0.01
Savage, Nev	Apr. 8	May 5	0.10
Silver King Con., Utah	Mar. 29	Apr. 14	0.10
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Union Con., Nev	Apr. 8	Apr. 30	0.10
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Month.	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.575	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.615	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.976	13.438
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.626	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska Mexican, g.	Alas	180,000	$ 5	$ 2,112,381	Jan. '09	$0.40
Alaska Treadwell, g.	Alas	800,000	25	10,385,000	Jan. '09	0.75
Alaska United, g	Alas	180,200	5	468,470	Jan. '09	0.25
Amalgamated, c.	Mont	1,538,879	100	69,249,554	Feb. '09	0.50
Am.Sm.&Ref., com	U. S.	500,000	100	16,000,000	Apr. '09	1.00
Am.Sm.&Ref., pf.	U. S.	500,000	100	30,625,000	Apr. '09	1.75
Am. Smelters, pf. A	U. S.	170,000	100	3,710,000	Mar. '09	1.50
Am. Smelters, pf. B	U. S.	300,000	100	5,625,000	Mar. '09	1.25
Am.Zinc, Lead&Sm.	Kan.	280,000	25	280,000	Nov. '07	0.50
Anaconda, c.	Mont	1,200,000	25	43,650,000	Jan. '09	0.25
Arizona, c.	Ariz	3,682,520	....	6,182,361	Apr. '06	0.50
Atlantic, c.	Mich	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s.	Mont	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D.,pf.,l.z.	Wis	196,607	1	10,949	Nov. '08	0.01½
Boston & Montana	Mont	150,000	25	52,950,000	Jan. '09	3.00
Bull.Beck. & Cham.g	Utah	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull.	Ida	300,000	10	10,926,000	Apr. '09	0.15
Butte Coalition, c. s.	Mont	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizonac.	Ariz	200,000	10	10,500,000	Mar. '09	1.00
Calumet & Hecla, c.	Mich	100,000	25	108,350,000	Mar. '09	5.00
Camp Bird, g., s.	Colo	820,000	5	5,510,400	Feb. '09	0.24
Carisa., c. g.	Utah	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s.	Utah	1,000,000	0.20	1,260,000	May '07	0.08
Columbus Con., c.	Utah	283,540	5	226,832	Oct. '07	0.20
Combi'tion Co. G'f'd.	Nev	320,000	1	688,000	Sept. '06	0.15
Con. Mercur, g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich	384,185	100	8,067,885	Apr. '09	1.00
Creede United, g.	Colo	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l.	Utah	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l.	Utah	180,000	20	5,931,000	Apr. '09	0.30
De Lamar, g. s.	Ida	80,000	5	835,200	Sept. '06	0.24
Doctor Jack Pot	Colo	3,000,000	1	277,000	June '06	0.00½
Doe Run, l.	Mo	59,062	100	1,765,005	Dec. '08	1.50
Elkton Con., g.	Colo	2,500,000	1	2,279,461	Feb. '09	0.01½
El Paso, g.	Colo	2,450,000	1	1,315,545	Sept. '08	0.01
Federal Sm., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.	Idaho	120,000	100	4,331,250	Mar. '09	1.75
Findley, g.	Colo	250,000	1	337,500	Sept. '06	0.01
Florence, g.	Nev	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev	910,000	1	546,000	Jan. '08	0.05
Gemini-Keystone	Utah	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.	Utah	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g.	Nev	3,532,471	10	1,770,428	Apr. '09	0.30
Grand Central, g.	Utah	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g.	Cal	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.	S. D.	218,400	100	24,155,040	Mar. '09	0.50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.	Ariz	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf.	N. Y.	89,126	100	1,871,646	May '09	1.50
Iron Silver	Colo	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal	390,000	10	339,300	Jan. '09	0.02
Jerry Johnson	Cal	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.	Mont	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s.	Colo	130,551	5	130,440	Jan. '07	0.15
Lightner, g.	Cal	102,253	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah	190,000	1	57,000	Sept. '07	0.01½
Mammoth, g. s. l.	Utah	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l.	Utah	800,000	1	108,000	Sept. '08	0.01½
Mohawk, c.	Mich	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Punch	Mont	80,833	25	9,437,274	Jan. '07	15.00
Nevada Hills, s. g.	Nev	746,000	5	373,000	Dec. '07	0.10
New Century, z. l.	Mo	300,000	1	213,000	Dec. '06	0.01
Newhouse M. & S. c.	Utah	600,000	10	300,000	Sept. '07	0.50
New Idria, q.	Cal	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc	U. S.	100,000	100	12,000,000	May '08	4.00
North Butte	Mont	400,000	15	6,800,000	Mar. '09	1.00
North Star, g.	Cal	250,000	10	1,911,988	Mar. '09	0.30
Old Dominion, c.	Ariz	292,200	25	849,332	Mar. '09	0.50
Old Dominion,M&Sc	Ariz	162,000	25	526,500	Mar. '09	0.10
Ophir, g. s.	Nev	201,600	3	1,816,360	May '08	0.10
Osceola, c.	Mich	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. s.	Mont	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g.	Cal	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co.	U. S.	44,934,600	1	1,123,365	Apr. '09	0.02½
Pitts. L. & Z., l. z.	Mo	1,000,000	1	30,000	July '07	0.02
Portland, g.	Colo	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.	Nev	100,000	10	375,000	July '07	0.20
Quincy, c.	Mich	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q.	Utah	1,000,000	1	225,000	Nov. '06	0.00½
St. Joseph, l.	Mo	1,000,000	10	6,158,357	Dec. '08	0.15
Silver Hill, g. s.	Nev	108,000	1	81,000	June '07	0.05
Silver King, g. s. l.	Utah	150,000	20	11,187,500	July '07	0.33½
Silver King Co't'n,†	Utah	1,224,285	5	1,105,402	Apr. '09	0.15
Shannon, c.	Ariz	300,000	10	450,000	July '07	0.50
Snowstorm, s. l.	Ida	1,500,000	1	690,000	Feb. '09	0.03
Standard Con., g. s.	Cal	178,394	10	5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo	1,000,007	5	4,895,865	Apr. '06	0.12½
Swansea, g. s. l.	Utah	100,000	5	329,500	Mar. '07	0.05
Tamarack, c.	Mich	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.	Colo	300,000	5	2,016,000	Dec. '08	.48
Tonopah of Nev.	Nev	1,000,000	1	4,600,000	Apr. '09	0.35
Tonopah Belmont	Nev	1,500,000	1	600,000	Apr. '07	0.10
Tonopah Ext'nsion	Nev	928,433	1	283,030	Apr. '06	0.15
Tonopah Midway	Nev	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l.	Utah	500,000	1	295,000	Dec. '08	0.02
United States, com.	Utah	350,933	50	1,973,565	Apr. '09	0.50
United States, pf.*	Utah	485,845	50	5,306,495	Apr. '09	0.87½
United Cop. com.	Mont	450,000	100	5,962,500	Aug. '07	1.75
United, c. pf.	Mont	50,000	100	1,500,000	May '07	3.00
United, z. l, pf.	Mo.-Kan.	19,556	25	312,782	Jan. '08	0.50
United Verde, c.	Ariz	300,000	10	21,385,322	Mar. '09	0.75
U. S. Red. & Ref. pf.	Colo	39,000	100	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah	100,000	10	323,000	Feb. '09	0.02
Utah Con., c.	Utah	300,000	5	7,500,000	Apr. '09	0.50
Utah Copper	Utah	725,950	10	1,088,925	Mar. '09	0.50
Victoria, Utah	Utah	250,000	1	177,500	Mar. '07	0.04
Vindicator Con., g.	Colo	1,500,000	1	1,980,000	Jan. '09	0.03
Wolverine, c.	Mich	60,000	25	5,400,000	Apr. '09	5.00
Work, g.	Colo	1,500,000	1	172,500	July '08	0.01
Yankee Con.	Utah	1,000,000	1	182,500	Jan. '07	0.03
Yellow Aster, g.	Cal	100,000	10	958,789	Aug. '07	0.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Allis-Chalmers, pf.	U. S.	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S.	181,530	100	1,747,620	Apr. '09	3.00
American Cement	Pa.	200,000	10	1,288,000	Jan. '09	0.30
American Coal	Md.	50,000	25	2,551,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa.	150,000	100	900,000	Nov. '06	0.75
Cambria Steel	Pa.	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo	51,250	100	2,536,875	Jan. '09	1.50
Central C. & C., pf.	Mo	18,750	100	1,453,125	Jan. '09	1.25
Col.&Hock. C.&I.,pf.	Ohio	69,244	100	383,818	Apr. '08	1.50
Consolidated Coal	Ill.	50,000	100	350,000	July '04	1.00
Consolidation Coal	Md.	102,500	100	x10,431,650	Jan. '09	3.50
Crucible Steel, pf.	Pa.	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf.	N. J.	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem. Com.	U. S.	74,103	100	2,223,090	Mar. '09	1.00
General Chem., pf.	U. S.	100,000	100	6,255,000	Jan. '09	1.50
International Salt	Penn	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f. C.&I., cm.	Pa.	15,000	100	330,000	Aug. '05	5.00
Jeff.&Cl'f.C.&I., pf.	Pa.	15,000	100	900,000	Feb. '09	2.50
Kern River Oil	Cal.	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav.	Pa.	382,260	50	*15,014,890	Nov. '08	2.00
Maryland Coal, pf.	Md.	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf.	Pa.	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com.	U. S.	55,000	100	715,000	Apr. '08	1.00
Nat. Carbon, pf.	U. S.	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com.	N. Y.	206,554	100	3,279,189	Apr. '09	1.25
National Lead, pf.	N. Y.	243,676	100	18,155,068	Mar. '09	1.75
Nat'lSteel&Wire, pf.	N. Y.	25,778	100	631,561	May '06	1.75
New Central Coal	Md.	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf.	W. Va	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax	Cal.	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil	Cal.	92,000	10	711,000	June '08	5.06
Penna. Salt	Pa.	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.	Pa.	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.	Pa.	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.	Pa.	120,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf.	Pa.	297,010	100	11,434,962	April '07	1.75
PocahontasC.C., pf.†	W. Va.	28,000	100	252,000	gan. '09	3.00
Pocah's Pc.C., cm.†	W. Va.	45,200	100	†408,800	Apr. '08	1.00
Republic I. & S., pfd.	Ill.	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala.	100,000	100	2,008,000	Mar. '09	1.25
Sloss-Sheffield, pf.	Ala.	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil	U. S.	970,000	100	644,072,905	Mar. '09	15.00
Tenn. C. & I., com.	Tenn.	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn.	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal	Texas	23,940	100	1,747,620	Apr. '09	1.50
Uni. Metals Selling	U. S.	50,000	100	5,875,000	Jan. '09	5.00
U.S. Steel Corp., cm.	U. S.	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S.	180,000	100	14,700,869	Apr. '09	2.00
Warwick I. & S.	U. S.	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal	Pa.	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. x Stock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia	Mex	9,600	50	$417,070	April '08	$1.36
Batopilas	Mex	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C.	503,000	5	201,200	Sept. '07	0.40
Buffalo, c.	Mex	900,000	1	399,000	May '09	0.03
Butters' Salvador, g.	Salv	150,000	5	600,000	Apr. '05	0.25
Cobalt Central, s.	Ont.	4,761,500	1	119,845	May '09	0.01
Coniagas (Cobalt)	Ont	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C.	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass	B. C.	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont.	1,750,000	1	612,500	Sept. '09	0.15
Dolores, g. s.	Mex.	400,000	5	540,000	Feb. '09	0.15
Dominion Coal, com.	N. S.	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf.	N. S.	30,000	100	‡630,000	Feb. '08	3.50
Dos Estrellas, g. s.	Mex	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro. g. s.	Mex	1,080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.	Mex	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s.	Ont.	1,000,000	1	50,000	Jan. '07	0.05
Granby Con.	B. C.	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper	Mex	864,000	10	6,137,800	Marr. '07	0.40
GreenGold-Silv'r, pf.	Mex	300,000	10	120,000	Mar. '07	0.40
Guanajuato	Mex	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. s.	Mex	10,000	100	30,000	July '08	3.00
Guggenheim Expl.	Mex	207,301	100	7,412,409	Apr. '09	2.50
Hinds Con., g. s. c. l.	Mex	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.	Ont.	600,000	5	1,090,000	Mar. '09	0.20
La Rose Con., s.	Ont.	1,143,368	5	628,252	Apr. '09	0.20
Le Roi, Ltd., g.	B. C.	200,000	25	425,000	Dec. '06	0.48
Le Roi No. 2, g.	B. C.	120,000	25	889,200	Mar. '09	0.48
McKinley-Darragh, s	Ont.	2,000,000	1	480,000	Jan. '09	0.05
Mex. Con. M.&S. Co	Mex	240,000	10	660,000	Mar. '08	0.25
Mex. Mill.&Trans.pf.	Mex	12,000	100	35,450	Jan. '08	3.00
Mines Co. of Am.	Mex	2,000,000	1	3,505,000	Mar. '09	0.02
N. Y. & Hond. Ros.	C. A.	150,000	10	2,467,000	Jan. '09	0.10
Nipissing, s.	Ont.	1,200,000	5	264,000	Apr. '09	0.25
N. S. St.&Coal, com.	N. S.	49,876	100	1,087,856	April '08	1.50
N. S. St. & Coal, pf.	N. S.	10,300	100	458,530	Oct. '08	2.00
Penoles*	Mex	2,500	100	8,630,000	Dec. '07	20‡00
Pereyrina, pf. s	Mex	10,000	100	538,656	Mar. '09	3.50
Pinguico, pf. s	Mex	20,000	100	240,000	Oct. '08	3.00
Platanillo	Mex	206,989	1	5,580	Sept. '06	0.00
Reco, g. s. l.	B. C.	958,000	1	327,082	April '06	0.02
Securities Corp., pf.	Mex	2,000	100	42,699	July '08	3.50
Silver Queen, s.	Ont.	1,500,000	1	345,000	Nov. '08	0.05
Temiskaming, s.	Ont.	2,500,000	1	525,000	Apr. '09	0.06
Tezuitlan Copper	Mex.	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c.	N. F.	59,000	2	495,630	May '08	0.55
Tretheway, s.	Ont.	945,450	1	217,463	Dec. '08	10.00
Tyee, c.	B. C.	180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The Wagner Electric Manufacturing Company announces the removal of its district office in Pittsburg to the Lewis block, and the appointment of Ludwig Hommel as district manager.

Stromberg-Carlson Telephone Manufacturing Company advises the appointment on March 1 of H. C. Slemin to the dual position of sales manager and advertising manager.

The new Johnson breaker of the Scranton Coal Company, at Olyphant, Penn., the main engine and most of the cross drums will be equipped with rope drives on which American transmission rope will be used exclusively. There will be 46 drives.

The Wood Drill Works, of Paterson, N. J., is distributing through its New York City and Boston representatives, Harold L. Bond Company, a folder giving the detailed points in the construction of the Wood rock drill with the advantages in these special features.

Among the recent orders taken by the Crocker-Wheeler Company, of Ampere, N. J., is one for a 250-k.w. motor-generator set for the Tennessee Coal, Iron and Railroad Company, at Ensley, Ala. It will consist of a 250-k.w., 275-volt, d.c. generator, driven by a 6600-volt, 3-phase, 25-cycle synchronous motor, and will be used as an exciter. Another order is one for about 50-h.p. of small elevator motors purchased by the Haughton Elevator and Machine Company, of Toledo, Ohio. Yawman & Erbe, of Rochester, N. Y., have also placed orders for a number of 2- to 5-h.p. motors for use on some of their specialties.

The Power and Mining Machinery Company, of Cudahy, Wis., reports the following sales of mining machinery: Through the International Machinery and Engineering Company, of Mexico City: Minera de Tenamache—One 10-stamp mill, with crushers and 5-ft. x 18-ft. tube mill; Cia. Minera la Victoria y Topada—One 10-stamp mill complete, with 5-ft. x 18-ft. tube mill; Cia. Minera San Antonia—One 10-stamp mill, with 5-ft. x 14-ft. tube mill. Through the San Francisco office, Harris Mining and Milling Company, of Nevada—Ten-stamp mill equipment; Seoul Mining Company, of Corea—One 5-ft. x 22-ft. tube mill.

To users of power machinery, simplicity is a most desirable feature. For many years the centrifugal pump, which is the simplest type of pumping machine, undeveloped and crude in design and construction, was used only for pumping against comparatively low heads, and where economy was of secondary importance. In recent years, however, a great advance has been made in the design and construction of centrifugal pumps; and the higher degree of economy now secured, both at high and low heads, also the use of the turbine pump constructed in multiple stages, have brought the centrifugal pump into general use for a great variety of purposes. Formerly it was not thought possible to operate centrifugal pumps at heads greater than 20 or 30 ft. with any degree of economy, but with the great advance in design the D'Olier Engineering Company, Philadelphia, Penn., is now able to develop economical pumps with heads up to nearly 200 ft. in a stage. Catalog T on application.

The Baldwin lamp consists of a water tank on top into which is screwed the carbide container. A pipe projects from the bottom of the water tank into the carbide container, and a wire of the exact size to permit just the required amount of water to flow down the pipe and on to the carbide passes through this pipe, projecting above the top. Should the flame become low, rotating this wire will, of necessity, clear the water tube, thus keeping the lamp burning brightly. No springs, valves nor regulating devices to get out of order, only a pipe and a wire through it to keep it clean; any miner can learn to turn the wire, and this is all that is necessary to keep the lamp burning brightly. Turn the lamp upside down, lay it on its side or let it fall, it will burn just the same. The Baldwin lamp gives a light of from 10 to 16 candle power, consuming not over eight ounces of calcium carbide in ten hours at an average cost of about two cents for the ten hours' run. To obtain a lamp of light weight a small water tank is made and extra bottoms to fit same supplied; the miner carries these extra bottoms filled with carbide in his pocket; on the charge being exhausted, it is taken out and the fresh one screwed into the lamp. The cover from the fresh charge being placed on the exhausted one, thus preventing all odor and any dirt in the pocket. On leaving the mine, the charges are emptied, and the receptacle refilled for the next day's use. Where the mines furnish the light, the general practice is, that some one man be instructed in the operation and maintenance of the lamps, and to keep them in repair and refill the charges. The miner on going into the mine is handed a lamp ready to burn, on the addition of a little water, which the miner puts in himself. Where the miners pay for their own light, they buy the carbide in bulk, keeping it in air-tight cans, and attend to the lamps themselves.

In presenting its catalog of Waugh drills the Denver Rock Drill and Machinery Company does not go into details relative to the merits of pneumatic hammer drills, as adapted for all classes of mining, in comparison with the old style piston drill. In the last few years rapid advancement has been made in the use of pneumatic hammer drills for mining. The hammer drill first came into prominence for use in stopes and raises where the cuttings would come out of the hole by gravity. The ability to put in a down hole and keep it free from cuttings, so that the drill bit would always have a fresh surface to cut against, for a time offered a problem difficult to solve. The Waugh sinking and drifting drill has solved this problem, and owing to its construction, a hole below the horizontal can be drilled with the same ease as a hole above the horizontal, and from which the cuttings will come out by gravity. The lightness of the hammer drill is its recommendation to the miner, and as it requires no "set up," a hole can be put in to take advantage of the seams and cracks existing in the rock to aid in breaking the greatest amount of material. The small amount of air consumed and the cheapness of maintenance, in connection with the large amount of work possible to be accomplished, must appeal to every mine manager who is endeavoring to break his ore at the lowest possible cost. Waugh drills are constructed out of tool steel, machinery steel and drop forgings. The workmanship is of the very best, and all parts are made to templet and are readily interchangeable. The use of the Waugh stoping drill is sufficiently well understood to make an explanation of its uses superfluous. It is now possible, by the use of Waugh drills alone, to do any and all kinds of drilling in a mine where formerly hand work and piston drills were used. Not only are the drills intended for use in mines, but they can be used to equally good advantage for all classes of quarry work and general rock excavation. Waugh drills have, in the past, represented the standard of excellence, not only in perfection of construction, but in economy and ease of operation.

A new pump has just been put on the market to meet the demand of a moderate-cost machine of simple construction which will stand that wear and tear of rough usage and which at the the same time can be operated without skilled attention. It is a strong plain pump designed particularly to overcome the objectionable features common to most pumps of this class, and results uniformly show that it has successfully accomplished this purpose. It is thoroughly adapted for rough mining service, for contractors' use, for boiler feeding or for any pressure work up to 200 lb. per sq.in. working water pressure. The valve gear is wholly inclosed and there are no exposed working parts that can be tampered with, or become broken by accident. The pump can be put into any kind of unskilled hands, will stand all sorts of abuse and neglect and still keep on doing its work without giving trouble. Suction openings are cast on both sides of the pump cylinder and the discharge outlet can be faced in four different directions for convenience in making pipe connections. The steam and water cylinders can be turned end for end on the centerpiece connection so as to bring the handholes and pipe connections into the most accessible position when the pump is used in cramped situations. The water valves and valve seats are securely locked into place so that they cannot get adrift under any conditions, and at the same time, they can be quickly removed for inspection or renewal. Great care has been taken to make this pump thoroughly applicable to the varied conditions that continually confront users of this class of machinery and the favor with which it has been received, particularly by miners and contractors, tells its own convincing story. This line of pumps, denominated type "M" pumps, is built in a great variety of sizes, and prompt shipments can be made, which is a point very much to the purpose in modern manufacturing service. These pumps are built by the Blake & Knowles Steam Pump Works, of New York and Boston.

Trade Catalogs

Dean Bros. Steam Pump Works, Indianapolis, Ind. Catalog No. 72. Hydraulic pressure pumps. Illustrated, 32 pages, 6x7 inches, paper.

E. M. Freese & Co., Galion, Ohio. Clay working machinery. Illustrated, 40 pages, 7x10 inches, paper.

The Williams Patent Crusher and Pulverizer Company, Old Colony building, Chicago, Ill. Bulletins. Crushers. Anthracite debris and bituminous coal. Illustrated.

Standard Diamond Drill Company, Chamber of Commerce, Chicago, Ill. Catalog No. 5. Standard diamond drills. Illustrated, 106 pages, 6x9 inches, paper.

Atlas Engine Works, Indianapolis, Ind. Catalog. Steam, gas and gasolene engines and boilers. Illustrated, 96 pages, 8x10½ inches, paper.

D'Olier Engineering Company, 119-121 S. 11th street, Philadelphia, Penn. Bulletin, Series T, No. 9. Horizontal centrifugal pumps. Illustrated, 8 pages, 6½x10 inches. Leaflet No. 10. Steam turbines. Illustrated, 4 pages, 6x9 inches.

Traylor Engineering Company, Allentown, Penn. Catalog. Concentrating mills and machinery. Illustrated, 63 pages, 6½x9½ inches, paper. Catalog. Furnaces and smelting accessories. Illustrated, 128 pages, 6½x9½ inches, paper.

Buffalo Forge Company, Buffalo, N. Y. Catalog 20B. Blacksmiths' and metalworkers' punches and shears, angle and tee-iron cutters. Illustrated, 24 pages, 7x10 inches, paper. Catalog 78B. Blacksmith tools. Illustrated, 40 pages, 7x10 inches, paper.

Blake & Knowles Steam Pump Works, 115 Broadway, New York. Bulletin BK-825. Vertical triplex power pumps, single acting. Illustrated, 24 pages. Bulletin BK-826. Vertical triplex power pumps, double acting. Illustrated, 8 pages. Bulletin BK-827. Deep well pumps. Illustrated, 16 pages. Bulletin BK-828. Ammonia pumps. Illustrated, 4 pages.

Dodge Manufacturing Company, Mishawaka, Ind. Catalog C7. Power transmission machinery. Illustrated, 408 pages, 6x9 inches, cloth. Bulletin No. 115. Ball and socket shaft hangers with plain and self-oiling bearings. Illustrated. Pamphlet. Friction clutches. Illustrated. Pamphlet. Safe Construction and Speeds for Flywheels. Illustrated. Pamphlet. The Harnessing of Water Powers. Illustrated.

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An Iron Deposit in the California Desert Region

The Ore Is a Soft or Semi-hard Hematite—A Replacement of Limestone near the Contact with Igneous Rock Accompanied by Vein Filling

BY CHARLES COLCOCK JONES*

The principal deposit described in this paper conforms exactly to the type referred to by Charles K. Leith in his report[1] on the iron ores of southern Utah. In the introduction to his contribution on this subject Mr. Leith says: "It early became apparent to me, as it had been to others, that the iron deposits of the West are prevailingly of a distinct and uniform type—an irregular replacement of limestone near the contact with igneous rocks, or a vein filling in both limestone and igneous rock—a type fundamentally different from that of the important producing districts east of the Mississippi river and probably of different origin."

While I do not entirely agree with Mr. Leith's generalization that the iron ores of the West are prevailingly of a distinct and uniform type, I have quoted from his paper because the deposit in question is so aptly described in the above paragraph. In the spring of 1906 while on a professional trip in the Providence mountains in the eastern part of San Bernardino county, Cal., between the Sante Fé railroad on the south and the Salt Lake road on the north, I first heard of and visited this iron deposit, later becoming the owner of it by U. S. patent in 1908.

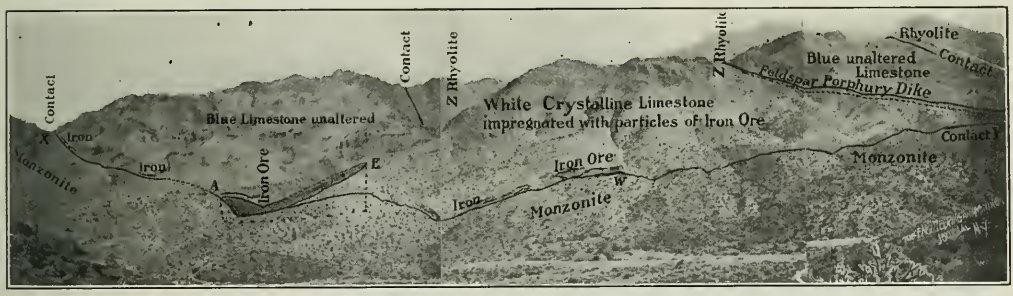

FIG. 1. PANORAMIC VIEW OF PROVIDENCE MOUNTAIN, SAN BERNARDINO COUNTY, CALIFORNIA

FIG. 2. ORIGINAL BEDDING PLANES PRESERVED IN THE IRON ORE

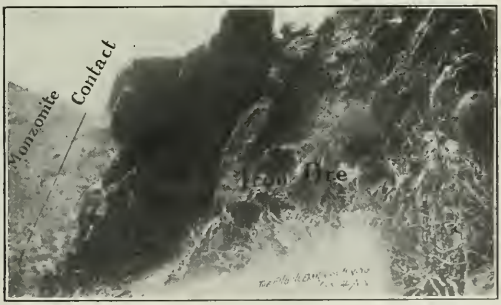

FIG. 3. IRON ORE CLIFFS AT POINT E IN GENERAL VIEW

Structure of the Mountain Mass

Without taking into account the semi-detached outliers to the northeast and southwest, the Providence mountain proper is a single mountain mass about 25 miles long by 8 miles wide in its greatest dimensions. It is deeply cut by precipitious cañons on both the east and west sides, and is divided unequally by a comparatively low pass running east and west near its south end. It rises from an elevation at the base of 2300 ft. to 6500 ft. on the highest peaks. The middle of the mountain is situated about 115 deg. 20 min. west longitude and 35 deg. north latitude. Kelso, the nearest desert town, lies about 4 miles west.

The longer axis of the mountain runs about north 20 deg. east, and this is also the general strike of the upturned sedimentary strata. Beginning at the base on the west side, at irregular intervals is seen the underlying granitic and gneissoid rocks; lying unconformably on this basement are about 500 ft. of quartzite with two thin shale beds near the top and a thin bed of conglomerate at the bottom; lying conformably above this are 4000 ft. of a series of generally heavy, bedded, blue limestones with several beds of shale in the top 1000 ft., the whole forming a

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[1]*Bulletin No. 338, U. S. Geological Survey, "Iron Ores of the Iron Springs District of Southern Utah."*

series of almost perpendicular cliffs on the west side. The general strike of the beds is north 20 deg. east, with a dip of about 24 deg. to the southwest.

In my investigations no characteristic fossils have been found, but I am inclined to place the sedimentary formation as a whole in the lower Paleozoic series. The actual horizon, however, is of minor importance as related to the ore deposits, the veins or iron-ore deposits being primarily dependent on or connected with intrusive igneous rock in a sedimentary formation.

Igneous Intrusions

Nine miles southeast of Kelso occurs the low pass, already mentioned, at an elevation of 4200 ft., Kelso being 2100. This, known locally as Fooshay pass, follows generally the line of contact between the sedimentary series and an intrusive monzonite mass, and divides the mountain both physically and geologically—to the north of the pass is the sedimentary series and to the south the igneous intrusive mass.

Previous to the faulting which brought the monzonite in juxtaposition to the sedimentary series, but subsequent to or coincident with the upheaval which tilted the 5000 ft. or more of sedimentaries, there was a faulting of the already tilted series and an intrusion of highly acid or rhyolitic rocks in the form of a neck or plug near the middle of the mountain. It is roughly elliptical in shape, 1¾ miles long by ¾ mile wide, and so far as known entirely surrounded by sedimentaries preserving their general northeast strike and dip to the southeast. The relative positions as outlined above are clearly shown in the sketch map.

This central core or intrusive mass forms one of the highest and most rugged peaks of the whole mountain and erosion has exposed several contacts from the top to the bottom in the deep cañons between it and the limestones. The chief feature of interest about these contacts is the entire absence of metamorphism or evidence of any appreciable heat effect on the various beds of limestone. Only insignificant mineral bodies or slight replacements of any kind have been so far discovered along these contacts. Several narrow dikes of a feldspar porphyry have penetrated the limestone from this central core, the especial dike having any collateral bearing on the iron deposits being the one indicated in the general view from *Y* to *Z*.

Adjacent Rocks

The panoramic view, Fig. 1, shows the monzonite rocks in the foreground and the line of contact with the sedimentaries. The chief iron deposit occurs as shown at *A* to *E* at the west corner of an oblong mass of marbleized limestone. To the northeast on the line *Z Y*, this block is bounded by a vertical dike of feldspar porphyry, about 75 ft. wide, which is an offshoot from the main porphyry core spoken of above and shown at the top and upper right hand corner of photograph. The monzonite contact bounds the south side of the block and curves eastwardly around the west end of the iron body for a distance of 200 ft. and probably projects at depth to a considerable distance further under the line to the northeast, forming the other boundary of the block.

The principal part of this block forms a sharp ridge about 3000 ft. long by 1000 wide and 500 ft. high, and shows almost complete loss of original bedding planes, a metamorphism of the limestones through heat and pressure to marble, and a shearing with a deposition of veinlets of iron in the cracks and a large distribution of shot iron throughout the marbleized lime. This latter condition, especially at and near the contact, shows all the phases from innumerable mere pin points of bright hematite to reticulated veins of the same in the metamorphosed limestone and on up to complete replacement of the limestone by iron ore

The chief deposit of iron ore occurs at the point *A* where erosion has exposed the body for a length of 775 ft. in a northwest-southeast direction with a greatest width of 290 ft. and an elevation above the cross gulch of 260 ft. The northwest portion of this body is in direct contact with the monzonite on the south, the west and for some distance on the north. The southeast portion of the orebody leaves the contact and projects into the limestone and by erosion the harder iron ore has been left standing above the surrounding metamorphosed limestone to a hight of from 10 to 50 ft. These features are shown in Figs. 5 and 6.

Effect of the Monzonite Intrusion

The general dip of the limestone beds in the Providence mountain to the southeast has brought what were among the top beds of the series at the west side into contact with the monzonite at the iron deposit and it appears to me as the simplest explanation that the pressure exerted by the intrusion of the monzonite in the special area under consideration, *A Y Z*, opposed by the rigidity of the dike *Y Z* and the mountain mass beyond to the northeast, resulted in a flat anticlinal beginning at the point *A* and including the small ridge.

This is plainly shown in Fig 5, where

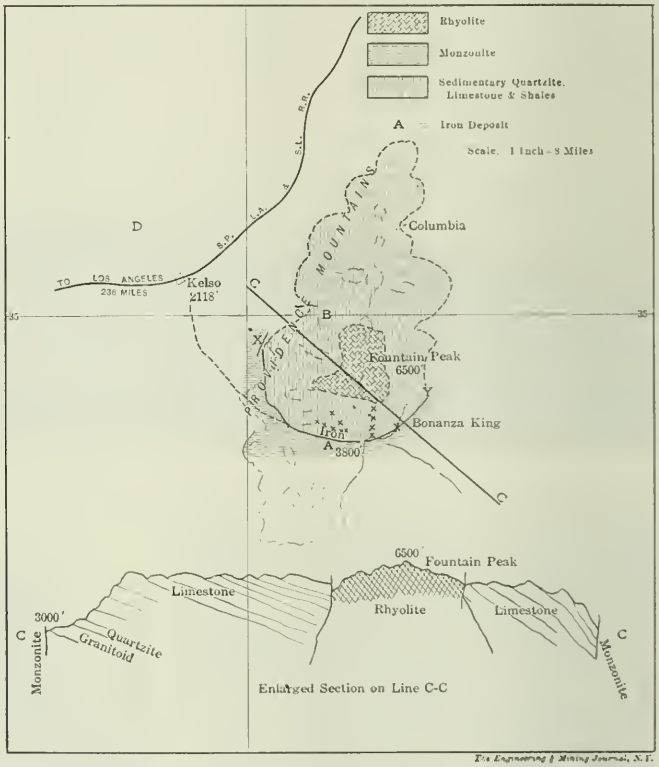


FIG. 4. SKETCH MAP SHOWING LOCATION AND GENERAL GEOLOGY

at the contact the old bedding planes of limestone are seen dipping to the southwest, cut at a steep angle by the monzonite, and (on a larger scale) in Fig. 2, just north of this showing the individual beds of iron, representing clearly the replaced beds of limestone, dipping slightly to the northeast. This anticlinal zone of compression, complicated by shearing stresses the results of which are indicated in short but effective north-south faulting (both being the effect of the intrusion of a large mass of igneous rock into favorable sedimentary strata) afforded excellent conditions for replacement by mineral bearing solutions from below.

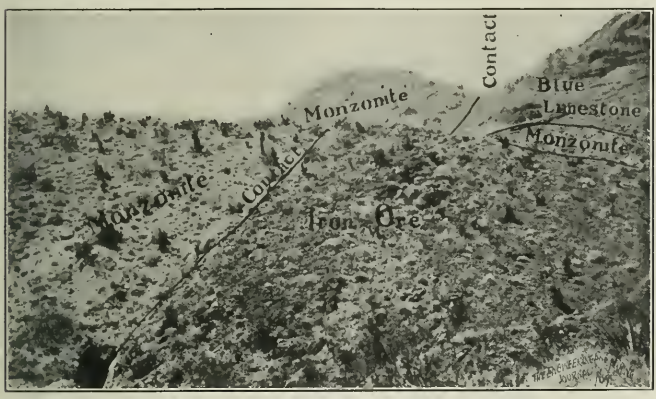


FIG. 5. VULCAN IRON DEPOSIT—LOOKING NORTHWEST

The contact generally for two miles shows small iron contact veins or deposits or metamorphosed limestone highly charged with iron particles, but with the exception of the large deposit and the bodies at *W*, they are not of any appreciable extent at the surface. The lenses or bodies at *W* differ from the chief ore deposit at *A* in being strictly contact deposits, as far as the surface indicates, running in size from several feet in thickness to 25 to 50 ft., accompanied by thicknesses up to 50 ft. of marbleized lime containing at least 50 per cent. iron in reticulated vein form.

The only copper indications so far observed are found to the east of point *W*, occurring as a small proportion of chalcopyrite at one place in the crystalline limestone immediately adjacent to the monzonite contact. There are no present features about the main ore body to indicate the presence of copper nor has it any similarity to a gossan capping.

Products of Metamorphism

Beyond the change of limestone to marble or highly crystalline limestone, the products of metamorphism so far as observed are few—a slight kaolinization of the monzonite immediately at the contact, and a few thin beds or patches of serpentine and actinolite some distance north of the contact in limestone. There is an absence of garnetization or epidotization in any of the limestone beds, which is rather noticeable in view of the somewhat common occurence of these products of metamorphism under similar conditions in this immediate region.

At a short distance from the contact considerable epidote has been developed in the monzonite following the action, which jointed it and which was probably connected with the intrusion of numerous diorite dikes or bosses, beginning a short distance south of the contact but nowhere seen as accompanying or cutting the actual contact.

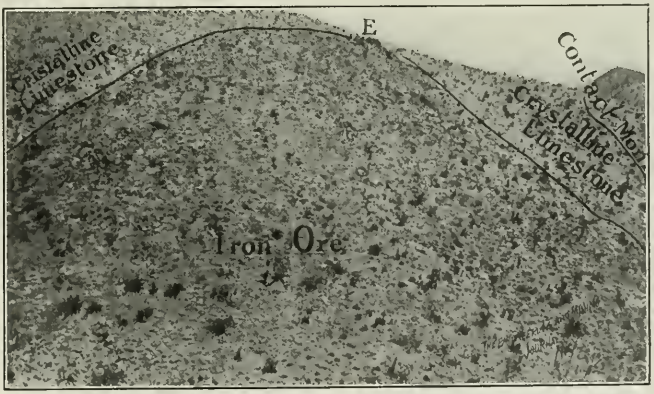


FIG. 6. VULCAN IRON DEPOSIT—LOOKING SOUTHEAST

The Iron Ore

The iron ore is a soft red hematite with considerable magnetism; on the surface it weathers hard and appears black, but upon penetrating it a few feet it is porous, shatters easily in mining and in the tunnels and on the dumps has the appearance of a limonite on account of the ocherous dust filling the pores. It belongs to a most desirable class of soft or semi-hard hematite ores of which there are unfortunately but a few deposits so far discovered in California. The analyses given herewith were made through the courtesy of E. N. Breitung, at the laboratory of the Breitung Hematite Mining Company, Negaunee, Mich.

IRON ORE ASSAYS.

	No. 1	No. 2	No. 3	No. 4
Iron	66.40	65.70	64.00	63.40
Phosphorus	0.046	0.088	0.045	0.052
Silica	1.02	2.67	4.00	4.47
Manganese	0.295	0.278	0.254	0.287
Alumina	0.213	0.187	0.468	1.403
Magnesia	0.226	0.179	0.204	0.197
Lime	0.421	0.347	0.562	0.445
Sulphur	0.042	0.076	0.070	0.049
Volatile	1.75	1.50	2.01	2.16
	70.413	71.025	71.613	72.463

No. 1 is a bulk sample from underground. Nos. 2, 3 and 4 are samples from the surface at different points. These four show the highest phosphorus obtained from a number of samples and it ranges from the figures above down to 0.020 per cent., the average of 10 samples is iron 64.82 per cent., phosphorus 0.0434 per cent.

Magnetic and Economic Features

As a matter of interest, when considering the magnetic qualities of the ore, calculations were made based on the above complete analyses in which by satisfying the iron as a hematite (Fe_2O_3) and not accounting for any other small amounts of oxygen the results ranged from 98.86 to 99.61 per cent. for the sum of complete analyses, and satisfying the same as magnetite (Fe_3O_4) the results were from 95.71 to 96.63 per cent., so that from an analytical standpoint the ores are unquestionably hematite. The matter of the magnetism or magnetic quality of iron ores is an interesting one and I should like to see published the observations of others on this subject.

It is conservatively estimated that there

are 2,000,000 tons of ore available above a track level on this property capable of being quarried and loaded at a minimum cost and as the iron beds are shown in place going down below this level and all conditions would point to a continuity to considerable depth, there is every reason to believe that the actual tonnage will be several times the above amount. Unlike a number of other desert deposits, this property is favorably situated in being but nine miles from a railroad with a down grade, and in reasonable distance from the sea coast.

Other Neighboring Deposits

Without being able to give a complete description it is interesting to know that four miles east of Kelso at the point *B* on the sketch map, and about three miles north of the orebody already described, occurs another iron deposit of a different class. Here the sedimentary formation has been faulted near the base and an igneous rock, similar to the monzonite occurring in Fooshay pass, but complicated with a more basic rock, has cut the quartzite at a high angle to the west of it, and parallel with its strike, north 20 deg. east, and along this contact a vein 40 to 50 ft. wide of hard specular iron ore of a high quality has been developed for several hundred feet. This occurrence is below the limestone and seemingly not connected with it in any way.

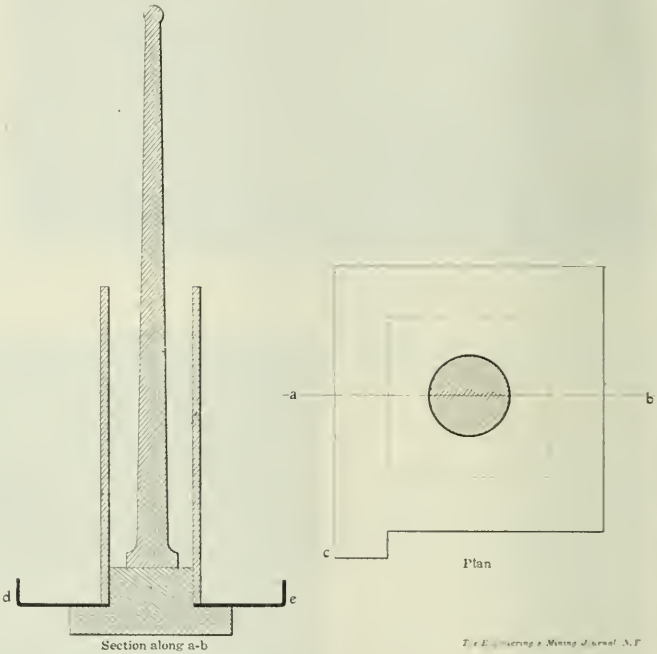
North of Kelso three miles, at the point *D* occurs a vein of high-grade, hard, red hematite, four to 10 ft. thick, standing vertically and traceable for 2000 ft. So far as the surface shows, it represents a replaced limestone bed just above the quartzite and is accompanied by unaltered parallel limestone beds. The quartzite is correlated with that at the base of the formation in the Providence mountains. The ore in this instance, while not seen in direct contact with intrusive igneous rocks, is undoubtedly one of the results of the injection of diorites into the sedimentaries which are close by.

The subject of western iron ores is likely to become of importance in the near future, not only by reason of the exhaustion of high-grade ore in other sections of the country, but on account of the necessity for filling the growing demands of the Pacific coast more cheaply than at present. China today is shipping cargoes of pig iron to California, a fact hardly appreciated, I think, by ironmasters advocating a reduction in tariff on iron and steel at the present time. With its known large resources, cheap labor and modern iron and steel plants, China is a factor not to be overlooked. The hope of the Western coast lies in cheap fuel on Puget sound or the utilization of California oil in smelting iron ores.

Novel Hand-Crushing Device

By Herbert L. Jene*

Having found the ordinary bucking plate quite unsuitable for crushing down samples of coarse ore on account of the fact that much of the material is apt to fly away in the process of bucking, I devised the apparatus shown in the accompanying illustration. It consists of a base or pedestal, a galvanized-iron tray and an iron pipe which, fitting over the base, forms the mortar. The base is a one-piece iron casting the bottom of which is 12 in. square and 2 in. thick, with a top projection 3 in. high by 6 in. diameter.



DEVICE FOR CRUSHING COARSE SAMPLES OF ORE

Over this fits closely a galvanized iron tray *d c* 20 in. square with the edges turned up 2 in. leaving a lip *c* 4 in. wide, in one corner. In the center of the tray is a hole 6⅛ in. diameter so that it can fit over the top of the pedestal. A piece of 3/16-in. iron piping 6⅛ in. diameter and 2 ft. long fits over the top of the pedestal and tray. The iron pestle or stamper is 3 ft. 6 in. long with a shoe 4 in. diameter by 1 in. thick; the stem of the pestle is 1½ in. in diameter at the bottom and gradually tapers to 1 in. at the top.

In using the apparatus the tray and pipe are placed in position, and then the coarse ore thrown in and broken down with the stamper. When sufficiently fine, the stamper and pipe are removed, and the ore brushed upon the tray. The pipe is then replaced, and the operation repeated until the sample is completed. The pipe is then removed, the ore on the mortar base is brushed off and the tray carefully removed. The sample ready for quartering and final grinding on a bucking plate is poured into a bag through the small lip *c*. This apparatus is particularly suitable for kerosene shale or any material which is apt to fly during crushing. The pipe can be made longer or shorter according to the nature of the material being crushed.

*Mine examiner and analyst, care Commonwealth Oil Corporation, Sydney, Australia.

In the annual report of the Transvaal State mining engineer, U. P. Swinburne reports that there are several large deposits of iron ore in the Barberton, Lydenburg, Middelburg and Pretoria districts, but most of them carry so high a percentage of titanium, that they are not available commercially at present. Some experiments are being made with limonite and hematite ores comparatively free from titanium, which are found near Pretoria. No iron is now made in the Transvaal.

Kimberlite Rock and the Origin of Diamonds

Serpentinization Responsible for Many Peculiarities of the Pipes; Kimberlite a Serpentinized Pyroxenite. Broken Diamonds; Exploding at Surface

BY F. W. VOIT*

Since I read my papers on these subjects I have had occasion to study microscopically a good many rocks from pipes and dikes, and the discussions of these papers have developed some new ideas which I should like to make known.

Kimberlite has always been described as a serpentinous breccia, the serpentinized portion of the rock being altered olivine; generally the term "serpentinized peridotite breccia" has been accepted. The material filling the pipes was said to have been formed at great depths and brought to the surface by volcanic action. The rock itself, its occurrence and the way it came to the earth's surface have been described as being unique and as having an extraordinary and unusual genesis.

I must admit that the decomposition of the kimberlite has gone so far that it will be extremely difficult to come to a conclusion as to its true character. My investigations convince me that up to the present time justice has not been done the kimberlite rock, and that some extraordinary characteristics, which certainly do exist, induced people to attribute to it an unusual genesis.

The slides which I examined are from pipe rock near Kimberley, the Roberts Victor, Voorspoed, Regina, Lovedale, Monastery, Premier, Zonderwater, etc., and dike rocks from Kimberley, Paardeberg, Prieska, Vulcan, Smaldeel, etc.

It is characteristic that while the pipe and dike rock of one district resemble each other very closely they can easily be distinguished from similar rocks of other districts, so that we have a Kimberley type, Roberts Victor type, Premier type, etc. From the description of the slides some of the more important of which are given below, it will be seen that I laid stress only on three points: First, on the imputed brecciated character, due to the movement of a molten mass in an open crater containing minerals of a deep-seated origin; second, to the structure of the rock; third, to the chief constituents building up the rock, whose presence gives it its name.

General Classifications

With regard to the term peridotite, with which generally the kimberlite is classed, I wish to point out that Harger first drew attention to the fact that in many cases pyroxene was undoubtedly prevalent in the rock. In the numerous slides examined, I did not find one in which the olivine occurred in such quantities that it would be justifiable to call the rock a peridotite. With reference to the use of the term breccia, I have previously pointed out that the kimberlite might be called a breccia only with regard to the sometimes angular, sometimes rounded inclosures of foreign rock fragments, though for my part I prefer the term agglomerate.

There are undoubtedly strong evidences of pressure in the rock in the shape of broken and bent minerals. In large specimens as shown by Mr. Harger, I would attribute this phenomenon in greater part to the secondary protrusions of a magma. The broken character, however, of phenocrists of mica and pyroxene is, under the microscope, clearly due to serpentinization. The more serpentinized the rock is the more we find the phenocrists broken and bent.

Pipe Rock more Porphyritic

With regard to the structure of the rock, we have to do with a rock very similar to "Ganggestein," that is, a rock standing between a plutonic and an effusive rock; we have a magma crystallized out *in situ* and under pressure. There are always two distinct generations, and the rock is more porphyritic in pipes and more basaltic in dikes. All the minerals have apparently crystallized out *in situ*, though occasionally crystallization during the ascension of the magma may have taken place since under the microscope we sometimes find corroded crystals.

The great variety of the accessory minerals may to a certain extent be due to the incorporation of rock fragments of different chemical compositions in a magma of great resorbing capacity. In fact I believe that the broken fragments of deep seated rocks have been dissolved to a certain extent by the ascending magma and in this way attained their rounded forms.

Description of Rocks

1. Kimberley Mine—(2400 ft.) Large phenocrists of pyroxene (diopside ?) and some mica in a finely crystalline mesostasis of serpentine, probably also pyroxene; typical porphyritic structure. Pyroxenite porphyry.

4. Robert Victor—Pyroxene phenocrists; much evidence of pressure, secondary green mica mesostasis finely crystalline, pyroxene (?) Typical porphyritic structure. Pyroxene porphyry.

5. Roberts Victor—Fissures. Augite phenocrists (a few small olivines) in augitic mesostasis; structure more basaltic.

7. Prieska Diamonds—Fissure. Cryptocrystalline rock, all augitic; a few augite crystals, structure basaltic.

9. Lovedale—This mine contains plentiful segregations of a (macroscopically) coarsely crystalline diopside rock containing many garnets (eclogite) in a finely crystalline diopsidic blue ground of very similar character. Under the microscope the segregations are a coarsely crystalline mixture of diopside and some enstatite, both strongly hydrated; garnets showing kolyphysation; this rock gives to a certain extent the impression of a holocrystalline structure. The zone into which the segregation gradually passes, is cryptocrystalline and shows besides serpentine, secondary sericitic mica.

12. Premier Mine—Bore core 500 ft. Pyroxene porphyry, containing small olivines.

16. Fissure from Klein Zonderhout—(Twenty miles south of Premier). (a) Augite crystals, fibrous by secondary products in augitic ground mass; basaltic structure. (b) Phenocrists of augite (partly altered into mica) and vaalite, feldspar (?) including a mica; more porphyritic structure.

I must note that a few times in examining the slides I got a suspicion that feldspar might be present. The decomposition, however, has gone so far that I doubt whether that point will ever be settled. I found in No. 16 b, a mineral which certainly showed faint traces of polysynthetic twinning. There are orderly arranged inclusions of secondary, highly hydrated nature which points to schillerization, though nothing definite can be stated with regard to this point. Characteristic of all these slides was the absence of any glass which one would expect in a rock cooled down in an open crater.

The difference in the structure of the pipe and the dike rocks is generally very marked, though apparently connecting links between both may exist (No. 16 b). The difference of both structures may be due to the slow cooling down of the pipe rock in a large basin and the quicker cooling down of the dike rock between the narrow walls of the fissure. However, we then would expect toward the walls of the pipe a rather basaltic structure similar to dike rock which is not the case.

Nearly always a few feet from the walls the pipe rock is simply found to be "hardibank," which is in no way except disintegration different from the soft blue rock. If microscopical examinations do not give

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NOTE—Abstract of a paper read before the Geological Society of South Africa.

us a final result with regard to the relation of dikes to pipe rock, field evidence shows a marked difference between the two rocks. We must abandon the term peridotite, as the rock is much more likely to be a porphyritic pyroxenite.

Diamonds in Diabasic Rocks

I am inclined to look upon kimberlite as the last evidence of a series of volcanic activities (in the larger sense of the word) during and after the sedimentation of the Karow formation, beginning with unusually acid quartz diabases in the lower beds of the Karow. In the middle and upper beds these diabase sheets take a more and more normal character (augite-felspar) until finally in the extrusion of the kimberlite the ultra-basic magma was extruded from the zone of reconstruction. Chemically we have a transition of diabases into kimberlites, and field evidence is apparently strongly in favor of this assumption. Everybody who has worked on the veldt has had the experience of being uncertain whether he has to classify certain rocks as diabase or as kimberlite.

If we have on the one side a kimberlite free of all the accessory minerals, and being simply a serpentinized pyroxenite, we occasionally find on the other hand in diabases large ilmenite segregations and numerous garnets. Rocks of diabasic character and belonging to the older horizons may even contain diamonds and many of the accessory minerals typical of kimberlite. This latter point may turn out to be of great interest, as we might then expect to find diamonds in diabases and similar rocks here in Africa, as they were found in hornblende diabases in other countries,[1] and this possibility throws a new light on the occurrence of diamonds on many of the so-called alluvial diggings.

Alluvial and Other Deposits

It is extraordinary how widely spread we find the diamonds in South Africa; there are diamond fields far from the river on the high plateau where the old river never flowed, as for instance, the Vaal river, Pniel estate, etc. We find diamonds 25 miles north of Bloemhof spread over a wide area where no alluvial gravel exists; again, we find them near Christiania upon the hights where also are no traces of old river gravel. Here the diamonds are simply found in the decomposition products of the country rock, a very green, hard, sometimes amygdaloidal rock of diabasic character, which as feldspar is inferior in quantity to pyroxene, would rather deserve the name of pyroxenite.

Generally the gravel of the so-called alluvial diamondfield is absolutely different from the gravel of the modern rivers, and it is most likely that the diamonds have weathered out there *in situ* from diamondiferous diabasic rocks of different ages. We may assume, for instance, that the diamonds on the Harrisdale ground came from a now denuded kimberlite sheet, as we know by borehole results that extensive sheets of kimberlite, or a rock very similar to it, still exist on the ground.

Weathered Products of Diabase Dikes

Some of these diamonds may weather out from diabase dikes and there is a strong suspicion that the diamonds on the Pniel and Vaal river estates have weathered out from the amygdaloidal diabase underlying the Dwyka conglomerate and are still doing so. The many blue, black, yellow, brown-banded chert jaspers and ferruginous cherts, known as bantams, looking as if they were waterworn, have weathered out from the Dwyka conglomerate, and were concentrated *in situ*.

There is a marked difference in the gravel of the present river beds of the true alluvial deposits, and the gravel of those alluvial deposits; furthermore, hard as the diamond is, it would show a good deal of attrition if it had traveled a long way, but in most cases these diamonds show sharp edges just as stones from the pipes. The contention has also been that the diamonds in these gravel deposits may come from a yet undiscovered pipe in the neighborhood. Following up this theory we may expect occasionally to find diamonds in pyroxene rocks of any geological horizon and the diamonds in the conglomerates of the Witwatersrand reef beds of the Klerksdorp district, for instance, may have been derived from those diabasic rocks which are members of the Swaziland beds or fundamental gneiss formation.

Eclogite Segregations

With regard to the much-disputed character of the eclogite nodules I should like to make the following remarks. From all sides, especially from Mr. Bonney and Mr. Harger, the rounded faces of all the "eclogites and similar boulders" have been taken as the stumbling block to the segregation theory. Mr. Bonney says that Mr. Corstorphine and myself tacitly repudiate the rounding of these eclogite and similar boulders by a sort of "cup-and-ball action" in a volcanic pipe.

I consider this term "cup-and-ball action" extremely ill chosen, as I think that nothing of that sort happened. I rather think the rounded nature of foreign rock fragments is due simply to the dissolving capacity of the kimberlite magma which has eaten away the corners and left a more rounded fragment. I always maintained that often a characteristic of segregations of a magma is their rounded shape, and we must not forget that contact metamorphism on foreign rock fragments included in a magma can also be found on segregations.

Specimens from Lovedale Mine

From many eclogite segregations which I saw, I brought before this society some specimens from the Lovedale mine with the including blue ground, and it is accepted that these cannot be anything else than segregations. The chemical composition of the nodule and its matrix is absolutely the same; in both cases a diopside rock with more or less garnet, still we have that smooth and absolutely rounded surface which Mr. Bonney perhaps would call waterworn.

Elipsoidal or perfectly round balls of these nodules—to which the term "cup-and-ball action" might be very well applied—exist in the mine and where they are still imbedded in the finely grained blue ground, their sharp contours can be seen; the contact of nodules and matrix is extraordinarily abrupt and well marked. I will not deny that occasionally an eclogite may be an exotic rock and may have been brought up by the ascending magma. Certain banded eclogites with pink garnets are probably exotic rock fragments but the greater number of all the eclogites and similar rocks are certainly segregations.

Serpentinization and its Effects

Before concluding this paper I wish to make some remarks about the alteration of the kimberlite. This point has been recorded by du Toit. I think that up to the present too little attention has been given to that point. Du Toit calculates that the increase in bulk of the material in passing into the stage which we know as blue ground would be something like 13½ per cent.; in fact it would probably be higher as the original mineral which built up the rock is in most cases diopside.

Covered as the pipes were, the pipe material during its serpentinization could not extend anywhere and it is clear that the breaking effect due to an increase in volume, must have been considerable. That effect of pressure we can observe under the microscope beautifully, and we can safely say the more decomposed the kimberlite is, the more its phenocrists are bent and broken. I think that this expansive force which did not find an outlet must have also had an effect on the large crystals of the accessory minerals which were broken, and here we may find an explanation for the broken diamonds.

The Cullinan and Broken Diamonds

Of these broken diamonds Gardner Williams says: "The frequent occurrence of broken diamonds imbedded in hard kimberlite is a conclusive proof that the diamonds do not occur in their original place of crystallization." I personally think that these so-called splinters are nothing but incomplete forms of crystallization but I should not like to give a definite opinion about it.

Certainly I am not so sure about the Cullinan being a broken diamond. It may

[1] "The Origin and Occurrence of the Diamond," by Prof. T. W. E. David, THE ENGINEERING AND MINING JOURNAL, Aug. 24, 1907.

have laid against a boulder and the growing of the crystal could only take place toward certain directions on a certain number of faces. However, I saw indubitable splinters myself and I think it is possible that some diamonds may have been broken in the blue ground itself by secondary magmatic and gaseous extrusions during and after the formation of the pipe, or by the pressure during serpentinization. We know that the diamond is very brittle and cracks very easily if only a slight pressure or blow is exercised.

Exploding of Diamonds

Whether it is true or not that diamonds explode when brought to the surface, I do not know. Croakes and Gardner Williams state it, and the latter says that this cracking is more due to the result of heat or drying than to the tension of inward pressure. If this exploding of diamonds really happens, then, I think, we may have to do with a displacement of the molecular arrangement due to a change in temperature very similar to the leucite phenomenon.

A similar displacement of the molecular arrangement in the diamond may take place during the cooling of the magma and may be responsible for the breaking of diamonds.

All the conditions which may make a diamond explode on the surface may have been present in the interior of the pipe during the various phases of temperature: Cooling down of the magma; rise of temperature during serpentinization.

If broken diamonds exist in such quantities as maintained by certain people, we have more than one sound explanation for this phenomenon and we need not look for such a far-fetched idea that diamonds formed at an unknown depth were separated from their original source and brought into the pipe by volcanic action through which they were more or less broken.

A Deep Diamond Drill Hole

At Bisbee, Ariz., in late years, there has been a great deal of prospecting with the diamond drill. Boring has recently been done on the property of the Warren Realty and Development Company, and on that of the American Development Company. The former has finished a hole 3200 ft. in depth, which is claimed to be the deepest diamond-drill hole yet bored in the United States. This hole was put down vertically on the flat ground about half way between Bisbee and Osburn Junction, a few miles southeast of Bisbee. It required one year and 10 days to complete the hole, working one nine-hour shift per day. About two weeks' work were lost in repairs not chargeable to the drilling. The drill used was a Sullivan, Class "C," single-cylinder, hydraulic-feed drill, having a rated capacity of 1500 ft., and removing a 1⅛-in. core. When work was begun it was not the intention to go to such a great depth, or a larger drill would have been installed. The "C" machine performed the work satisfactorily, however, the only trouble caused by the severe overload being the breakage of a gear stand, which was easily remedied.

The drilling of this deep hole involved some interesting features. Diamond drills have received more or less criticism from time to time on account of the deviation of the hole from its true course under certain conditions. Some writers have gone so far as to say that drill holes will deviate in any case, whether conditions outside of the drill are favorable for this action or not. This particular bore hole was perfectly true from top to bottom. At its completion it was tested several times with a clinometer, consisting of a closed glass tube about half full of hydrofluoric acid. This instrument was placed in a metal tube, carefully sealed to exclude water, and lowered in the core barrel to the foot of the hole. After waiting a half hour or longer, it was removed. The acid in each case etched a horizontal circle on the glass, showing that the tube had maintained a vertical position.

The time required to hoist or lower the rods at the final depth was 2¾ hours. The rods were pulled 20 ft. at a time by means of a single sheave, and lowered with the engine. In the course of the year's work five ⅝-in. first-quality steel ropes were worn out. A timber derrick 36 ft. high served to pull the rods. For the first 580 ft. the drill bits had to be reset about every 8 ft. Below that depth more favorable ground was reached, so that a size "A" bit ran for 30 ft. on an average. Eight carbons were used, being set with 1/64-in. clearance. Care in setting the bits evenly and with a small clearance was probably responsible for the success of this hole. It has often been noted that excessive clearance results in more or less serious deviation. In fact, in the case of a number of deep bore holes in South Africa, in which serious deviation from a true direction occurred, it was observed in each instance that the diamonds had been habitually set with an excessive clearance.

The mining company, through its drilling superintendent, Louis Buese, of Republic, Mich., gives the following information regarding the progress of the work: Standpipe was driven through 38 ft. of surface, and the casing secured by drilling it 4 ft. into the rock. Soft ground was encountered at several places, down to 580 ft. Instead of reaming out the hole and casing it, to overcome the trouble, the cementing method was employed. After drilling as far as possible in the soft ground, cement was pumped down through the rods, the rods pulled, and the cement left to harden until the next day. This cementing kept the hole tight, and secured return water as far as 580 ft. In the lower part of the hole the water gradually decreased and at last failed to return at all. As the core was good, however, no effort was made to get the water back. Power was supplied by a 20-h.p. upright boiler.

Most of the very deep holes bored in recent years have been in the Transvaal. At least three have gone to depths of more than one mile, viz., 5560, 5582, and 6340 ft., respectively. For this heavy drilling the Sullivan Class "P" (4000-ft) or Class "K" (5000-ft.) drills were used. The rods were hoisted in 50-ft. sections, with double sheaves. A mile of rods required about 8 to 10 hours constant labor for its removal from the hole.

New Proposals for Zinc Extraction

Woldemar Hommel and Henry L. Sulman, London, Eng. (Brit. pat. No. 23,901 of 1907) describe an improved process based on British patent No. 21,672 of 1906 granted Henry L. Sulman. The ore is generally roasted, and if there is not sufficient sulphur present, iron pyrites or an ore rich in sulphur is added to supply the necessary quantity for sulphurous acid, while the iron serves as a flux for the subsequent smelting of the lead. The ore is then placed in a furnace, the zinc volatilized and collected in a series of fluxes or condensing chambers. It is then treated with a solution of sulphurous acid to obtain a solution of bisulphite of zinc, from which monosulphite is precipitated, and calcined to produce zinc oxide.

Antoine H. Imbert, Grand Montrouge, Seine, France (Brit. pat. No. 13,492 of 1908), describes an invention that follows his British patents, 10,303 of 1906, and 12,591 and 12,592 of 1907, which claimed that in the reduction of blende and analogous ores and also certain oxide ores, peroxide of iron (Fe_2O_3) might be used with a basic oxide or a metallic sulphide to form the solvent. The present invention is based on the discovery that peroxide of iron itself may, under certain conditions, be employed as a solvent.

The blende or ore is heated in a furnace with the peroxide of iron in the proportion of two equivalents of the former to one of the latter. The reacting metal, i.e., the iron, may be used in a solid form, but is preferably heated to a molten condition in a furnace. Baths from the furnaces are brought together in a hermetically closed chamber protected from the air, the iron being added in a sufficient quantity to balance automatically the zinc of the ore. The zinc is released as a vapor and is led into a condensation chamber, while the liquid residuum is drawn from the reaction chamber.

The Three Producing Gold Mines of France

Associated with Antimony and with Arsenic the By-products Are of Importance. Brief Outline of Reduction Plants for These Refractory Ores

BY E. WALCH*

There are at present three producing gold mines in France. To those who have not made a study of the French mineral production, it will be of interest to note the geographical distribution of these three mines. One is in almost the exact center of the Republic in the Department of Creuse. The other two producing mines are situated respectively in the Departments of Mayenne and Maine et Loire, in the northwestern part of France, about 150 miles southwest of Paris. The latter two have been completely equipped for some years, and the Société Anonyme des Mines d'Or du Chatelet, in Creuse, is erecting an entirely new plant which is expected to be in running order during the early months of this year.

The oldest of these three mines at Le Genest (Mayenne) is worked by the Société Nouvelle des Mines de la Lucette, capitalized at 3,150,000 fr. This mine was "granted" in 1889 as an antimony mine. The old company, after a futile attempt to work the mine, sold its rights to the present company, which was floated by Baron Léonino, a relative of the Baron de Rothschild, assisted by Jules Strap, a mining engineer who had examined the property and confirmed the existence of gold in payable quantities in the ore. These gentlemen later disposed of their interest in order to bring all their efforts to the opening of another gold property, the Mines de la Bellière.

The Lucette mine is now under the management of Mr. Biver, at the head office, and Mr. Normandin, at the mine. It is one of the largest antimony mines in the world. Its production in 1906 was 7300 metric tons, or nearly one-quarter of the world's production, and about one-half of the production of France. The ore bodies are almost vertical, and are worked from three shafts to a present depth of 200 m. The ore contains gold as an auriferous quartz, and antimony chiefly as stibnite. Both metals are recovered.

Metallurgical Treatment

The run-of-mine ore is first picked and separated into two general classes, antimony ores and auriferous quartz. The former is treated in a concentrating plant of a maximum capacity of 300 tons daily. This plant consists of crushers, a Cox screening machine and 3-compartment Harz jigs. According to their percentage in antimony, the products of this mill are either smelted to regulus, or roasted to obtain the oxide of antimony for which there is a good market. A new smelting plant has just been started to recover the gold contained in the antimony. This plant is capable of producing monthly 200 metric tons of oxide of antimony and 150 tons of regulus.

The gold quartz is further separated by hand into rich and poor quartz, the former being at present sold to smelters, and the latter being treated in the 20-stamp mill. The stamps, 10 of which were recently started, are of 1000-lb. weight, and it has been found that about 50 per cent. of the gold is free-milling. The pulp from the stamp batteries is concentrated on No. 5 Wilfley tables, of which there are 12, giving two classes of concentrate, one with 50 grams and the other with 500 grams of gold per metric ton. These concentrates are sold

The company is installing a 5-ft. Elmore vacuum concentrator for the purpose of experimenting upon various classes of product, especially on the old slimes

Electric power is produced by the company with an 800-kw. machine and is used for all purposes. About 600 workmen are employed in the mine and reduction works. Although the price of antimony dropped considerably during 1907, from about 25c. per lb. to 8c., the company sold 2,629,061 fr. worth of antimony and antimony oxide. From gold bullion and concentrates they realized 1,050,379 fr., when 10 stamps only were at work. The company declared for 1907 a dividend of 35 per cent.

The next gold mine opened in France was la Bellière, controlled by the Société des Mines de la Bellière, which was also floated by Baron Léonino and Mr. Strap, with a capital of 4,000,000 fr. in 1905, when the mine was granted to them by the French government. This mine is situated at St. Pierre-Montlimart (Maine et Loire), south of the Loire river and about equidistant between Nantes and Angers. This property is supposed to have been worked by the Romans at an early date to a depth of about 20 to 30 m. when water was met and work abandoned.

ST. JEAN SHAFT—MINES DE LA BELLIERE

GENERAL VIEW OF REDUCTION WORKS

The ore consists of quartz and mispickel with some pyrite, chalcopyrite and galena. The mispickel contains the largest part of the gold and yields from 35 to 40 grams of gold per metric ton, while the ore after the hand-sorting carries only from 15 to 16 grams per ton. The gold content increases with the percentage of galena, which also carries a fair amount of silver so that the bullion contains from 15 to 20 per cent. silver. The orebody varies in thickness from 12 to 19 m., and is surrounded by ancient shales, and has been identified for a length of over 1600 meters.

The ore is treated in a 40-stamp mill, with concentrating, roasting and cyanide adjuncts. The ore as it comes from the shaft is crushed in a 20x10 Blake crusher, which delivers it to a Robins picking belt, which conveys the ore to two 11x15 Dodge

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crushers placed over the bins of the stamp mill. The stamps weigh 1050 lb., and the mortars are fitted with 30-mesh wire screens. Copper amalgamating plates are used and inside amalgamation is also practiced. According to the varying character of the ore, from 35 to 48 per cent. of the gold is amalgamated. Amalgamation with the Bellière ore is difficult, as films of oxysulphides are soon formed on the surface of the quicksilver. Careful attention by the millman is required, and each five stamps are stopped every four or five hours to clean up the copper plates. The quartz itself is very hard, and the capacity per stamp is only about 3.4 metric tons per 24 hours.

After passing through the stamp mill the pulp is sized in spitzkasten and concentrated on Wilfley tables. The concentrates which are very high in arsenic and gold are then roasted. In the roasting department the company recovers As_2O_3 and SO_2. The sulphurous anhydride is used to make hyposulphite of lime. The roasted concentrate as well as the tails from the Wilfley tables, which carry a few grams of gold, are cyanided.

A Modern Cyanide Plant

The cyanide plant at la Bellière is fitted with many modern appliances, such as excavators, movable distributors and an extensive system of Robins belt conveyers for feeding and emptying the leaching vats and taking the tails to the waste heap. Slimes are agitated by air and the gold is precipitated in the usual way by zinc shavings. A new 30-stamp mill with 1500-lb. stamps is under construction. It is expected that it will enable the company to double the capacity of the plant which mills at present about 130 tons daily. The concentrating and cyanide plants will, of course, be increased in proportion.

The results in 1907 were satisfactory, although the cyanide plant did not work regularly, being mainly used for experimenting and determining the best way of dealing with the refractory ores. As a very small proportion of the ores milled passed through the cyanide plant, the particulars published by the company are not of great interest. The only interesting feature is that on the portion of the ore which was fully treated 89 per cent. of the gold was saved. At the stamp mill 43,415 metric tons of ore were milled in 1907, producing 1052 kg. of amalgam (about 805 kg. were recovered on the copper plates and 247 in the mortars), containing 284 kg. of fine gold and 42 kg. of fine silver. The average content of the ore, calculated from about 1400 assays of samples taken at the feeders, was 14.5 grams (about 0.5 oz.) per ton, the recovery in the stamp mill being about 45 per cent. The Wilfley tables produced 1260 tons of concentrate and 7185 tons of middlings and sands. The sands and slimes from the tables will be fully treated in the new cyanide plant.

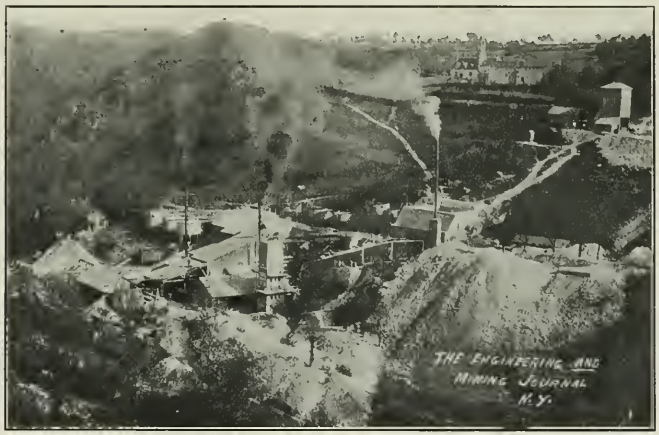
Additional gold was recovered in the experiments in the cyanide plant, bringing the total gold saved by the company in 1907 up to 347,610 grams having a value of 1,193,796 fr. They sold in addition 79,566 kg. of oxide of arsenic bringing 40,920 fr. In the near future it is expected that the arsenic plant will produce from 300 to 400 metric tons per year. The whole plant is electrically driven from a power station of 750 h.p., and an average of 450 workmen are employed in the mine and the dressing plant.

The Chatelet Mine

The third producing gold mine is controlled by the Société Anonyme des Mines d' Or du Chatelet (Creuse), with a capital of 7,500,000 fr. The mine which was only recently opened is situated at Chambon-sur-Voueize in the Department of Creuse in a very hilly region in the center of France. The mine was granted by the French Government in 1907 for an area of 800 hectares. An enlargement of the property is now demanded. Ore of high grade was found there, and many shipments averaging 200 grams (about 7 oz.) per metric ton have been made. The ore is a quartz with a very small percentage of mispickel, and telluride of gold. It does not carry more than 5 or 6 per cent. of arsenic, sulphur and tellurium taken as a whole, but none of the gold is free milling. The main shaft is now down 94 meters and from it two lodes are worked. Another group of veins will be worked from a new shaft that has been sunk at present to 60 meters. It is reported that the average gold content of the veins found on the company's property is 45 grams per metric ton.

The reductions works installed on the property during the prospective period is now being dismantled and replaced by an entirely new plant of 100 tons daily capacity, divided into several units. The first unit is now almost completed, and will be started during the first half of 1909. In the dry crushing plant are dryers, Blake crushers and ball mills. Following the crusher a 20-in. picking belt has been installed. From the ball mills the ore crushed to 10 mesh, falls into an ore bin which delivers to a 12-in. belt conveyer that feeds two duplex Merton roasting furnaces. The roasted ore is elevated on an incline to two tube mills for sliming the ore, the gold being very finely divided. It is then cyanided with air agitation in six vats, filtered in two Ridgway filters, and the gold precipitated in the usual way on zinc shavings. The whole plant is electrically driven, a 3-phase current being used.

Other sections of France are now being prospected for gold mines by various companies. The Société de Recherches Minières Françaises claims to have found in the center of France some promising ore-bodies similar in character to those of la Bellière mine. I might also mention the plant of the Carballino Gold and Arsenic Mines, Ltd., at Harfleur in the department of Seine Inférieure, close to Havre. This company owns in Spain in the province of Orense at Carballino an auriferous mispickel mine, the ore from which is concentrated on the property. The concentrates are shipped to Harfleur where they are roasted in a Brown furnace, 7 ft. 6 in. by 60 ft. The gold is amalgamated, and the arsenic is recovered in brick dust chambers.



REDUCTION PLANT—MINES D'OR DU CHATELET, FRANCE

A new syndicate has been organized to work 24 mica base-metal claims of an area of about 334 acres, situated on the Oliphant's river, Zoutpansberg (*Min. Journ., Feb.* 13, 1909.) The plan of the company is to treat the product on the ground, as heretofore high transportation costs have made the exploitation of these claims unprofitable.

Analysis of Proposed Change in Power Contract

An Examination of the Proposal Reveals That There Is an Increased Expenditure Due to Unity Power Factor Clause and Peak Load Penalties

BY ROBERT SIBLEY*

Power plants designed a few years ago, with presumably ample equipment to supply their demands for years to come, have in certain sections of the country found their capacity wholly inadequate for the needs of today. Realizing this condition of affairs, one great water-power company in the Northwest has introduced a novel and clever system of penalties for peak loads. The idea in view is to force the consumer to do away entirely with peak loads, and by making him pay for his power on the unity power-factor basis, to force him by means of synchronous motors to make the current keep as nearly as possible in phase with the electromotive force.

These conditions are certainly ideal for the power company, as they can then realize the utmost from their vested equipment. It has been argued that the new conditions will mean cheaper rates to the consumer. The data of an exhaustive series of tests, however, indicate that the new system will involve a large increase in the annual expenditure in at least one case. It is certainly true that it is to the advantage of both power company and consumer to have a uniform load at all times and to keep the power factor as near unity as possible. This is a matter of coöperation on the part of both parties, and in justice the burden should be borne by both alike and some system should be evolved by which the consumers can realize a saving as well as the power company, in case they can meet the new conditions.

Under the old system a certain consumer has been using power under a contract which calls for a minimum monthly bill of $1200 and allows therefor a consumption of 156,000 kw.-hours with 400 kw. as a maximum ever to be used; true power to be the basis of measurement, excess of 156,000 kw.-hours to be paid for at $0.0112 per kw.-hour.

The Proposed New Contract

During recent years the consumer has needed more power and instead of allowing him to raise his minimum on the old basis, the following is proposed by the power company and argued that it will result to the consumer's advantage:

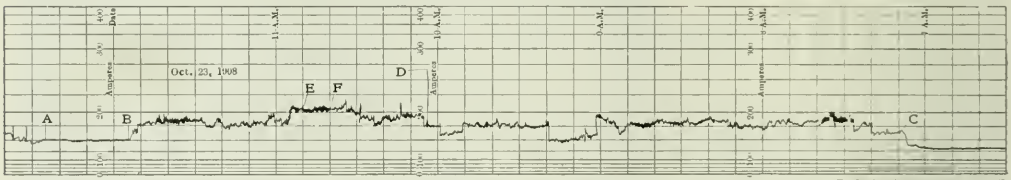
The minimum monthly bill is to be $1675, which will allow the consumer to use 219,000 kw-hours. The consumer must not exceed a maximum of 500 kw. and a penalty of $3.35 is imposed for each kilowatt lasting five minutes, or over, above 500 kw.. For every dollar thus paid the consumer is given an additional 130 kw.-hours in excess of the 219,000 kw.-hours. Any power used in excess of these grants must be paid for at the rate of $0.0112 per kw.-hour. After six months a new minimum bill shall be established at $3.35 per kw. for the lowest maximum recorded during the preceding months. Each dollar advance in the minimum bill again allows the consumer 130 kw.-hours additional and energy consumed above this amount is again to be charged for at the rate of $0.0112 per kw.-hour. Energy is to be paid for on the basis of unity power factor and each minimum bill thus established can never be reduced during the life of the contract.

The particular company for whom this test and compilation was undertaken is equipped with a hydraulic auxiliary and also a Curtis steam turbine. This turbine is of the following type: 60-cycle, 3-phase, 4-pole, 2300-volt, 126 amp. per phase, 1800 r.p.m. For 10 months the turbine had been kept in continuous operation during the 10 hours of the day shift and had been given all the peak loads to handle, which it did in an admirable manner.

Unity Power Factor Clause

Tabulations of every cost were kept during this entire time and it was hoped that the turbine thus carrying the peak loads might be made to so dovetail with the supply of power from the power company that advantage might be taken of the peak-load penalties and thus juggle the power consumption so that the excess at $0.0112 per kw.-hour would never appear against the company. This could be made possible were it not for the unity power-factor clause that has been inserted by the power company entailing virtually a raise of 18 per cent. in the cost of actual power. As the load is so varied and the cost prohibitive for the installation of synchronous motors it is practically impossible to improve the power factor any appreciable amount.

In order to see how completely the turbine generator would dovetail as mentioned above, it was necessary to find out the exact cost per kw.-hour for generation of electric power by means of the steam turbine. In the series of tests performed, it was found that the turbine was equal to every guarantee of its makers, but the peculiar conditions necessitated in carrying the peak load and the high price of very inefficient fuel made the cost of power production so high that it has been decided to reserve the turbine for emergencies only in the future. The cost of production of power was considered from two separate standpoints, one of which is to charge a fair rate of interest and depreciation against the turbine, and the other was to consider the turbine as already paid for and thus obtain the lowest actual monthly cost.



GRAPHIC RECORD OF CURRENT USED, SHOWING HOW POWER COMPANY IS RELIEVED OF PEAK LOADS BY THE TURBINE

Cost of Turbine Operation

The accompanying tabulation shows the actual cost for nine months' operation of the Curtis steam turbine. In all cases maximum costs are considered as those in which interest and depreciation and a portion of attendance charges are set against the turbine. By the installation of the turbine the engineer who formerly attended to the compressor alone now operates both. To be fair, however, a

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portion of his time has been charged in the maximum case.

TURBINE OPERATING COSTS.

Month, 1908.	Hours Run.	Kw.-Hours Produced.	Labor Cost, Maximum.	Labor Cost, Minimum.	Wood Cost.	Repairs and Maintenance.	Interest and Depreciation.	Total Cost Maximum.	Maximum Cost per Kw.-Hour. Cents.	Total Cost, Minimum.	Minimum Cost per Kw.-Hour. Cents.
January	250	23,170	$250	$125	$ 285	$40	$300	$ 876	3.79	$ 451	1.95
February	178	40,660	178	89	502	40	300	1020	2.50	631	1.55
March	281	60,298	281	140.50	745	40	300	1366	2.27	925.50	1.55
April	290	86,080	290	145	1063	40	300	1693	1.97	1248	1.45
May	300	89,080	300	150	1101	40	300	1741	1.95	1291	1.45
June	285	91,790	285	142.50	1134	40	300	1759	1.92	1316.50	1.44
July	272	86,500	272	136	1069	40	300	1681	1.94	1245	1.44
August	278	83,580	278	139	1032	40	300	1650	1.97	1211	1.45
September	239	59,470	239	119.50	735	40	300	1314	2.21	894.50	1.50

The table represents every-day costs as they were met in the nine months' time. A special test was put through to find what would be the costs, running under the most ideal conditions for expense of wood, labor and electric generation ever to be experienced on the company's plant. Several days' run gave the results shown herewith and from

IDEAL TURBINE COSTS.

	Maximum.	Minimum.
Wood	$50.00	$50.00
Labor	10.00	4.37
Repairs	1.33	1.33
Interest and depreciation	10.00	
	$71.33	$55.70

these ideal circumstances, which are that the turbine might be continuously operated at a load of 500 kw., or fully loaded, the consumer might expect to generate his power at 1.112 cents per kw-hour, if interest and depreciation be not counted, and at the rate of 1.427 cents per kw-hour if the same be charged against the turbine.

Power Factor and Distribution

To obtain some idea of the general distribution of power throughout the company's workings, a careful set of data was taken in January and the percentage determined as indicated in the accompanying table. This represents average conditions fairly accurately with the

POWER PROPORTIONS.

Department.	Kw.-Hours.	Cost of Power.	Cost per Kw.-hr.	%
City lights	47,380	$448.97	$0.0095	14.27
D. C. haulage and elevator	24,060	228.57	"	7.26
South mill	116,269	1101.55	"	35.03
North mill	78,907	748.61	"	23.79
Sawmill	13,252	125.89	"	4.00
K. T. pumps	19,221	182.60	"	5.80
Conveyer belt	7,725	73.39	"	2.33
Rock house	7,412	70.41	"	2.23
Machine shop	1,315	12.49	"	0.40
Mine lights	4,752	45.14	"	1.43
Air compressor	2,069	19.65	"	0.62
Mill light	9,408	89.38	"	2.84
Totals	331,770	3146.65		100.00

exception that the percentage of power as used by the air compressor is unusually low especially as relates to future operations. A large electric compressor is now being installed. Most of the compressed air has usually been obtained from a Nordberg cross-compound compressor driven jointly by steam and a hydraulic unit owned by the company. In the above tabulation most of the peaks are caused by the D. C. haulage, elevator, sawmill and rock house.

In order to get at the average power factor of this particular consumer, conditions were varied as far as possible during October, 1908. From the tabulations shown, it is seen that the power factor

POWER FACTOR.

Hours, Oct. 22,'08	Amp.	*Volts.	Kw.	K-Volt-Amp.	Power Factor.
8 a.m.	95	126	310	374	82.8%
9	92	126	290	362	80.0%
10	85	125	270	332	81.3%
11	90	125	280	352	79.6%
12	85	125	265	332	79.8%
1	90	125	280	351	79.6%
2	90	124	280	349	80.2%
3	90	124	280	349	80.2%
4	92	123	285	354	80.5%
5	110	124	380	426	89.1%
Oct. 23,'08					
7:20a.m.	145	124	480	562	85.3%
8:00	165	123	540	634	85.2%
9:25	165	123	540	634	85.2%
11:00	200	122	680	763	89.1%
11:30	175	123	590	673	87.6%
1:30p.m.	170	122	570	648.50	87.9%
3:30	165	121	550	625	88.1%
5:40	116	124	380	449	84.6%

*Transformers for voltmeter have ratio $\frac{2200}{122}$.

of this installation is 80 per cent. or under for a load of 300 kw. or less, and 85 per cent. or over for a load of 450 kw. or over. From the average conditions noted during the test a power factor of 82 per cent. was decided upon. The installation of the new electric compressor will still further lower this power factor.

Peak Load Penalties

The accompanying automatic graphic record of total amperes was taken from the power company's line on Oct. 23, 1908. From *C* to *B* the turbine was closed down and the irregular curve shown is thoroughly characteristic of the periods when the power company is carrying the full load of the consumer. From *B* to *A* the steam turbine was again in operation and the resultant curve is also characteristic of the manner in which the turbine relieves the power company of all peak loads.

The high point reached at *D* is not considered as a peak as it was only momentary. At this point a short-circuit in the electric tramway occurred and the circuit breaker was thrown. From *F* to *E*, however, we have an average peak of 200 amp., and as this lasts for five minutes or over it is the maximum load occurring. As a matter of fact this is the average maximum peak that has occurred during the nine months' previous run.

The voltage at the secondaries of the transformer is 2300 and the system being 3-phase, this would give a peak of 800 kw., or 300 kw. above the allowable load. Hence the company would be penalized $1005, which added to the stated minimum charge of $1675, would make the minimum bill for the month to be $2680. According to the new contract the consumer is to be allowed 130 kw.-hours for every dollar so paid. Consequently the consumer is allowed 349,650 kw.-hours. If all this power can be used and if power were measured as true power and not kilo-volt-amperes this would doubtless be ideal for the consumer and at least equal to the old basis. The operation of these two conditions, however, is best shown in the practical application as is found in our deductions below.

Analysis of Proposed Contracts

Having gotten the above data together, eight different propositions for signing a contract with the power company were then considered as follows: (1) On the basis that the power company would sign a new contract similar to the old one, but raising the minimum to 300,000 kw.-hours. (2) That the power company would agree to omit the unity power-factor clause from the new proposal. (3) That the old contract continue in force and the steam turbine be shut down, thus calling upon the power company for all the electric energy consumed. (4) That the consumer sign on the basis of the new contract proposed by the power company. (5) That the consumer continue as previously with the old contract and run the turbine to carry the peak loads, considering turbine costs on minimum basis above mentioned. (6) That the consumer continue as previously with the old contract and run the turbine to carry the peak loads, considering turbine costs on maximum basis above mentioned. (7) That the consumer generate its entire electric power by operating its turbine alone, considering turbine costs on minimum basis above mentioned. (8) That the consumer generate its entire electric power by operating the turbine alone, considering turbine costs on the maximum basis previously mentioned.

Summarizing the costs for the first nine months of 1908 and making a proportional figure for the annual cost of operation, we have the yearly power expense for the eight different proposals outlined in the accompanying table. Thus it is seen that if the power company would allow the consumer to continue on the old contract basis at the same time raising the monthly minimum from 156,600 kw.-hours to 300,000 kw.-hours, the power company would then have an assured minimum monthly account of $2298 instead of $1200, and the company would save annually $13,110, or a net gain of 31.6 per cent. Or, if the power company would not insist on the unity power-factor clause being inserted and otherwise put the new contract into effect the company would save $11,110 annually, or a net saving of 26.9 per cent.

Without either one of these concessions, it would be far wiser for the company to shut down its turbine and purchase its entire power on the old contract basis and pay $0.0112 per kw.-hour in excess of the 156,000 kw.-hours now allowed them on their minimum payment. On this basis of operation, it is seen that the consumer would save $6740 annually and net a saving of 16.2 per cent.

YEARLY SUMMARY OF COSTS ON EIGHT DIFFERENT SCHEMES.

Total Cost 2,681,478 Kw.-Hours.	Total Cost 9 Months' Run.	Nine Months' Gain or Loss.	Yearly Gain or Loss.	Per Cent. Gain or Loss.	Cost Per Kw.-Hour.	Cost Per H.P.-Year.
Scheme No. 1	$21,344 30	Gain $9,849.22	Gain $13,110.00	31.6	0 795 cents	$52.20
Scheme No. 2	22,804.00	Gain 8,389.52	Gain 11,110.00	26.9	0 851 cents	55.90
Scheme No. 3.	25,107 60	Gain 6,085.92	Gain 8,110.00	19.5	0 936 cents	61.50
Scheme No. 4	26,137.05	Gain 5,056.47	Gain 6,740 00	16 2	0.975 cents	64.10
Scheme No. 5	27,307.02	Gain 3 886.50	Gain 5,180 00	12.5	1 019 cents	66 90
Scheme No. 6	31.193.52	0 00	0.00	—	1 162 cents	76 40
Scheme No. 7.	29,797.00	Loss 2 489.98	Loss 3,320.00	12 2	1 112 cents	73.10
Scheme No. 8	38,212.00	Loss 7.018. 18	Loss 9,350.00	22 5	1 427 cents	93.70

The question of peak loads and unity power factors is becoming a serious problem in all of our overloaded power plants of today and it presents a problem upon which much can be said on both sides. It seems to me that some system should be devised whereby the consumer might be spurred on to maintain ideal conditions by holding out to him a reward for doing so, rather than whipping him into line by making him pay more than formerly when the power company would also profit by an increased income on practically the same vested outlay

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At the Premier diamond mine, South Africa, during 1908, according to *South African Min. Journ.*, Jan. 16, 1909, 2,078,825 carats were recovered, or an average of 0.25 carats per truck-load. During 1907 the working cost was 2s. 9d. per load.

The Copper Mines of Algeria

The Kef Oum Theboul mine, situated 11 km. to the southeast of La Calle, has been extensively developed, but is not now in operation, although it does not appear to be exhausted. The deposit consists of a wide vein of chalcopyrite mixed with blende and argentiferous galena in schists and sandstones. Samples of the pyritic ore showed 2 to 14 per cent. copper and 400 to 1500 grams (14 to 53 oz.) of silver to the ton.

The Ain-Barbar mine, 22 km. from Bone, yields a complex sulphide ore for the treatment of which experiments are now being made. The Achaiches mine, 36 km. from Collo, is operating in a deposit of cupriferous pyrite in old schists. The Cavallo mine, 18 km. west of Djidjelli, has been worked but is now idle; the ore is found in a lenticular mass, consisting of complex sulphides in igneous rocks. The Tadergount mine, 34 km. southeast of Bougie, has opened a group of veins containing gray copper and oxides, in schist and Liassic shales.

The Djebel Ouenza mines belong to the Compagnie des Mines d'Ouenza, and are situated near the Tunisian frontier, 25 km. from the station of Clairfontaine, on the Tébessa railroad. It is a deposit, originally sulphides, but now covered by an immense capping of cupriferous hematite. The ore contains copper oxides carrying grains of argentiferous copper. This is the most important copper mine in northern Africa.

The Bou-Kadra deposit is the property of the Compagnie de Mokta-el-Hadid and is situated a little north of Ouenza. It consists of copper-bearing pyrites veins running through a mass of hematite which also contains copper and manganese. The Mouzaïa deposit consists of a capping of iron ore traversed by veins of argentiferous gray copper, with masses of copper oxides and pyrite veins. The development of this deposit was once active, but little work has been done since 1876.

The Hendjir deposits are 14 km. west of Ain Sefra (Oran), and belong to the Compagnie Industrielle et Minière des Cuivres d'Algérie. The ore is in the form of gray copper, containing about 2.5 per cent. of metal. A considerable amount of exploration has been conducted on other parts of the same concession, which has an area of 3800 hectares.

Gold and Copper Deposits of Rumania

Vein deposits of gold have been discovered in the Jiu valley, and in the Stan valley in the Lotru mountains. These deposits, according to the Rumanian engineer, Pasco, in the *Moniteur Commercial Roumain*, consist of quartz veins in crystalline schists. Alluvial deposits have been known and worked for many years in the valleys of the Lotru, Jiu, Olanesti, Olt, Arges and other rivers. At Dobroudja, gold has been discovered in the sands adjoining the copper deposits, and it has also been found in the quartzites and chalcopyrites of Carapelit. A new and important deposit carrying as much as 60 grams of gold to the ton has been discovered at Kiutukluk.

The copper deposits, however, are of more definite value. They occur in three districts: Mehedinti, Dobroudja and Suceava. At Baia-de-Arama in the first mentioned district, and throughout almost the entire zone of serpentines and andesites are found veins of chalcopyrite. The mineralized zone is extensive and continuous, and the geological occurrence is identical with that at the great Servian mine at Bor. In Dobroudja, numerous discoveries of copper ores have been made near the center of the Tulcea district, notably at Akpunar and Altântepe, at which localities considerable development has been done.

The Cape to Cairo Railway

Railhead is still at Broken Hill, 375 miles north of the Victoria falls, where it has been pending the negotiations as to the construction of the extension northward. This has now been arranged. From its present terminus the line will run due north as far as the Congo border, and will strike northwest along the copper belt, past the mines belonging to the Tanganyika Concessions, as far as the Star of the Congo. It is hoped that the new section will be completed this year, and that copper from the mines near the frontier will be shipped out over the Rhodesian system before 1910. When the boundary is reached there will be about 2200 connected miles of railway from Cape Town to the Congo. It is probable that extensions will be made northward in the Congo territory. The Cape-to-Cairo railway is no longer a dream; at present it is possible to travel from Alexandria to Cape Town by rail or steam except for a distance of about 600 miles.

Mining Coal with Machines in England

Detailed Costs Show That Economy in Mining Results More from Increasing Value of Coal Produced Than from Reducing Working Costs

BY GEORGE R. DIXON*

In working thin seams of coal a serious item in the working cost is the shooting of the stone canches to make the necessary hight in the gateways.

At many collieries where the grade is easy, the necessity for shooting very thick stone canches is obviated in some measure by doing the hauling by hand. The cost of stone is in these circumstances much less than when ponies are taken into the face, but the cost of haulage is higher. Face conveyers were introduced with the idea of doing away with haulage altogether and saving that cost, as well as the still more important cost of making the haulage roads.

It was obvious that new items would be introduced into the cost sheets, and these were somewhat problematic. A paper was read before the Institution of Mining Engineers, Great Britain, by S. C. Blackett and R. G. Ware, on the conveyer system of loading at the face, and this paper together with the valuable discussion following it, gave a great impetus to the use of these appliances. I have frequently wondered whether some of the contributors are still in the same sanguine frame of mine. It seemed to me in reading some of the detailed descriptions given, that it was extremely unlikely that the production of coal would be cheapened by the new method. The ability displayed in the application of the conveyer system in varying circumstances, was worthy of the highest commendation. In one particular case the method of face timbering described was most ingenious. It was at the same time laborious. I have had good opportunities of comparing the conveyer system with the old method, and I propose to take the 400 yd. of face, with coal 2 ft. 10 in. thick, that I took in my last two articles, and go into the question of cost. In doing this I will not describe face conditions with which I am most familiar, but will adopt the arrangement alluded to above.

Fig. 1 shows how I would attack the 400 yd. of face, or to be more exact, 402 yd. I would divide it into 4 conveyer faces. The coal from two faces would be delivered into one main road or mothergate. Fig. 2 is a section showing how the roads are arranged. The roads are lettered *A, B, C, D* and *E*. The faces are lettered *L, M, N* and *O*. On each face the coal is undercut by a disk coal-cutting machine. All the roads are driven in front of the cutter faces. In the case of the roads *B* and *D* this is done for the following reason:

Fig. 3 is an enlarged plan, and Fig. 4 an enlarged section of one of these roads. The stone below the seam must be shot of such a thickness that the conveyer end can project over the cars on the mothergate rails. It must be possible to pass the cars through, one after the other. To be able to do this, the mothergate is kept at least 30 yd. in front of the conveyer. Two ways are laid in the mothergate. The empty cars are driven past the conveyer, and then on moving, the points can be passed under the conveyer end, on the other way. As the cars are filled they are run forward, made up into sets and driven away.

The usual practice is for the coal-cutting machines to cut out into a stable. To form this stable the roads *A, C* and *E* are driven a yard or two ahead. Fig. 5 is a plan, and Fig. 6 a section of one of these roads. It will be seen that in this case a top canch is ripped, and only wide enough for a single way. It will be seen on referring to Fig. 3 that side coal is taken off to form a stable at the mothergate end, wide enough for the machine to rest in, and clear of the mothergate.

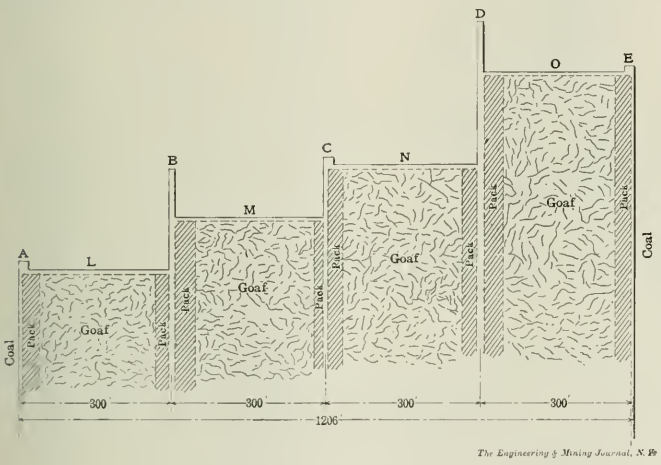

FIG. 1. SHOWING ARRANGEMENT OF ROADS AND PLAN OF ATTACKING FACE

FIG. 2. THE 402 YARDS OF FACE ARE DIVIDED INTO FOUR CONVEYER FACES

Volume of Stone to be Handled for a Specified Cut

The bottom canch in the mothergate *B* is shot 10 ft. wide at the bottom and 3 ft. 6 in. thick. The drainage in the coal is 12 ft. wide, and the sides of the canch slope up to the coal. The average width of the canch is thus 11 ft., and the stone taken for an advance equal to the depth of a machine cut 4 ft. 3 in., is $11 \times 3.5 \times 4.25 = 163.62$ cu.ft. This stone is filled into a stone car and run back to the conveyer face. It is then thrown up behind the conveyer and stowed away as far along the face as it will last. Four men will be required for this work.

In the barrier place *A*, shown in Fig. 5, and in section in Fig. 6, a top canch 4 ft. thick is shot down, wide enough at the top to set a 6-ft. long plank. The width at the bottom will be 7 ft. For an advance of 4 ft. 3 in. the stone shot down is $6.5 \times 4 \times 4.25 = 110.5$ cu.ft. This stone is also stowed behind the conveyer, as shown in Figs. 1 and 5. Two men will be required for this work. The length between the packs at each end is not

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stowed at all. This is shown in Fig. 1. The coal gotten in *A* is not filled onto the conveyer, but is filled into cars, and comes out on the road *A*. All timber used at the face goes in by the road *A*, and is distributed by being placed in the conveyer and run to where it is required.

Figs. 7, 8, 9 and 10 show how the face is timbered and how the conveyer is moved up. These sketches leave little to be added to explain the process. It will be seen that it is a laborious operation, and as a matter of fact seven men are required to do it. It is important that when the conveyer is left, it should lie in perfect alinement.

Referring back to Fig. 1 let us abstract the hand-hewing and machine-got coal. The length out of the 402 yd. of coal got by hand hewing is in *A*, 18 ft., *B*, 34 ft., *C*, 18 ft., *D*, 34 ft. and *E*, 18 ft., a total of 122 ft. The length the machine cut is $1206 - 122 = 1084$ ft. The cut on each of the 4 faces is

$$\frac{1084}{4} = 271 \text{ feet.}$$

Practically 10 per cent. is got by hand, and 90 per cent. is secured by machine mining.

In some cases the advancing places are undercut by machines of the chain-jig type, or by punchers. I would have only two faces out of the four going at once. Then the others would serve as spare places, if they were so needed, and they are sure to be needed time and again. Suppose *L* and *O*, Fig. 1, to be the two faces going. Then the length hand hewed would be: 18 ft. in *A*, 12 ft. stable in *B*, 12 ft. in *D*, 12 ft. stable in *D*, and 18 ft. in *E*, a total of 72 feet.

The Quantity of Coal Produced

The coal produced in the 2-ft. 10-in. thick seam, with an advance equal to a machine cut of 4 ft. 3 in. at 19 cwt. per cu.yd. of coal would be

$$\frac{24 \times 0.94 \times 1.42 \times 19}{20} = 32 \textit{ tons.}$$

The quantity of coal produced on the two faces, 271 ft. of coal, would be

$$\frac{90.33 \times 0.94 \times 1.42 \times 2 \times 19}{20} = 230 \textit{ tons.}$$

Total quantity of coal per day $= 230 + 30 = 260$ tons. Allowing 3 tons of coal per shift per hewer, the number of hewers would be $\frac{32}{3}$ = say 11; allowing 9 tons of coal for each filler, there would be $\frac{230}{9}$ say 26 fillers, and in addition there would have to be a man placed on the mothergate, to put on the fillers tokens, and assist in passing the cars through under the conveyer end.

One of the difficulties of the conveyer system is, that the fillers would all have to share their earnings. 013 men is a large number to get to agree. I have known many cases where the filling was let as a bargain. The prices they had to go for, considering that the coal is to fill into the conveyer trough lying within 1 ft. 6 in. of the coal, was very disappointing. The men usually earned wages some 20 per cent. above the wage we have taken as a hewer's wage.

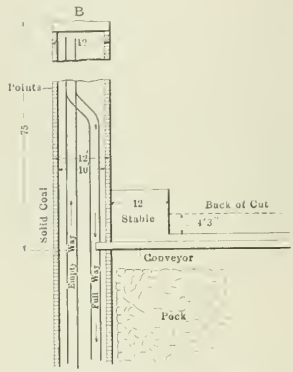

FIG. 3 Plan showing Face of a Mothergate, the Stable to Cut into, and Arrangement of Car Roads.

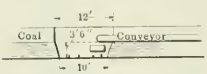

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FIG. 4. AN ENLARGED SECTION OF ONE OF THE ROADS

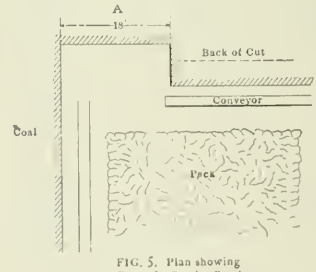

FIG. 5. Plan showing Face of a Barrier Road.

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FIG. 6. SECTION OF ROAD SHOWN ABOVE

There is a deputy in charge of each working face in the day shift, also a conveyer brakeman, and a lad to help with the cars. The cutting of the faces and moving up of the conveyers is done at night. A filler is employed in the mine to keep the cutting machines and conveyers in good order. The motive power may be compressed air, or electricity. Each face is cut in two shifts of cutter-men. A man goes in front of the machine setting a plank with a middle prop under it. As the machine cuts along, he goes behind and puts in the end prop next to the coal. The machine man drives the cutting machine. These men are paid the same wages. Four men put in a shift in crossing each face. The cut is made under the coal, and the dirt has to be thrown over the conveyer into the goaf, where a pack is built behind the conveyer, the dirt has to be cast along the face, till it can be thrown into the goaf; 3 men are required on each face for this work.

When the second face feeding each mothergate is advancing, a top ripping is made in the mothergate, and the stone from it is packed behind the conveyer.

A Conveyer on the Mothergate

The stone to pack behind the second face on a barrier is obtained from falls from the sides. It is, therefore, only a thin pack as shown in Fig. 1. It will be obvious that the conveyer end of the second face on a mothergate will need careful watching, as the stone must be very much broken. From this point of view it would be a great advantage to have two faces feeding on to a mothergate progressing in line. To do this, and to avoid having to drive the mothergate a long distance in advance, in some collieries a conveyer has been put into the mothergate. It is supported on cross girders. The face conveyer delivers onto this mothergate conveyer, which delivers the coal into the cars at some distance from the face. In this case the stone obtained in the face of the mothergate is distributed behind the two face conveyers. The mothergate conveyer can elevate the coal, as well as deliver it behind, if necessary. It is thus not necessary to shoot such a thick bottom canch. However, any advantage got from this would be balanced by the fact that in ripping the second canch off-hand stowage would not be available for the stone.

There is another important advantage that can be claimed for this method. On referring to Fig. 1 it will be seen that the mothergates *B* and *D* will be difficult to ventilate. It will be obvious that any method which shortens the distance that these roads must be in advance of the face air current, must be of considerable benefit.

Continuing our consideration of the working of the faces *L* and *O*, referring to Fig. 1, it will be seen that the coals from the roads *A* and *E* must be driven out on these roads. This lead of necessity is often a long one. The whole of the roads are cut off periodically by a cross road, so that the distance for horse haulage is shortened, and the electric or compressed-air mains kept within reasonable distance of the face. The cost of

these roads must not be overlooked. Again there is a considerable amount of dead work to be done in preparing conveyer faces when first beginning, and a fair conception of it can only be got by keeping out the cost over a long time. Let us make a calculation similar to those I made in my previous articles:

26 men filling on the 2 faces, 2 men on the motbergate putting on tokens and passing cars under the conveyer, producing 230 tons at 26c	$59.80
10 hewers in advancing places producing 30 tons at 68c	20.40
8 men working cutting machines at $1.92 per shift	15.36
6 men cleaning dirt and casting it into the goaf at $1.32 per shift	7.92
The last two items are special work and will be done by piece work, therefore add	4.80
Supervision proportion for 260 tons	2.50
2 deputies at $1.68	3.36
2 coal putters in barrier places at $0.72	1.44
2 conveyer drivers at $1.20	2.40
2 conveyer helpers at $0.96	1.92
1 fitter at $1.68	1.68
1 changeman for men moving conveyers at $1.68	1.68
14 men engaged in moving conveyors and face timber at $1.92	26 88
2 inspectors and changemen for stonemen on road at $1.44	2.88
10 stonemen doing work on roads in face at $1.92	19 20
4 men repairing roads at $1.92	7.68
92 shifts	$179.90

$$\text{Cost per ton} = \frac{179.90}{260} = \$0.69.$$

The cost per ton for putting and cleaning =

$$\frac{15\ 36 + 7.92 + 4.80}{260} = \$0.108.$$

The cost per ton for hewing and filling =

$$\frac{59.80 + 20.40}{260} = \$0.31.$$

$$\text{Tons per shift } \frac{260}{92} = 2.83.$$

A Comparison of Costs

In my last article I showed how the saving cost of 15.6c. per ton, which at first sight appeared to be the result of the putting in coal-cutting machines, very soon disappeared on a closer examination. We have just found a working cost, when using face conveyers in connection with coal cutters, of 68c. per ton. The cost of coal putting with ordinary gateways was 76 cents. This represents a saving of 8c. per ton when using conveyers.

The labor cost for repairs, and pipe or electric main laying will be more. The cost per ton for power and interest and depreciation of capital sunk in plant is sure to be more. The cost per ton for timber with a projecting roof ledge of 11 ft., instead of 5 ft., will be much more. The use of conveyers makes it imperative to have a large siding for cars near the conveyer, and the proportion of cars must be much higher than when the other methods we have considered are applied.

When new faces are being prepared the cost per ton on coal mined at that time is high, and it is only fair that all costs connected with conveyers should be included. Again, the costs have been worked out on the assumption that the conditions given are average conditions. So they are, but we must remember that there are times when the fillers fail to clear the face, when there are faults or swells on the face, and there are breakdowns of cutter machines or the conveyers; all the subdivisions of labor must work together with exactitude.

If one division is delayed, the whole scheme is thrown out of joint with necessarily an increased cost. Summing up the above I suggest that the 8c. can be struck off as a possible saving, and we must look elsewhere than the decreased working cost to pay us for introducing conveyers. Remember another fact, that from the 400-yd. face, using conveyers as described, 260 tons of coal would be obtained as aginst 170 tons by the coal-cutting alone, and 350 tons with hand-hewing. On the other side there is first the increased output per person employed at the face. Then by using conveyers the percentage of large coal is increased by 5 per cent., that is, from 70 to 75 per cent. Taking the selling price for large coal at $3.36, and for small coal $1.68 per ton, the average selling price will be 0.75 of $3.36 + 0.25 of $1.68 = $2.94 per ton. When the percentage of large coal was 70 the selling price averaged $2.85. There is, therefore, an increased price for vended coal of 9c. This is certainly of great importance, and if there is a fair prospect of securing it as a profit, the adoption of conveyers is certainly worth while.

It is an evident fact that machinery cannot be introduced into the face of a mine without increasing the danger to life. The skilled miner trusts to his ears in great measure. When the language of the rock becomes menacing he knows he must take precautionary measures. When a coal cutter is working, these sounds are drowned in the noise of the machine. When conveyers are used this is especially so. This does not constitute the only source of danger. It is possible to become entangled in some part of the mechanism, and when electricity is used there is the danger of death from shocks. Many such accidents come to my mind as I write. With a compensation act in force, all this has a financial as well as a sentimental side.

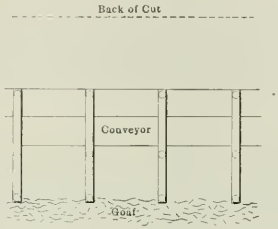


FIG. 7. SHOWING INITIAL POSITION OF CONVEYER AND PROPS

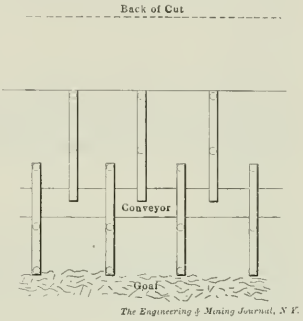


FIG. 8. BOTH THE CUT AND TIMBERS HAVE BEEN EXTENDED

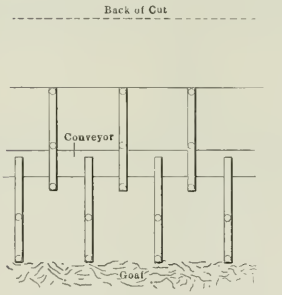


FIG. 9. THE CONVEYER IS THEN MOVED CLOSER TO THE FACE

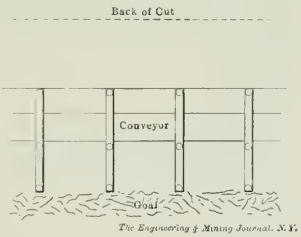


FIG. 10. THE GOAF IS ADVANCED AND A NEW CUT MADE

Coal Cutters Are Not Advisable Where Faults Occur

I have assumed in working my costs that conditions are good in each case. But conditions are not always good. The seam does not lie regular; faults and swells occur. Every engineer knows what this means. If he does not know by experience, he can readily appreciate the fact that these conditions will be more ad-

verse to the continuation of machine mining than hand mining. The former can never possess the flexibility of the latter. It is an axiom that coal cutting cannot be successful where many faults occur, and conveyers are quite out of the question.

In almost all mines there are special zones where faults are most numerous. In these mines coal cutters and conveyers may be introduced; however, they are put into the best parts of the pit, while the difficult parts are kept on hand hewing. This is where many misleading figures come from.

In my first article I found a face cost for hand hewing to be 92c. per ton. Under adverse conditions in a particular part of the mine this might have been 8c. per ton more. If in this particular mine, the cost (as found in my second article), for a coal face be 77c., the saving appears to be much more than it has any right to be considered.

We are now, in fact, comparing good conditions for coal cutting, with bad conditions for hand hewing. This is obviously unfair. It may be taken as a rule that where coal-cutting face costs and hand-hewing face costs are given from the same seam, in the same mine, the coal-hewing face is not getting a fair representation, and the comparison is worthless.

The same remark can be applied to the percentages of large coal with equal truth, systematic way, and calls for constant and close supervision by the head officials.

If ordinary longwall, with hand hewing, was applied in the same systematic way, and if the same close supervision was given to it as is given to machine mining, it is doubtful ifthe latter could show the advantages claimed for it.

In answer to the question as to whether machine mining pays, I have shown by the examples taken, that generally it can be made to pay. This is done not by reducing working costs, but by increasing the value of the coal produced. In working thinner seams than I have referred to, it is probable that a saving could also be secured in working costs.

The power required to lift a quantity of water depends upon the hight to be raised, and, like the problem of winding, the slower the speed and the larger the quantity dealt with per stroke, the higher the efficiency. This problem of pumping, however, is largely influenced by the initial cost of the plant, and it may be cheaper to install a high-speed pump with a low efficiency and a low capital cost than to install a high-efficiency slow-speed type of pump at a larger cost, when question is mainly affected by the cost of the power.

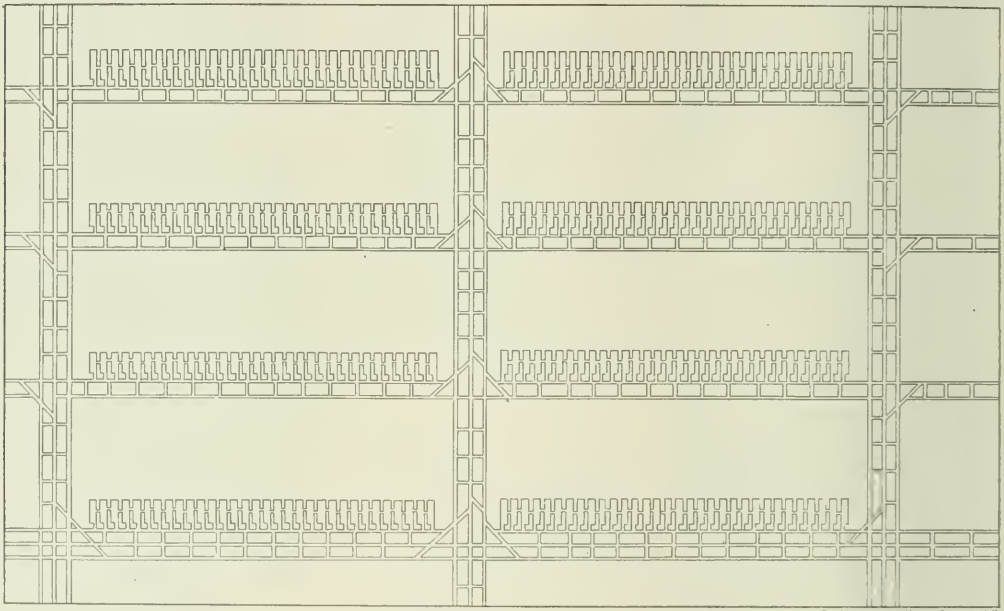
M. Marchand states (in *Echo des Mines*) that the timber covering three deposits of magnetite, recently discovered near Bagnères de Bigorre, is frequently struck by lightning, although the woods are situated in hollows, while the adjacent ridges are rarely struck. This is ascribed to the higher attraction of the magnetite.

Economical Devolopment of Coal Mines

By H. J. Nelms*

In the design of coal mines, the engineer loses sight of the fact that occasionally there is a sudden rush of orders equal to double the quantity of coal the plant may normally be producing. If the mine cannot produce this coal, the manager usually wants to know why. Here lies one of the great evils the engineer or superintendent has to overcome, and here also is one of the most common causes for waste in mining.

I have known superintendents and engineers to attack their stumps, ribs and even new coal in a mad desire to fill these orders, and when the rush is over, they usually lose more coal than they have just produced. The accompanying drawing shows a plan that will enable a superintendent to produce better results than any similar room-and-pillar method.



The Engineering & Mining Journal, N.Y.

GENERAL SCHEME FOR DEVELOPING A COAL SEAM, WHERE UNUSUAL OUTPUT DEMANDS ARE ANTICIPATED

The Advantages that Result

One of the great advantages that would come from using this plan of development would be, that with the same machinery, the tonnage of the mines could be doubled by only increasing the number of men employed. This method would also isolate the men from each other, for only one butt entry would be

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mined at a time, and separate splits of air could be used for each of the working butts.

Here you have short hauls for either locomotive or mules, whichever is used. Also short moves for mining machinery, for at least one machine will be required on every working butt; if mules are used, electric wires can be kept entirely off the working butt, and strung on some entry which is not working; jumpers can be used across the different breakthroughs, and if locomotives are employed, an operator can then be sure his locomotive will be on a haul where it can produce at least 100, 2½-ton cars; any number of cars less than this will raise the cost of haulage above that incurred with mule power.

The American coal operator does not seem to take kindly to standardizing his coal mines to a proper distance between butts and between main entries and face entries. I remember one mine in particular where we had to drive our main entries nearly 1100 ft. before we turned a set of 480-ft. butts. This plan was far from being correct, for an operator can't help finding some tracts of coal in every field, which it will be impossible to mine.

The accompanying plan shows three main entries, the center main being used both for locomotive haulage and as an intake airway. This system is designed to give easy curves for haulage. The crosscuts are made every 100 feet.

The face entries are driven parallel to the mains from 1400 to 2000 ft. away, the smaller distance being used for 5-ft. coal. Here again the center entry of the three is used for an intake airway and also for haulage.

The butts are driven with 450- or 500-ft. centers and are turned at right angles off the main entry. The butt entry and its air-course are driven on 50-ft. centers. The rooms are turned 90 deg. off butt entries, and are driven 25 ft. wide for a distance of 250 ft., where 500-ft. centers are used between each set of butts. The ribs between rooms under these conditions should be from 13 to 15 ft. with breakthroughs every 100 ft. The rooms are all cut across at the 250-ft. mark. The protecting pillar between rooms and entries should be from 60 to 70 ft.; the cover overlying the seam deciding this.

The plan here outlined is sure to meet with success where an operator desires to keep his mines up to a standard point of development; he can also feel assured that the only step he need take to increase his normal output is to employ more men. American mines are conceded to be the worst in the world for spreading out over a great area, and not producing nearly the amount of coal that could be mined if operations were confined more to certain districts.

Colliery Notes

In some coalfields it is common to find the seam cut by an igneous dike, varying from 5 to 40 ft. in thickness. At such localities it is often a question how far into the coal seam the prejudicial effect of the dike extends. Experiments carried on at the St. George's colliery in Natal, to ascertain this uncertain point, resulted in proving that 18 ft. away from the dike contact the coal is practically unaltered. The dike in this latter case was 22 ft. thick. It was also shown that the distance affected does not bear a uniform ratio to the thickness of the igneous body.

Among other reasons for the waste in coal mining, is the practice of many operators in mining only the low sulphur areas of coal seams. This is caused by the discriminating trade the mine manager has to deal with. In some States, Massachusetts for instance, such regulations are in force, that the manufacturer of gas is absolutely confined to the use of low-sulphur coals. The amount of sulphur contained in gas is naturally a function of the percentage of sulphur in the coal from which the gas is made. It will not be many years before those coals containing less than 1 per cent. sulphur, will be practically exhausted. When this time arrives, the gas manufacturer will have to use high-sulphur coal and adopt more economical methods for purification.

English colliery owners are now using reinforced-concrete construction for a variety of purposes, both on the surface and underground. One of the latest installations of this kind was that at the Dawdon colliery where reinforced concrete is utilized for the tipple-house floors. The area covered is about 2500 square yards. The main girders consist of rolled-steel joists of 35-ft. span and placed at 11- to 14-ft. centers. Between these girders are placed secondary beams, 16x8 inches, with about 6-ft. centers. This floor is at least 40 lb. per sq.ft. lighter than any other method proposed; the large span of the main beams adds considerably to the potential live strength of the floor. This plan of using reinforced concrete construction has proved most satisfactory where perfect rigidity is an absolute necessity, and it is stated that this system lends itself admirably for such heavy colliery works as hoppers, shaft linings, water-storage tanks, foundations in unstable soils, etc.

Concerning the initial processes that have occurred in forming our coal seams, one English authority still contends that our coal beds were formed by forests growing up, after which a depression of the earth's surface occurred, swamping the forest with water. This same writer tells of experiments where an attempt has been made to produce coal artificially in the laboratory. He states that when a piece of wood is placed in a sealed tube and heated from 200 to 300 deg. C., the wood becomes something similar to a mass of charcoal; when heated above 300 deg. C., it resembles a lump of coal, and when a heat of 400 deg. C. is applied, the material is similar to anthracite. Along this line a French geologist says the conversion of vegetable matter to coal is due to the action of bacteria. The action of bacteria may be seen occasionally upon a heated damp haystack. The presence of moisture is essential to produce bacterial action. The center of haystacks sometimes get so hot as to heat the end of an iron bar to redness. When the heat has reached, say 100 deg. C., the bacteria are killed, and chemical changes, such as oxidation, take place. Those authorities who assert that pressure is the great transforming agent call attention to the fact that the deeper we go down through a peat bog the fainter are the traces of the vegetation, until the vegetable origin can scarcely be recognized; however, on the surface of the same peat bog we have living plants.

There is a divergence of opinion as to the advisability of providing baths and a wash house near the mouth of coal mines for the use of employees. In a number of instances the opponents of this plan base their objections on the fact that at many mines where the wash houses have been provided, the miners have failed to avail themselves of the opportunity to use them before going home. It is even claimed that the majority of coal miners prefer not only to go home in their working clothes, but also evince a desire to eat their evening meal in this uncleanly condition. Only recently a competent authority advanced many arguments to prove that this latter course of action on the part of the men was most beneficial. Since bath houses fitted with lockers and showers are so popular at the large iron mines of Michigan, as well as other metal operations, it seems incredible that such sanitary arrangements leading to both comfort and cleanliness on the part of the men, should lack favor at our coal mines. It is for this reason that the outcome of experimental bath-house installations in Great Britain will be awaited with interest. At one of the large collieries in Scotland, where 1100 men are employed, an elaborate system of baths is being installed. At this mine it is proposed to take the names of the workmen who are willing to make use of the baths and pay 2c. per week toward their maintenance. This sum is barely half of the anticipated cost of providing the desired facilities. At dozens of mines in the United States the miners are obliged to travel 8 or 10 miles by trolley or train to and from their work. It is hard to believe that these men would not favor a plan that would enable them to go back and forth in clean, comfortable clothing.

The Mount Morgan Metallurgical Works

Three Distinct Methods of Treatment Are Employed, Chlorination, Chlorination after Roasting, and Smelting; Separate Plant for Each Method

BY GERARD W. WILLIAMS*

The metallurgical works of the Mount Morgan Gold Mining Company, Ltd., in Queensland, Australia, are divided into three distinct portions: the west works, treating oxidized ore from the open cut; the mundic works, treating sulphide ore from the stopes below the cut and above 500 ft. vertically; and the copper smelter, treating ore from the copper mine.

The west works is the oldest portion of the present plant and was erected in 1898 from designs prepared by the present general manager, Captain Richard. The plant has a capacity of 11,000 tons per month. The ore is delivered into the bins, which have a capacity of 2000 tons, by an electric tram running out from the floor of the open cut. On their way to the bins the trucks are weighed and the weight is automatically recorded.

The mill itself is divided into four units each comprising one ore breaker, one tubular dryer, one elevator and four Krupp No. 5 ball mills. On one section a 24x14-in. Blake-Marsden is installed, but Jaques rotary crushers are used on the other units. Under similar conditions the reciprocating crusher possesses the highest efficiency, and maintenance costs are also slightly in favor of the former type.

From the breakers the ore passes to the cylindrical dryer, built of mild steel, 30 ft. long and 6 ft. 8 in. internal diameter. It revolves on three pair of rollers, the base of the rollers being set 30 deg. to the horizontal. The inclination of the dryer is 3/4 in. per foot. The tires are tapered the same amount, the rollers being also tapered so that the line of contact is horizontal. The dryer is built in five sections which are fitted with cast-iron tires riveted to the shell. The dryer is driven by means of a spur wheel bolted to the outside of the shell, and makes one revolution per minute. The lining of locally manufactured fire bricks lasts about 12 months. Wood fuel is used in the furnace and the consumption is 3.3 per cent.

BALL MILLS AND FURNACES.

From the dryers the ore is raised 30 ft. by a bucket elevator to the ball mill bins. The chutes from the bins to the mills are controlled by sliding doors, and one man per shift attends to all 16 mills. Automatic feeders were tried, but the ore varies so much in composition that they were discarded. The cost of regulating by hand amounts to 4c. per ton. The mills carry a load of one ton of 6-in. steel balls, and have a capacity of one ton per hour. The screens have a life of about 50 days. The balls are worn away at the rate of 0.725 lb. per ton of ore, and the total loss of steel from all parts including ball averages 1.6 lb. per ton crushed. Spare balls are added during the periodic overhaul of the mills. This seems open to criticism for it involves the mill's working with diminishing efficiency during the period between overhauls. The method of adding a fresh ball daily, or so many times a week, seems preferable.

All the 16 mills are driven from the

GENERAL VIEW OF MINE AND WORKS LOOKING NORTHWEST

*Consulting engineer, Melbourne, Australia

main crank shaft of the mill engine, being arranged in pairs on each side of the shaft and driven by a 21½-in. pinion working into a spur wheel 94½ in. in diameter. The mills run at 21½ r.p.m. and require 13 h.p. when running under full load. Each mill can be thrown out of gear by means of a jaw clutch.

From the ball mills the ore falls to the furnace bins. The furnaces are four in number and of tubular type, 43 ft. long. The tubes are built up of boiler plate flanged and stiffened with roller bands so that all the weight is carried on the bands. The bearing and drive wheels are arranged as in the dryers. The diameter of the shell varies from 7 ft. at the upper end to 7 ft. 8 in. at the lower end, and the firebrick liner is 13 in. thick at the firebox end and 8 in. at the upper end. The feed is by means of two eccentrically placed scoops at the upper end of the tube. The scoops dip into a "well" kept filled with crushed ore and in consequence the rate of feed varies directly with the rate of revolution of the furnace, which averages one revolution in 1⅝ min.; the ore takes about a half hour in passing through the tube.

A separate engine is attached to each furnace for regulating the speed. Two tubular conveyers, water cooled, take the ore from each furnace to the bins above the chlorination vats. The furnaces are wood fired, but a producer gas plant is kept as a stand-by, and is sometimes used to increase the heat when, for one cause or another, the ore requires more roasting than usual.

The chief effect of the roasting is the dehydration of the kaolin ore and a general sintering of the product. Sulphur is only present in the oxidized ore to the extent of 2 per cent.; copper in traces.

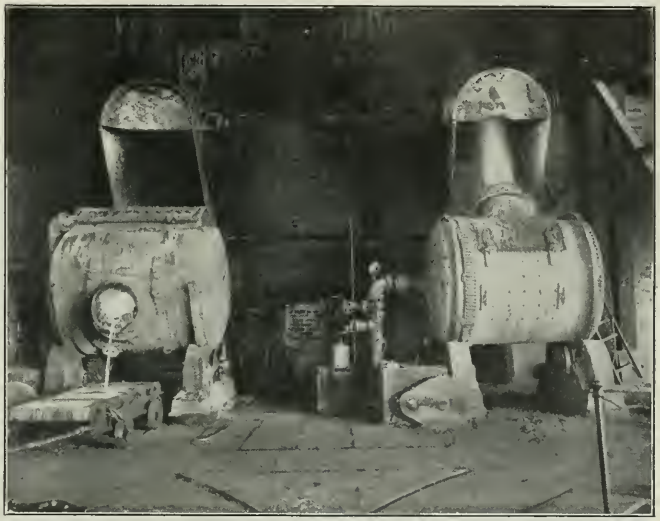
The leaching vats are 16 in number, built of brick with cement mortar. They measure 60 ft. long, 12 ft. 6 in. wide and are 6 ft. deep. The capacity of the vats is 200 tons. The leached ore is discharged by sluicing through side doors in the vats.

Treatment of the Ore.

The treatment of the ore is as follows: From the bins it is distributed to the vats by means of push conveyers, and after leveling off, a water wash is given to cool the ore. After draining, a solution of chlorine water is run on and kept slowly leaching until the effluent liquor smells strongly of chlorine. The vat is then placed "in contact" for eight hours. After the solution has been leached off another chlorine wash is given, followed by a water wash. The actual time consumed is: (1) Water wash to cool ore, 24 hours; (2) chlorine solution, 30 hours; (3) washing out with water, 18 hours.

When the water wash no longer carries gold the contents of the vat are sluiced down the creek. The consumption of chlorine averages 2.5 lb. per ton of ore. The gold-bearing solutions are pumped to storage vats from which they are delivered to 12 charcoal filters of brick-lined concrete, 10x12x5 ft., each holding two tons of charcoal. The precipitation is absolute and the effluent liquids from the boxes contain no free chlorine. At present the ore averages 4 dwt. and a recovery of 95 per cent. is effected. The costs for 117,000 tons treated for the year ending May 31, 1908, were: crushing, 87c.; roasting, 93.5c.; chlorination, 75c.; total, $2.56. The gold-charged charcoal is sent to a central gold refinery for treatment.

Power to drive the mills, breakers, etc., is supplied by a 500-h.p. triple-expansion, horizontal engine. The cylinders measure 15, 24 and 39 in. in diameter with a 24-in. stroke. Five 125-h.p. Babcock & Wilcox boilers are installed at the west works.



CONVERTERS IN OPERATION AT COPPER-WORKS

The Mundic Works.

The ore treated at the mundic works has the following general composition: silica, 68 per cent.; pyrite, 26; copper, 1; and magnesia and alumina, 5 per cent. The gold averages 10 dwt.

The ore breakers are placed at the main incline shaft and after breaking down to 1-in. cubes it is delivered to the mill bins by an electric tram. The bins have a capacity of 2000 tons, and the plant is designed to treat 11,000 tons per month. The plant is divided into two units, each of which comprises one tubular dryer similar to those in the west works, and an elevator for the delivery of the dried ore to the mill bins. The ore is fed to seven No. 5 Krupp mills.

The crushed ore is raised by an elevator to the bins at the top of four shaft furnaces, which are 59 ft. high and contain 11 floors each measuring 29 ft. 6 in. by 11 ft. 8 in. The lower hearth projects 25 ft. 6 in. and serves as a finishing hearth. The older furnaces were hand rabbled but a mechanical rabbler is being experimented with at present. The ore occupies 24 hours in transit through the furnace. The consumption of wood fuel is equal to 18 per cent. of the weight of ore treated. From the finishing hearth the roasted ore is delivered by small tubular conveyers to a large helical conveyer which runs along the front of the eight furnaces.

From this large conveyer the ore is delivered at any desired point to push conveyers which run on rails over the vats. There are eight vats of 200 tons capacity, two of 400 tons and two of 1000 tons capacity. The treatment vats are constructed of brick, set in cement and are provided with sluice gates at the sides for the discharge of the leached ore. The course of treatment is as follows:

(1) Acid wash of 0.2 per cent. sulphuric acid followed by a water wash. This removes about 50 per cent. of the copper which is precipitated in tanks filled with scrap iron. The acid treatment and water wash occupies two days.

(2) Three days' treatment with chlorine solution.

(3) Water wash, from one day in the smaller vats to three days in the 1000-ton vats. The residues are sluiced down to a dam where they accumulate. The spent liquors from the precipitation works are pumped to the dam and the leachings are precipitated in scrap-iron tanks. The

residues contain 0.4 per cent. of copper which is slowly recovered from the leachings.

Recovery and Costs.

The recovery of gold on 10-dwt. ore is 96 per cent. The chlorine is manufactured from salt and manganese ore, the latter mined locally and the salt obtained from the coastal lagoons. The chlorine is dissolved in towers filled with rubble down which the water flows against the ascending stream of gas.

The 14 ball mills are gear-driven from a main line shaft belt-driven from the crank shaft of a 200-h.p. engine. Another engine of 100 h.p. furnishes power for pumping, etc.

The charcoal from the precipitation boxes in both the west and mundic works is treated at the central refinery. After burning off in large muffles the ash is smelted in a reverberatory furnace with sand and soda, and the bullion is tapped into molds. From the molds the bullion is remelted in large graphite crucibles in circular coke-fired furnaces. The bullion is refined with air which is blown through the molten metal.

The cost of treating 115,000 tons of ore during the year ending May, 1908, was, crushing, 78.8 c.; roasting, $1.376; clorination, $1.01; total, $3.174.

The Copper Smelting Plant.

The ore sent to the smelter has the following average composition: silica, 45 per cent; iron, 25; sulphur, 25; copper, 3.5; alumina, 1.5 per cent. Iron ore is obtained from the company's mine at Iron island, a small island at the mouth of Kepple bay, 18 hours steam from Rockhampton. The company pays a small royalty and mines the ore with its own men. Two steamers are engaged in bringing ore from the island to the wharves at Rockhampton.

The limestone is obtained from the company's quarries at Marmor, 53 miles by rail from Mount Morgan. The limestone is encrinoidal and contains only 2 per cent. of silica. Delivered into the smelter bins iron ore costs $4.44, limestone $1.60, and coke $9.50 per ton.

The normal daily charge of each furnace is as follows: ore, 200 tons; limestone, 100 tons; iron ore, 45 tons; low-grade mattes (purchased) and converter slags, 15 tons; coke, 40 tons.

The forehearths are circular in shape, 12 ft. in diameter and 3 ft. 6 in. deep. They are lined with chrome ore imported from Noumea (French Caledonia). A small auxiliary forehearth takes the slag overflow from each of the primary ones. The matte obtained averages 45 per cent.

There are two converter stands. When freshly lined the converters take a charge of three tons of matte, and toward the end of their life, averaging six blows, the capacity is increased to six tons. The time of blowing varies from 1¾ hours for the first to three hours for the final blow with six tons. On the first charge air at 5 lb. pressure is used for the first hour, the slag is then poured off and the blast increased to 10 lb. From the converters the copper is poured into molds for export. Seven converters are kept in reserve.

The lining is composed of silicious gold ore obtained from the open cut, and carrying 2.5 dwt. to the ton, cemented together with kaolinized felsite dike carrying a small quantity of black sulphide of copper. A little fire clay, also obtained on the lease, is added to increase the binding capacity of the kaolin. A rock drill mounted by a universal joint from a swing arm is used for tamping.

The blister copper is sampled in the following manner: A wooden templet, in which are 100 holes arranged in rows of 10, is placed over the slab of blister and one hole is rubbed with chalk. A drill sample is then taken with a ½-in. bit at the point marked. As the bars are sampled the holes in the templet are taken in turn and the drillings from 100 bars are mixed and divided for assay. The blister averages 99.1 per cent. copper and 12 oz. gold. It was sold to the Delamar refinery, Chrome, New Jersey, but a large refinery has been erected at Port Kembla, New South Wales, and now the company is refining its blister copper at that place

COPPER, MUNDIC AND WEST WORKS, LOOKING NORTH

Power Plant

Seven Connersville blowers are direct-gear driven by motors each of which delivers 10,000 cu.ft. of air per minute at 35 oz. pressure. For the converters three electric-driven Parsons turbo-blowers at 3000 r.p.m. deliver 3000 cu ft. of air each at 15 lb.. All power is obtained from the central power station.

The McMurtry sintering process is being installed for the treatment of the flue dust which averages 2.25 per cent copper and 4 dwt. gold.

Cost of Smelting

Under present conditions the cost of production of copper is in the neighborhood of $250 per ton, but as previously pointed out, mining costs are abnormally high and large quantities of barren flux are used. The company has recently secured an option on the Many Peaks sulphide mine, 147 miles from Mount Morgan; a railway to the property is under construction. The Many Peaks orebody has been opened up over a length of 2640 ft. and the width at the lowest level, 470 ft. from the crest of the outcrop, is 48 ft. The ore will be worked by adit levels, and mining costs will not exceed $1.50 per ton.

The ore has the following composition: iron, 39.96 per cent.; sulphur, 35.48; copper, 2.1; silica, 4.6; alumina, 3.52; calcium carbonate, 5.8; water, etc., 2.0 per cent.; gold 25c. and silver 16c. per ton.

It is estimated that this ore will be landed at the mine for a freightage charge of $2.05 per ton. It is estimated that with the present plant 100,000 tons of Many Peaks ore will flux 250,000 tons per annum of Mount Morgan ore. Under these conditions the cost of blister copper will not exceed $165 per ton.

It is probable that advantage will be taken of the reduced freights for back loading to send silicious mundic ore back to Many Peaks for smelting there with the pyritic ore. If this is done it may in time result in the closing down of the chlorination works at Mount Morgan and the treatment of all the ore, excepting the low-grade oxidized ore from the open cut, by smelting.

Central Power Station

All electric power for pumping, for the smelter plant, the electric winder at the main underlay shaft at the mine and general purposes is generated at a central station. The boiler plant comprises nine Babcock & Wilcox boilers generating 1250 h.p., and five Hornsby boilers generating 1000 h.p. The boilers are self-stoking. The plant consists of three Parsons turbines, two of 400 and one of 1000 k.w. capacity, and two Brown-Boveri-Parsons turbo-generators of 400 k.w. each. All the turbo-generators deliver direct current at 500 volts. The domestic lighting plant consists of a motor generator, 25 kw. and 230 volts. The switchboard embraces all the modern improvements.

The compressors are installed in the same building. There are Reidlers, delivering 3000 and 2000 ft. of air per minute respectively, and one Schram compressor delivering 1200 ft. of air per minute. All air is delivered at 80 lb. pressure. For the water supply Perms compound verticals are installed. These pumps raise 750,000 gal. per day against 250 ft. head at a cost of 3.2c. per 1000 gallons.

A horse power costs 29c. per day of 24 hours and electric power is generated for 1.8c. per k.w. hour. Coal having an actual evaporative power of 6.5 lb. of water per pound costs $4.35 at the coal bins. Stokers receive $2.16 and drivers $2.64 per shift.

Administration

In a large concern such as this the question of administration is of equal if not greater importance than that of actual technical methods. The basis of correct administration lies in the correct apportioning of costs for the various departments; for unless the true costs of every subdivision of the work is accurately known it is difficult, if not impossible, to effect any marked improvement in existing methods.

The basis of all cost keeping at Mount Morgan is the card system, and this system has been extended into every department of the mine. The system is too well known to need description. As a result of the introduction of this system it is possible to do at this mine what is done on no other mine with which I am familiar; at 10 a.m. every morning every officer receives a complete cost sheet for the preceding 24 hours' work.

The importance of this to the smelter bosses and the metallurgist is obvious; its importance to the general manager is even greater. When costs are estimated monthly or even weekly it is not possible to notice the effect of small stoppages or of those interruptions in regular work which result from accident or other abnormal causes. When cost sheets are made up every day the effect of any slight departure from the normal is immediately perceptible and working costs are largely an epitome of unconsidered trifles.

The construction engineer receives cards indicating progress and expenditure on every piece of work under construction. Similar cards are kept for the purpose of rendering a daily statement of all ore raised, treated or stored, of its value and of the chlorination and smelter returns. Fluxes and coke supplies are presented in a similar manner. The system has been extended to the shops, and complete records of every job done are filed. It is therefore possible to compare the relative economy of two methods of work, and to determine the actual working value of various workmen on similar jobs.

Not only has the introduction of this extended application of the card system resulted in the management's obtaining complete control of every department with a minimum of effort, but it has paved the way to marked reductions in the matter of minor working costs where previously the source of loss was undetected. On every hand the system has resulted in the reduction of costs, and a corresponding increase in efficiency.

The transport department of the mine is run on the lines of a railway traffic office, and the various departments are charged exact and not approximate rates for the handling of their various stores. All administrative, head office and directorate costs are apportioned over the working departments; the mine cost sheet has no "General Expenses" item.

Economy of the Card System

The pertinent question as to the cost of the system in all its ramifications naturally arises. As nearly as I could learn it has more than doubled the capacity of the clerical staff and, once installed, the working costs are less than with ordinary book-keeping methods. In every way it has justified its introduction. Calculating machines have been installed in all the time-keeping and stores offices with most satisfactory results. One final advantage the card system possesses, the entire cost keeping and accountancy cards are immediately intelligible to a layman. The system makes men accountants in spite of themselves.

The members of the staff were nearly all trained at the mine, and most all the shift bosses and foremen started work as miners or laborers. There is a good technical school in the town, and the management insist that all youths employed at the mine take certain courses and obtain certificates for attendance at the school.

At a mine, such as this, remote from other mining centers and for many years the only mine of importance in Central Queensland it might be expected that the staff would tend to become somewhat self-centered. In Kalgoorlie and Broken Hill there is a very notable absence of that knowledge of contemporary mining in other fields which is so essential for progress, and one might even go so far as to accuse those fields of something approaching to parochialism. But, on the contrary, the officers of the Mount Morgan mine are free from any suspicion of being self-centered. For many years Captain Richard has encouraged the staff to keep abreast with modern work and an extremely up-to-date technical library and reading room has been provided. All the senior members of the staff have visited the leading mines of Australia or America during their periods of leave. Above all, every inducement has been given to every officer to think for himself, and not to rely entirely on precedent.

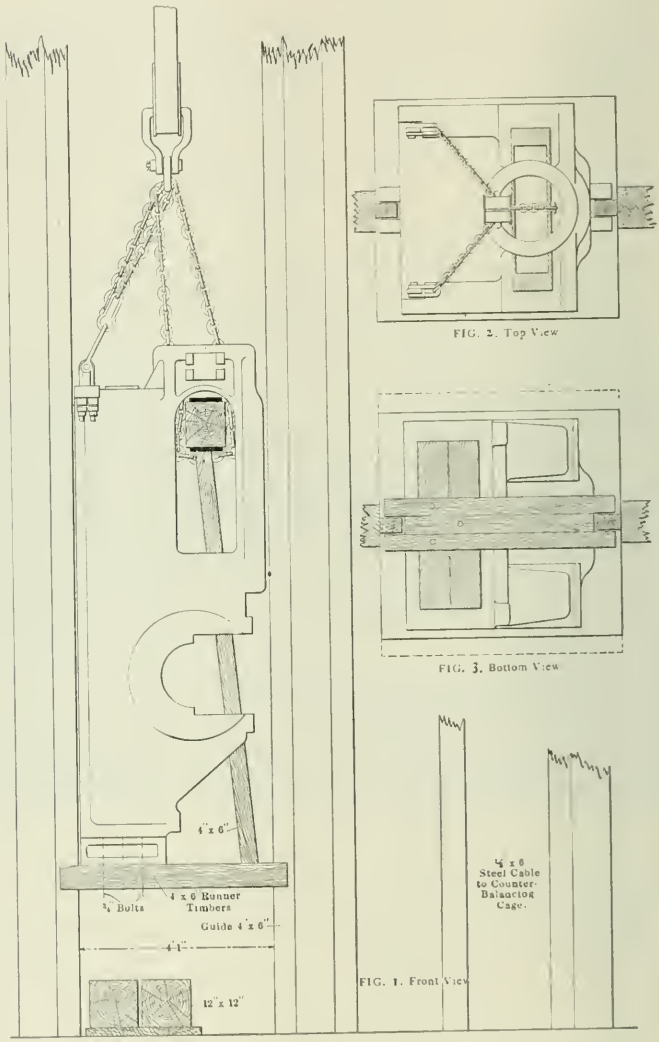
In this brief sketch of the works and system at "the Mount" I have paid the highest tribute that is possible to the man under whose control the whole plant and system has been built up, Captain G. A. Richard, the general manager of the company. I wish to acknowledge my thanks to the management for the kindness extended to me during my visit and for the plans and photographs which were prepared for my articles.

Lowering a Large Pump Into a Mine

By George J. Young*

The handling of heavy machinery in the limited space of a mining shaft is a matter of interest to engineers. Recently a large Knowles duplex, high-speed, motor-driven pump was erected on the 2475-ft. station of the Ward shaft at Virginia City, Nev. This pump was constructed so that the largest piece would pass a 4x5-ft. compartment. The engine frame and main journals were constructed in a single piece, and this constituted the largest and heaviest part of the pump. The approximate weight of the piece, stripped and ready for lowering, was seven tons. Two of these pieces were to be lowered through a compartment 4 ft. 1 in. between guides and 5 ft. 6 in. wide. The hoisting engine in use, a light, steam-driven, direct-connected, double-reel hoist, was found to be inadequate, and a double-reel, gear-driven hoist with a single engine, having a 24¼x30-in. cylinder, was constructed for the special purpose of lowering the pumping machinery. This engine and parts of the hoist were taken from the Combination shaft and the necessary additional parts constructed. The hoist was erected while the foundations for the pump were being laid.

The gross dimensions of the pump-engine frame were: Width, 4 ft. 4 in.; hight, 3 ft. 10 in.; and length, 10 ft. 10 in. The guides in the south compartment were tested and set back where insufficient clearance was found. By Aug. 6 everything was in readiness to lower the first piece. This was moved by rollers and block and tackle to a position close to the compartment and between the shaft and the hoist. It was then turned over on its side and the lifting tackle adjusted. A short 10x12-in. timber, protected on both sides by ¾x8-in. iron plates, was placed between the crosshead guides, and a ⅞-in. chain passed around it and through a gathering ring. Two ¾-in. chains were attached through U-bolts passing through lugs on the base of the casting and then passed through the gathering ring. All chain ends were made fast with pins and links. The gathering ring was made fast to the cable-attachment pin, as shown in Fig. 1. The piece was then lifted and swung into position over the compartment. Bars were used to force it into approximate position between the guides, since the length of the chains would not permit the piece to assume a vertical position. It was next lowered onto a greased plate supported upon two 12x12-in. timbers placed across the compartment. Hydraulic jacks were then used to place it in exact position. The chains were next adjusted by the U-bolts until, by trial, the piece swung vertically. The guide shoe was bolted in position and a 4x6-in. strut wedged between the free end of the shoe and the upper timber. Two lanterns were suspended from the shoe, and, with two men riding, the piece was lowered to the station.



THE METHOD OF LOWERING THE PUMP-FRAME IN THE SHAFT

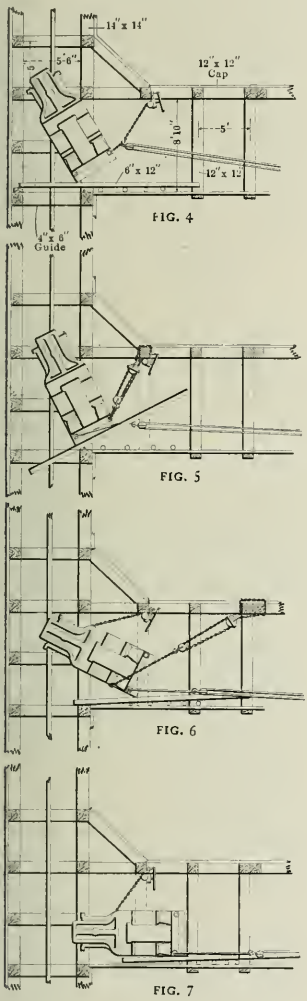
Method of Handling the Frame

The conditions at the 2475-ft. station are shown by Figs. 4, 5, 6 and 7. The position of the wall plate at the station gave a clearance of 8 ft. 10 in. Two 6x12-in. planks on 4-in. rollers were placed across the compartment reducing the clearance to 8 ft. The side clearance was 1½ in. on each side.

The proposed method of handling was to lower the piece until it just cleared the planks and then by the aid of a chain block to swing the lower end into the station. A 7-ton weight on the end of 7½ tons of steel cable and controlled by a single engine at the surface would hardly admit of nice adjustment of position, and in consequence the greater part of the weight was thrown upon the planks. An attempt to swing the lower end caused the planks to slip off the edge of the opposite wall plate and the piece to assume the position shown in Fig. 5. Two chain

*Professor of mining and metallurgy, Mackay Mining School, University of Nevada, Reno, Nevada.

blocks and a pulley tackle were required to partly lift and partly swing the piece into the position shown in Fig. 6. At this point the chain blocks and rope tackle were adjusted, as shown in Fig. 6. Then, by simultaneously pulling on all three blocks and lowering with the main cable



THE METHOD OF LANDING THE PUMP-FRAME AT THE STATION

at the same time, the piece was landed upon the floor of the station, as shown in Fig. 7. It was then blocked up and by means of rollers and jack-screws moved into position to be handled by the 8-ton crane of the pump chamber.

The cost of lowering this piece of machinery and the time consumed are shown by the following: To place engine frame in position ready for lowering required nine men and a foreman, 3¼ hours; to lower the piece 2475 ft. required 38 min., with two men at the hoist and two men riding; to land the piece at the station required nine men and a foreman 3½ hours; to move from station to pump chamber required five men 2 hours. The total time required: Shaftmen, 82 man-hours; enginemen, 16 man-hours; or a total of 98 man-hours. With wages at the prevaling rate of $4 per eight-hour shift and $6 for foreman, the labor cost for lowering amounted to $55. A counterbalance was used in lowering and consisted of the cage and loaded ore car in the adjoining compartment.

I wish to acknowledge the courtesy of Leon Hall and Superintendent McCormick in permitting me to be present and to take the above notes.

Calumet & Arizona Mining Company

The report of the Calumet & Arizona Mining Company, March 20, 1909, shows that for the year ending Dec. 31, 1908, the production of refined copper was 28,048,000 lb. In addition to this there was produced $234,358 in gold and silver. The average price received for the refined copper delivered in 1908 was 12.948c. per lb. During the year $800,000 in dividends were paid. The average number of men employed at the mines was 567. The number employed at the smelter was 484.

Mine

The policy of the management has been to treat as low a grade of ore as can be handled at a reasonable profit. This has resulted in a somewhat lower production for the year, but at a satisfactory cost. The market and industrial conditions have not been such as to justify any attempt to increase the production, and it is believed that the ultimate profit to the stockholders will be increased by the conservation of the ores.

The company still holds options upon claims amounting in all to $530,000, payments of which are spread over the next 12 months. The amount expended in developing lands under option in 1908 was $274,721, and for payments on options $99,900. Development work done during the year at the Oliver, Irish Mag and Wagner shafts was as follows: Drifts, 18,444 ft.; raises, 2072; sinking, 135; total, 20,680 feet.

The company has options on 23 claims in the Courtland district. During the year 530 ft. of development work were done, 317 ft. of which were on the Germania No. 1 claim. The principal development, and that which resulted in showing the most ore has been from the 260-ft. level of this shaft. On this same claim a diamond-drill hole was put down to the depth of 1007 feet.

Smelter Plant

During the year a new converter stack was erected, using the material from the former 150x5-ft. boiler stack. A new dust flue leading from the converters to the stack was installed, and all of the converter stands were moved to the south side of the converter room. One new converter stand was added. This change was necessary to make room for the construction of a new furnace and the lengthening out of some of the old furnaces.

A new 25-ft. by 44-in. furnace was built, which has a nominal capacity of 500 tons per day, but which has averaged 557 tons per day since it was put in operation. The operation of this furnace has proved satisfactory and has effected material economy.

During the latter part of the year one of the old furnaces was rebuilt, making it the same size as the new one.

Assets and Liabilities

The balance sheet Dec. 31, 1908, compares with 1907 as follows:

Assets.	1907.	1908.
Cash and copper on hand	$1,240,474	$1,230,783
Ore in stock	46,060	87,310
Supplies on hand	694,560	470,989
Accounts receivable	380,141	336,914
Notes receivable	917,245	1,382,055
Stock in other companies	105,250	167,500
Total	$3,383,732	$3,675,550
Liabilities.		
Accounts payable	$277,908	$252,280
Excess of assets	$3,105,823	$3,423,270

Operating expenses at the mine and smelter were $2,089,158; construction, $158,197. General expenses, including salaries, freights, refining and marketing, $523,504.

The *Cleveland Marine Review* says that the first shipment of Lake Superior iron ore was made in 1852, and regular commercial shipments began in 1856. In that year there were brought down 11,597 tons; in 1857, 26,184 tons; in 1858, 31,035; in 1859, 65,679 tons; in 1860, 116,998 tons; in 1861, 45,430 tons; in 1862, 115,721 tons; in 1863, 185,257 tons; in 1864, 235,123 tons; in 1865, 195,256 tons; in 1866, 296,872 tons, and in 1867, 469,320 tons. From these figures can be seen the state of increase in shipments in each year. Coming on down to the year 1872, was a period of 18 years in which the iron ore business had slowly grown in volume, until the total number of tons brought down that year was 948,553. In 1907, the year of largest shipments, the total was 42,266,668 tons.

A discovery of tin is reported (*So. African Min. Journ.*, Jan. 23, 1909) on the Umfusi river, Melmoth. The pegmatite formation carrying the tin is 30 ft. in width and has been traced for several miles.

Copper Mining in New Jersey

By Henry B. Kümmel*

Many attempts to mine copper have been made in New Jersey, but so far they have been economically unsuccessful. The most persistent attempt, and one which best promises success, is that of the company operating the mines along the base of First mountain, three miles north of Somerville.[1] Here underground workings, comprising several thousand feet of drifts and tunnels, demonstrate the presence of a very considerable body of low-grade ore. Beyond the first 600 ft. the ore is practically all native copper. Numerous side drifts show the continuation of the same kind of ore beyond the line of the main slope, which has a length of about 1400 ft. on a 10-deg. dip. Many openings for several miles along the face of the mountain at the same geological horizon demonstrate the occurrence of ore at these several points similar to that found in the shallower workings at the main mine. There are many facts, therefore, to warrant the conclusion that the ore can reasonably be expected to continue beyond the areas in which it has been actually revealed by the workings. There is nothing in the geologic structure, so far as known, or in the theories regarding the origin of the ore, which is opposed to the supposition that it extends far beyond its observed limits. Although its occurrence over wide areas beyond the actual workings has not been established by actual development, nevertheless from a geological point of view the inference that there is a large amount of ore available and that the present workings could, in all probability, be very considerably enlarged without reaching its limits, is a safe one.

The ore occurs chiefly in a sheet of altered shale (1 to 3 ft. thick) immediately beneath a thick sheet of trap rock, the lower few inches of which is also frequently mineralized. The trap sheet and underlying shales have a gentle dip to the northeastward. The ore can be easily undercut by the removal of the underlying soft red shale and then shot down in large masses. Most of the shale can be left in the mine to fill work-out chambers. The firm trap sheet affords a solid roof, which needs no timbering. The ore can be blocked out by slopes and gangways, as is done in coal mines where the beds are horizontal or nearly so, so that many feet of working face can be readily obtained. Under these conditions mining costs ought to be low.

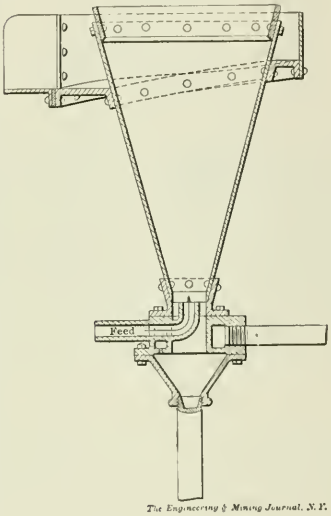
The copper occurs native in thin sheets, nuggets, flakes and minute particles irregularly diffused through the ore. Owing to its irregular distribution, the percentage of copper cannot be accurately determined by any system of sampling. Such results as have been obtained have led to the belief that it would carry 2 per cent. copper. Accurate determinations made after careful mill runs on quantities of ore from different parts of the mine may show a somewhat lower percentage.

Since the ore is native copper, the problem of its successful working reduces itself chiefly to one of economic and effective concentration. The old experimental mill has recently been entirely rebuilt and enlarged to a daily capacity of 350 tons. Concentration is effected by means of jigs and Wilfley tables; five of the former and three of the latter now being used. After breaking, the ore is hand-cobbed as it passes along a belt elevator, the best material going directly to the smelter. Of the remainder, that under 1 in. goes to the first jig, while the coarser material is recrushed. The second and succeeding jigs receive successively finer material, the tailings from each being recrushed before going to the next. The tailings from the fifth jig are classified before going to the Wilfley tables, so that each table deals with material of a different size. From 12 to 20 tons of ore are by these means reduced to one ton of concentrates. It is stated by the management that experimental runs made during the latter part of 1908 show that the low-grade concentrates carry from 6 to 10 per cent. of copper, that the high-grade concentrates reach 60 per cent., and that the final tailings contain not more than 0.1 per cent. of copper. A small reverberatory furnace has been completed, but it is not in operation. In addition to the improvements in power and equipment necessary to these changes, the mine has recently been equipped with an electric-lighting circuit.

For the first time conditions seem to be favorable for a thorough test of these New Jersey copper ores, and there is apparently good reason for hoping that the test will be economically successful. Credit is certainly due to the owners of this mine for their perseverance in the face of many disappointments. If the mill runs demonstrate that the ore averages 1½ per cent. of copper, or better, and if the great body of ore which it seems reasonable to infer exists here, shall be proved and its grade established by actual exploration, it would seem as if efficient management only was necessary in order to put this mine on a paying basis.

*State geologist, Trenton, N. J.

[1] Annual reports of the State geologist of New Jersey for 1902, p. 129, 1906, p. 145.



MERRILL CLASSIFIER

The Merrill Classifier

Charles W. Merrill describes (U. S. Patent 907,387, Dec. 22, 1908) an improvement on the forms of classifier previously patented by him (U. S. Patent 728,487, May 19, 1903). The classifier, one form of which is shown in the accompanying illustration, has either an inverted cone or pyramid-shaped receiver, with comparatively steep sides, the latter construction being adopted to reduce the velocity of the ascending pulp and promote the gradual descent of the heaviest particles of the pulp. An upward feed is used and the casting at the truncated apex provides not only the inlet or feed pipe, but also a pipe for wash water.

In describing his patents Mr. Merrill points out that in practice there are many classifiers provided with a downward feed, and that the overflow of particles from such classifiers have to make a complete turn in their direction before they can be overflowed. While such classifiers make a rough separation of fine slimes and coarse sands, the construction is not well adapted where a close separation between fairly heavy or coarse material and the very coarsest or heaviest material, such as concentrates, is to be effected. The patent letter states that "if an upward feed be substituted for the downward feed and the classifier provided with an outlet space adjacent thereto and preferably surrounding same but without the zone of the feed, it is possible to separate the concentrates or heaviest particles and overflow not merely the slimes, but also comparatively coarse sand, for the reason that there is no change of direction involved in the upward flow," as there is in the case of the downward feed.

The production of pig iron in the United States in 1908 required the handling of approximately 56,000,000 tons of raw material—ore, fuel and flux. A considerable part of the ore used was carried over 1000 miles.

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The Present Status of the Tariff Question

The passage of the Payne Bill by the House, and the introduction of the amendments of the finance committee of the Senate enable us to see more clearly what the enactment is likely to be. Even after the bill now before Congress becomes a law, no one can say with absolute precision what it will accomplish. As usual, there will be many matters for the courts to decide. A good deal will depend, moreover, upon the nature of the administrative law. Finally, after all is said and done, it will remain for time to tell what will be the effect upon industry. Mr. Payne and Senator Aldrich with their comparatively few associates, who have been really instrumental in framing the tariff legislation, do not possess the prescience to name justly the rates upon thousands of substances, as to any one of which even the experts in that particular field will not agree. As matters stand, however, the position of the metals, in which the mining industry is particularly interested, is as follows:

Aluminum—Ingot will be dutiable at 7c. per lb., or 1c. less than at present. Inasmuch as the price in this country is now practically the European price, plus freight and duty, consumers will gain a trifle.

Antimony—The present duty of ¾c. per lb., on the metal, which rate was retained by the House, has been increased to 1½c. by the Senate. The latter also imposes a duty of 1c. per lb. on the antimony content of ore and matte, at present free and also free in the House bill. The effect of this will be to increase the price of antimony in the United States, which will be chiefly to the advantage of the producers of antimonial lead (which may be the "joker"). The gain will not be enough to help the domestic producers of antimony ore and the smelting interest will be at a little disadvantage as compared to now. The Senate amendment as to the antimony schedule shies into the ring a new subject of dispute, which the courts will doubtless be called upon to decide.

Iron and Steel—The Senate proposes to have a duty of 25c. per ton on iron ore, which the House put on the free list. Pig iron remains at $2.50 per ton, but the rate on scrap is raised to the same figure as a substitute for the House proposal of 50c. per ton. On bar iron, blooms, billets, etc., the Senate has made a further reduction; on beams, girders, etc., an increase. The duty on iron ore penalizes by just so much the manufacturers on the Atlantic seaboard who obtain supplies from Cuba, etc., without being of particular advantage to any of the American miners. The iron and steel industry can easily stand all of the reductions that have been made, the chief effect of which, as we have remarked before, will be to restrain an excessive rise of prices at a boom period.

Lead—The Senate has restored the rate on pig lead to the present figure. The House had maintained the rate on lead ore, but had reduced that on pig lead. This would have continued to deprive the smelters of ability to obtain foreign raw material, but would have advantaged consumers a little by preventing excessive rises in the price for the metal. In other words the average over a series of years would probably have been a little less. The leaving of this metal in *statu quo* will please both miners and smelters.

Quicksilver—This remains unchanged at 7c. per lb.

Tin—This remains on the free list.

Zinc—The Senate leaves the House proposal unchanged. The rates as to this metal have been sadly bungled, and serious industrial disturbance is inevitable. In deference to the wishes of the miners, who desire to obtain a higher price for their ore, a tariff of 1c. per lb. on the zinc contained in imported ore (now duty-free) has been imposed, but the rate on spelter has been reduced to 1c. per lb. and on sheet zinc to 1¼c. per lb. The differential between spelter and sheet zinc is less than the cost of rolling. The rate on zinc in ore is relatively higher than on the metal, because the smelter has to pay on the 15 to 20 per cent. that he loses in the process (unless the administrative law shall make allowance for this) besides paying on the lead in such ore which he may not recover at all. The effect of this will be to exclude largely the foreign ore, create a scarcity in the supply for our smelters, and boost the prices of both ore and spelter. The latter will be limited to the point at which it will be profitable to import spelter. There will be even more danger of imports of sheet zinc. The manufacturers of sheet zinc will, moreover, feel more keenly the competition of substitutes. The rather large quantity of

dross that is exported will doubtless remain in this country for smelting. The upset in conditions will be so complete that it is difficult to predict how the industry will readjust itself. It is even conceivable that the change will not work out to any great advantage to the operators in the Joplin district. Under existing conditions 5.40, New York, or 5.25, St. Louis, may be considered a normal price for spelter, at which the base price for ore at Joplin would normally be about $39. At 5.50-5.35 ore would be about $40. At that point, according to the tacit understanding, the wages of miners increase 10 per cent., which adds about $2 to the cost of a ton of concentrates, so the price for spelter must rise above 5.70-5.55 before the operator begins to reap any further advantage, but long before that the European smelters may be delivering spelter in the Eastern market. Anyway it is certain that our smelters are confronted by a calamitous prospect. As between miners and smelters the advantage in the market ordinarily is sometimes one way, sometimes the other, but in the long run their interests are the same, and what hurts one is apt to hurt the other.

The Copper Statistics

The statistics for March, reported on the 12th inst., together with those for previous months, are as follows:

	March.	February.	January.
Production	117,058,661	103,700,817	112,135,200
Deliveries	108,063,007	74,546,614	90,362,421
Balance	8,995,654	29,154,203	21,772,779
Prev. sur.	173,284,248	144,130,045	122,357,266
Surplus	182,279,902	173,284,248	144,130,045

The deliveries include the copper sold for both domestic consumption and for export. Deducting the exports gives the following:

	March.	February.	January.
Deliveries	108,063,000	74,546,000	90,362,000
Exports	46,645,760	31,104,640	42,985,500
Difference	61,417,237	43,441,974	47,376,821

It appears from the above that the deliveries for domestic consumption increased 18,000,000 lb. in March, but any such inference would be obviously incorrect inasmuch as it would indicate a consumption in excess of that of 1906, when it was 668,576,336, or about 55,000,000 per month. The explanation is, of course, that some copper shipped from the refineries for export had not been entered in the export statistics, being either on lighters or on the docks, etc., while perhaps some manufacturers, buying cheap metal, took into their yards something in excess of their requirements. However, there is no question that the statistics indicate a healthy domestic consumption and reveal a turn of the tide in that respect, especially when we recollect the substantial buying that took place in March. Exports also appear to be rising to nearly the normal rate.

The disquieting feature is the continuing increase in production. So long as this goes on at undiminished rate we can hardly expect a higher level of prices (of course, disregarding slight and temporary fluctuations). The production in March was 3,776,000 lb. per day, compared to 3,703,600 in February and 3,617,265 in January. But it is worth while to point out that in March the refineries were still working on blister copper produced in December, when there was general ignorance as to the real situation in copper, and producers were operating at full capacity, believing that the prospect was for the maintenance of the rather fair price that existed then, if not for some improvement. Since then there has been some material curtailment by the closing of several high-cost mines, while only Ely, Cananea and Cerro de Pasco have been increasing materially. It would not be surprising if the production of refined copper should show a decrease in April and if the accumulated stock would begin to wane.

The Two Leading Steel Producer

The make of pig iron and steel in Germany, like that in the United States, reached its maximum point in 1907. From that point there was a considerable recession in both countries during 1908, though the drop in German production was moderate in degree. The total output of pig iron and steel in both countries for two years past is given below: American figures being in long tons, and German in metric tons:

	United States 1907	United States 1908	Germany 1907	Germany 1908
Pig iron	25,781,361	15,936,018	13,015,760	11,813,511
Steel	23,362,694	14,007,627	12,063,632	11,186,379
Prop. steel to iron	90.6	87.9	92.6	94.7

In the United States the decrease in pig iron last year was 9,845,343 tons, or 38.1 per cent.; in steel, 9,355,007 tons, or 40 per cent. In Germany the changes were much less marked, the decrease in pig iron having been 1,232,249 tons, or 9.4 per cent.; and in steel, 877,253 tons, or 7.8 per cent. These decreases are large for Germany, where the iron and steel production had increased steadily for a series of years; and where the changes in either direction are always much slower and less marked than in this country. The extent of the difference is shown by the statement that the German pig-iron production in 1907 was only 50.6 per cent. of that in the United States; in 1908 it equaled 74.1 per cent. In both countries by far the larger part of the pig iron made is converted into steel, from which most of the finished products are manufactured.

The details of the steel production of the two countries in 1908 were as follows:

	United States Tons.	United States Per Ct.	Germany Tons.	Germany Per Ct.
Acid Converter	6,116,755	43.6	374,100	3.3
Basic Converter	.....	....	6,510,754	58.2
Total Converter	6,116,755	43.6	6,884,854	61.6
Acid open-hearth	696,304	5.0	224,211	2.0
Basic open-hearth	7,084,568	50.6	3,969,595	35.5
Total Basic	7,780,872	55.6	4,193,806	37.5
Crucb. and Spec.	110,000	0.8	107,719	1.0
Total	14,007,627	100.0	11,186,379	100.0

Of the steel made in the United States 49.4 per cent. was acid and 50.6 basic; the proportions in Germany being 6.3 per cent acid and 93.7 basic. The basic converter, in which more than half the German steel is made, is not used in the United States at all. It is to be noted that the German report includes, for the first time, electric steel; the quantity made in the electric furnace having been 19,536 tons.

The use of the various processes is, of course, largely determined by the character of the supplies of raw material. The German industry is based upon ores which are for the most part too high in phosphorus to make pig iron amenable to conversion by the acid process. In the United States there is a large supply of ores which are below the so-called bessemer limit in phosphorus, and will, therefore, make pig iron suited for the acid converter. Nevertheless, the reserves of low-phosphorus ores are smaller and are being drawn upon more heavily than those of basic ores; for which reason the basic open-hearth process in the United States is the branch of the steel industry which has grown most rapidly in recent years, and is sure to grow most in the future.

Reports are now becoming more frequent of copper mines that are being closed to make necessary repairs, or are letting a part of their furnaces go out of blast "while copper continues so low," etc.

California Oil Companies

For the last two years the production of the hydrocarbons, including petroleum and asphaltum, in California, has been of greater value than the gold output of the State. In 1907, according to State statistics the combined value of the hydrocarbons and gases produced reached $18,029,937 against $16,727,928 for gold, and the 1908 oil output is estimated as valued at $23,000,000.

The accompanying table published in the San Francisco *Call* of April 2, 1908, shows the dividends paid (amounting in all to $19,154,058) by the active listed oil companies up to April 1, 1907.

DIVIDENDS PAID BY LISTED CALIFORNIA OIL COMPANIES.

COMPANY.	No. of Dividend.	Date Paid.	Amount per Share.	Amount of Dividend.	Total Paid to Date.
Alma	12	Sept. '08	$0 03	$11,400 00	$136,800 00
Amalgamated oil	20	Mar. '09	1 00	50,000.00	1,000,000 00
Apollo	2	Mar. '05	0 01	2,000 00	4,000 00
Associated oil company	4	Mar. '07	1.50	420,000.00	1,522,309 39
Brookshire	35	Mar. '09	0 02	10,000 00	362,500 00
Caribou	47	Mar. '09	0.25	20,175 75	458,422 74
Chicago Crude	2	Mar. '07	½c	5,000.00	15,000 00
Claremont	46	Mar. '09	0 01	4 500 00	215,000 00
Coalinga Pacific	11	Mar. '09	0.10	6,500 00	65,000 00
Columbia	—	Mar. '09	0 01	9,992 66	194,856 28
Esperanza	17	Mar. '09	0 01	1,600.00	27,050 00
Euclid	25	Mar. '09	0 01	3,500 00	82,000 00
Four	62	Feb. '09	0 01	3,000 00	195,000 00
Globe	16	Jan. '09	0 01	6,000.00	57,000 00
Hanford	30	Jan. '06	2 00	4,000 00	80,000 00
Home	A5	Mar. '09	0 02	2,000 00	450,000 00
Homestake	37	Oct. '08	0.10	1,000.00	69,250 00
Illinois Crude	25	Mar. '09	0.01	2,000.00	56,000 00
Imperial	63	Jan. '09	0.60	60,000.00	1,700,000 00
Junction	5	Mar. '09	0 01	2,500.00	12,500 00
Kern River	39	Feb. '09	0.10	2,000.00	98,000 00
Linda Vista	12	Mar. '09	0 01	3,838.50	42,223 50
Lucile	9	Mar. '09	0.10	2,670.40	24,033 60
Monte Cristo	53	Aug. '07	0.01	5,000 00	265,000 00
Nevada County	3	Oct. '08	0 04	10,000 00	40,000 00
Peerless	71	Mar. '09	0.06	6,000 00	765,000.00
Piedmont	4	Feb. '09	0 1	3,890 00	15,207 30
Pinal	—	Mar. '09	0.15	22,500 00	684,841 00
Pittsburg	10	Nov. '07	0.24½	58,800 00	124,800 00
Reed Crude	9	Nov. '08	0 06	6,000 00	1,107,000 00
Rice Ranch	8	Aug. '07	0.03	9,000 00	69,000 00
Royalty	4	Feb. '09	0 04	800 00	2,400 00
S. F. & McKittrick	10	Mar. '09	0 30	15,000 00	135,000 00
Sauer Dough	37	Mar. '09	0.05	9,975 00	369,075 00
Sovereign	13	Dec. '08	0 01	5,000 00	70,000 00
Sterling	19	Mar. '09	0.25	62,500 00	559,500 00
Superior	7	Dec. '08	0 01	5,000 00	35,000 00
S. W. & B	8	Nov. '08	0.04	15,080 00	15,080 00
Thirty Three	57	April '07	0.30	30,000 00	640,000 00
Union	152	Mar. '09	0.50	117,711 00	4,891,805 15
United Petroleum	91	Mar. '09	0.50	40,375 50	1,694,453 93
Wabash	15	Feb. '09	0 01	3,000 00	84,000.00
West Shore	47	Dec. '08	0 05	5,000 00	235,000 00
Western Union	—	Dec. '07	2 00	20,000 00	484,951 00
Total dividend paid to date.					$19,154,058 89

Total dividends paid by the above companies for March, 1909, $402,509.21.

Coalinga Pacific paid two dividends in March, dividend No. 10 of 10c per share on March 1 and dividend No. 11 as above noted. Lucile paid dividends No. 8 and No. 9, of. 10c each, on March 15.

According to *Echo des Mines*, a company styled the Banque de Radium has been founded by Henri Farjas for the purpose of purchase and sale of radium salts. The capital is 1,000,000 francs, to be subscribed entirely in cash. Mr. Farjas has promised to supply the company within a period of two years, dating from the day of its formation, with a minimum of three grams of pure radium bromide at the price of 400,000 francs per gram. During the first year he will deliver one gram, and in the next two grams. In remuneration for this, 3000 beneficiary shares, giving the right to 15 per cent. of the profits, are presented to Mr. Farjas.

The Anthracite Situation

The anthracite labor situation is still entirely uncertain. At the conference which began April 7 the operators made a final offer to renew the old contract for three years. In reply the miners submitted a counter-proposition which carries with it moderate requests. One was that in all instances where wages were reduced during the last three years for any cause, the operators should restore them to comply with the scale fixed by the Strike Commission; the other was a stipulation that any miner who is discharged shall have the right to appeal, and if it is shown, after an investigation, that the dismissal was not justified, he shall be reinstated. The third request was in the nature of a concession on the part of the miners. In it they gave up their demand for recognition of the United Mine Workers of America, and substituted the suggestion that the operators sign the new contract with the delegates as representatives of the "United Mine Workers of Anthracite." This counter-proposition was rejected and the conference adjourned without result. Another general convention of the mine workers in the anthracite field is to be called by the committee.

A general conference of operators was held in New York April 12, at which all the large companies were represented, and there was a large number of individual operators present also. An official statement of the proceedings says: "The action of the operators' committee of seven in the conference with the mine-workers' representatives was unanimously approved. It was not decided to reduce the wages of the mine workers at the present time. A committee of 11 was appointed and instructed to formulate a policy to be followed by the operators. This committee will report at another meeting on April 22."

The special committee is made up as follows: W. A. Lathrop, Lehigh Coal and Navigation Company; W. J. Richardson, Philadelphia & Reading Coal Company; S. D. Warriner, Lehigh Valley Coal Company; R. A. Phillips, Delaware, Lackawanna & Western; Robert Quin, Susquehanna Coal Company; C. C. Ross, Delaware & Hudson; W. A. May, Pennsylvania Coal Company, and the following individual operators: W. L. Connell, Frank Borden, T. M. Righter, and John R. Bryden.

Meantime work continues at the mines as usual, neither side, apparently, wishing to take the responsibility of a stoppage of production. In this respect the situation is altogether an unusual one.

Canadian Duties on Coal

SPECIAL CORRESPONDENCE

The suggested removal, by both Canada and the United States, of the existing duty on coal interests western Canadian coal-mine operators chiefly in regard to the latter, for there is little present probability of coal from either Washington or Oregon coming into competition in either British Columbia or Alberta with that produced from mines in those provinces. From a Dominion point of view, though the question presents serious difficulties, for, while it would benefit both the coal producers of western Canada, who already have a market for much of their product in the northwestern States and Alaska, and the consumers of Ontario, who buy from the States, to have reciprocity in connection with the sale and purchase of coal, coal-mine owners in eastern Canada would find the competition of the eastern States very harmful to their trade interests of the former. It is, therefore, thought by many in the West that, notwithstanding the considerable increase in the export of coal from western Alberta and British Columbia that would result were the United States duty removed, the eastern Canadian interests that would be disadvantageously affected by the removal of the corresponding duty on coal from other countries brought into Canada are so important that the Dominion government will be slow to take action prejudicial to the coal trade of the eastern maritime provinces of Canada.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Manufacture of Blasting Powder

I shall be obliged if the JOURNAL will inform me respecting the manufacture of blasting powder by coal miners. I understand that in some parts of America the coal miners themselves manufacture blasting powder to some extent. Some fellow will come along with a recipe which he sells, usually at about $1. He assures the miners that they can make their own powder very much cheaper than they can buy it. Accordingly they begin the manufacturing process, ordinarily using the kitchen stove to prepare their concentrated sugar water, which serves as a binder to hold together the other ingredients.

E. H.

We are unaware that this practice is indulged in. Perhaps some of our readers can throw light upon the subject. We surmise that the fakirs who sell such recipes give simply a formula for mixing sugar and chlorate of potassium. It is dangerous for the ignorant to make any experiment of this kind.

Iron Ore Reserves of the World

I have here an extract of a report by Professor Tornebohn for the Swedish government, with relation to the available supply of iron ore of various countries. The figures shown in Professor Tornebohn's report are as follows:

United States	1,100,000,000	tons
Great Britain	1,000,000,000	"
Germany	2,200,000,000	"
Spain	500,000,000	"
Russia	1,500,000,000	"
France	1,500,000,000	"
Sweden	1,000,000,000	"
Austria Hungary, etc	1,200,000,000	"

I have consulted all available records here, such as libraries, etc., with a view of checking or confirming these figures in connection with certain data which I am preparing, but have not been successful in securing any data that gives the iron-ore resources or reserves of the above countries. I am, therefore, writing to you to see if you can advise me of any publication which will give this information. I would like to add Mexico to the list. I am very anxious to secure the data for Mexico as the iron-ore resources of that country are not shown in the abstract of the report above given.

C. J. H.

The question of iron-ore supplies is a very large one, and cannot be answered readily with any approach to definite figures. Even with regard to ore deposits more or less definitely proved, the opinions of experts differ widely. With those known to exist, but not explored nor worked, the quantity is a matter of conjecture. Moreover, there are known deposits not considered available under present conditions, which may be utilized hereafter when proper methods of concentration, or of freeing the ore from impurities are devised. It would not be safe to neglect these in any estimate of the future of the iron industry in the various countries.

As to the various European countries, where iron ores have been mined for many years and where the deposits are well known and have been more or less thoroughly explored, Professor Tornebohn's estimates appear to be fairly correct. The possibility of further discoveries is comparatively small in view of the thorough prospecting which has been done. The only new finds of iron ore of importance in Europe in the last 10 years were those in Briey basin in France, which increased the known ore reserves of that country by nearly 50 per cent.

As to the United States, however, the figures are manifestly too low, and it looks as if the author had taken as a total some current estimates of the ore reserves of the Lake Superior region, made a year or two ago, which placed the total between 1,000,000,000 and 1,100,000,000 tons. This estimate has since been extended by explorations on the western Mesabi and by discoveries of ore at greater depths on the Gogebic and Menominee ranges in the Lake region. Moreover, the inclusion of lower-grade ores, down to 40 and 35 per cent. iron, would increase the known reserves by at least one-third. Besides the Lake reserves, the known iron-ore deposits in South are conservatively estimated at 700,000,000 tons. In addition to these there are deposits in the East, as in New York where the Adirondack region has large reserves, which will be increased when means are devised of utilizing the titaniferous ores not now classed as available. Other large ore deposits known to exist, but not now available on account of their situation and lack of transportation, are in Virginia and West Virginia; in northern and western Texas; in southern Utah, and in Wyoming. It is hardly going too far to say that the Tornebohn estimate for the United States should be multiplied by four, if not by five.

As to Mexico, to which the question applies especially, the only large deposit of iron ore worked so far is in Durango; but others have been discovered, though not worked nor explored enough yet to give any reliable estimate of their probable contents. An estimate of the Mexican ore reserves at present would be very largely conjectural.

Canada is also omitted in the table. But Canada already mines a good deal of iron ore in the Lake Superior region, at Moose mountain and in other sections of northern and western Ontario, and in Nova Scotia. In all these sections there are large reserves, and others remain to be developed in Ontario and in British Columbia. Outside of these there is undoubtedly iron-bearing territory as yet little explored, but having many indications of possible value.

Some deposits now worked which Professor Tornebohn does not include are those of Algeria and Tunis in northern Africa, from which considerable exports are made to France and England; and those of Cuba, which are extensive, and which supply some furnaces in the United States. Others known to exist, but not explored to any extent are on the Orinoco in Brazil; in Venezuela; in Peru and possibly in Argentina.

It is apparent that the iron-ore resources of the future already definitely known are very much larger than the Swedish authority would lead us to suppose. Beyond this there are possibilities, above outlined, which may extend the supply for many generations. There is no need of anticipating the failure of the world's supply of iron and steel because of a failure of the raw material.

The data on this subject must be sought in many reports and other publications. There is no one publication in which they can be found.

In a report on the metallurgical plants of China, M. de la Batie, French Consul at Han-Kow, describes in *l'Echo des Mines* an ore-dressing plant at Wou-tchang. The mill was erected by a Swiss company, which transferred it to Carlowitz & Co., a German corporation, that has operated it since 1903. The plant has a complete equipment of crushing and concentrating machinery, with the necessary motive power, and a stone pier on the Yang-ste-kiang. Lead and zinc ores from Hunan and Kuei-tcheou are treated, at the rate of about 12,000 tons per year. Ore containing 34 per cent. zinc is concentrated to 55 per cent., and lead ores with 42 to 45 per cent. metal are dressed to 78 per cent.; the concentrates are shipped to Europe.

It is announced that the asbestos deposits in the Urals, near the Bajénovo station on the Perm railway, are about to pass into the control of a German company, with headquarters at Ekaterinburg. The company has already secured the Poklefsky-Kozel mines and works and the Girard de Soukanton mines, the two leading producers in the district. The Korevo mines, according to *l'Echo des Mines*, are included in the negotiation. The asbestos resources of this district are said to be second only to those of Canada.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Tamping Shot Holes in Coal Mines

I have been reading carefully and with much interest the articles relating to tamping shot holes. There seems to be quite a divergence of opinion on this subject, and it is apparent that some recent writers have had little actual experience in tamping and firing shots. Some authorities contend that it is necessary to tamp the hole completely and tightly with some adhesive substance, such as damp fireclay, while other engineers are equally positive that just as good results can be obtained by partially filling the shot hole with slack or fine coal.

I have had 25 years practical experience at such work and have been a shot-firer for several years; in the performance of such duties it was necessary to tamp hundreds of holes. My observation leads me to believe that it is not so much a matter of how much or how little tamping is used, or the kind of stuff that is used for tamping, as it is in the preparation of the shot. Where the shot is well balanced and the hole is not drilled in the solid, making what is termed a "dead" hole, and the right amount of powder is used, one will get just as good results by using a few inches of tamping as if he tamped the hole tightly clear out to the mouth. Of course, where the antiquated style of using a needle and exploding the shot with a squib is in vogue, then the hole must be tamped completely and tightly so as to leave an orifice for the flame from the squib to reach the powder in the hole. But where fuse or a blasting barrel is used, no such precaution is necessary.

In driving headings or entries, it is common occurrence to encounter some very wet holes. In such cases I have made the cartridge as nearly water-proof as possible, inserted the blasting barrel, pushed the cartridge into the hole, run the tamper in on it, lighted the squib so that the shot would explode in a few seconds and got just as good results as if all the hole had been tamped tightly to the mouth.

An Actual Case

One incident that happened in southern Illinois, where the coal was being shot off the solid, and where heavy charges of powder were required to dislodge it, proved to me conclusively that tamping has little to do with it. The coal was scarcely 5 ft. thick. The hole was 4 in. in diameter, 8 ft. deep, and was fully 5 ft. on the solid, but was well balanced, being about the same thickness at the toe as at the heel. The miner had just inserted the cartridge, which contained 8 lb. of standard grade black powder. Just as he had pushed the cartridge to the back of the hole, using a small iron scraper for that purpose, he raised his light a little too high and ignited a small pocket of gas just over the hole. He became alarmed and immediately ran away fearing the shot would explode and kill him.

Now there was not a particle of tamping on the shot, not even the scraper, for he jerked it out of the hole in his haste to get away. The flame from the gas ignited the fuse at the outer end, which burned as usual and caused the shot to explode. I stood within 100 ft. of the shot when it exploded and was not harmed. After waiting until the smoke had cleared away, I returned to see what the effect had been, and was certainly surprised to see that the shot had done its work well, having dislodged the coal from one end of the hole to the other end. It made nice, chunky coal and laid it over in a pile. Since this occurrence I have been convinced that lots of tamping rammed in tightly is not necessary under proper conditions. Of course, I believe it is advisable to use some tamping in every hole.

John E. Williams.

Springfield, Ill., March 25, 1909.

Tungsten and Vanadium

The article of Professor Baskerville on tungsten in the Journal of Jan. 23, 1909, and that on vanadium in the issue of March 6 contained some errors, and there are also some omissions. In discussing tungsten, he fails to mention Boulder county, Colo., as a source of the ore. Hübnerite is not "abundant" in the mines at Osceola, Nev. On the contrary, the Osceola mines are of but little, if any, commercial value as a source of this metal; the orebodies have not been at all persistent. The district near Nederland, Boulder county, Colo., is admitted by all authorities to be the most important tungsten field that is known, not only as to extent, but also as to the richness and purity of the ore. Colorado is not worth mentioning as a source of scheelite.

With respect to vanadium, Professor Baskerville makes no mention of the most important ore of that metal, viz., "patronite" (vanadium sulphide). This ore is found in Peru and is unquestionably the most important source of vanadium so far discovered. Irrespective of the discovery in Peru, roscoelite is not the most important vanadium mineral. The vanadate of lead found in Spain has been an important source of vanadium. The slag from the iron works at Creusot, France, was for many years one of the most important sources of vanadium.

Tungsten and vanadium are now two of the most important metals in the manufacture of "alloy steel" and the makers of that class of steel throughout the world are very much interested in these two metals and their occurrences. Tungsten gives hardness to steel, and also the peculiar property of cutting metals when the tool is at a "red heat." Tungsten steel is one of the poorest "shock" resisting steels known, but it has great crushing strength. When it comes to turning surfaces where the "cut" is interrupted, such as the teeth of a gear, tungsten steel has but little advantage over ordinary carbon tool steel.

A. H. Hale.

Denver, Colo., March 15, 1909

Suggestion for a Fuse Spitter

Different miners, and especially different mining districts, have different ways of spitting a round of fuses. When one miner is to spit, for example, 12 fuses, probably the best method in use is to hold the fuses in one hand between the fingers, in the order they are to "go," and run over them with a "spitter" (a short piece of notched fuse).

This method, like every other one I know of, has its drawbacks. If one fuse will not spit it will be necessary to stop and cut it again. This is difficult to do. Sometimes one fuse has been overlooked. It is not easy to find it after the rest have "gone," and when finally spit is liable to spoil the round by "going" out of its turn.

In spitting a round I like to have both hands available for an emergency, so have finally developed this system. I keep a clothespin in my pocket, and after splitting the fuses I put them into the clothespin in the reverse order in which they are to "go," i.e., so that the first to be spit can be pushed out if desired, the last one to be spit being in the crotch of the pin. With a "spitter" I run over the fuses in the order they are to "go." After they are all spit the clothespin is removed.

This method does away with all the disadvantages of other methods except one; that is, that the fuses must be held or tied in the pin until they are all spit, or they

will fall out. In a case where a dozen or more fuses must be spit in a wet place, and where they must be spit at the moment when the signal is given by other miners—which may be one or 20 minutes hence—this method works very well.

As stated, the difficulty is the tendency of the fuses to drop out unless held in place. To make a perfect device for this purpose, combined with a crimper and fuse cutter, would be a simple matter, and perhaps a profitable one. A pair of ordinary crimpers could have handles made of rigid metal such that when crossed they would have their inside faces parallel and just a little closer together than the thickness of the fuse.

By putting proper teeth on the inside faces of the handles and an easily closed and opened clasp, it would be possible to put a dozen or more fuses in this device, clamp it so as to hold them, and whenever desired, to split and spit them in their order, and then unclasp the crimper and release the fuses. A crimper made to hold the fuses for spitting would probably save many missed holes, or rounds spoiled by the holes going in the wrong order. This is offered as a suggestion for those who may be in a position to manufacture such a device.

ARTHUR O. CHRISTENSEN.

Dorchester, Colo., April 9, 1909.

Ammonia Cyanide Process

I note with interest S. E. Bretherton's letter on the "Extraction of Zinc from Mixed Ore," in the JOURNAL of March 27 1909. The extraction of both zinc and copper with incidental precious metals from complex ores by means of ammonia-cyanide methods now promises to become of importance to the mining industry. Both myself and Mr. Ludlow have worked hard for many years to put the technical side of the process on a practical basis. Instead of the expensive potassium or sodium salt in my recent U. S. Pat. 911,254, cheap calcium cyanide dissolved in ammonia is to be used in the extraction of gold and silver when present with zinc or copper in an ore.

Calcium cyanide is prepared from the new and cheap product, calcium cyanamide, by exposing the latter at a red heat to generator gas or acetylene for several hours, or until the conversion of cyanamide into cyanide is complete.

In the *Electrochemical and Metallurgical Industry* of March, 1908, the ammonia-cyanide process, including the Mosher-Ludlow continuous boiling-out still was described in detail. The main value of ammonia in the extraction of zinc from ores is in its refining feature, a snow-white product consisting of almost pure zinc oxide being obtained from complex ores without difficulty

D. MOSHER.

San Francisco, Cal., April 5, 1909.

Submarine Petroleum

In the JOURNAL, of Jan. 2, 1909, there was published a view of the Summerland oil wells, accompanied by the statement that, "as far as we know the situation of these wells is unique." I beg to call attention to the fact that at Zorritos, on the northern part of the coast of Peru, there are several wells on the beach and one in the sea at the end of a pier built to facilitate the drilling of the well.

Manila, P. I. GEORGE I. ADAMS.

Wallaroo & Moonta Costs

In the statistical number of the JOURNAL, Jan. 9, 1909, page 125, the cost of producing copper at the Wallaroo & Moonta mine has been inadvertently doubled owing to the actual total cost of $261 having been inserted between "shipping and other charges," and the total cost per ton of fine copper has thus been made to read $522. I regret the error in my manuscript and hasten to make this correction.

F. S. MANCE.

Sydney, N. S. W., Feb. 24, 1909.

A Volumetric Method for the Determination of Barium

A new volumetric method for the determination of barium (E. A. Hill and William A. H. Zink, in *Journal*, Am. Chem. Soc., Jan., 1909) depends upon the precipitation of the barium as iodate and upon the oxidizing action of this compound upon an iodide solution, with subsequent titration of the free iodine with sodium thiosulphate. A series of experiments showed that in a neutral or alkaline solution, with an excess of potassium iodate the precipitation is so complete that the filtrate shows no turbidity upon being warmed with sulphuric acid.

The properties of precipitated barium iodate are almost ideal for analytical work. It forms a white granular substance, settling quickly, leaving a perfectly clear liquid above. The precipitation is complete in five minutes, if the mixture is thoroughly stirred. The precipitate filters easily.

Since barium iodate is soluble in water, the critical point in the analysis of barium iodate is its treatment after filtration. A series of experiments showed that it could be washed with concentrated ammonia at least three times, and this followed by three to five washings with 95-per cent. alcohol without any appreciable loss.

The solutions required for the analysis are approximately one-sixth normal solution of potassium iodate and one-tenth normal sodium thiosulphate. The soluble barium compound to be analyzed is taken in an amount that will contain about one gram of barium, rendered faintly alkaline by addition of ammonia.

Calculate amount of potassium iodate required, and then add about 25 c.c. in excess. The precipitate is then washed with concentrated ammonia and alcohol. Transfer to Erlenmeyer flask, add 50 c.c. 10-per cent. solution of potassium iodide, the iodate content of which is known. Add 10 c.c. concentrated hydrochloric acid, and allow to stand five minutes; wash down sides of flask, and titrate the free iodine with standardized thiosulphate solution, using starch as an indicator.

The method as given may be applied to solutions of barium as hydroxide, chloride, bromide, iodide, nitrate and acetate, or other soluble salt of an organic acid. Sodium salts may be present in any amount, and magnesium, ammonium, or potassium salts in amounts up to one-half gram, calculated as chlorides. Calcium and strontium must not be present.

An Unusual Pump Installation

A horizontal centrifugal pump, performing a somewhat unusual service, is used to withdraw the water from the hot well of a surface condenser against a vacuum of 28 in. on the suction side. This vacuum of 28 in. would be equivalent to a 32-ft. lift which would not be advisable for a pump of this small size if operating against this suction lift. That the pump operates successfully is due to the fact that it is placed lower than the hot well of the condenser and for this reason the water flows by gravity to the pump, notwithstanding that there is a vacuum on the surface.

The pump is a 3-in., class A, centrifugal type, manufactured by the Buffalo Steam Pump Company and is driven by a 10-h.p. 600-volt, vertical shaft Crocker-Wheeler motor operating at a speed of 1200 r.p.m. The pump has a normal capacity of 213 gal. per min. against a total head of 78 ft. including a discharge lift against which the pump handles the water.

A brass impeller machined all over is used in pumping this hot water. At the top of the main frame is mounted the motor which drives the vertical pump shaft by a flexible coupling. About midway of the main frame the removable thrust bearing housing is suspended from a heavy rib of the main frame. This pump is fitted with ball bearing type of thrust, and the stuffing box on the pump shaft bearing is sealed to the vacuum by water pressure obtained through a small pipe. Owing to the careful design and the machining of the pump runner, there is said to be little loss by slippage and a high combined efficiency.

New Publications

Das Oberschlesische Steinkohlenbecken. By C. Gaebler. Pp. 300; illustrated. 7½x10½ in.; paper, 15 marks. Kattowitz O.-S., 1909: Gebrüder Böhm.

Thirteenth Biennial Report of the State Coal Mine Inspector, Colorado, 1907-1908. By John D. Jones. Pp. 256; illustrated. 6x9 in.; paper. Denver, Colo., 1909: The Smith-Brooks Printing Company.

Glaciation of the Uinta and Wasatch Mountains. By Wallace W. Atwood. U. S Geological Survey, Professional Paper No. 61. Pp. 96, illustrated, 9x11½ in.; paper. Washington, 1909: Government Printing Office.

Geschichte des Eisens in Inner Oesterreich von der Urzeit bis zum Anfange des XIX Jahrhunderts. By Alfons Müllner. Pp. 144, illustrated. 7½x11 in.; paper. Wien und Leipzig, 1908: Hahm und Goldmann.

Die Rationelle Auswertung der Kohlen als Grundlage fuer die Entwicklung der Nationalen Industrie. By Franz Erich Junge. Pp. 91, illustrated. 6½x9½ in. paper, 3 marks. Berlin, 1909: Julius Springer.

Law and Business of Engineering and Contracting, with Numerous Forms and Blanks for Practical Use. By Charles Evan Fowler. Pp. 162. 6x9 in.: cloth, $2.50. New York, 1909: McGraw Publishing Company.

Twenty-second Annual Report of the Commissioner of Labor for the Year 1907. Labor Laws of the United States with Decisions of Courts Relating Thereto. Pp. 1562. 6x9 in.; cloth. Washington, 1908: Government Printing Office.

The Interpretation of Topographic Maps. By Rollin D. Salisbury and Wallace W. Atwood. U. S. Geological Survey, Professional Paper No. 60. Pp. 84 and 170 plates. 9x11½ in.; paper. Washington, 1908: Government Printing Office.

Les Moyens de Production et L'Effet Utile de L'Ouvrier dans les Houilleres Belges. By L. Denoël. Commission D'Enquête sur la Durée du Travail dans les Mines de Houille. Pp. 136, illustrated. 8¼x10¾ in.; paper. Bruxelles, 1909: E. Daem.

Ground Waters of the Indio Region, California, with a Sketch of the Colorado Desert. By Walter C. Mendenhall. U. S. Geological Survey, Water-supply Paper No. 225. Pp. 56, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

Reconnaissance of the Book Cliffs Coal Field between Grand River, Colorado, and Sunnyside, Utah. By G. B. Richardson. U. S. Geological Survey, Bull. No. 371. Pp. 54, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

Social Engineering. A Record of Things Done by American Industrialists Employing Upward of One and One-half Million of People. By William H. Tolman, with an Introduction by Andrew Carnegie. Pp. 384, illustrated. 6x9½ in.; cloth, $2. New York, 1909: McGraw Publishing Company.

Washing and Coking Tests of Coal at the Fuel-testing Plant, Denver, Colo., July 1, 1907, to June 30, 1908. By A. W. Belden, G. R. Delamater and J. W. Groves. U. S. Geological Survey, Bull. No. 368. Pp. 53, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

Heat, Energy and Fuels. Pyrometry, Combustion, Analysis of Fuels and Manufacture of Charcoal, Coke and Fuel Gases. By Hans v. Jüptner; translated by Oskar Nagel. Pp. 306, illustrated. 6¼x9½ in.; cloth, $3. New York 1908: McGraw Publishing Company.

Practical Calculation of Transmission Lines for Distribution of Direct and Alternating Currents by Means of Overhead, Underground, and Interior Wires for Purposes of Light, Power, and Traction. By L. W. Rosenthal. Pp. 93, illustrated. 6¼x9½ in.; cloth, $2. New York, 1909: McGraw Publishing Company.

Bibliografia Geologica y Minera de la Republica Mexicana Completada Hasta el Año de 1904. By Rafael Aguilar y Santillan. Boletin del Instituto Geológico de México, Número 17. Pp. 331. 9½x13 in.; paper. City of Mexico, 1908: Secretaría de Formento, Colonización é Industria.

Economic Geology of the Georgetown Quadrangle (Together with the Empire District) Colorado. By Josiah E. Spurr and George H. Garrey with General Geology by Sydney H. Ball. U. S. Geological Survey, Professional Paper No. 63. Pp. 422, illustrated, 9x11½ in.; paper. Washington, 1908: Government Printing Office.

The Gas Engine. By Cecil P. Poole. Pp. 97, illustrated. 6¼x9¼ in.; cloth, $1. New York and London, 1909: Hill Publishing Company.

Contents: Elementary principles. Pressures and temperatures. Cooling and heat loss. Valves and valve gear. Ignition. Mixing liquid fuel with air. Methods of governing. Some considerations of design. Care and management of engines. Pressure, temperature and output calculations.

Mr. Poole is one of the editors of *Power*. His book is an admirably concise, lucid and thoroughly satisfactory treatise upon this type of prime-mover that is every day increasing in importance.

Berechnung und Untersuchung des Eisenhochofens. By Carl Brisker Pp. 101, illustrated. 7x10½ in.; paper. 4.50 marks. Halle a. S., 1909: Wilhelm Knapp.

This is a careful and laborious investigation of the chemistry of the blast furnace, and brings together in a condensed form, easy to examine, a great many scattered data concerning the blast furnace.

Clays: Their Occurrence, Properties, and Uses with Especial Reference to those of the United States. Second Edition, Revised. By Heinrich Ries. Pp. 554, illustrated. 6x9 in.; cloth, $5. New York, 1908: John Wiley & Sons; London, Chapman & Hall, Ltd.

Contents: Origin of clay. Chemical properties of clay. Physical properties of clay. Kinds of clays. Methods of mining and manufacture. Distribution of clay in the United States, Alabama, Louisiana, Maine, North Carolina, North Dakota and Wyoming. Fuller's earth.

Rapid Methods for the Chemical Analysis of Special Steels, Steel-making Alloys, and Graphite. By Charles Morris Johnson. Pp. 221; illustrated. 6x8¼ in.; cloth, $3. New York, 1909: John Wiley & Sons; London, Chapman & Hall, Ltd.

Contents: Qualitative tests for chromium, vanadium, copper, titanium, nickel, molybdenum and tungsten in steel. Analysis of vanadium steel and ferro-vanadium. Analysis of titanium steel and ferro-titanium. Analysis of tungsten powders. Analysis of tungsten steel and chrome tungsten steel. Analysis low per cent. tungsten steel. Analysis of molybdenum powders. Analysis of tungsten-molybdenum steels. Analysis of ferro-chrome, chrome ore and carbonless chrome. Determination of aluminum in steel. Determination of copper in steel and pig iron. Separation of nickel and copper from iron and vanadium by potassium ferricyanide. Determination of copper in metallic copper. Rapid determination of nickel in the presence of chromium, iron and manganese. Analysis of ferro-manganese. Rapid volumetric method for manganese in the presence of iron, calcium and magnesium. Determination of carbon in iron and steel by direct ignition with red lead or litharge. Determination of carbon in steel, ferro-alloys, and plumbago by means of an electric combustion furnace. Also by gas and blast. Carbon in steel by color. Phosphorus in steel, pig iron, bar iron and wash metal. Sulphur in steel, bar iron, pig iron and wash metal. Manganese in special steels, bar iron and wash metal. Silicon in iron and steel. Analysis of graphite and graphite crucibles. The annealing of plain and special steels. Percentage reduction of acids. A practical automatic steam water still. A simple laboratory method for making clay combustion boats.

The Pittsburg Coal Company

This company owns and leases a large area of coal lands in the Pittsburg and Hocking valley districts, and is the largest miner and shipper of bituminous coal in those districts. It also controls the Monongahela River Consolidated Company, which operates most of the river mines in the Pittsburg district.

The capital stock is $32,000,000 common and $32,000,000 preferred. The debt includes $20,602,000 first-mortgage bonds; $1,423,451 bonds of subsidiary companies; $1,799,572 mortgages and purchase money obligations. The depreciation reserve fund amounts to $1,006,283; pension fund to $86,243. Dividends on the preferred stock have accrued since March 1, 1905. Of the stock there are 49,282 shares preferred and 38,954 common held in the company's treasury. The net current assets, or working capital, amounted to $3,355,561 at the close of the year.

A comparative income statement for two years is as follows:

	1907.	1908.	Changes.
Net earnings....	$5,731,983	$3,024,921	D. $2,707,062
Depreciat'n coal lands.....	$ 725,937	$ 564,062	D. $ 161,875
Depr. plant, etc.	964,809	952,346	D. 12,463
Bond interest...	1,082,644	1,042,797	D. 39,847
Total charges.	$2,773,390	$2,559,205	D. $ 214,185
Net surplus...	$2,958,593	$ 465,716	D. $2,492,877
Special adjustments....	59,001	433,284	I. 374,283
Balance.....	$2,899,592	$ 32,432	D. $2,867,160
From previous year.....	4,089,211	6,988,803	I. 2,899,592
Total surplus..	$6,988,803	$7,021,235	I. $ 32,432

The net earnings are the results obtained after deducting all operating and general expenses and taxes.

The coal statement for two years is as follows:

	1907.	1908.	Changes
Pittsburg district.	18,005,382	13,217,545	D.4,787,837
Hocking district..	1,348,112	1,064,586	D. 283,526
Total mined.....	19,353,494	14,282,131	D.5,071,363
Coke made.....	456,933	55,099	D. 401,834

Coal mined includes coal used in making coke. The decrease in Pittsburg coal last year was 26.6 per cent.; in Hocking, 21; in total coal mined, 26; in coke, 88 per cent.

The coal-land statement for the year is as follows, in acres:

Pittsburg District:	Owned.	Leased.	Total.
Held Jan. 1.....	185,838	23,017	208,855
Bought or leased.....	1,001	2	1,003
Mined out or sold	1,643	408	2,051
Held Dec. 31.....	185,196	22,611	207,807
Hocking District			
Held Jan. 1.....	8,127	1,943	10,070
Bought or leased	57	.....	57
Mined out.....	71	207	278
Held Dec. 31.....	8,113	1,736	9,849
Total Dec. 31.....	193,309	24,347	217,656

Of the Pittsburg district lands 141,735 acres are on the Pittsburg vein and 43,461 on the Freeport vein.

The report says, in part: "The total tonnage for 1908 was the lowest in the history of the company, excepting that for the year 1901; but maintenance of the tonnage proportion of the company in former years, from the district, was preserved. Three mine plants were abandoned during the year, reducing the number of separate coal-mining plants to 76 owned and leased. Of this number 26 plants, or 34 per cent. of the whole, were idle throughout the year; the remaining 50 plants, by reason of loss in running time, due to delays at all of the plants, were reduced to an equivalent of 38 plants running full time throughout the year. The 76 coal-mining plants were used to the extent of but 49.41 per cent. of the full coal-mining capacity of the company, and 29.11 per cent. below such use for 1907. That the tonnage loss was but 26.2 per cent. below 1907 was due to better work on the part of labor and improved facilities at the plants worked.

"The company experienced unfavorable trade conditions practically throughout the year. The falling off in demand for coal, due to the general decline in business, which set in during the latter part of 1907, continued as to the general trade during the year, and still continues; and as to the Lake trade, the same cause was added to by an open winter. The unusually large dock stocks carried over from 1907, the heavy falling off in demand everywhere, better labor supply, and the great stimulus to coal production in other fields through release of railroad facilities from general business, were the main causes of the large decrease in tonnage.

"The average selling price of the product fell off 3.52c. and the cost of production increased 4.53c. per ton run-of-mine coal, compared with 1907. The coke ovens were practically idle during the year, and at a net loss. The decrease in selling value was due to a weakening in general market prices, brought about by the conditions of lessened demand and unusual competition, the latter chiefly from the more distant fields of cheaper production, and which had to be accepted to some extent; and the increase in cost was wholly due to the effect of so large a decrease in the output, as costs of labor and supplies, the condition of the plants and the efficiency of the organization in charge, would have held the total cost on at least the level of 1907, on the same tonnage.

"The suspension of dividends upon the preferred stock occurred as of March 1, 1905. The net earnings of the company since then have been $6,242,001. This money has been used for the payment of:

Advance royalties.....	$ 454,088
Bonds of subsidiary companies.....	339,242
Car trust notes.....	459,403
Monongahela River Consolidated preferred stock..	1,496,229
Preferred and common stocks of this Co.	1,983,397
Property purchase money mortgages....	322,956
Stocks and bonds of other companies..	538,510
Dividend on preferred stock: for Jan. and Feb., 1905...	343,273
Deductions from 1905 earnings.....	197,315
Property and equipment purchases.. ..	113,588
Total...	$6,242,001

"The obligations as above discharged were all incurred prior to 1905, and the paramount interest of the shareholders was regarded in meeting them. The payment of them has given additional value to the stock.

"The amount of taxes other than for local special improvements, for the year 1908, paid to the State of Pennsylvania, and to the different municipalities, was $466,354, being about 13 per cent. of the gross, and more than the whole net earnings of the company. The results of the year show that of the cost of production nearly 70 per cent. was labor, 5 per cent. was the assumed value of the coal in place, and after the company had been cleared of all costs and charges, that there was an average net gain of 3¼c. per ton of run-of-mine coal mined and sold. . . . . It would seem that State taxation should be more on a parity with corporations engaged in manufacturing, and whose capital and labor are thereby preferred; and that local taxes should be laid with more regard to the coal actually mined during the tax period, together with the value of the plants and equipments actually in use to produce the same, and as is done with others minerals. . . . .

"The Darr mine disaster of Dec. 19, 1907, cost the lives of 238 men, all mine were in the mine at the time of the explosion. There are now pending 60 suits for damages. The cost of rescue work, interments and relief, amounting to $82,407, has been charged to the personal injury fund; and the cost of restoration of the mine property, in the sum of $69,866, has been charged to the depreciation reserve fund. The heavy money loss is of little note as against the loss of life, which occurred after all the safety provisions believed possible, and in addition to those under law and custom of the district, had been taken by the operating department officers."

Wages at Broken Hill

In the Broken Hill labor dispute, Justice Higgins, the arbitrator, has fixed the rate of wages for unskilled labor at Broken Hill and Port Pirie at 8s. 7½d. and 8s. 3d. a day, respectively. Miners are to receive 10s. a day. This award will remain in force until the end of 1910. The hours of labor are fixed at 48 a week. The arbitrator declined to interfere with the contract system or to compel the Proprietary Company to continue work. Justice Higgins' award provides for wages on the same scale as heretofore. The Proprietary Company has appealed from this decision

According to the *Queensland Government Mining Journal*, Dec. 15, 1908, the highest mine in the world is the Santa Bolivia, South America, which is at an altitude of 18,000 ft above sea level.

The National Lead Company

The report of this company, which is the largest consumer of lead, for the year ended Dec. 31, gives the following comparative statement of conditions at the close of 1907 and 1908:

	1907.	1908.
Common stock	$20,655,400	$20,555,400
Preferred stock	24,367,600	24,367,600
Surplus	4,294,204	4,458,455
Accounts payable	176,470	222,797
Total liabilities	$49,493,674	$49,704,252
Investments	$38,062,111	$38,259,377
Stocks on hand	5,700,865	7,252,231
Accounts receivable	3,506,334	3,258,968
Cash	1,224,364	933,676
Total assets	$49,493,674	$49,704,252

The company holds unissued $4,334,600 of its common and $632,400 preferred stock. The net earnings and payments for 1908 were:

Net earnings	$2,902,753
Dividends, 7 per cent. on preferred stock	$1,705,732
Dividends, 6 per cent. on common stock	1,032,770
Total	$2,738,60
Surplus for 1908	$ 164,261
Previous surplus	4,294,206
Total, Dec. 31, 1908	$4,458,455

As compared with 1907 the net earnings showed a decrease of $39,493. Expenditures for maintenance and repairs were $239,193, which was charged to current expenses.

The report says: "The volume of business done suffered a shrinkage in the aggregate of but 2 per cent. in comparison with the year 1907, which was the largest in your history. The protection afforded by the varied character of your output was demonstrated most forcibly in a year of general depression and the early expectations of the management were more than realized in both tonnage and profit. The properties which you have from time to time acquired have also generally contributed to your prosperous condition and in no instance failed to pay, not only fixed charges, but some additional measure of profit. Inventories at all points and of every character have been as usual taken at protective values and lower than any raw material prices yet quoted.

"Business for the current year exceeds that of last but this was to be expected. It halts in some features and we do not look for confident trade until all doubt as to the future tariff is dispelled. Competition is increasing but your position will be maintained by such conservative activity as may be necessary to protect trade. New articles are added to the list of your manufactures of lead in its various forms as its uses are extended or when it is found useful and profitable to conserve existing tonnage. One of the companies in which you are interested, and which makes shot on a large scale, has prepared plans for the manufacture of metallic and shot gun ammunition, but these are held in abeyance for the time being. Your mining and smelting interests have a plant in process of erection for the manufacture of sublimed lead, a product which now enters into a variety of uses, including ready mixed paints."

High Stamp Duty on the Rand

In the light of American practice the statements published in the *South African Min. Journ.* of Feb. 6, 1909, regarding milling methods on the Rand are of interest. According to that publication there are now on the Rand 120 tube mills in operation, hundreds of stamps dropping which weigh between 1250 and 1800 lb., the average stamp duty for the whole Rand during December, 1908, having been 6.64 ton per stamp per 24 hours. Three mills are engaged in construction work which will result in duties of 10 tons per day or over. At the West Rand Consolidated 1800-lb. stamps to deal with 12 tons of ore each per day are being installed.

That the economic value of stamp duties is generally appreciated in South Africa is shown by the fact that over 28 companies use stamps giving duties of over 7 tons, and during 1908 the average duty for the whole region was increased in each month. At the opening of 1908 there were 72 tube mills in operation and the average stamp duty was 5.8 tons per day. By January, 1909, the average duty had been increased to 6.56 tons per 24 hours, and 118 tube mills were in operation.

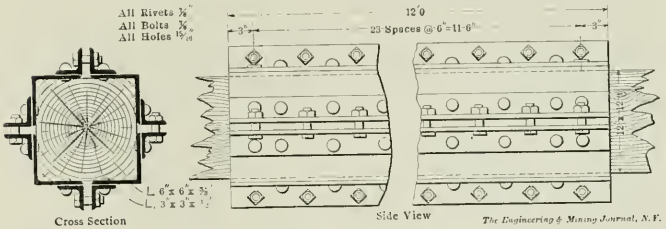
Superior & Pittsburg Copper Company

The report of the Superior & Pittsburg Copper Company, March 20, 1909, shows that for the year ending Dec. 31, 1908, the operating expenses at the mine and smelter were $2,490,858; construction, $30,939; salaries and general expenses, $36,649; freights, refining and marketing, $264,868; total assets, $1,216,193; liabilities, $1,695,775. Balance, assets, $459,581. The development work during the year at the Cole, Junction and Hoatson shafts consisted of drifting, 24,666 ft.; raises, 3388 ft.; winzes, 42 ft.; stations, 1016 ft.; or a total of 29,572 ft. The Junction shaft was sunk 206 ft. during the year, and is now 1555 ft. deep. The principal development work during the year has been confined to the 1300- and 1400-ft. levels, where large bodies of high-grade sulphide ore have been opened. This ore occurs in lenses up to 30 ft. in thickness and 180 ft. in length. The Hoatson shaft was sunk 252 ft. during the year, and is now 1680 ft. deep. Most of the development work at this shaft was on the 1300-ft. level, and ore has been opened up that meets with the management's highest expectations.

The production of refined copper for the year 1908 was 21,924,359 lb., as compared with 9,602,553 lb. for the year 1907. The increase in production during 1908 was due to both an increase in amount of ore treated and through a better grade of ore.

Sectional Gin Poles

At mines, mills and smelters it is often necessary in construction work to have a long gin pole. Usually these gin poles are in one piece, even if very long, because there is a prejudice against spliced or sectional rigs. Sometimes it is difficult to obtain the long timbers necessary and then a spliced pole similar to the one described in *Eng. News*, Jan. 28, 1909, by W. E. Boldsworthy can be used. These sectional gin poles, which the Dover Boiler Works, Dover, N. J., uses in raising heavy iron chimneys, have a total length of 92 ft. and a lifting capacity of 10 tons. They are so made that if they should fail rupture will take place outside the splices. The poles are made of 12x12-in. longleaf yellow pine and each pole consists of two 36-ft. lengths and one 20-ft. length. The splices are made with angles arranged as shown in the accompanying illustration; each splice is in four duplicate parts joined by ⅞-in. bolts spaced at 6-in. centers along the splice plates. This manner of splicing is especially applicable for timbers of smaller size.



SPLICE FOR 12X12-IN. SECTIONAL GIN POLE

The features which commend this form of splices are that no holes are bored in the timbers, the ends of the timbers need not butt, any splice plate is interchangeable with any other, and, if any loads beyond the normal capacity of the poles are to be raised, truss bars can easily be attached to the splices.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

C. Colcock Jones is in the Tintic district in Utah, on professional business.

W. M. Brewer was in Victoria, B. C., recently, after having spent some time in southeast Alaska.

W. S. Keith, of Seattle, Wash., is making an examination of copper properties in Douglas county, Oregon.

C. Willard Hayes and David T. Day, of the United States Geological Survey are investigating the oilfields of Mexico.

J. W. Bryant, one of the Tyee Copper Company's engineers, has returned to Victoria, B. C., from a trip to Mexico.

R. B. Brinsmade expects to reach New York about April 27 from San Domingo, where he has been exploring a mining concession.

George H. Garrey, Mexican representative of Spurr & Cox, has recently been engaged in geological work in the vicinity of Mapimi, Durango.

J. D. Hurd, of Fernie, B. C., general manager of the Crow's Nest Pass Coal Company is on a business visit to Chicago, St. Paul and other cities.

Charles Emmerson, manager of the mines of the West Canadian Collieries, Ltd., recently left Bellevue, Alberta, on a three months' trip to England.

William M. Gibson, assistant superintendent of the Calumet & Hecla mines, has returned to Calumet, Mich., after spending three months in Europe.

John C. Brydon has been elected president of the Isabella-Connellsville Coke Company. He is now general manager of the Western Kentucky Coal Company.

John Hampson, formerly superintendent of the Brown-Alaska company's Mamie mine, on Prince of Wales island, Alaska, recently left British Columbia for Arizona.

Juan Felix Brandes has been examining mines in the Harz Mountain district in Germany. He will shortly return to Colorado and Mexico, after an absence of six months.

Bradley Stoughton has opened offices as consulting metallurgical engineer in the City Investing building, 165 Broadway, New York, and in the Betz building, Philadelphia

J. E. Johnson, Jr., has resigned his position as superintendent of Princess Furnace at Glen Wilton, Virginia. He will be for some months at Wilmington, Del., engaged on special work.

H. F West, having spent the winter inspecting the Cobalt district in Ontario, is proceeding to El Oro, Mexico, to rejoin the staff of R M Raymond, general manager of El Oro Company.

J. M. Ruffner, manager of the North Columbia Gold Mining Company, of Cincinnati, O., has gone north to operate the company's hydraulic gold mines in Atlin, B. C., for the ensuing season.

Superintendent Lawton, of the Quincy mine at Houghton, Mich., is visiting various mining and milling plants in Utah. He is accompanied by James Shield, superintendent of the Quincy stamp mill.

J. E. Spurr, who for the last three months has been engaged in geological examination work in various mining camps in Mexico and also in Arizona, has returned to his headquarters in New York.

J. Morgan Clements, mining geologist, and Frank Klepetko, metallurgist, have taken offices together at No. 42 Broadway, New York City. Mr. Clements has gone to Cananea, Mexico, on professional business.

James W. Paul, now connected with the Government testing station in Pittsburg, sailed for England April 10. He will spend some time studying mining methods and safety appliances in England, France, Belgium and Germany.

Godfrey D. Doveton, metallurgical engineer for Spurr & Cox, Inc., has returned to Mexico City from Guanajuato, where he has been, for the last three months, in charge of extensive cyanide and other milling tests for the Guanajuato Development Company.

Obituary

William H. Sayre died in Bethlehem, Penn., April 7, aged 78 years. He had lived in Bethlehem practically all his life and had been for 57 years connected with the Lehigh Valley interests. He was an officer of the Lehigh Valley Coal Company from its organization, and for a number of years had been second vice-president and in charge of the sale and distribution of coal. He was a brother of the late Robert H. Sayre, who was chief engineer and afterward president of the Lehigh Valley Railroad Company.

Dr. Persifor Fraser died at his residence, Philadelphia, April 7, aged 64 years. He was born in Philadelphia and graduated from the University of Pennsylvania in 1862. After serving two years in the army, he went abroad and studied three years at Freiberg in Saxony. Doctor Frazer held many important positions in geological and chemical research work. At different times he was lecturer in chemistry, assistant professor of natural philosophy and chemistry and professor of chemistry at the University of Pennsylvania. In 1874 he was appointed assistant geologist of the second Geological Survey of Pennsylvania, in charge of the southeastern section of the State. He was an editor of the *Franklin Institute Journal* from 1882 to 1894, and in 1889 was made professor of horticultural chemistry by the Horticultural Society of Pennsylvania. He was the author of several books and of many technical papers. In recent years he had devoted much time to the study of handwriting, and published a book on that subject.

Societies and Technical Schools

American Institute of Chemical Engineers—The semi-annual meeting will be held in Brooklyn, N. Y., at the Polytechnic Institute, June 24 and 25 The program will consist of papers, excursions and an exhibit of chemical engineering apparatus.

Institution of Mining and Metallurgy—The annual dinner will be held at the Hotel Cecil, London, April 30, 1909. The secretary of the Institution has prepared an exhaustive index to the first 15 volumes of the *Transactions*, comprising about 250 pages (in double columns) of references and cross-references. The cost is 7s. 6d. per copy.

Utah State School of Mines—The Senior class of mining engineers will take an extended trip this spring through the mining districts of Colorado, Nevada, Arizona, New Mexico, Mexico, California, Idaho and Utah. This is the most extensive trip ever undertaken by any technical-school graduates. Arrangements have been made for the inspection of the most important mines, mills and smelters.

The John Fritz Medal—The John Fritz medal for 1900 has been awarded by the board of award specially selected for the purpose and consisting of four members of each of the national engineering societies, to Charles T. Porter, for his work in advancing the knowledge of steam engineering, and in improvements in engine construction. The public ceremony of the presentation of the medal to Mr. Porter took place in the large auditorium of the Engineering Societies building, No. 29 West Thirty-ninth street, New York, at 8:30 p.m., on Tuesday, April 13, 1909. Besides the simple ritual of the presentation of the medal, in the presence of invited guests and distinguished representatives of engineering, there were addresses by representatives of the four groups of the profession most concerned, as follows: "The Debt of Modern Industrial Civilization to the Steam Engine as a Source of Power," Dean W. F. M. Goss, University of Illinois; "The Debt of the Modern Steam Engine to Charles T. Porter," Prof F. R Hutton, Columbia University "The Debt of the Era of Steel to the High-speed Steam Engine," Robert W Hunt, Chicago, "The Debt of the Era of Electricity to the High-speed Steam Engine," Frank J Sprague, New York. Henry R Towne was chairman of the committee of arrangements.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Goldfield, Indianapolis, Toronto, Berlin, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 7—Arrangements have been made by a firm of local shipping men to place a fleet of seven vessels on the service between this city and New York. Three vessels are already at sea, and now four new four-masted steel sailing vessels are to be added, the largest sailing ships afloat, each with a cargo capacity of 5500 tons. About 120 days will be allowed for the trip, which will make about six round trips a year. The minimum freight rate is to be 30c. and the maximum 35c. Two steamships are in the line, each of 6000 tons. Not only is this an important matter for shippers of many kinds of California products, but for certain mining interests as well. The freight rates by rail from this city to New York have been for years virtually prohibitive for certain mineral products, notably asphalt, chrome, magnesite and manganese. When there was a fleet of sailing vessels carrying freight to New York years ago, chrome and manganese ore were mined here and shipped, but of late years most of the mines have been closed for want of a market. Magnesite cannot profitably be shipped under present railroad rates, nor can the other substances named. Only one or two chrome mines are being worked in California, and scarcely any manganese mines. The greatest benefit to be derived from these new lines of vessels will be for the California asphalt industry.

Large quantities of asphalt are made at the oil refineries not only in Los Angeles, but around San Francisco bay. Some of the California oil carries as high as 20 per cent. asphalt, and so much is made that there is not enough local demand to consume it. For this reason thousands of tons are made into coke. If there is an outlet by sea at reasonable rates, such as is now to be established, this asphalt can be shipped to New York and other cities.

The Camminetti bill to create a consulting board looking to a more general resumption of hydraulic mining in the central part of the State failed to become a law. It passed the Senate, but was defeated in the Assembly. The valley people looked with suspicion upon the proposed measure, fearing that too many hydraulic mines might be permitted to start up. This is another evidence of the fact that hydraulic mining will never again become an industry of great prominence in this State.

The Mercantile Trust Company, of San Francisco, has commenced suit to foreclose on the property of the San Francisco & San Joaquin Coal Company under a deed of trust for $500,000. The coal company gave the deed of trust to secure the payment of a bond issue of that amount. The agreement also provided that the coal company was to pay the bank 5c. for every ton of merchantable coal mined and to put in escrow 4975 shares of the capital stock of the Alameda & San Joaquin Railway Company. Neither of these provisos was carried out. The coal mines are those sometimes known as the Treadwell mines, in Alameda county. The Treadwells—of Alaska fame—put a fortune into these properties, but the coal was of poor quality and there was not so much as supposed. They tried briquetting the product but that failed. There was several subsidiary companies, one for the manufacturing of window glass from the glass sand, brick and pottery from the clay, etc. A manganese property was also included. The brick and pottery works are still active.

The Keane Wonder mine, in Inyo county, one of the large producers of the State, has put into commission a new 100-ton cyanide plant, which begins work on an accumulation of about 20,000 tons of tailings. There is a 20-stamp mill on the property, which is kept in constant operation on high-grade ore. The capacity of this mill is to be doubled, to keep up with the cyanide tonnage.

The United States grand jury at Carson, Nev., has returned indictments against L. L. Partick and M. B. O'Farrell, two Goldfield "brokers," charging them with using the mails fraudulently in connection with the promotion of mining stock. It is understood that this is the first of a series of indictments to be considered by the grand jury, and a general hunt for fraudulent stock transactions is expected in Nevada.

Tonkins, Sanford and others have sued W. H. Remington and J. D. Barber for possession of the Patricia, Marie and Sanford mines near Columbia, Tuolumne county. The defendants made an agreement to do certain work under an option and to put in certain machinery to unwater the mines, to make certain payments, and to pay 50 per cent. of the net proceeds of operation. The plaintiffs say these things were not done as agreed and ask that the mines be returned to them.

At Salome, in Ellsworth district, Inyo county, on the Arizona-California branch of the Santa Fé railway, where discoveries of high-grade ore were recently made, things are quite lively just now. Eastern people have purchased a half interest in the Bonanza mine and made a substantial payment, thus giving the new camp a good start-off.

Butte

April 8—Judge Hunt, of the Federal district court handed down his decision last week in the case of the United States against the Northern Pacific Railway and its subsidiary companies. The suit was brought for the Government by Special Attorney T. J. Walsh for the purpose of securing to the Government certain coal lands in the Red Lodge district, Carbon county, of the value of $2,912,000 now held by the railroad. Years ago the railway took this land from the Government in exchange for land along its right of way. At the time it was supposed that the land was non-mineral in character but it was later found to contain coal deposits of great value. By the decision the Government is given the lands in question and the court holds that, even though the Government engineers had previously classified the land as non-mineral in character, yet this classification was not conclusive, and when proof was made that the lands were in truth valuable for their mineral deposits the title of the railway to the lands must of necessity fail. In view of the amount involved the case will in all probability be appealed to the United States circuit court of appeals.

The monthly report of the United States assay office at Helena states that there has been a gain of $108,378 in the amount of gold received during the first quarter of 1909 over that received during the first quarter of 1908. The total amount of precious metals received at the office for the first quarter of the current year is $458,574. For the month of March, Madison county leads with a production of $42,081.

E. W. Beattie, of Boston, has instituted action in the Federal district court for the purpose of securing a receiver and winding up the affairs of the Bald Butte Mining Company. In his petition he states that the company is indebted to him in the sum of $20,145 and that its other debts are of such amount that a sale of the entire property will be necessary before payment can be made.

J. A. Murray has begun an action in the local district court against the Monitor-Tunnel Mining Company, W. S. Switzer and James H. Maloney, for the purpose of compelling the transfer on the company's books of 2,146,650 shares of stock

which plaintiff alleges he is the owner of. In his complaint Murray states that he advanced money to Switzer and received the stock as collateral and that the latter has never paid the money borrowed and that therefore the plaintiff is entitled to the transfer.

Work on the new Gilmore & Pittsburg Railroad between Armstead, Montana and Salmon City, Idaho, is being pushed with all possible speed. Attorney Wheeler, of Pittsburg, who has been securing the right of way for the company, states that between 3000 and 4000 men will be put to work on the road within two weeks' time.

The Monida Trust Company has recently brought suit against the Red Metal Company for the purpose of securing the partition of the Mountain Chief lode claim, situated in the Butte district. The complaint states that the trust company is the owner of an undivided one-third and the mining company of the remainder.

The Davis-Daly has been the topic of much speculation during the last several weeks. At the Colorado shaft a crosscut on the 1400 level, which recently intersected a large vein of low-grade ore, is being pushed ahead, and it is expected that another vein will be cut in a short time. A new 22-drill Nordberg compound compressor, electrically driven, and ore bins of 500 tons capacity are being set in place.

Oscar Rohn, of the Pittsmont company, has left for the East, and an official announcement is expected in the near future concerning the reported consolidation of the Pittsmont and East Butte.

Denver

April 9—It is stated in the daily press here that the president of the International Smelting and Refining Company, John D. Ryan, is coming here soon in the interests of his company for the purpose of determining if it shall enter Colorado, and if so, where its plants shall be built. He is to be met here by Dennis Sheedy of this city, the vice-president of the company, and they will make a tour of inspection together.

The Portland Gold Mining Company now proposes to build a mill at the mine on Battle mountain to treat its enormous dump and its low-grade ores, and in view of this expenditure the directors have decided to reduce the quarterly dividend from 4 to 3c. per share. The March production of the Vindicator mine is given at 2000 tons of ore, averaging two ounces of gold per ton. The Elkton Consolidated Mining and Milling Company has declared a dividend of 1½c. per share, payable April 24. The Union Leasing Company is credited with a production in March of nearly 3000 tons of gold ore, of a gross value of about $75,000. This product came from the Gold Dollar, El Paso, Pinto and Deadwood mines.

After a year's idleness the mill of Stratton's Independence, Ltd., is now running on the low-grade ore of the dumps, this enforced shut down being due to financial reasons; the company was, however, reorganized last fall and ample capital provided to pay off all indebtedness and provide for future needs; in fact the published report of the company shows that $250,000 of new capital was put into its coffers, and it is well known that the debts were about $100,000. The dump mill was so far completed last spring that it could be operated in ordinary weather, but the winter has been so severe that no attempt was made at operation until March, and even then they had to shut down a few days on account of freezing in the concentrating department. It is hoped that the mill will soon be in continuous and successful operation as it is a bold attempt to treat the low-grade ore by fine grinding, concentrating the sulphotelluride ores, and cyaniding the tailings. The dump is said to average $3.70 per ton, and at best the profits cannot be large in a 100-ton mill. However, the company has the funds to treble the plant whenever success is demonstrated, and should it be shown that ores of $3.50 gross value can be treated at a profit, it will add greatly to the value of the Cripple Creek district, and the operation of this mill is consequently followed with much interest.

In the San Juan region, Silverton has been relieved from the snow blockade and over 7000 tons of concentrates have been sent from the neighboring mines to the Durango smelter during the month ending April 8.

The Sigafoos, one of the many boring machines designed for rock tunneling without the use of explosives, has been installed on Columbia mountain, near Georgetown, and is scheduled for a practical test as soon as ample water is available to insure a steady run. The demonstration will be watched with interest by mining engineers of this State.

The Mohican, supposed to be an extension of the Gold Coin vein, just above the town of Victor, also reports a strike of five feet of $20 ore at the 700 level. The leasing company operating the mine is now prospecting for the same shoot on the 1000 level. The Friday, an adjoining parallel vein to the Hoosier, one of the early big producers of Tenderfoot hill, reports a new ore shoot discovered at the 200 level. The values are said to run from one to four ounces per ton. A 5-ft. vein of shipping ore is also said to have been discovered on the Ocean Wave, on Battle mountain. An aërial tram three miles in length will be built from the Midget mine, owned by the Gold Issue Company, on Gold hill, to the mill of this company between Mineral and Carbonate hills. The mill has been remodeled, and will treat 100 tons per diem

A report has just come to hand of the discovery of a shoot of that phenomenally rich telluride of gold product in the W. P. H. on Ironclad hill, Cripple Creek district, and which in 1904 was a spectacular producer, ore worth as high as $6000 per ton in gold being then produced from the 245-ft. level, and $315,000 was taken out. The new vein is said to be four feet wide. The ore is being sacked for an initial shipment and the orehouse and workings meantime are patrolled by watchman day and night. The ore is mainly silicified breccia and occurs near the contact with the outlying schist.

In Leadville, the Garbutt mine, which adjoins the Ibex group (locally known as the Little Johnny), on the south, has made a strike of rich gold ore. It is worked by lessees, and owned by the Cheesman estate. There are upward of 150 leasers working on the Little Johnny, and all of them are doing well.

In closing out a loan in New York, a sale of securities at auction recently resulted in the transfer of nearly 10 per cent of the stock of the United Rico Mines Company, 276,832 shares being sold, together with 1000 shares of King Edward Silver Mines Company, of Cobalt, and $55,000 in 6-per cent. bonds of the United Rico company.

Goldfield, Nevada

April 6—The estimated value of the output of the Goldfield mines for March is: Consolidated Mines, $1,074,000; Goldfield Florence, $95,000; Combination Fraction, $88,000; Daisy, $17,500; other mines and leases, $20,000; aggregating $1,294,500.

Tonopah ore shipments for the week ending March 27 were: Tonopah Mining, 3250 tons; Montana Tonopah, 775; Belmont, 300; MacNamara, 270; Jim Butler, 200; West End, 130, and Midway, 100 tons; total estimated value, $125,000.

As a result of the visit to Goldfield of James F. Calbreath, Jr., secretary of the American Mining Congress, Oct. 11 has been chosen for the date of the Goldfield meeting. Various committees were appointed and a strong effort will be made to secure low railroad rates. The mint at Carson was unable to treat a $200,000 bullion shipment from Goldfield last week, owing to insufficient facilities. The shipment in question was forwarded to San Francisco. The superintendent of the mint has appealed to Washington for additional help, but thus far has been unsuccessful.

The Nevada-California Power Company has let contracts for extending its lines from Millers to Manhattan and Round Mountain; the material is now arriving at Millers and construction will start at once The introduction of electric power in these camps will do away with a great handicap that has faced operators heretofore and will serve to make possible the operation of many properties now lying idle. The output of the Goldfield mines for the week

ending March 27 was 6400 tons, estimated value, $330,000.

Grading has begun for the car shops to be erected at Las Vegas, Nev. This is to be a division point on the Clark road. It is claimed that the shops when completed will furnish employment for about 400 men.

In a decision for the defendant, Judge Peter J. Somers, of the District Court, holds that the good faith of the owner of mining claims in expending money for the annual assessment work, is all that is necessary if he, the owner, can prove that the money actually went into the ground. The action was based upon the question of sufficiency of labor performed on a group of four claims east of Goldfield, on three of which shafts 4x6x10 ft. deep were sunk, and on the fourth a shaft of similar dimensions already existing was deepened 8 ft. The owner, a nonresident of Goldfield, arranged by letter to have the work done, a contractor agreeing to do the annual assessment work for the sum of $400,. The work was performed and the money paid. Later the claims were jumped by men who claimed that shaft of the above dimensions was not worth $100, and was an evasion of the United States statutes, the court holding the contrary.

Governor Dickerson has appointed Edward Stewart, of Manhattan, as State mine inspector at a salary of $3000 per year. Mr. Stewart will assume his duties at once and will name his assistant who will receive $2400 per year.

The executive board of the American Mining Congress in accordance with the plans of that organization to appoint a vice-president in each of the Western mining States, recently appointed George Wingfield to that office for Nevada.

Indianapolis

April 12—That the big steel mills at Gary, Ind., are preparing to get a large part of their soft coal from southern Indiana is shown by contracts now being written—and there is every reason to believe that they will be signed—for the delivery, beginning not later than May 1, of 3000 tons of coal daily to that point. Most of the coal, according to advices, will be produced by the mines in Sullivan, Clay, Green and Vermillion counties, but there are indications that a part of it will come from the Gibson and Warrick county fields.

The supply of Indiana coal which the Steel Corporation will take will mean at least 50 carloads a day. The Corporation is interested in some mines and coal lands near Terre Haute, and may also secure some fuel from that field. The news is welcomed by operators and miners alike, since it assures steady and increased work for miners.

Toronto

J. M. Laing, president of the Gowganda Board of Trade, publishes a statement to the effect that there is now no danger of a shortage of food supplies in the camp on the break-up of winter communications, as was at one time feared. There are, he states, 1050 tons of supplies in the hands of merchants, while 600 teams on the road from Charlton and 200 teams on the road from Sellwood to Gowganda are busy hauling in additional supplies, mostly provisions.

Mexico City

April 4—There is much interest in Mexico in special and improved ore-treatment processes to meet the conditions of the metal market, and to utilize the large deposits of complex low-grade ores. The most extensive dry-concentration experiments have been carried on at the Tiro General mine, at Charcas, S. L. P., using the Sutton-Steele method, and the result has been a commercial success. The ore here is mixed sulphides of copper, iron, lead and zinc, finely crystallized, and with the individual crystals interwoven in the mineral so as to make the application of the ordinary gravity concentration methods of no avail. The di-electric process was also applied at this mine as an adjunct to the pneumatic concentration method. The San Francisco del Oro mine, near Parral, has also been working on the application of the pneumatic concentration method. A modification of the dry-concentration tables was developed at the mine and it is reported that the ore could be successfully treated by this method. However, there has been a change of management and a new manager is now on the ground to try some of the Australian methods for the treatment of the ores.

The Avino mines in Durango have tried oil concentration unsuccessfully, and now the London board is talking of smelting the ore. At the Calera mine in Chihuahua the Sutton-Steele pneumatic tables are being used in separating zinc-lead ore. A testing plant, to demonstrate the Potter flotation method, is being erected in Mexico City by an English and Australian company that has been instrumental in developing these processes at Broken Hill and at other Australian camps. The company will also introduce a new electromagnetic process from Germany. In the Parral camp the treatment of the zinciferous ores by magnetic methods is in use successfully and extensively.

The beneficiating of the complex ores is a new feature in the development of Mexican mining and it is likely to be far-reaching for there are many localities containing important ore deposits that cannot be marketed or treated by any of the ordinary methods. The problem is being taken up in the same spirit as was the cyanidation of the silver ores a few years ago, and it is expected that with the experience gained in the United States and in Australia that the men at work on the complex ore problems of Mexico will meet with a measure of success that will materially benefit the industry.

The Mexican congress will take up the consideration of the new mining law at the session which is now convened. The law as submitted by the government and indorsed by the executive department, eliminates the objectionable clause 144, and the other clauses which were considered unfavorable. The law is mainly a codification of the existing statutes, decrees and rulings of the departments, and is very much needed, as there has been no general mining legislation enacted since 1892. Some of the points in it are considered favorable to the industry and in the main the enactment of the law, with the objectionable clauses removed, will be advantageous to the interests of foreign investors.

During the first half of the fiscal year, 2150 title deeds to mining lands were issued covering 39,987 hectares, a decrease from the corresponding period of last year of 28 per cent.

The Institute of Geology of Mexico has just published a complete bibliography of Mexican mining and geology to 1904, prepared by Sr. José G. Aguilera, director. The Geographical Exploration Commission has completed a large map of the state of Tamaulipas and will shortly issue some sheets of the Puebla and Tlaxcala map. Field work is being carried on in Sonora, Chihuahua, Morelos, Oaxaca and Yucatan.

The International Smelting & Refining Company, according to reports, has dropped negotiations for the Torreon smelter owing to a disagreement as to price, and so far the new company has not made any direct move in the Mexican field, although it is known to have made some general investigations here recently.

Berlin

April 2—It is reported that Prussian government has introduced a bill in the Diet forbidding foreigners from acquiring mineral properties and operating mines within Prussia without the especial permission of the King or the authorities representing him.

It is assumed that this bill is largely due to the discussion which has been going on for some weeks among those interested in the potash industry, regarding the probable purchase of potash mines in Prussia by American fertilizer combinations, so as to render themselves independent of the German potash syndicate.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

The latest news from the old Koyukuk diggings on Nolan creek are encouraging. A big clean-up for the season is anticipated. Mining activity at Circle City has again revived and some pay streaks have been encountered. It is reported that wages are $10 per day and men from the neighboring towns are being urged to accept employment.

Klondike

There is renewed activity here and a good output of gold from lode and placer claims is anticipated. On the Dome last year a large amount of prospecting was done and an air compressor and drills have been installed. Lode mining from now on will go hand-in-hand with placer mining in the Klondike country.

Tanana

Brumbaugh, Hamilton & Kellogg have just completed the installation of the first stamp mill in this district. A second stamp mill will be installed very soon and is now being hauled in by sleds over the trail from Valdez. The installation of these two mills has given quite an impetus to lode mining.

Empire—A tunnel is being driven on this property and a number of good quartz lodes are reported in the immediate vicinity.

Valdez

Tacoma Copper Company—The property is at the head of Cordova bay. A plant for the treatment of ore, a large dock, and buildings for the accommodation of employees will be erected at once. The company proposes to spend $150,000 in development work.

Galena Bay—With the tunnel in 1500 ft. a diamond drill, at a depth of 300 ft. farther, struck an orebody 40 ft. in thickness. The ore contains a fair percentage of copper.

Arizona

Cochise County

Phelps, Dodge & Co.—At the annual meeting held in New York, James Douglas, Cleveland H. Dodge, Arthur C. James, James McLean, George B. Agnew, E. Haywood Ferry, Francis L. Hines, George Notman and William Church Osborne, all of New York, were elected directors.

Swisshelm Development Company—The property is about 16 miles southeast of Courtland. The shaft is now 80 ft. deep and is in rock that carries both gold and silver.

Heffern Mining—The company has fifty claims in the Swisshelm district, thirty miles northeast of Bisbee. Thirty-two men are employed. The two-compartment shaft is now 320 ft. deep. Native gold, silver and copper can be panned from the lead ore in the bottom of the shaft.

Copper Queen—A power house, 45x70 ft., is being built at the company's workings, in Courtland. The building will contain an air compressor, which will furnish air for the several working shafts. All the power used will be on an electric basis.

Courtland—A post office was established recently and the town is growing rapidly. The Southern Pacific and El Paso & Southwestern railroads will both be in the camp within a few weeks and ready to haul ore to the smelters at Douglas.

Gila County

Old Dominion—Drifts on the 1000, 1200 and 1400 levels in the United Globe ground are being driven to strike below the workings of the old Hoozier mine. Another furnace was blown in at the smelter recently, and in the future four furnaces will be kept in operation.

Gibson—A winze from the 400-ft. level has encountered a rich body of chalcopyrite. The property was sold recently to a Boston syndicate.

Inspiration—Two crosscut adits, and one drift are in low-grade sulphide ore. Two shafts are also being sunk. Gasolene hoists are being installed. Churn drills will be used to prospect portions of the ground.

Superior & Boston—Shipments are being made to El Paso at the rate of 50 tons per day. February shipments averaged 9 per cent. copper, with some silver.

National—A 3-compartment shaft has been started. The new shaft is for the development of the Black Hawk vein.

Graham County

Arizona Copper—March production was 2,072,000 lb. as compared with 2,546,000 lb. for February.

California

Alpine County

Nevada-Hercules—The Loope properties at Loope have been started and the company will begin operations in both mine and mill.

Amador County

Garibaldi—After extensive surface stripping by hydraulic process, the gravel channel has been opened and is proving rich in both coarse and fine gold.

Butte County

E. Gunn has sold the old Gunn or Blue Hog mine at Magalia to D. Casterline for $40,000. A company will be formed in Los Angeles to work it.

Magalia Consolidated—This company was organized by S. P. Moody and Mc Cubbin Brothers, of Oroville, to work the old Mineral Slide mine south of the Mammoth Channel Company's mine.

Calaveras County

Mike Tisher—Porteous & Oliver have sunk a shaft on this mine and have bottomed the old workings. The ore is heavily sulphureted, but is of high grade.

El Dorado County

Alpine—Since George Wingfield and associates gave up the bond, Mr. Lane and his associates have kept at work on a wide vein of $8 rock. Twenty men are employed.

Manhattan - California — Development work has been renewed. A heavier surface plant is to be put in. W. P. Hyatt is superintendent.

Inyo County

Casa Diablo—The mill has been started with ore enough for a 40-day run.

Skidoo Mines Company—The 15-stamp mill is turning out bullion.

Mono County

Hess—A good grade of ore from the 3-ft. vein in this mine is being milled.

Nevada County

Giant King—The machinery for the new 20 stamp mill is on the ground and will be set up as soon as possible. The lower tunnel is expected to cut the vein in a few days.

Peek-a-Boo—In this mine, Grass Valley district, a small ledge of high-grade ore has been struck.

Placer County

Begole Mines Syndicate—This Goldfield company, holding a bond on the

Annie Laurie and Alameda group of claims, six miles from Colfax, is about to install a 150-h.p. electric plant. An air compressor has been installed.

Cash Rock Dredge—The Long Beach-Los Angeles company, owning the dredge which was at work in the north fork of the American river near Forest Hill is being reorganized with a view to building a new dredge. The old one was damaged in the winter floods. So far the dredging work in that section has not been profitable.

Colorado

Lake County—Leadville

Penn—Two hundred tons of ore are being shipped daily from this Breece hill property and development work is being pushed in new territory. The ore is obtained mainly from the lower levels.

Grabutt—In recent development work near the Little Johnny, a body of high-grade gold-bearing quartz was encountered. About 20 tons per day are now being shipped. Several years ago this property shipped mainly copper ore.

Iron Silver—It is announced that Mark Woodruff, of Detroit, Mich., one of the officers of this company, is to take charge of the property until the successor to Waldemar Arens is appointed. Only a limited force of men are to be employed on the company account until Mr. Woodruff's arrival. Lessees, however, are working to full capacity.

Butte—Lessees on this claim in the south Mosquito district recently opened a 2-ft. vein of gold ore.

Houston—The tunnel is now in 93 ft. Several promising streaks have been encountered.

Dinero Tunnel—Regular shipments are being made from the orebody recently opened in this tunnel and the bore is being driven ahead to develop claims farther north under control of the same interests.

Fanny Rawlings—In the lower workings on Breece hill a good body of ore has been opened and the mine is shipping 20 tons daily.

Gilpin County

Ann Rutledge—The Mann lode in the Vermilion district has been sold to the Ann Rutledge Gold Mining Company, of Youngstown, O. This property produced high-grade ore in the early days and is now to be unwatered and the shaft sunk deeper. The upper workings will also be prospected.

East Pewabic—A lease for two years on this mine in the Russell district has been granted to M. Edwards and associates. It is announced that the shaft will be sunk 200 ft.

Teller County

Ophir—The new oreshoot opened on the 1000 level has been exposed for a distance of 65 ft. and stoping will be commenced at once. Two cars of ore have already been shipped.

Doctor-Jackpot—A suit for $2,245,000 for ore alleged to have been unlawfully taken from the Doctor-Jackpot properties has been filed against the Work Mining and Milling Company. This ore is alleged to have been taken from veins Nos. 1 and 2 and the Timber Drift vein.

Iron Clad Hill—The recent rich discovery on the W. H. P. has resulted in considerable activity on Ironclad hill. Lessees are sinking on the Teutonic, Seven Thirty and other properties in that section.

Prince Albert—The Union Leasing Company has begun shipping ore from this Beacon hill property. The tunnel is now in 1150 ft., and is to be driven an additional 400 ft. to the north end line.

Idaho

Idaho County

Reports from Elk City are discouraging. The camp is 70 miles from the railroad and supplies are high in price. Only one mine is at work, employing 10 men. There are a number of idle 10-stamp mills. All of the work is in the prospecting stage.

Indiana

Greene County

Vandalia mine No. 5 has been closed. This is the oldest mine in the district, and employed nearly 100 men. The mine is not all worked out, but the remaining coal will be taken by the men of mines Nos. 2, 4 and 6, which are connected with No. 5.

A company has been formed at Linton to take over the city electric light plant. The company proposes to open a new mine and erect a plant at the mouth of the mine and furnish electricity to a number of cities in the territory.

Vigo County

Plans and arrangements are being made as rapidly as possible, to erect a safety device station near Terre Haute. A number of coal operators, mine superintendents, officials of the United Mine Workers and Terre Haute city officials will go to the Illinois State University at Urbana, April 12, to witness a demonstration of the safety device for which it is intended to establish a station in Terre Haute.

Louisiana

The production of petroleum in March was 273,500 bbl., being 24,800 bbl. less than in February. Shipments were 91,542 bbl. by rail and 18,829 by pipe-line; a total of 110,362 bbl. In March 19 new wells were completed, of which 13 were producers. There were 32 new wells under drill at the end of the month.

Michigan

Copper

Calumet & Hecla—Twenty Chilean mills and about 40 Wilfley tables are in service, and in the course of about a month the complete regrinding mills will be ready to go into commission. At No. 10 shaft a decided improvement in the copper contents of the rock was encountered in the south drift from the 73d level. A continuation of this strike will not only be of benefit to this company, but will afford great possibilities for the Osceola. The southern portion of the property has carried but little copper.

Isle Royale—At the annual meeting of the stockholders the Calumet & Hecla interests entered the directorate. The following were elected: George A. Flagg, A. R. Agassiz, R. L. Agassiz, O. A. Shaw and C. N. King.

Mass—The same mineralized condition continues that was first exposed by means of the crosscut from the 17th level. This lode is entirely new and its further opening may mean much to this company. Drilling is under way from the upper levels of "A" shaft to cut this formation.

Atlantic—Sinking continues at this company's Section 16 shaft at a depth of about 2200 ft. Drifting and crosscutting from the shaft toward the north are under way from the various levels. The shattered and broken formation continues.

Ojibway—A crosscut has been started to cut the formation on the 800-ft. level of No. 2 shaft. No. 1 shaft is sinking close to this same level. This company will in all probability run a mill test during the coming summer, utilizing the Phœnix mill which is now idle. The lode, so far, has more than come up to the expectations of the management.

Iron—Gogebic Range

Seven diamond drills are at work in the Copps district, near Marenisco. This is in new territory, on the eastern end of the range.

Iron—Marquette Range

Portland—Contractors have begun stripping at this mine near Michigamme, on the western end of the range, which is to be worked by steam shovel. The mine belongs to the Buffalo & Susquehanna Company. The ore is a rather low-grade non-bessemer, but can be cheaply worked.

Iron—Menominee Range

M. A. Hanna & Co. have several diamond drills at work on sections 28 and 34, 46-33, a few miles north of Amasa, and west of the Hemlock. This is new territory, and if ore is found it will extend the western limit of the range.

Minnesota

IRON—MESABI RANGE

Adams—That part of the ground formerly mined from Nos. 1 and 2 shafts at Eveleth is being stripped for mining by steam shovel.

Kellogg—Arrangements have been completed to work actively at this mine. There is some ore on the stockpile already. The mine belongs to the New York State Steel Company.

Perkins—Stripping is well advanced on this property, two miles northeast of Aurora. It is owned by Joseph Sellwood.

Sparta—The town of Sparta is being moved or torn down, and the work of stripping will soon be begun. Prospecting showed a large orebody under the town. This property is being opened by the Oliver Iron Company.

Missouri

ZINC-LEAD DISTRICT

Silver Moon—This company has made its initial turn-in from its new mill with 40,000 lb. of jack and 18,000 lb. of lead.

Continental Zinc Company—The workings at Prosperity are still shut down and the company is installing new pumps to recover the ground lost by a cavein over the pumps.

Black Cat—This company, three miles west of Joplin, has completed a shaft to the sheet ground and will erect a 250-ton mill. B. H. Poindexter is manager.

Endeavor—The new mill of this company at Prosperity has been destroyed by fire.

Symmes—This company has struck rich ore in open ground on the Riesling land west of Joplin. Seven drill holes show the ore at from 62 to 84 ft. depth.

Joplin Separating Company—This company is enlarging its plant to handle a larger amount of ores containing an excess of iron.

Ruby Jack—This mine and lease have been sold to J. A. Wettich, of Nowata, Okla., for $20,000. A 300-ton mill will be erected.

Pinnacle—This company at Oronogo has started its mill on its 42-acre lease. J. H. Tonkin, of Joplin, is manager.

Herald—This company, at Cave Springs, will install an electric hoist of large capacity at the incline shaft and is sinking a shaft from the upper to lower levels to facilitate loading the skips

Montana

BUTTE DISTRICT

Davis-Daly—A new vein has recently been intersected in the Colorado mine by the crosscut on the 1400-ft. level at a point about 400 ft west of the shaft. Another vein was recently cut on the same level and showed a width of about 17 ft. Both of these veins were located by means of diamond drilling, and a third, also located by that means, will not be reached for another month at least.

La France Company—Shipments from the Lexington mine have been stopped and the work confined to development. It is not known at what time the mine will resume shipments.

MISSOULA COUNTY

Saltese District—Work is being carried on with a large force of men at the Iron Mountain, where new machinery has been installed. The Carter properties are also in operation. The Swastika has recently made a shipment of copper ore. At the Iron Mask a large shoot of concentrating galena ore has been opened up, and a concentrator is being built. The Monitor, which has been in constant operation during the past winter, has been forced to discontinue work on account of the lack of wood for use in the boilers. Enough fuel has been reserved, however, to keep the pumps going and the workings free from water. As soon as the weather breaks a fresh supply of fuel will be secured and work resumed.

SILVER BOW COUNTY

Pittsmont—This mine is said to be developing well, and at present is yielding about 150 tons daily of first-class ore and 200 tons of second-class. The smelter, at present of 200 tons daily capacity, is being enlarged to 500 tons; probably the concentrating mill will be enlarged also. Plans are in hand for refinancing the company.

Nevada

CHURCHILL COUNTY—WONDER

Nevada Wonder—It is definitely decided that the company will erect its own mill, and J. B. Daniel is now in San Francisco with a view of securing bids on the material and machinery necessary for a 15-stamp mill.

ESMERALDA COUNTY—GOLDFIELD

Combination Fraction—This property is maintaining an average daily production of 90 tons of ore averaging $40 per ton, in addition to some high-grade ore which is being shipped to the smelter.

Daisy—The daily production is about 10 tons, averaging from $35 to $40 per ton

Goldfield Star Mining and Leasing Company—Walter Stopford has purchased Ernest Kennedy's interest, and has made arrangements to sink the vertical shaft, now 250 ft. deep, another 100 ft., and then crosscut for the orebody.

Goldfield Consolidated—Senator Nixon has disposed of his entire interest in this company, amounting to 308,000 shares, at a price of $7.50 per share, according to the common report His holdings were purchased by George Wingfield and Bernard M. Baruch and associates. Net earnings of the company in March are said to have been $950,000 against $450,000 in February.

ESMERALDA COUNTY—LUNNING

Daniel E. Storms, B. F. Baker and L. K. Gregory are now building a cyanide plant to treat an old tailings pile about 10 miles west of Mina.

ESMERALDA COUNTY—RAWHIDE

Dromiac—This company, operating the old Bradshaw lease, made a shipment of 10 tons to the sampler at Hazen last week, returns from which show a net value of over $400 per ton.

Bethania Mines, Incorporated—Daniles & Bridges, lessees, have opened up ore at a shallow depth, from which about a ton of high-grade ore is being sacked per day.

Gold Reef—This lease operating on the Bethania estate is working in a good grade of milling ore. The leasers are under contract to have a power hoist in operation by April 15, in which case they will be granted an extension of two years.

Marigold—This lease on the Coalition estate is reported as having opened some rich ore in a winze sunk from the 300-ft. level. The face of the north drift on the 130-ft. level shows 4 ft. of good ore. Daily shipments of about five tons are being maintained.

Rawhide Coalition—Victor lease is now being developed, but not much ore is being taken out, owing to the poor milling facilities. The Rawhide Truett lease continues to sack ore and make shipments to the different mills in Rawhide and Salt Lake City.

Golden Hour—This lease, on the Consolidated Mines estate, has the largest gallows frame in the district, and expects to sink to a depth of 500 ft. Milling ore is being extracted.

Black Eagle—This property is now under bonds to Chicago mine operators for $110,000.

Rawhide Western Railway—This company is now being financed in New York by its president, Charles Wesley Reed. He has taken an option for 90 days on the Rawhide Coalition and Rawhide Queen properties.

ESMERALDA COUNTY—STIMLER

Nevada Cottonwood—There are now six sets of leasers working on this property Several are saving ore, and are doing systematic development work Barnes & Collins, lessees, recently sent out an 18-ton shipment which returned $78 per ton

EUREKA COUNTY—EUREKA

Windfall—In the east crosscut on the 200-ft. level a body of high-grade lead-carbonate ore was recently encountered. The orebody has been penetrated 6 ft. with the wall not yet in sight and gives

high assays in gold, silver and lead. The ore-shoot is a new one and is entirely distinct from the main gold-bearing orebody being blocked out west of the shaft. A station is being cut at the 325-ft. level and crosscuts will be run at this depth to further prove the orebodies. The 200-ton mill will be completed May 15. A 50-h.p. hoist will replace the present 25-h.p. hoist.

HUMBOLDT COUNTY—SEVEN TROUGHS

Wihuja Lease—Another shipment will be made to the Kindergarten mill. Crosscutting is being carried on from the 375-ft. level to explore the southern part of the holding. A winze is being sunk from the 275-ft. level for the purpose of an air connection with the 375-ft. level. The shaft will be put down an additional 100 ft. making it nearly 500 ft. on the incline.

Mozuma Hills—This property was closed down for two weeks on account of internal dissension in the company as to the proper method of development. Manager John Harnan is expected at the mine any day and it is reported that he will start a vertical working shaft which will be sunk to a depth of at least 600 feet.

LINCOLN COUNTY—INDIAN SPRINGS

Pioneer Oil—The machinery for drilling is now arriving and is being hauled to the seat of operations, about three miles from the station.

NYE COUNTY—BULLFROG

Crystal Bullfrog—Machinery for the construction of the mill has been received and the foundations are in place. At a late date the Bullfrog chamber of commerce called a meeting to endeavor to secure for Rhyolite the location of the mill instead of South Bullfrog as now proposed. The result of the conference has not yet been made public.

NYE COUNTY—HELENA

Broken Hills—W. H. Whitmore and Thomas G. Murphy, leasing on Block No. 4, made a shipment last week of 15 tons, the ore coming from a raise from the 70-ft. level.

New Mexico

GRANT COUNTY

Last Chance—Work has been resumed by the newly organized Sutton Consolidated Mining Company.

Viola—The Lordsburg Mining and Reduction Company is working this old mine. It is reported that a 100-ton concentrating plant will be built.

Penn—The property is best known as the Aberdeen. The Malachite shaft is being repaired in anticipation of sinking from the 367-ft. level to the 600, where crosscuts will be made.

Eighty-Five—Two carloads of ore are shipped weekly. The ore carries copper, silver and gold.

Clemmie—Returns from the first carload shipment of ore to the Douglas smelter gave $30.40 per ton.

Buena Vista—J. H. Chamberlain is manager. Good ore is reported at the bottom of a 40-ft. shaft.

SOCORRO COUNTY

Mistletoe—A 50-ton dry concentrator is being built to treat zinc ore.

Oklahoma

According to the *Oil Investors' Journal*, petroleum production in Oklahoma in March was 3,504,609 bbl., 300,027 bbl. more than in February. Shipments in March were 3,159,414 bbl., and 345,195 bbl. were added to stocks. The total stocks of Oklahoma oil reported on March 31 were 54,356,947 bbl. In March 327 new wells were completed, of which 305 produced oil and four gas; while 18 dere dry. There were 272 new wells in progress at the end of the month.

OTTAWA COUNTY

Miami-Yankee—This company has leased 18 acres of land from the Emma Gordon Company at Miami, and will develop it at once.

South Carolina

LANCASTER COUNTY

Haile Gold Mine—By order of the district court on April 2, Charles D. Jones, of Lancaster, S. C., and L. W. Amerman, of Bayonne, N. J., were appointed receivers for this company, and will at once resume operation of the mines. The application for a receivership was made by Harry S. Seeley, of New York, trustee for the bondholders, the bonded indebtedness of the company amounting to $224,000. The mines were closed during the financial depression last year.

Tennessee

POLK COUNTY

Ducktown Sulphur Copper and Iron Company—It is expected that the first section of the sulphuric-acid plant will be completed about Sept. 1. The company is said to have contracted its acid for a period of five years at a price which will show a profit of more than 11 per cent. on the capital stock of the company, including the new issue.

Texas

The production of petroleum in the Southeast Texas district in March is estimated at 772,797 bbl., an increase of 1422 bbl. over February. Shipments by water were 270,477 bbl.; by rail 400,261; total, 671,738 bbl. During the month 54 new wells were completed, of which 36 were producers and 18 dry holes. There were 72 wells in progress at the end of the month.

Utah

JUAB COUNTY

Chief Consolidated—The stock of this company, which purchased the Little Chief and other properties, has recently been listed on the Boston curb. The capitalization is $1,000,000 of which 692,030 shares of par value of $1, each, have been issued.

Plutus—A 3-ft. vein of lead carbonate ore was recently encountered in the one of the old Tetro stopes near the Godiva lines.

May Day—This mine will soon be operating an additional depth of 200 ft., or a total depth of 1000 ft. At the recent annual meeting the old directorate was reelected. The report shows that during the year 5218 tons of crude ore were sold, bringing $83,192, and 1768 tons of concentrate, bringing $44,026. The operating expenses for the year were $86,410. Dividends were paid amounting to $44,000.

Opohongo—A body of arsenical copper ore of shipping grade has been opened at a depth of about 700 ft. The work is being conducted from the 300-ft. level of the Black Jack mine.

Iron Blossom—An initial dividend of 8c. per share is announced payable April 25. The Colorado and Sioux Consolidated have also posted dividends of 8c. and 7c., respectively.

TOOELE COUNTY

Boston-Sunshine—The new cyanide mill has been started and it is expected that it will be running at full capacity as soon as the damage caused by a slight accident in the vacuum filter department is repaired.

Western Utah Copper—A crew of men has been taken to the properties near Gold in the Deep creek district where development will be continued under the direction of Sup. J. E. Bergh.

International Smelting and Refining Company—The price paid for the Raritan works is said to have been $6,500,000. The earning capacity of the plant is said to be $1,000,000 per annum. The company has so far issued $10,000,000 of its capital, the remaining $3,500,000 being for the construction of the Tooele smeltery and working capital.

Virginia

MONTGOMERY COUNTY

Virginia Iron, Coal and Coke Company—The Laura furnace at Radford has resumed work.

Washington

OKANOGAN COUNTY

Penn-Wash—Fifty claims in the Mineral hilll district, including properties controlled by the Washington Consolidated Copper Company, have been sold to

the Penn-Wash Consolidated Mines Company, composed of Pennsylvania and Minnesota people. President, William Baines.

SNOHOMISH COUNTY—SILVERTON

Dahl—J. Newhall has lately financed a company in London to develop this property upon which a strike of gold ore, reported to run $60 per ton, was made two weeks ago.

Canada

BRITISH COLUMBIA—BOUNDARY

Dominion Copper Company—In the Supreme Court of British Columbia an order has been issued for the sale of those of this company's properties as were mortgaged by it to secure the bond issue. Justice Clement upheld the contention of the liquidator of the company and the unsecured creditors that the property acquired by the company after the mortgage had been given should not be included in the order for foreclosure and sale applied for by the National Trust Company, of Toronto, trustees for the bondholders. This decision of the court is expected to result in the unsecured creditors being eventually paid in full.

British Columbia Copper Company—The first payment of 10 per cent. has been made on a group of mineral claims in Wellington camp, bonded last September. Development work done during the six intervening months has shown the occurrence of ore in quantity and of good grade.

BRITISH COLUMBIA—NELSON

Eureka—L. B. Reynolds, manager, has obtained capital for further development of this property, situated on Eagle creek. Copper ore, with some gold and silver occurs in considerable quantity.

Silver King—Shipment of ore has been resumed, with an output of about 50 tons per day. The ore is conveyed to Nelson by aerial tramway, and thence about 50 miles to the Trail smelter by railway. The mine is under lease and bond to the Kootenay Development Syndicate, and Louis Pratt, of Nelson, is directing operations.

Second Relief—A syndicate of Wisconsin men has bonded the Second Relief gold-quartz mine, near Erie. There is a 10-stamp mill, mine and mill have been employing 25 to 30 men.

BRITISH COLUMBIA—PORTLAND CANAL

Portland Canal Mining Company—Financial arrangements have been made for the construction of an aërial ropeway from the group of claims on Glacier creek to Bear river, which flows into the Portland canal. A concentrating mill and water power plant are also provided for. C. H. Dickie, who is at the head of the enterprise, is conferring with W. J. Ehmendorf, of Spokane, Wash., who twice reported on the property, as to class of equipment to be put in.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended April 3 were: Buffalo, 55,520 lb.; Coniagas, 65,800; Crown Reserve, 123,476; Chambers-Ferland, 60,000; Kerr Lake, 55,040; La Rose, 260,070; McKinley-Darragh, 55,160; Nipissing, 218,000; O'Brien, 127,970; Right-of-Way, 119,800; Trethewey, 129,000; total, 1,270,826 pounds.

La Rose—Net earnings during the first quarter of 1908 are said to have averaged upward of $75,000 per month.

QUEBEC

Amalgamated Asbestos Corporation, Ltd.—This company has been organized as a consolidation or combination of the principal asbestos mining concerns in Canada. The capital authorized includes $10,000,000 in stock and $15,000,000 in debentures, though not all of these will be issued at the present time. The mines included now produce about 80 per cent. of the Canadian output of asbestos, or over 70 per cent. of the world's supply. The companies named as entering into the consolidation are the Beaver Asbestos Company, the Bell Asbestos Mines, Ltd., the British Canadian Asbestos Company, the Dominion Asbestos Company, King's Asbestos Mines, Ltd., and the Standard Asbestos Company. Some smaller mines also will be taken in. The directors of the Amalgamated company are: Thomas McDougall, Quebec; Hugh A. Allan, E. B. Greenshields, Robert Mackay, William McMaster, Montreal; H. H. Melville, Henry M. Whitney, Boston; Richard V. Mattison, Ambler, Penn.; H. A. Berwind, Theodore W. Cramp, C. Hartman Kuhn, Howard E. Mitchell, Philadelphia; James M. Beck, R. H. Martin, New York.

Mexico

BAJA CALIFORNIA

Boleo—The 1907 output was 24,530,000 lb. refined copper. When the Greene Cananea property shut down, this company secured many Greene laborers, as a result of which its operations were materially increased, and its production for 1908 is placed in excess of 30,000,000 pounds.

CHIHUAHUA

Batopilas—The silver production for the first three months of the current year was, Jan., 210,500 oz.; Feb., 205,810 oz. and March, 114,200 oz. bullion.

Negrita Carmen—Walter Maclachlan, managing director of the San Francisco del Oro Mines, Ltd., closed a deal here this week for the purchase of the Negrita Carmen group of mines of 10 pertenencias in the Sta. Eulalia district, 15 miles from Parral.

COAHUILA

Mexican Coal and Coke—It is reported that a coal bed 8 ft. thick has been penetrated at shaft No. 8.

SONORA

El Tigre—It is reported that the Lewisohn engineers will examine this property in the near future, with the view of purchasing the mine.

Nacozari District—An important copper deposit is reported as having been discovered by R. L. Van Dusen and Fritz Kohlmeyer. It is 3 miles from Pilares, and 500 ft. of development work has been done.

El Globo—It is reported that $80,000 will be spent to install machinery to develop gold-bearing claims.

Barrigan—Telluride of gold has been found here. About 200 denouncements have been made.

Santa Fe—P. J. Tehaney has acquired this property. The ore carries gold and silver.

Santa Rosalia—Clancy Brothers have purchased this mine, and are equipping it with modern machinery.

Chispas—An 8-mile tramway was installed recently.

Belen—A body of bismuth-gold-silver-ore was opened a short time ago.

ZACATECAS

Zacatecas Smelter—A new 350-ton furnace was completed March 31. It will be supplied with ore from the Magistral Mining Company. The plant is said to have cost $100,000, and is 4 miles north of Zacatecas.

Africa

NATAL

The report of the Mines Department for the year 1908 shows a gold production of 442 oz., or 436 oz. less than in 1907. Other productions were 10 tons of copper ore, 20 tons manganese ore, 3 tons graphite and 770 tons lime. Coal production was 1,600,774 tons, an increase of 130,731 tons. The coal was disposed of as follows: Exported overland, 100,242 tons; exported by sea, 446,915; sold to steamships, 710,777; used in colony, 405,840 tons. Labor employed in mines included 400 whites, 3319 East Indians and 4741 negroes; total, 8460. The number of persons killed in mining accidents was 93, and the number injured 87, the death rate per 1000 employed either above or below ground being 10.37 and the death or injury rate 20.08.

Peru

Cerro de Pasco—The enlargement of the smelting works has been completed, and on April 15 the output of the plant will be increased from 2,500,000 lb. of blister copper to 4,000,000 lb. per month. The company employs between 5000 and 6000 men.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 14—The coal trade in the West continues to show some improvement, the demand for steam coal apparently increasing as spring opens. The Steel Corporation has closed some large contracts for coal for its Gary plant, and other interests have also closed contracts for the year.

The Eastern bituminous trade shows a slight improvement, but is still rather quiet. Manufacturers have not recovered from the habit of buying for immediate needs, and seem to be still uncertain about the future.

The anthracite trade is quiet and steady, so far as current business is concerned. Of course, the chief topic of discussion in this trade is the possibility of a strike, and we are as far from knowing anything definite on this point as we were a week ago. Negotiations have halted and the future is entirely uncertain. A fuller statement of the situation in the anthracite field will be found on another page.

The Anthracite Coal Trust Case—The United States Circuit Court of Appeals has granted an extension of time until July 1 for the taking of testimony by the defendants in the Government suit against the companies in the alleged Anthracite trust.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 3, short tons:

	1908.	1909.	Changes.
Anthracite	1,306,946	1,284,300	D. 22,646
Bituminous	8,780,011	9,699,892	I. 319,881
Coke	1,847,418	2, 70,164	I. 722,746
Total	11,934,375	12,954,356	I. 1,019,981

Total increase this year to date was 8.5 per cent.

Coal and coke tonnage, Chesapeake & Ohio railway, eight months from July 1 to Feb. 28, short tons:

	Coal.	Coke.	Total.
New River	4,285,613	162,380	4,447,993
Kanawha	3,424,734	19,879	3,444,613
Kentucky	236,428	.....	236,428
Connecting lines	173,171	52,137	225,308
Total	8,119,946	234,396	8,354,342
Total, 1907-08	7,508,097	251,203	7,759,300

Deliveries this year to points west of mines, 4,247,117 tons coal and 137,584 coke; points east, 1,019,974 tons coal and 96,812 coke; tidewater, 2,846,888 tons coal; anthracite to line points, 5967 tons. Total increase in shipments this year, 595,042 tons, or 7.7 per cent.

Anthracite coal shipments in March were the largest ever reported, reaching a total of 6,332,474 long tons, an increase of 1,366,316 tons over March, 1908. For the three months ended March 31 the totals were, in long tons:

	1908.	1909.	Changes.
Reading	2,734,146	3,328,316	I. 594,170
Lehigh Valley	2,400,503	2,627,560	I. 227,057
N. J. Central	1,859,7.2	1,971,000	I. 111,248
Lackawanna	2,356,281	2,330,991	D. 25,290
Del. & Hudson	1,702,599	1,635,700	D. 66,899
Pennsylvania	1,428,594	1,429,588	I. 994
Erie	1,732,719	2,032,334	I. 299,615
N. Y., Ont. & West.	673,659	736,334	I. 62,675
Total	14,888,253	16,091,823	I. 1,203,570

The total increase this year was 8.1 per cent. The Delaware & Hudson and the Delaware, Lackawanna & Western had small decreases; all the other companies made gains. The large March tonnage was due to the desire of the companies to accumulate stocks in case of a stoppage of work.

New York

Anthracite

April 14—Current trade in the hard-coal market is good, dealers being inclined to put in stocks. There was a report that the April discount would be suspended owing to the strike situation, but no action of this kind has been taken. Prepared sizes are in good supply, but steam sizes are scarce.

Prices are $4.25 for lump and $4.50 for egg, stove and chestnut f.o.b. New York harbor points. For small steam sizes prices are nominally unchanged as follows: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Advances of 10 to 25c. are asked by commission merchants.

Bituminous

The market continues irregular, business being done still in bunches, while shippers are unwilling to keep any considerable stocks at tide. Contracts continue to be closed slowly, and are not as generally coupled with immediate orders as is usually the case. The only feature this week has been some inquiry for offshore business, especially for the West Indies and South America.

The far East has been quiet, but is showing some signs of waking up. The Sound is taking small but rather regular quantities. All-rail trade is still improving. Transportation is fully up to schedule and there is no question about car supply.

New York harbor trade is irregular, customers apparently watching for bargains. Steam coals of fair grade can be had at $2.40@2.50; better kinds at around $2.60, and George's Creek at $3@3.40, all f.o.b. New York harbor points. Gas coal has sold very low, ¾-in. bringing 90@95c., run-of-mine, 70@75c. and slack 55@60c. all at mine.

The Coastwise vessel market is dull and captains are hunting for trade. Rates are very low as follows, for large vessels from Philadelphia: Boston, Salem and Portland, 60c.; Portsmouth, 65c.; Lynn, 65@70c.; Newburyport, 70c.; Providence and the Sound, 50c. per ton.

Birmingham

April 12—The coal-market conditions in Alabama continue quiet. The coke demand is a little improved and the larger iron concerns are accumulating stock for an emergency. The coal operations are as dull as they have ever been. Reductions in price have had no influence. A cargo of Alabama coal went from Pensacola, Fla., recently to Mexico, but a steady trade to that country is not anticipated. Coke prices are up a little and the output is somewhat better than it has been.

Chicago

April 12—The coal market continues quiet, with fine sizes strong, from Eastern and Western mines, and domestic in much less demand except for anthracite, sales of which at April are reported good. Recent cool weather has aided domestic sales a little, but lump is in general in lessening demand and should be shipped lightly to the Chicago market if demurrage sales are to be avoided. Under existing conditions Western coal is frequently sold for 10 or 20c. below its fair price because of overshipments. Steam coals are in steady demand, though the slow increase in consumption disappoints many dealers.

Contract making shows no great change from a year ago. Perhaps more large consumers are holding off in the hope of continued depression of prices and a satisfactory open market. The number of small- and medium-sized contracts entered into, however, is probably greater than a year ago. Contract prices are in general low.

Eastern coals are fairly firm, with the tendency of shippers to caution about overshipments continuing, especially with regard to smokeless. Hocking is still on the weak list, but is improving through

lessened shipments, the list price being cut 10 to 30c. Smokeless holds well up, lump bringing $3.20@3.45, and run-of-mine $3.05@3.15. Illinois and Indiana bring $1.65@2.25 for lump, $1.65@1.75 for run-of-mine and $1.45@1.65 for screenings.

Cleveland

April 13—Better accounts come from the head of the Lakes. Coal is being taken from the docks there at a more rapid rate than for some time past, so that there is a prospect for storage room when the Lake trade opens. A few small cargoes have been loaded here, but not much will be done till ore begins to move.

Steam coal is rather quiet. The best demand is for slack, which is not in plentiful supply. This will probably be the case till Lake coal begins to come in large quantities, which will increase the quantity of slack made.

Pittsburg

April 13—A meeting of large producers of coal in this district is being arranged for the purpose of reëstablishing firmly the prices of coal on the basis of $1.15 for mine-run at the mine. Lately a number of contracts have been taken at $1.10 and lower. Slack is quoted at 65c., but sales this week of fairly large tonnages were made at 55c. Lake shipments are increasing, but no shipments have been made to points in the Northwest. All shipments have been confined to ports on Lake Erie. It is estimated that production in the Pittsburg district this week is about 55 per cent. of normal. A number of large contracts have been taken and the tonnage this season promises to be greater by Lake than last season. The rivers were navigable for a few days but no coal was sent out. A number of empty barges and flats were brought up from southern ports and sent to the mines. All the river mines are in practically full operation.

Connellsville Coke—Conditions continue dull and prices low. Some sales of furnace coke said to be of an inferior quality are reported to have been made as low as $1.35. The market for spot furnace coke is around $1.50. Some producers are holding furnace coke for deliveries running to July 1 or Oct. 1 at $1.75, but contracts covering requirements for the rest of the first half are being made at $1.60. Foundry coke for spot shipment may be had at $1.80@1.90 and on contract from $1.90@2.10 at oven.

The *Courier* gives the production in both regions at 245,450 tons. The shipments were 9103 cars as follows: To Pittsburg district, 3406; to points west of Pittsburg, 4726; to points east of Connellsville, 971 cars.

Foreign Coal Trade

French Coal Consumption—The consumption of coal in France for the full year is officially estimated as below, in metric tons:

	1907.	1908.	Changes.
Production.....	36,753,627	37,622,556	I. 868,929
Imports.....	14,868,967	14,732,530	D. 136,437
Total.....	51,622,594	52,355,086	I. 732,492
Exports.....	1,163,286	1,092,110	D. 71,176
App. Cons.....	50,459,308	51,262,976	I. 803,668

In this estimate no allowance is made for stocks on hand, which did not vary greatly during the two years.

Transvaal Coal—Coal production in the Transvaal is officially reported at 2,883,342 tons in 1907, and 3,012,692 in 1908; an increase of 129,350 tons. This coal is practically all consumed at the gold mines and mills of the Witwatersrand.

Welsh Coal Prices—Messrs. Hull, Blyth, & Co., London and Cardiff, report current prices of coal as follows, on April 3: Best Welsh steam, $3.54; seconds, $3.42; thirds, $3.30; dry coals, $3.48; best Monmouthshire, $3.12; seconds, $3.06; best small steam, $2.46; seconds, $2.16. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, April 14—Notwithstanding the delays and cross currents in the tariff work at Washington, the iron and steel markets have been much stronger and more active than certain interests would like to have it supposed. Orders are coming forward quite liberally on several lines and many buyers seem to be realizing the advantage of the lower range of prices which has now been generally established.

In finished material the ordering of structural steel and the closing of building and fabricating contracts continue to furnish a large amount of business. A number of contracts have been concluded and others are pending, with a probability that they will be closed soon. New building projects are coming forward on rather a large scale, and the mills seem to be assured of a good amount of work for some time. Other lines are not quite as active, though much business has been done in bars and plates. Wire has rather lagged behind, owing to the general expectation that lower prices will be made by the leading interest, which has so far made very few concessions. The demand for nails and other iron work used in general building continues good.

The rail question is still unsettled and orders are generally held up, with the exception of a few small ones. It is understood that there will be sharp competition on some heavy orders for Canada and also upon some South American orders which are pending. The railroads are in the market for a good deal of bridge work and some equipment.

Pig iron is the weakest end of the market, but foundries are ordering more freely, especially in Seaboard and New England territory. Some furnaces are rather inclined to hold back in this business, being unwilling to take much at current prices, but others are meeting the market freely. Some transactions in basic pig are reported, but of moderate size.

Pig Iron Production—The reports of the blast furnaces, as collected by the *Iron Age* shows that on April 1 there were 224 coke and anthracite stacks in blast, having a total weekly capacity of 409,200 tons. This is a decrease of 9600 tons from the March report. Making allowance for charcoal furnaces, the production of pig iron in March was, approximately, 1,880,000 tons; for the three months ended March 31, it was 5,427,000 tons.

Baltimore

April 13—Exports for the week included 183,123 lb. spelter and 4,999,200 lb. steel billets to Great Britain; 2000 tons steel rails to Buenos Aires. Imports included 100 tons ferromanganese and 1000 tons manganese ore from Rotterdam; 3806 tons iron pyrites from Huelva, Spain; 5350 tons iron ore from Cuba.

Birmingham

April 12—The Southern pig-iron market shows improvement as to demand and some stiffening of price. The greater portion of the sales being made are at $11 basis, No. 2 foundry, though some of the larger companies are holding for $11.50. The production is being held up well. There is a little accumulation of iron to be noticed throughout this section. The foundries and machine shops have a little spurt on in their business and the cast-iron pipe makers are busy. The announcement is made that the American Radiator Company, of Chicago, has leased the little works of the Birmingham Pipe and Casting Company. There are rumors again of the shutting down of the steel plant at Ensley.

The announcement that Birmingham was now practically on a basis point for steel selling was a piece of cheering news. Heretofore all sales of steel by the Tennessee company have been on Pittsburg price, plus freight. There has been a demand for some time for a Birmingham basis for steel and the statement that it had been granted caused good feeling. There is plenty of room for improvement in the steel market

Chicago

April 12—The pig-iron market shows some encouragement to furnacemen in a number of inquiries for large amounts of iron to be delivered in the second half of

the year, and an increased number of sales for current use by foundrymen generally. The average consumer of iron is still buying for the needs of 30 to 90 days in the future. Local producers of iron are holding firm to $16@16.50 for Northern and find no temptations to cut prices as Southern interests have done, the demand for Northern being steady and chiefly for special uses.

Southern iron sells in general for $11 Birmingham, or $15.35 Chicago, with some contracts made at $10.50, but a tendency to hold more firmly than formerly to $11 as the bottom price. A number of large contracts are said to be hovering about the $11 mark with a prospect of their being closed at once on any decided tendency of the market to improve. Everything dependent on agricultural interests shows prospective need of a large tonnage of iron in the last half of the year.

Cleveland

April 13—The first long contract of the season has been closed and is at 65c. per ton from Duluth to a Lake Erie port. The price question for the season is still unsettled, and no ore is being sold.

Pig Iron—Sales have been in small lots only, and contract iron is being taken slowly. On new sales the price is on the basis of $15@15.25 for No. 2 foundry.

Finished Material—There is a good deal of inquiry for steel bars. A number of structural contracts are under negotiation, and a few have been closed. There is a demand for sheets in small lots.

Philadelphia

April 14—There is no perceptible change in the pig-iron situation. Several good sized orders have been placed for future delivery, Southern furnaces having secured the business. There is very little disposition to buy even at present low prices. Iron is accumulating at several furnaces. Buyers look for further shading because of outside competition. Basic has not weakened; agents of makers say no further shading is probable. About the same volume of foundry work is being turned out and the demand for forge iron is at a low ebb.

Steel Billets—No sales have been definitely closed this week.

Bars—The mill output has not increased during April. Hardware material and all material entering into it are more active in consequence of increasing building activity.

Structural Material—Large requirements are before the trade and bids will be submitted this week. Quite a number of orders for a few hundred tons each have been placed.

Scrap—No business has been done outside of the usual small sales. The large dealers are keeping a close watch on certain holders of large quantities of scrap. The dealers want to be well stocked with cheap scrap when the upward turn comes.

Pittsburg

April 13—More new business has been booked during the past week than in a similar period since the opening of the year, chiefly, however, in small tonnages. The outlook is regarded as greatly improved. There is considerable new business pending, but is held back in anticipation of more favorable prices and also until the new tariff measure is definitely settled. The greatest activity is in the Youngstown district where practically every manufacturing plant is in operation, some at capacity.

The Ohio works of the Carnegie Steel Company are running almost at capacity. In this district the Carnegie company has increased production to a certain extent at its Homestead and Duquesne plants, but the Edgar Thomson rail mills are not running more than one-third The company is operating 26 of its 59 blast furnaces and its general operations are something over 60 per cent.

An announcement of a stiff reduction in wire prices is likely to be ordered by the American Steel and Wire Company within the next few days. It has developed that one producing interest has cut the price, not openly, however, of nails 15c. a keg and plain wire about $2 a ton. In merchant pipe trade has been entirely satisfactory for a dull period. The Southern Pacific likely will close in a short time for about 200 miles of 8-in. pipe and the Busch-Everett Syndicate for 260 miles of pipe for a line from its gas wells near Shreveport, La., to New Orleans. Structural-steel trade is dull and prices are so low that large concerns refuse to accept some of the business offered. There are a number of good tonnages being held up on account of failure to reach terms on prices. The tinplate trade continues active and the leading interest is still operating 202 of its 213 active mills.

Pig Iron—There is absolutely nothing doing. The only inquiry in over a week was for 1000 tons of basic iron for the United Steel Company, of Canton, O. Valley furnaces bid $14.50, but did not get it, the order going to a Canal Dover furnace which has a 40c. freight rate, while the Valley rate is 90c. The price is said to be $15, delivered. Quotations are about as follows, but not based on actual transactions: Standard bessemer, $14.75@15; malleable bessemer, basic and No. 2 foundry, $14.25@14.50, and gray forge, $13.25, all at Valley furnaces.

Steel—No sales of billets at the market price of $23, Pittsburg; some billets have been sold on sliding-scale contracts. Sheet bars and tinplate bars are still quoted at $25.50 delivered. Merchant-steel bars are being sold on contract up to Jan. 1 at 1.20c. and on all material ordered now and taken out before July 1 a concession of 5c. per 100 lb. is made. Plates remain at 1.30c., but this has been shaded.

Sheets—The sheet trade shows some improvement and prices are being maintained. Black sheets are quoted at 2.30c. and galvanized at 3.30c. for No. 28 gage.

Ferro-Manganese—The market is quiet, but prices firm at $43.50@44, Pittsburg.

Foreign Iron Trade

The production of steel in Germany for the year 1908 is reported as follows, in metric tons:

	Acid.	Basic.	Total.
Converter ingots..	374,100	6,510,754	6,884,854
Open-hearth ingots	146,768	3,854,155	4,000,923
Direct castings .	77,443	115,440	192,883
Crucible steel .	88,183	...	88,183
Electric steel. .	19,536	...	19,536
Total	706,030	10,480,349	11,186,379
Total, 1907. .	685,161	11,378,471	12,063,632

The decrease in 1908 was 877,253 tons, or 7.8 per cent. Acid steel was 6.3 per cent. of the total in 1908, and basic 93.7; against 5.7 and 94.3 per cent., respectively, in the previous year.

German Iron Production—The German Iron and Steel Union reports pig-iron production in February at 949,667 metric tons, being 72,054 tons less than in January. For the two months ended Feb. 28 the make was, in metric tons:

	1908.	1909.	Changes	
Foundry iron	383,652	376,554	D.	7,098
Forge iron.....	116,944	114,732	D.	2,212
Steel pig.....	177,253	182,067	I.	4,814
Bessemer pig.....	76,243	72,671	D.	3,572
Thomas(basic)pig	1,301,423	1,226,364	D.	76,059
Total.....	2,055,516	1,971,388	D.	84,127

Total decrease this year, 4.1 per cent. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

Metal Market

New York, April 14—The metal markets generally are still inclined to be quiet, but show rather more strength in some directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,676,413	Exp. $5,284,401
" 1908..	1,967,697	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,674
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,862,649	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,756	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended April 10: Gold, $525,000, chiefly to Argentina; silver, $1,116,655, principally to London. Imports: Gold, $114,193; silver, $73,402, both from Central and South America.

So far this year this the United States Mint has bought only 450,000 oz. of silver, all in January. The purchases and prices were: 125,000 oz., at 51.734c.; 100,000 at 52.096c.; 125,000 at 51.882c; 100,000 at 51.920c. The average price was 52.133c. for the whole quantity.

Gold and silver movement in Great Britain, two months ended Feb. 28:

	Imports.	Exports.	Excess.
Gold.....	£ 7,976,765	£ 8,458,778	Exp. £ 482,013
Gold, 1907...	7,372,149	6,580,042	Imp. 792,107
Silver.....	2,195,465	2,130,456	Imp. 65,009
Silver, 1907.	1,507,664	2,643,964	Exp. 1,136,330

Of the silver imports this year a total of £1,886,323 is credited to the United

Gold—The price of gold on the open market in London continues unchanged at 77s. 9d. per oz. for bars and 76s. 4d. for American coin. There is no pressure to secure gold, and most of that arriving has gone to Austria and Germany. In New York an additional $1,000,000 has been shipped to Argentina on London account, but none has gone to Europe.

Platinum—Business is reported to be a little better, demand being apparently on the increase. Dealers' prices are unchanged at $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our St. Petersburg correspondent writes under date of April 1 that business is dull. At Ekaterinburg crude platinum, 83 per cent., is quoted at 5 rubles per zolotaik—$18.87 per troy ounce. At St. Petersburg prices are lower, 19,500@19,600 rubles per pood—an average of $19.13 per ounce. The financial embarrassment of Prince Demidoff may lessen the offers of platinum on the market.

Silver—The market has been steady the past week on buying by the China banks, and closes strong at 23 9/16d. in London.

SILVER AND STERLING EXCHANGE

Apr.	8	9	10	12	13	14
New York....	50 7/8	50 7/8	50 7/8	50 7/8	51 1/8	51 1/8
London.....	23 7/16	....	23 7/16	....	23 9/16	23 9/16
Sterling Ex..	4.8780	4.8770	4.8765	4.8770	4.8770	4.8770

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 1:

	1908.	1909.	Changes.
India.	£ 1,941,438	£1,094,600	D. £ 846,838
China.	501,400	926,600	I. 424,200
Straits.	78,270	82,800	I. 4,530
Total... .	£ 2,521,108	£2,103,000	D. £ 418,108

Receipts for the week, £2500 from South America and £183,000 from New York; total, £185,500. Exports, £2000 to Egypt, £11,500 to India and £268,500 to China; £282,000 in all

Copper, Tin, Lead and Zinc

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
8	12 7/8 @13	12 1/2 @12 5/8	57	29 1/2	4.10	3.95	4.67 1/2 @4.70
9	12 7/8 @13	12 1/2 @12 5/8	....	29 1/2	4.10	3.95	4.70 @4.72 1/2
10	12 7/8 @13	12 1/2 @12 5/8	....	29 1/8	4.10	3.95 @4.00	4.70 @4.72 1/2
12	12 7/8 @13	12 1/2 @12 5/8	....	29 1/2	4.15	4.00 @4.05	4.72 1/2 @4.77 1/2
13	12 7/8 @13	12 1/2 @12 5/8	57 5/8	29 1/2	4.15	4.00 @4.05	4.82 1/2 @4.85
11	12 7/8 @13	12 1/2 @12 5/8	57 5/8	29 3/8	4 15	4.05	4.82 1/2 @4 85

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—More business, both for domestic consumption and export, has been done during the past week. Manufacturers report a steady increase in their orders and it is evident that the consumption of copper is creeping up. The demand has been met freely by the selling agencies and the market closes unchanged at 12 7/8@13c. for Lake copper; 12 1/2@12 5/8 for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12 3/8@12 1/2 cents.

Copper sheets are 16 1/2c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14 1/4c. base, carload lots at mill.

Owing to the Easter holidays, there was only three days' business in the London market since our last report, during which the market was strong and advancing. It closes at £57 12s. 6d. for spot, £58 6s. 3d. for three months.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@75.

The statement of the Copper Producers' Association for March, and the figures for the three months ended March 31, are as follows, in pounds:

	March.	Three Months.
Stocks in U. S. March 1 and Jan. 1	173,284,248	122,357,266
Production for period	117,058,661	332,894,678
Total supplies	290,342,909	455,251,944
Deliveries, consumption and export	108,063,007	272,972,012
Stocks, April 1	182,279,902	182,279,902

The increase in stocks during March was 8,995,654 lb.; during the three months it was 59,922,636 lb. As exports were approximately 47,400,000 lb. in March and 129,253,000 lb. for the three months, the deliveries for consumption would be 60,663,007 lb. and 143,719,042 lb., for the two periods, respectively.

Exports of copper from New York and Philadelphia for the week, 6718 long tons. Our special correspondent gives the exports from Baltimore at 516 tons copper

Imports and exports of copper in Germany, two months ended Feb. 28, metric tons:

	1908.	1909.	Changes.
Imports	29,817	23,207	D. 6,610
Exports	1,413	1,087	D. 326
Excess, imports.....	28,404	22,120	D. 6,284

Of the imports this year 21,660 tons were from the United States.

Tin—On account of the intervening holidays the London market was rather dull, but firm. Quotations close at £133 5s. for spot, £134 7s. 6d. for three months.

The domestic market shows no new features, business still being confined among dealers and traders. Spot tin can be bought at the close at about 29 3/8c. per pound.

Supplies of tin in March are reported by A. Strauss & Co., London, at 6082 long tons; consumption, 7279 tons; visible stocks on April 1 were 19,715 tons, or 1197 tons less than on March 1.

The suit of Th. Goldschmidt against the Vulcan Detinning Company, for alleged infringement of patent on the process for removing tin from tinplate scrap has been withdrawn, having been settled out of court, on terms not made public.

Lead—There has been a good business done in this metal at somewhat higher prices and the market closes at 4.15 New York, 4.05 St. Louis.

The London market has been quiet during the week and prices have eased off. Spanish lead being quoted £13 5s., English £13 7s. 6d. per ton.

Spelter—There was a considerable business done at advancing prices. Stocks in the hands of smelters are decreasing and in view of the proposed tariff changes, they are not disposed to press sales The market has advanced to 4.82 1/2@4.85c., St Louis, 4.97 1/2@5c New York.

New York quotation for spelter, April 8, was 4.82 1/2@4.85c.; 9 and 10, 4.85@4.87 1/2c.; 12, 4.87 1/2@4.92 1/2c.; 13 and 14, 4.97 1/2@5 cents.

The London market is firm, good ordinaries being quoted at £21 10s., specials at £21 15s per ton.

Base price of sheet zinc is now 6 3/4c per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

New York Metal Exchange—The quotations committees for the coming year are as follows: Copper, B. Hochschild, L. Vogelstein, H. W. Hendricks, Paul Koning, W. P. Todd. Tin, Paul Koning, E. Baerwald, A. B. Hall, E. A. Caswell, Edwin Groves. Lead, B. Hochschild, J. H. Lang, Frederick Steiner. Spelter, L. Vogelstein, B. Hochschild, B. Elkan.

Other Metals

Antimony—Prices unchanged at 8c. per lb. for Cookson's, 7¾c. for Hallett's and 7½c. for ordinary brands. There is some discussion over the duty of 1½c. per lb. proposed in the new tariff bill, and business is rather in suspense.

Aluminum—No change. No. 1 ingots are 22@24c. base. Wire, 31@32c. base, and sheets, 33@34c. base.

Quicksilver—The market is quiet, with only a moderate business doing. New York prices are unchanged at $45@46 per flask of 75 lb. San Francisco, nominal at $44@45 for domestic orders and $42@43 for export. The reported reduction in London was not made; the price is still £8 7s. 6d. per flask, but 5s. less is quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Platteville, Wis., April 10—This week $39.50 was the highest price paid for zinc ore; the base price was $38 per ton of 60-per cent. zinc. A base of $50 was paid for 80-per cent. lead; one choice car brought $53 per ton.

SHIPMENTS, WEEK ENDED APRIL 10.

	Zinc Ore. Lb.	Lead Ore. Lb.	Sulphur Ore, Lb.
Platteville	570,290	.....	141,700
Benton	472,760	64,600	...
Linden	199,490	.....	
Hazel Green	180,400	.....	..
Cuba City	171,000	.....	
Strawbridge	165,000	87,100	. .
Livingston	160,000	....	. .
Total	1,918,940	151,700	141,700
Year to April 10	28,160,874	779,280	2,571,550

In addition to the above there was shipped to the American Zinc Ore Separating Company 303,200 lb., and to the Joplin Separator Works 437,000 lb. zinc concentrates.

Joplin, Mo., April 10—On a base price of $38 per ton of 60-per cent. zinc the highest price paid for sulphide ore was $41, the base ranging down to $36. The market was no stronger, ore selling at $36 @38 base, same as previous week. Zinc silicate sold on a base of $17@19, with the high price at $22. The average price of zinc ore, all grades, was $35.70. An enormous demand developed for lead ore, the St. Louis Smelting and Refining Company purchasing several of the large bins that have been accumulating for months. The base price was $54@54.50 per ton of 80-per cent. lead, and some ore is said to have sold as high as $56. The average price, all grades, was $54.32 per ton.

Zinc prices averaged higher on account of the small amount of silicate shipped compared to the previous week. The general shipment was a decrease of 1011 tons. In lead the shipment was increased 534 tons.

SHIPMENTS, WEEK ENDED APR. 10

	Zinc, lb.	Lead, lb.	Value.
Webb City Carterville	3,404,050	771,040	$ 83,983
Joplin	1,827,550	329,720	43,168
Miami	885,030	629,580	31,159
Duenweg	438,560	667,890	26,303
Alba-Neck	798,670	.....	16,174
Prosperity	497,950	201,060	14,688
Galena	598,420	78,990	13,821
Spurgeon	522,290	101,590	10,375
Aurora	470,550	26,890	7,867
Granby	440,500	7 500	5 900
Badger	262,030	8,270	5,146
Carthage	270,250	.....	5,134
Zincite-Sherwood	187,810	10,790	3,210
Quapaw	175,370	8,120	3,113
Sarcoxie	103,330	.....	1,910
Carl Junction	41,100	.....	799
Totals	10,893,460	2,841,440	$271,750

Fifteen weeks.....167,258,530 27,166,080 $3,689,885
Zinc value, the week, $194,573; 15 weeks, $2,990,548
Lead value, the week, 77,177; 15 weeks, 699,337

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.66	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	36.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.06	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.76	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, April 14—The chemical market is dull and prices are practically stationary.

Copper Sulphate—There is a little activity in this line, but prices hold at $4.60 per 100 lb. in carload lots and $4.85 per 100 lb. in smaller quantities.

Arsenic—Owing probably to the large stocks on hand, prices hold low at 2⅞c. per lb. for white arsenic.

Nitrate of Soda—Spot and futures are both quoted at 2.15c. The market is dead for the present.

A despatch from Santiago, Chile, says that at a meeting held in Iquique to consider the continuation of the present combination of nitrate producers, a majority voted against it. This means the breaking up of the present agreement for limiting and apportioning production, so that each producer will be free to mine and sell nitrate as it can.

Sulphur—Messrs. Emil Fog & Sons write from Catania, Sicily, under date of March 26: "Eighty of the smallest mines—those worked by the most primitive methods, the ore being carried on the shoulders of men—have been closed during the year, thus reducing the total number working to 500. Of big mines producing over 10,000 tons there are only six, which are responsible for about one-third of the total production. The remainder are by no means in a flourishing condition, and a strict enforcement of the law now in force prohibiting the employment of boys for the carrying of the ore would compel many of them to close down. It will, therefore, be seen that the much debated proposal to reduce the production could be carried out without much difficulty. Another matter which awaits attention is that of the disposal of the stocks which were taken over from the Anglo-Sicilian Sulphur Company. Apart from the expense of storing, interest, renewal and even increase of the government mortgages, one must take into consideration that the sulphur will not improve in quality by keeping it in the open for some years exposed to the rain and dust.

"The members of the Consorzio in Palermo having disagreed among themselves, the ministers in Rome dismissed the board and sent down a commissioner to take over matters.

"The erection of a large American refinery at Marseilles is nearing completion, and in the course of three or four months this new competition will have to be reckoned with. That some arrangement will be necessary with Mr. Frasch is very apparent. His representative is already in Rome discussing the matter, and we think one may take it that the formation of a sulphur trust is but a matter of time."

Mining Stocks

New York, April 14—The week on the Stock Exchange has been a short one, being broken by a two-day holiday. The Exchange adjourned from Thursday over to Monday. In London Monday was a holiday also, which was a matter of some importance in view of the recent large buying of American securities there. Notwithstanding this break, the market had been generally strong and there has been little or no interruption to the bull movement, to which reference was made last week. On the open days sales were large and prices showed a tendency to advance.

On the Curb trading was good, but not to any unusual extent. The copper stocks were moderately in demand, but with no special large selling movement. Cobalt stocks continued in demand at good prices. The excitement of the week was a break in Rawhide Consolidated, a stock which has been quiet for some time. It was

brought out again this week and was hammered down to a pretty low point on large sales.

Boston, April 13—The mining-share market has backed and filled, and the net results are general declines in the week's time. Activity has been in spots and in some cases drives have precipitated sharp declines. The two days' holiday period caused advances to carry over the week end, but outside of Amalgamated they have not held. Utah Consolidated broke $3 to $38.75 on persistent bear selling. There seems to be a strong bear clique in this specialty which manifests itself from time to time. United States Smelting common has been a weak spot and a low price was made today at $39.50, a decline of over $2.

The report of the Copper Producers' Association was at first construed favorably, but later was used as a bear argument. Amalgamated showed good action last week, but weakened after the holiday. Arizona Commercial has been a strong spot, but closes with a net loss of $1.75 at $41.50. Mass Consolidated has furnished a strong market, the price reaching $9.37½ today.

Kerr Lake Mining has been taken from the Curb and placed on the unlisted department of the Exchange. It is worthy of mention that Kerr Lake is the first Cobalt mining company to be so listed. Two new stocks have been admitted to Curb dealings, Chief Consolidated, an Arizona company, and Inspiration, a Cobalt company.

STOCK QUOTATIONS

NEW YORK Name of Comp.	Apr. 14 Clg.
Alaska Mine	50
Amalgamated	77
Anaconda	45⅛
Balaklala	‡2 1/16
British Col. Cop.	6½
Buffalo Mines	3¾
Butte Coalition	24¾
Colonial Silver	⅛
Cum. Ely Mining	7¾
Davis-Daly	5½
Dominion Cop.	⅛
Douglas Copper	2¾
El Rayo	3½
Florence	3/16
Foster Cobalt	34
Furnace Creek	12
Giroux	8
Gold Hill	⅛
Goldfield Con	8 1/16
Granby	96
Greene Gold	¼
Greene-G. & S.	7
Guanajuato	1⅞
Guggen. Exp.	176
Hanapah	15
Kerr Lake	7 13/16
McKinley Dar.	98
Miami Copper	14¾
Miemac	¾
Mines Co. of Am.	1/16
Mitchell Mining	⅛
Mont. Sho. C.	1½
Nev. Utah M. & S.	2 1/16
Newhouse M. & S.	3¼
Nipissing Mines	10⅛
Old Hundred	⅝
Silver Queen	48
Stewart	¾
Tennessee Cop'r.	42
Tri-Bullion	1/16
Union Copper	1⅛
Utah Apex	6½
Utah Copper	43½
Yukon Gold	4⅜

BOSTON Name of Comp.	Apr. 14 Clg.
Adventure	8¼
Allouez	38
Am. Zinc	‡25¼
Arcadian	4⅛
Arizona Com.	41⅜
Atlantic	11
Boston Con.	12
Calumet & Ariz.	101½
Calumet & Hecla	623
Centennial	30¼
Copper Range	78
Daly-West	10¼
East Butte	14¾
Franklin	15
Greene-Cna.	10⅝
Hancock	11¼
Isle Royal	25
Keweenaw	3⅛
La Salle	14¼
Mass.	9
Michigan	12¾
Mohawk	62
Nevada	20⅞
North Butte	70¾
Ojibway	12⅛
Old Colony	160
Old Dominion	52¼
Osceola	129
Parrot	34
Quincy	90½
Rhode Island	14⅜
Shannon	14⅛
Superior	40
Superior & Bost.	15¾
Superior & Pitts.	13⅞
Tamarack	73
Trinity	14¾
U. S. Smg. & Ref.	40
U. S. Sm. & Re., pd.	44⅛
Utah Con.	39
Victoria	4¼
Wilmna	5
Wolverine	144
Wyandotte	2¼

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38½
Am. Smelt. & Ref.	88⅝
Am. Sm. & Ref., pf.	106½
Colo. Fuel & Iron	39
Federal M. & S., pf.	82
National Lead	84¾
National Lead, pf.	107¾
Pittsburg Coal	11¼
Republic I. & S.	22⅝
Republic I. & S., pf.	74½
Sloss-Sheffield	‡76
Standard Oil	670
U. S. Steel	51¾
U. S. Steel, pf.	114⅞
Va. Car. Chem.	46⅞

BOSTON CURB	Low.
Ahmeek	160
Black Mt.	1
Chemung	18
Globe Con.	4½
Helvetia	3
North Lake	‡7⅛
Ray Central	2¾
Ray Con.	14¾
San Antonio	12¼

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS N. of Com.	Apr. 10 High.	Low.
Adame	.40	.30
Am. Nettie	.05	.04
Center Cr'k	1.75	1.50
Cent. C. & C.	82.00	80.00
C. C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.50	11.00

LONDON Name of Com.	Apr. 14 Clg.
Dolores	£1 6s 0d
Stratton's Ind.	0 2 9
Camp Bird	1 3 0
Esperanza	2 16 3
Tomboy	0 18 9
El Oro	1 5 0
Oroville	0 10 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Apr. 14.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.44
Best & Belcher	.42
Caledonia	.18
Chollar	.07
Comstock	.26
Con. Cal. & Va	.65
Crown Point	.36
Exchequer	.17
Gould & Curry	.10
Hale & Norcross	.19
Mexican	.78
Ophir	1.12
Overman	.16
Potosi	.12
Savage	.22
Sierra Nevada	.22
Union	.36
Utah	.02
Yellow Jacket	.66
TONOPAH STOCKS	
Belmont	.95
Extension	.60
Golden Anchor	...
Jim Butler	.17
MacNamara	.32
Midway	.20
Montana	.72
North Star	.03
Tono'h Mine of N.	6.93¾
West End Con.	.32
GOLDFI'D STOCKS	
Adams	.02
Atlanta	.14
Blue Bell	.04
Booth	.21
Columbia Mt.	.14
Comb. Frac.	1.18
Con. Red Top	.07
Cracker Jack	.04
Dia'dfield B. B. C.	.07
Goldfield Belmont	.05
Goldfield Daisy	.41
Great Bend	.18
Jumbo Extension	.22
Kendall	.07
Lone Star	.04
May Queen	.03
Oro	.11½
Red Hill	.15
Roanoke	...
Sandstorm	.15

Name of Comp.	Clg.
Silver Pick	.31
St. Ives	.16
Triangle	.03
BULLFROG STOCKS	
Gibraltar	.03
Homestake King	.03
Mont. Shoshone C.	1.43½
Tramp Cons.	.04½
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1.25
Nevada Smelting	1.00
Nevada Wonder	.75
Nevada-Utah	2.87½
Penn-Wyoming	.02
Pittsburgh S. Pk.	.63
Rawhide Cnol't'n.	...
Round Mt. Sphinx	.10

COLO. SPRINGS Name of Comp.	Apr. 9 Clg.
Acacia	‡.06⅛
Black Bell	....
C. C. Con.	‡.03⅛
Dante	.05⅛
Doctor	.06⅜
Elkton	.89
El Paso	.46¼
Findlay	.14½
Gold Dollar	.11
Gold Sovereign	.03
Isabella	.23¾
Jack Pot	.06½
Jennie Sample	.07⅜
Jerry Johnson	‡.06¼
Mary McKinney	‡.38
Pharmacist	.03
Portland	.88⅛
Un. Gold Mines	.05⅛
Vindicator	.73
Work	.07¼

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida	Mar. 10	Apr. 10	$0.05
Blackjack Con., Utah	Apr. 15	May 7	0.01
Caledonia, Nev.	Mar. 16	Apr. 16	0.05
Comstock & C., Ida.	Mar. 20	Apr. 20	0.001
Crown Point, Nev	Apr. 18	Apr. 28	0.10
Exchequer, Nev.	May 5	May 26	0.05
Hypothenk, Ida	Mar. 11	Apr. 12	0.005
Imlay, Nev.	Apr. 6	Apr. 28	0.03
Mexican, Nev.	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reliance, Ida.	Mar. 23	Apr. 20	0.001
Rexall S. & C. Utah	Mar. 26	Apr. 26	0.01
Savage, Nev.	Apr. 8	May 5	0.10
Sierra Nevada, Nev.	May 4	May 25	0.10
Silver Hill, Nev.	Mar. 30	Apr. 23	0.05
Spanish Ridge, Cal.	Feb. 11	Apr. 10	0.03
Union Con., Nev.	Apr. 8	Apr. 30	0.10
Utah, Nev.	May 6	May 27	0.03
Yellow Jacket, Nev.	Mar. 17	Apr. 24	0.15
Yerington Gold, Nev.	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	61.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909
January	13.726	13.893	13.901	14.280	62.386	57.658
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.698	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.677	28.727	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.615	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.878	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.069	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.728	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton

The Engineering and Mining Journal

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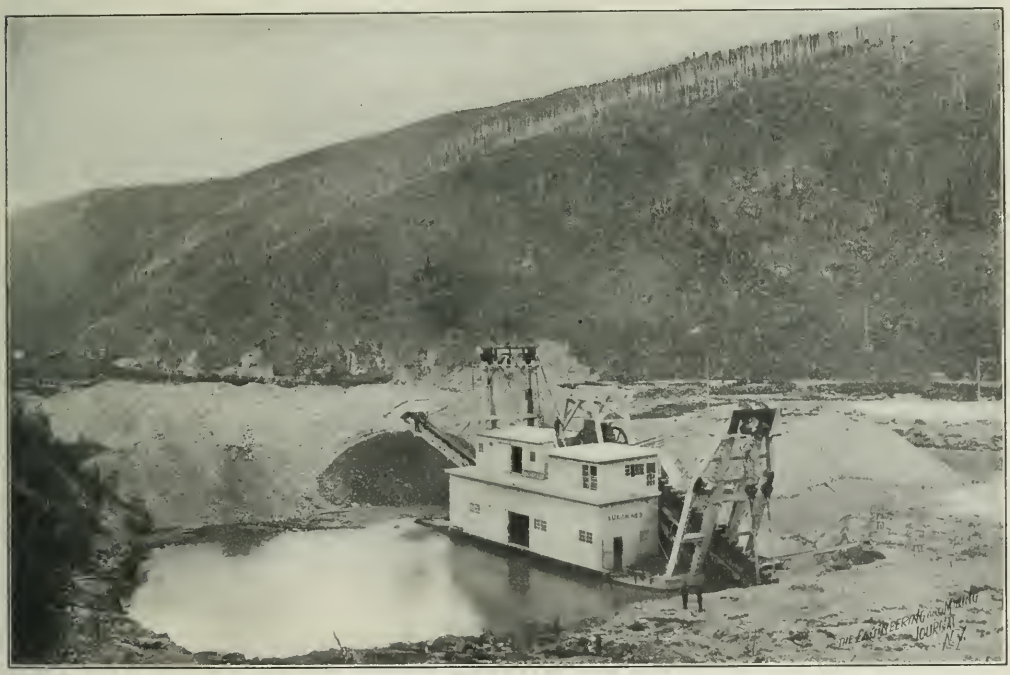
Development of Dredges for Placer Deposits

Size of Buckets Has Increased from 3 Cu.Ft. to 13 1-2 Cu.Ft. in Favorable Gravel. Buckets of 8 Cu.Ft. Capacity Most Common

BY GEORGE B. MASSEY, II *

The gold dredge has taken from placer mining much of the glamour which has surrounded it, but it has elevated it from a haphazard calling of the more adventurous spirits to an industry which demands technical and systematic attention. For the last 25 years the dredge has been undergoing a process of evolution, and it is only within about six years that it has attained the excellence which enables it at the present moment to claim the interest of the investing public.

The first gold dredges were built in New Zealand. They were small, light machines, with inadequate power and of little capacity. Their owners were content with a very small interest on their investment. In the course of time some were built in the United States and used in California. As they were found to be too light for the work attempted, development commenced. Much of this development was ill-advised, as the great number of unsuccessful dredges throughout the West will bear witness.



GOLD DREDGE AT WORK ON BONANZA CREEK, YUKON TERRITORY

Two Types of Dredges Abandoned

Two distinct types have been tried and definitely abandoned. One of these is the dipper dredge which has a crane or boom extending over the bow and carrying a long handle at the end of which is a large dipper. The boom may be revolved and the dipper can excavate all of the material immediately in front of the dredge. The bottom of the dipper is closed by a door which is opened when it is desired to dump the excavated material into the hopper of the screening and washing apparatus. The trouble experienced was that the dipper deposited large amounts at irregular intervals and so made washing difficult and irregular and also that the water and most of the gold would run out of the crack around the door. No practical means of preventing this have been found.

The other type abandoned was the hydraulic dredge. In this device the water, gravel and gold are sucked up a pipe by a centrifugal pump and discharged into the washing apparatus. But as gold is many times heavier than either gravel or water, it naturally had a tendency to remain where it was while the gravel and water were elevated. This was invariably found to be the case.

*50 Church street, New York City.

The Chain-bucket Dredge

The elevator dredge, or chain-bucket dredge as it is sometimes called, has an endless chain of buckets carried on a long, steel ladder extending from above the hopper on the dredge down into the water. As the chain is pulled upward each bucket slowly fills with gravel and water, all of which is elevated—each bucket being watertight—to the hopper where, in turning to go down again the buckets are inverted one after the other over the hopper, and deliver practically a steady stream of material to the washing apparatus.

Gold will settle very readily in the gravel when it is agitated, but the action of the buckets in filling is so quiet and steady that the gold has no chance to settle or get away. The elevator dredge is, therefore, acknowledged as the only satisfactory type for working placer ground. The size of a dredge is given by stating the capacity of each bucket in cubic feet. Seven years ago the most successful dredges had at that time buckets of 3 cu.ft. capacity. They soon gave way to the 5-ft. machine, while at present the dredges with 7½- and 8-ft. buckets are found in greatest numbers. There are two dredges near Folsom, Cal., which have 13½-ft. buckets that are working successfully in a loose gravel which digs easily.

Speaking in a general way, the larger the dredge the less the cost per yard of gravel handled, as the larger output is obtained with practically no increase in labor cost. A 5-ft. dredge is often installed on a placer property to start operations and this followed with 7½-ft. dredges.

Operating Conditions Severe

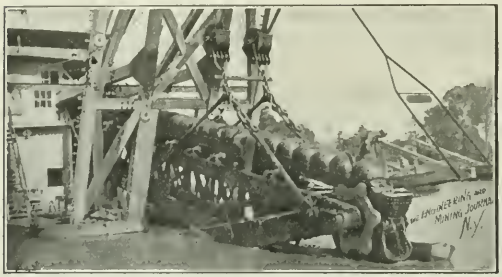
It may be safely said that no machinery is called upon to operate under more trying conditions than are present in placer dredging. The gravel, sand and water form an ideal wearing mixture which cuts in a short time anything but the very best of material. Repairs have to be made constantly to offset this action and they form a large part of the total cost of operation. The question resolves itself not into avoiding repairs, but into keeping them as low as possible in comparison with the amount of material excavated. Breakage is avoided by using only the best machinery and material obtainable.

The first cost of a dredge is small, when compared with the cost of repairs where inferior machinery is used, and it should not form an obstacle in the way of purchasing the best machinery on the market. The best dredges now built will run 21 hours per day out of the possible 24. The three hours lost time are due to repairs and the periodical "clean-up" of the gold.

Low Dredging Costs in California

The dredges in California are operating more cheaply than it is possible to do elsewhere. The reason for this is that the gravel is somewhat easier to dig and wash than the average encountered in most other districts; in addition, there are in each case several dredges under one superintendent so that the office expenses, superintendence and other fixed charges are less per dredge. Other features which tend toward cheapness are the low-priced electric power and the excellent labor obtainable. There are so many dredgemen who live in the vicinity that the wages are much less than the same men would demand in most other localities.

In almost every prospectus of gold-dredging companies in which the public is asked to join, the California costs are given as average dredging costs. This is far from being the case and is extremely misleading. In the tropics the labor cost may easily be twice that in California, and the fuel cost greatly in excess on account of procuring fuel and putting it on board the dredge. The chances are, too, that the best men cannot be obtained and the poorer labor used results in more expensive repairs to the machinery. In other localities it is impossible to work all the year round and the shorter season reduces the yardage and makes the overhead charges per yard greater. In countries like Alaska and Yukon Territory, it is necessary to thaw the frozen ground be-



LADDER, LOWER TUMBLER AND CLOSE-CONNECTED BUCKET-LINE

LOOKING BACK ALONG THE EDGE OF THE CUT

SLUICES AT STERN OF A 13 FOOT DREDGE

THE TAILINGS STACKER

fore the dredge can dig it at all. In Burma the season of rain precludes dredging for many weeks each year.

The Dredge Crew

In addition to a superintendent, who may attend to several dredges, the crew on each dredge consists of a dredge captain and an "extra man," as he is known in California, who is capable of taking the place of the captain, or of any of the other men who may be off. They work usually 10 hours. The dredging day is 24 hours, divided into three shifts of eight hours each. On each shift is a winchman who occupies the "pilot house" or winch room, where are located levers to enable him to absolutely control every movement of the dredge. There is also an oiler on each shift who looks after the lubrication and the flow of water.

If the dredge is steam-driven a fireman must be added to each shift. In addition to the above, it is necessary to have two deck hands, who work 10 hours during daylight shifting the electric-power cables, grubbing in front of the dredge, planting "dead men" to which to fasten the swinging lines, building dikes to keep the pond level at the proper hight, assisting in making repairs and, if a steam-driven dredge, procuring fuel and putting in on board the dredge.

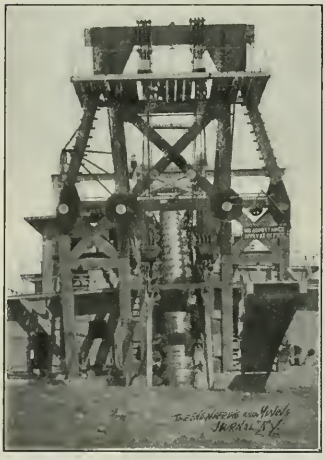
The wages of these men in California are: Captain, $125 per month; extra man, $3.25 per day; winchmen, $3 per day; oiler, $2.50; deck hands, $2.50. As a rule, this does not include board or lodging, the men "finding" themselves. Often a bonus is given for good yardage. Logs are as carefully kept as in the engine room of a battleship, with meters to show the amount of power used, and an explanation for each minute of shutdown. The ground is surveyed in front of the dredge and the area worked is put down. A recording device is also in use which records the depth of digging for every moment. In this way the exact yardage is computed.

It is the custom to shut a dredge down for a half day every two weeks to "clean up." This is done by two men who do not usually belong to the crew. The material on the gold-saving tables is washed in a small sluice and the gold recovered. It may not occur to the average reader that a man may be about the dredges for weeks without so much as seeing a "color," since for every pound of gold recovered about 6,000,000 lb. of sand and gravel have to be handled.

Treatment of the Gravel

After the dredged material is dumped from the buckets into the hopper it passes into a revolving screen, or over shaking screens with holes varying from ¼ to ⅜ in. The water for washing is sprayed under pressure on the material as it passes over the holes in the screens. The water, gold, sand and small pebbles pass through the holes and down over the large area of gold-saving tables where the gold is caught and the water and sand pass on to the stern of the dredge where they flow back into the pond. The larger pebbles and boulders which could not pass through the holes are discharged at the lower end of the screens on an endless rubber belt which is carried on the tailings-stacker frame. This conveys the large material astern and upward to a sufficient hight to allow of the disposal of all the material the dredge digs without crowding in upon the stern of the dredge.

The tailings as stacked have a natural slope of about 35 deg. from the horizontal, while the maximum angle at which gravel can be carried up the belt is about half that angle. The water used is furnished by centrifugal pumps of the proper size and speed to deliver the required quantity of water at sufficient head to thoroughly disintegrate the dredged material and carry it over the tables.



BOW OF 13-FOOT DREDGE

A large amount of experience is essential in the designing of a well balanced dredge. It involves a complete knowledge of the requirements of the case from both a theoretical and a practical standpoint, and the latter point of view can only be had from a critical examination of the dredges in operation.

Experiments with Broken Hill ore are to be made by Dr. Gustav de Laval, at London, using his cyclone process. The experimental plant to be installed there will also be used for testing ores from other parts of the world.

Since the discovery of chrome ore in Beluchistan in 1903, at least 19 small mines have been developed yielding, according to *l'Echo des Mines*, an annual output of 7000 tons.

Gold Mining in the Transvaal

Special Correspondence

At the annual meeting of the Chamber of Mines, J. J. S. Langerman, of the Robinson group, was elected president in succession to Lionel Phillips. In moving the adoption of the report for 1908, Mr. Phillips said that the year had been marked by extraordinary progress in the gold industry. Never before were the prospects so bright or so stable. He congratulated the industry on the undoubted development of the native labor supply. The output for 1908 rose over two and one-half millions, bringing the total output of gold in the Transvaal since 1884 to £227,084,385. With the exception of £11,360,000, the whole had been produced on the Witwatersrand. The number of tons crushed exceeded those in 1907 by 2,670,000. Dividends had increased by £1,659,670. The total dividends paid by the Transvaal gold mines up to 1908 had amounted to £55,041,587. The profits earned by the producing companies equaled a distribution of 8.79 per cent. on the market value of the shares on Dec. 31, 1908.

The Transvaal in 1908 contributed 34 per cent. of the world's output of gold. The profit per ton milled by all the companies exceeded that in 1907 by 2d., despite the deliberate milling of ore with 2s. 7d. less per ton, hence the working costs had fallen by 2s. 9d. per ton. Owing to a fall of 2s. 4d. per ton in the working cost of sixty-seven of the principal producing mines, these had been enabled to include in their total reserves of payable ore an additional 5,400,000 tons, an increase of 9 per cent., though there was still room for a very considerable farther reduction.

Mr. Phillips emphasized the point that the lower the working cost, the longer was the life of the industry. The development of many of the deep mines during the past year had given such encouraging results that most of the engineers were of opinion that no appreciable diminution in the average yield, down to the present depths, need be predicted. The immense life of the industry was due to the slow rate of increase in the temperature of the earth, only 1 deg. F. being registered for every 255 ft. in depth. At this rate only 92 deg. would be attained at a depth of 7000 ft. vertical, being a much greater depth than any reached in the mining world.

Dealing with the expansion for 1909, he said it was probable that the amount of ore crushed would exceed that in 1908 by 3,500,000 tons. He contemplated an increase in the crushing capacity of the machinery of over 5,000,000 tons per annum.

An Electrically Operated Suspended Railway

By Alfred Gradenwitz*

An interesting suspended railway operated by electric power was recently installed for the blast furnaces of a Belgian metallurgical works. This installation is especially remarkable for the configuration of the tracks and for the exceptional weights of the loads to be handled on an industrial railway of this type. As the track winds about the plant it is made up almost entirely of a number of curves, only a few sections being on straight lines. The shortest radius of these curves being 7 meters, the train frequently describes a complete semi circle.

On each trip about 15,000 kg. (33,100 lb.) of various iron ores are to be transported from the ore bin to the mixing hoppers. It was decided to use trains made up of a number of suspended cars, the motive power to be supplied from an electric locomotive equipped with a motor of 25 horsepower. This locomotive, a good view of which is shown in Fig. 3, is provided with a complete electrical equipment similar to that of any electric locomotive running on the ground, viz., controllers, fuses, substantial brakes, sanders, etc. Having no grounded rail the current is carried by a double-wire system, the wires being placed on either side of the rail and collected in the usual manner by sliding bows. Considerable power is required in starting on account of the numerous curves and the weight of the train, and in order to allow the starting torque of the motor to be fully utilized, the tractive weight of the locomotive is raised to about six tons by the addition of artificial ballast.

The driving wheels of the locomotive and the wheels of the car trucks run upon the lower flange of an I-beam, 500 mm. in hight (19.7 ft.). The lower level of this I-beam is 2.555 m. above the ground. The running rails are fixed on brackets attached to the ore bins or buildings. Wherever such brackets could not be fitted to the walls of the neighboring building, independent bents of structural steel have been provided. In view of the heavy loads, all switches were designed as stub shifting switches, running on idlers like traveling paltforms, and having one rail curved and the other straight to connect with the curved or straight sections of the track. These switches, which are illustrated in Fig. 2, are operated from the ground by means of chains acting on the shifting mechanism of the platform.

The cars of the suspended railway are of various designs, according to the requirements of the works, their contents varying between 600 to 1800 liters (21.2 to 63.6 cu.ft.) Those cars which have a capacity of over 1200 liters (42.3 cu.ft.) are self-discharging trucks, the ore being discharged through valves in the bottoms, which are unlocked at destination by the operator and locked automatically by means of a special device designed to strike against a jack, after which the trucks are immediately ready for another charge. Those cars designed for 1200 liters and less are tilted by hand by a releasing lever, but they are also automatically raised and fixed in position for a new charge. The suspended railway illustrated in the acompanying engravings was installed by A. Koppel, Ltd.

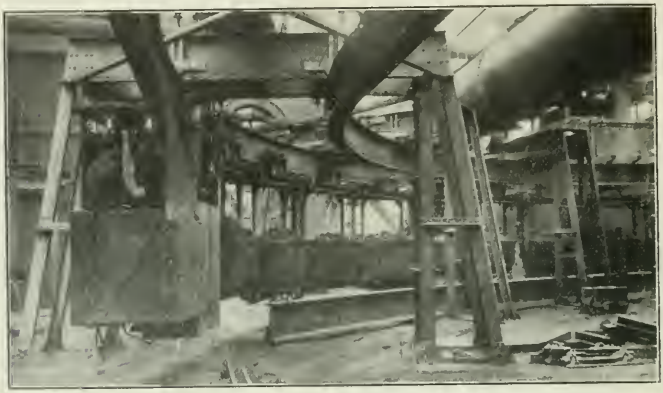


FIG. 1. AN ORE TRAIN ON THE SUSPENDED RAILWAY

FIG. 2. OVERHEAD SWITCH AT ONE OF THE CURVES

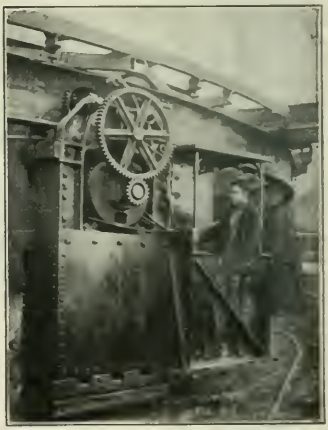


FIG. 3. SUSPENDED ELECTRIC LOCOMOTIVE

*Regensburgerstrasse 3, Berlin, W. 50., Germany

Slime Settling before Cyaniding

An efficient and novel method of slime settling has been developed by Horace G. Nichols[1]. The principle involved is that of removing the solid matter as it reaches the bottom of the tank in which it is settled. The effect is two-fold. It is found that the solid matter settles very compactly when not allowed to accumulate, and its removal prevents the thickening of the liquid above, which is one of the principal causes of the slow and imperfect settlement of slimes.

It is well known that retardation is a function of the depth measured from the top of the still turbid portion of the liquid, to the bottom of the vessel, and an increase of suspended matter causes a decrease in the rate of subsidence[2].

When distilled or hot water is employed, there is a noted acceleration in the settlement of slime. This is due, doubtless, to the reduced density of the medium. This indicates the marked effects on settlement which may be produced by very small variations in the specific gravity of the liquid.

It occurred to the author that if, in place of providing a receptacle for settled slimes, such slimes were removed as fast as settled, the specific gravity of the medium would not be allowed to increase toward the bottom of the settler, and the settling would so be accelerated.

Experiments were made in British Columbia on an ore of quartz with argillaceous material containing about 2 per cent. of sulphide of iron, zinc and lead. Particular care was taken to separate out the heavier and coarser portions from the pulp to be used. This was effected by crushing in a stamp battery furnished with a very high discharge, and passing the pulp through a hydraulic classifier.

An apparatus consisting of a pyramidal tank about 4x5 ft. connecting at the bottom through an 8-in. square aperture with a closed box was constructed. A 10-in. belt, *C* in Fig. 1, was made to travel slowly in the closed box. A tank was provided with a trap door just above its connection with the box *B*. This door was arranged so that it could be opened from above as desired and so allow of free passage between the two vessels.

In carrying out the tests a charge of pulp from the agitator vat was run into the tank *A* and the trough *B* was filled with water up to the same level. While all the pulp was still in suspension, air agitation being used, the trap was removed and the belt run in the direction of the arrows at a speed of 4 ft. per minute. The solid matter was removed from the belt by a scraper.

It was found that the finest slime was carried out of the tank and discharged by the belt. It did not tend to accumulate in the tank and under the belt. In some cases the average discharge of a finely crushed ore did not contain over 25 per cent. of moisture. When a pulp containing 40 per cent. of solid was treated the initial discharge carried only 22.5 per cent. of moisture. Such a discharge is more comparable with that of filters than with the product of settling tanks.

Method of Application

It is found that in practice this method of slime treatment may be applied in one of two ways: (1) It may be used as an intermittent process in which a charge of pulp from an agitator vat would be run directly to a separator which would be of sufficient capacity to hold the whole of such agitator charge in addition to a residual charge from a previous operation. The object of this provision being to allow of extracting on the belt only such proportion of the solid contents of a separator charge as could be effected with the economic minimum of moisture. The belt discharge from this separator would be delivered into a second similar tank, with the addition of a weaker solution or of wash water, or of both. The liquid so added may be sprayed upon the discharging belt in such a way as to loosen and disintegrate the discharged slime, or a mixer may be added for that purpose.

After the withdrawal of the required proportion of the solid contents and classification of the solution left in the tank, the latter would be withdrawn either by decantation or suction, to the original level, thus permitting of the introduction of a second charge. (2) It may be applied as a continuous process by the simple introduction of a suction and filter. The percentage of moisture carried over in the discharge varies inversely with the percentage of solids in the separator charge. The first portions of a discharge from any given separator charge are always better than the succeeding portions. It consequently follows that if the density of a separator charge is maintained at its initial density the percentage of moisture in the discharge will be kept at a minimum and the rate of discharge will be materially increased. It has been found that when provision is made for keeping a filter or screen surface free from accumulated caked slime, which may be done by providing an automatic periodic cutting-off of the suction applied to such filter or screen, and applying a small back pressure it is possible to withdraw continually clear solution from a pulp having as high a specific gravity as 1.4.

When the belt and suction are so correlated with regard to a given supply of pulp that when the one removes the solids the other takes out the proportionate amount of solution, a continuous supply of pulp can be kept running to the separator which would then always contain a charge of uniform specific gravity.

In applying this method to cyanide treatment, it may be noted that in other processes the completeness of washing is dependent upon time and capacity of the plant, inasmuch as each instalment of slime is taken separately and the washed solution passed through it as long as possible. Then it has to be removed, whether perfectly washed or not, to make room for the next succeeding instalment.

In the method described, continual progression through the plant is unimpeded, and the slime may be washed with any reasonable amount of weak solution desired, without in any way affecting the time of treatment, the only factor affected being the capacity of the extractor boxes.

The conveyer belt takes the place of the usual means of transference, such as pumps, carrying machinery, etc., which are employed for filtering slime. Gravity alone performs the separation by reason of the possibility of taking advantage of the principle of free settlement.

The separation of sands from slime is not called for. Consequently, the many disadvantages attendant upon attempts to deal with such classes of material as depend upon close classification are obviated. The best results from the treatment have been obtained from charges of high percentages of solids. It is probable that the only limit to the thickness of a charge is the point at which it will not run. This feature is of great importance as it is only necessary to run the charge from the agitator to the first separator and, consequently greater opportunities are afforded for preliminary decantation and thickening of the agitation charge.

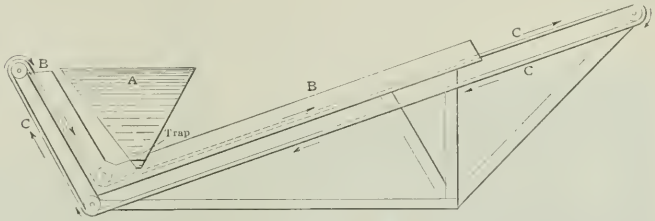


FIG. 1. MACHINE FOR SETTLING SLIMES UPON AN ENDLESS BELT

[1]Bulletin No. 41, Inst. Min. and Met., Feb., 1908.

[2]Julian & Smart, "Cyaniding Gold and Silver Ores," p. 219.

Metallurgical Treatment of Mount Morgan Ores

The Chlorination Processes Employed Were Developed to Suit the Peculiarities of the Ores. Copper Ores Are Smelted in Usual Way

BY J. BOWIE WILSON*

The Mount Morgan Company started with the usual stamp battery, but the poor recoveries soon convinced the management that this method of recovering the gold was quite unsuitable for the ores. The extreme fineness of the gold and the slimy nature of the oxidized material made it impossible to amalgamate a large proportion of the gold. After the battery had been found to be inefficient, experiments were made with Berdan pans, Wheeler pans, arrastres, Watson and Denny pans and Chilean mills, but all without success.

Experiments were then made with different chlorination processes, and it was found that if the oxidized ore was first calcined the gold could be leached out with chlorine. The calcination was necessary to dehydrate the ore and to convert it into a leachable product. Finally a barrel-chlorination process was installed and the old lower and upper works were first erected for this method of chlorination.

The ore delivered from the mine was dry crushed in Krom rolls after having first been dried in revolving dryers. The finely ground ore was then calcined in reverbatory furnaces, 11x10 ft., taking a charge of about one ton and requiring about three hours to finish. The hot ore was cooled upon a large floor and then trucked to revolving barrels holding about one ton, and water, bleaching powder and sulphuric acid added and the barrel slowly revolved for between two and three hours.

The barrels were made of hardwood and lined with lead. When the barrels had sufficiently treated the ore the charge was emptied into vats placed below and having a sand filter in the bottom, and the gold chloride was leached out with water and the gold precipitated upon charcoal bedded in filters.

About 1892 the barrels were superseded by the Hall-Richard method of chlorinating which consisted in leaching the calcined ore in open vats with a solution of chlorine in water, it having been discovered that the old idea that nascent chlorine was required to dissolve gold was erroneous, and also that an equally good extraction could be made in open vats as under pressure in the barrels. This of course led to a great reduction in the working costs as the barrels were heavy to wash and costly to keep in repair.

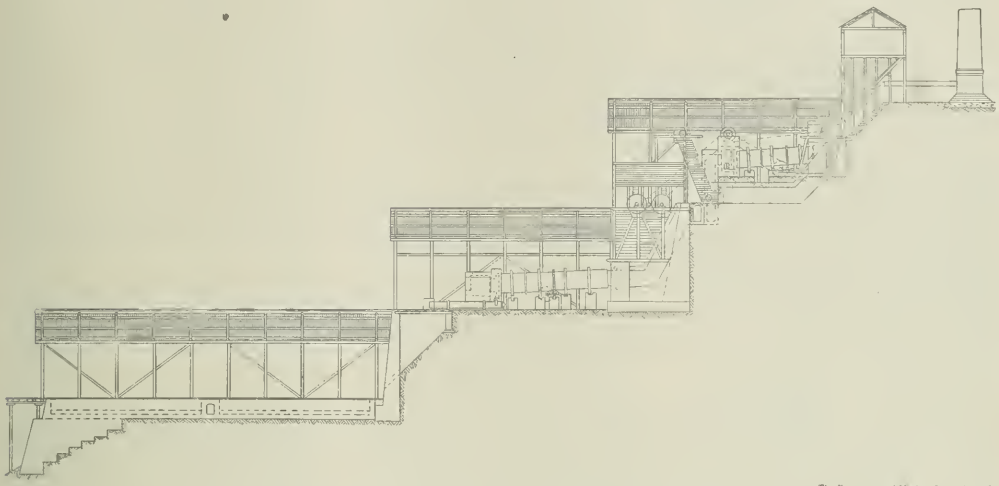
The chlorination process as used today was described in a recent issue of the JOURNAL. The description shows the improvements that have been made since the first chlorination plant was erected.

The chlorine for making the solution is generated in stills made of slabs of sandstone from manganese ore, salt, and sul-

MOUNT MORGAN COPPER WORKS—LOOKING NORTH

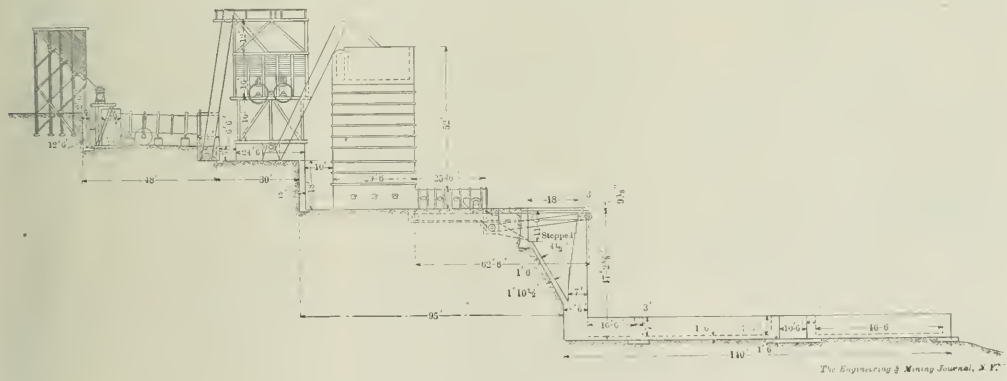
*Mining engineer, Sydney, N. S. W.

phuric acid, the mixture being heated and kept mixed by jets of steam entering at the bottom of the sides. The chlorine gas is led in earthenware pipes to the bottom of concrete scrubbing towers where the gas rises against a falling stream of water and is absorbed by it. The strength of the solution used is generally 80 grains per gallon.



The Engineering & Mining Journal, N.Y.

WEST CHLORINATION WORKS HANDLING OXIDIZED ORES AT MOUNT MORGAN



The Engineering & Mining Journal, N.Y.

MUNDIC WORKS AT MOUNT MORGAN—SECTIONAL ELEVATION

The mundic works was completed in 1900 and is constructed in two sections. The general arrangment of the plant is similar to that of the plant which treats the oxidized ore with the exception that, the ore being a sulphide, Richard's shaft furnaces replace the cylindrical calcining furnace. There are four of these furnaces in each section or eight in all. These furnaces were designed and patented by G. A. Richard, the general manager of the company, and have not been tried on any other works with the exception of that of the Boulder Main Reef Company in West Australia where one furnace was erected, and thrown out of commission after a short trial.

These furnaces have given good working costs but their first cost is great and would have been prohibitive if it had not been possible to make firebricks locally. It can readily be understood that finely ground heated ore falling in showers through a current of heated air will result in a large amount of dust being formed and the amount of ore thus carried away is large. This is a great defect in the furnace.

The copper-smelting plant was completed in 1906, but it was enlarged in 1907 and now consists of four blast furnaces of which three are kept in blast and one in readiness to blow in. The bins for the storage of ore, iron ore, limestone and flux are built in rows four deep immediately behind the feed floor and parallel to it. There are 64 bins in all and in the first two rows each bin has a sampling chute, 3 ft. x 10 in., in its center over which the ore trucks are emptied, so that a proportion of the ore falls through the bottom of the bin on the floor below and is taken as a sample.

The Queensland Government Railway has a siding to the top of these bins, so that all coke and limestone can be discharged directly into the bins. Each bin has a capacity of 4000 cu.ft. and the hight of the rails above the feed floor is 31 ft.

On the feed floor the materials for the charge are weighed separately upon weighbridges in hand charge cars. The cars are tipped upon iron plates (water cooled) at the mouth of the furnace and the mixture is shoveled in.

The furnaces are built of two tiers of mild steel water jackets the bottom jackets being 7 ft. and the top 4 ft. high. There is 8 ft. of water jacketing above the tuyere level. Each furnace has 40 tuyeres spaced 9¼ in. apart and 3¼ in. in diameter.

Open-Tank Method of Preserving Timber*

By Howard F. Weiss†

The successful impregnation of wood with preservatives without pressure was first brought before the public in 1867 by Prof. Charles A. Seely, of New York. The principles which Professor Seely then described are the ones mainly followed in the process as it is employed at present, yet, owing to the low price of lumber and the comparatively inexhaustible supply of timber, the open tank process attracted little attention until in 1904 the Forest Service began to test this process at the Louisiana Purchase Exposition. At the same time a similar series of tests were made at this exposition by the promoters of the Guissani process, which is based upon principles almost identical with those used in the Seely process. There are, I believe, two commercial plants in Italy which are successfully treating wood by the Guissani process.

Since 1904, the Forest Service has carried on a number of tests in various parts of the United States in order to develop the open-tank method. Different kinds of wood have been tested, for all sorts of purposes, in coöperation with telephone, mining, lumber and railroad companies. As a result, enough information has been obtained to place this process on a sound, practical basis.

Seasoning Wood

All wood is more or less porous, and contains various amounts of air and water. As no preservative can be forced into wood while it is thoroughly saturated with water, it is necessary to reduce the amount of moisture in it. In the open-tank method this is accomplished chiefly by air seasoning, but there are drawbacks to this method of seasoning owing to the large storage yards required, the considerable stock of timbers which is tied up, subject to fire risk and accumulating interest, and finally the demands of business often require that timber shall be treated as soon as possible after it has been felled in the woods. Besides, if timber not properly piled is held for a long period in the seasoning yard, it is liable to decay, especially if the atmosphere is warm and damp. On this account quicker methods of seasoning have been adopted especially since the rapid increase in value of lumber. There are two methods for quickly seasoning timber, seasoning by means of steam and seasoning by means of oil. The saturated steam method is practically the only one used now, for the difficulty of preventing charring of the wood, when superheated steam is used has caused the abandonment of its use. The chief objection to saturated steam is that it does not dry out the wood, but only heats it; consequently a vacuum must be subsequently applied in order to remove the moisture from the wood. In the oil-seasoning method it is different, for when green wood is steeped in oil at a temperature above the boiling point of water, the water is evaporated and driven away. As yet few plants employ oil as the heating medium, but it seems highly probable that this method will come into prominence in the near future.

Oil drying is used in the open-tank method to prepare green timber for the reception of the preservative, but owing to the greater length of time and the greater expense of drying out wood containing 80 per cent. moisture than of drying out wood containing only 20 or 30 per cent., it is recommended for the open-tank process that whenever possible at least partially seasoned wood should be used.

Absorption of Preservative

Wood consists of cells bounded by cell walls composed chiefly of cellulose. As yet all tests made to detect the presence of creosote in cell walls of timber treated with preservative have failed to find it there. If this is the case, then the preservative can only be absorbed into the cellular and inter-cellular spaces of the wood. In the open-tank process impregnation with a preservative is accomplished by heating the air and moisture in the cellular spaces of the wood and then cooling the timber while in a bath of the preservative. A partial vacuum is thus created in the cells, which causes the preservative to be sucked back into the cells. In practice all of the air and water cannot be driven out of the wood by heating, nor can a perfect vacuum be obtained by cooling. The maximum practical absorption, therefore, is always less than the theoretical, but an absorption of 38 lb. of oil per cu.ft., or an efficiency of 83 per cent. based on a theoretical absorption, has been obtained by the open-tank method with loblolly pine.

All parts of a piece of timber are not equally easy of impregnation with preservatives; for instance, sap wood can almost always be much more easily treated than hardwood. This resistance appears to be a problem entirely distinct from the density of the wood and may be due to the lignification of the cell walls, which would be greater in the older cells. It is safe to state that the sap wood of practically any species of timber can be completely impregnated by the open-tank process, but the amount of preservative injected per cubic foot can be varied without affecting the distance of penetration. In other words, a full or empty-cell treatment can be easily obtained. Tests made on loblolly mine props showed a penetration of 3½ in., while the absorption of the creosote varied in amount from 6 to 18 lb. per cu ft. The amount of absorption is controlled largely by the degree and duration of the heating and cooling periods. If held for a long time in hot oil and then submerged in cool oil until no further cooling takes place, the wood will be thoroughly saturated. If heated in hot oil and then submerged in cool oil for only a short period, the cells of the wood will be only partially filled with the preservative. This alternate heating and cooling of the wood can be carried on until complete impregnation results.

When it is desired to impregnate the timber with an aqueous solution, such as zinc chloride, it is first heated in oil and then submerged in a cold-water solution of that salt. Poles cut from Western yellow pine were treated in this manner in California, and the zinc chloride penetrated to a depth of 4 in. The absorption of dry zinc chloride varied from ½ to 2 lb. per cu.ft. The amount of the absorption was controlled by the strength of the solution and the duration of the hot and cold baths.

The open-tank process of impregnation is well adapted to treating round timbers of any kind, such as stulls and posts, or for dimension timbers such as are used for other purposes about mines, but in this treatment it must be remembered that the heart wood is very hard to treat. It happens that the woods which are at present the most abundant and cheaper are almost always the ones best suited to preservative treatment. In a great many cases these can be more advantageously used than the more expensive varieties. Tests made in Louisiana without pressure on hot longleaf-pine ties showed that the creosote had penetrated ½ in., which is a good treatment for this class of material.

Cost of Different Sizes of Open-tank Plants

There are at present two general types of open-tank plants in use. In one, the wood is moved during the bath; in the other, the preservative is moved. The former is a simpler type and the one best suited for the treatment of small pieces of timber when a cheap plant is desired and the quantity of timber to be treated is small. These plants can be built for as little as $5. Those commonly used by the Forest Service cost from $35 to $180 each and have a capacity of from 50 to 200 fence posts per day. When heavy, large timbers, such as mine props, poles, etc., are to be treated, it is cheaper to build a more expensive plant and to move the liquid rather than the wood. These plants are largely patterned after the pressure plants, but can be built at a much less cost on account of the lighter material and machinery used in their construction. A plant, including a treatment cylinder 50 ft. long and 6 ft. in diameter, will cost about $8000. Plants of this type consist

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†Chief, Section of Research, Office of Wood Preservation, United States Forest Service, Washington, D. C.

of a horizontal cylinder of ¼-in. steel, with swinging door locked by bolts. A small dome is fitted on the top of the cylinder and connected with a surface condenser, so that the vapors and oil which distil over during the hot bath can either be turned back into the treating cylinder or run to waste. The cylinder is fitted with a track for running the cars in and out, with steam coils for heating the oil, and with thermometers for recording the temperature. One or more closed measuring tanks are built either directly over or to one side of the treating cylinder, so that the preservative can flow by gravity. These tanks are fitted with a gage which shows the absorption of the preservative. A receiving tank is built in a pit so that the oil can run from the treating cylinder into it by gravity. The oil is then pumped back into the measuring or storage tank.

The open-tank process has been developed very recently and as yet many problems remain to be solved, but this is also true of the various pressure processes. In order to solve these problems the Forest Service is erecting in Washington, D. C., a laboratory which will be the most complete of its kind in the world. In it there will be retorts strong enough to permit of experimenting with preservatives when pressures as high as 500 lb. per sq.in. are used.

Precipitation of Gold and Silver by Soluble Sulphides

In answering the discussion of his article, "Some Futures of Silver Ore Treatment in Mexico," W. A. Caldecott (*Journ.* Chem., Met and Min. Soc. of South Africa, July, 1908) describes the following experiment to test the possibility of reprecipitation of gold and silver from working solutions by soluble sulphides. A mixture of oxidized and pyritic gold-silver ores from the El Oro, Pachuca, and Guanajuato districts, Mexico, was used. The analysis of the mixed ore is as follows: Silica, 77.89 per cent.; metallic iron, 0.65; ferric oxide, 3.39; alumina, 5.73; lime, 5.52; magnesia, 1.33; sulphur, 1.61; carbonic acid, 1.97; water (loss on ignition), 2.02; total, 100.11 per cent.

The ore assayed 16.3 dwt. gold per 2000-lb. ton (equal to 27.9 grams per metric ton), and 490 dwt. silver per ton of 2000 lb. (equal to 840 grams per metric ton). The metallic iron shown in the above analysis was separated as such by magnet, and was, no doubt, introduced during fine-crushing on the iron bucking board. Part of the iron reported as oxide was probably combined with sulphur as pyrites.

All experiments were made on ore dry-crushed through a screen of 200 holes per linear inch. Hence the crushed ore was practically slimes from a metallurgical standpoint. By long boiling in strong nitric acid, and then, after washing, in aqua regia, an extraction of 93 per cent. of the gold and 91.4 per cent. of the silver was obtained. Such a treatment would, of course, dissolve any base-metal compounds, as well as the gold and silver, which the preliminary fine-crushing had exposed to the action of these powerful solvents.

To test the possibility, indicated in my original paper, of reprecipitation, by soluble sulphides derived from the ore, of the gold and silver in solution, the following experiment was made: 100 grams of the above finely crushed ore was mixed with 200 c.c. of sodium-cyanide solution titrating 0.05 per cent. KCN and 1 gram lime, and the mixture shaken at intervals for six hours. The pulp was then halved into *a* and *b*. The half *a* had its solution, which contained free cyanide, at once filtered off and assayed. The half *b* was put aside in a small, closed flask, which it almost completely filled, for six weeks and shaken once weekly; at the end of this time the solution, which then contained no free cyanide, was filtered off and assayed. The results are shown in an accompanying table:

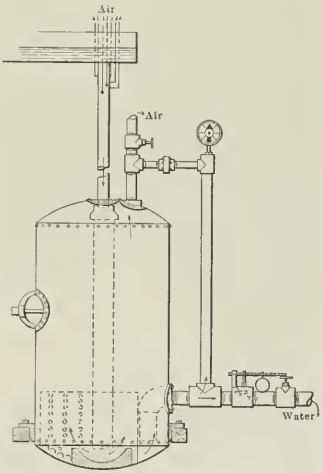
THE RESULTS OF EXPERIMENT ON REPRECIPITATION OF GOLD AND SILVER

Treatment.	Gold Dissolved.			Silver Dissolved.		
	Per Ton of Ore.		Per Cent. Extraction.	Per Ton of Ore.		Per Cent. Extraction.
	Dwt. per 2,000-lb. Ton.	Grams per Metric Ton.		Dwt. per 2,000-lb. Ton.	Grams per Metric Ton.	
a, 6-hours' treatment.	10.00	17.1	61 3	155	266	31.6
b, after 6 weeks.....	0.50	0.9	3.1	21	36	4.3

This showed that very serious reprecipitation takes place under these extreme conditions involving destruction of all free cyanide present, but a similar test with 0.25 per cent. solution showed practically no reprecipitation after 66-hours' contact, when the residual free cyanide strength was 0.21 per cent. The possibility, however, of reprecipitation under certain conditions may partly serve to explain why such short and imperfect settlement in decantation slime treatment is practiced in Mexico, if experience there has shown that prolonged and undisturbed contact between slimes and solution results at times in higher residual values through reprecipitation. Tests of a week's contact of ore submerged in cyanide solution and only shaken once daily gave poor results, so that favorable conditions rather than prolonged treatment seem to be the essential requisite. In general, there would appear to exist the opposing influences of solution, aided by the aëration due to agitation; and of precipitation of dissolved gold and silver favored by absence of oxygen and destruction of free cyanide. A similar condition has been noted in regard to gold precipitated on zinc shavings in contact with cyanide solution.[1] The practical conclusion appears to be that separation of solution from solids should be prompt after the gold and silver is dissolved.

Blakney Hydraulic Air Compressor

Blakney's hydraulic air compressor has been designed to furnish a cheap means of compressing air at mines at which a high head of water is available. It works on the principle of hydraulic compression that has been used in several large installations, but, while the others are in use where there is a moderate head and a shaft is sunk to get the necessary pressure for compression, this machine is de-



BLAKNEY AIR COMPRESSOR

signed to be connected to the pressure pipe, using part of the head to obtain the compression. The degree of compression is regulated by a weighted valve. The escaping water can be used for running an impulse wheel for driving other machinery.

According to the inventor's experiments with a head of 184 ft., the water will furnish by means of this machine 1 h.p. in compressed air at 100 lb. per sq.in. for each square inch of cross-section in the feed pipe. This device is the invention of R. I. Blakney, 4123 Fremont avenue, Seattle, Wash. As yet none of these compressors is in operation.

[1] *Proceedings* of Chem., Met. and Min. Soc., of South Africa, Vol. II, July, 1899, p. 746.

Notes on Cyanidation*

By Leo D. Bishop†

Most ores that are amenable to the cyanide process contain both free and latent acids; these destroy cyanide. Consequently, a protective alkalinity must be maintained to prevent the consumption of cyanide. Alkalies must also be used for the purpose of hastening the filtration of solutions, especially where there is any appreciable amount of slime or finely ground ore.

For the purpose of settling slime it is not necessary that an alkali or hydroxide be used. More effective settlement can be had by the use of distilled water than by the use of either acid solution or hydroxides. Sodium hydroxide produces a coagulation of the slime and a rapid and compact settlement, but leaves a poorer clarification than lime. However, when properly slacked lime is added to the slime, a flocculent effect is obtained and the slime coagulates into a flaky curd that does not settle out so compactly by gravity, but does leave a clearer and more brilliant solution than either sodium hydroxides or acids give.

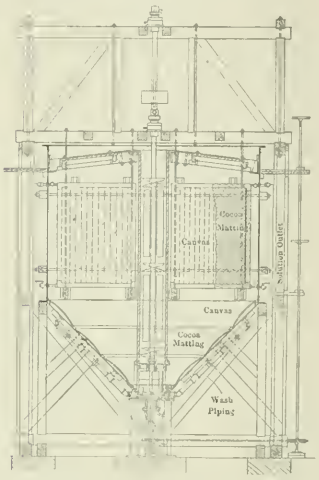
It is not necessary for the purpose of settlement that the slime be coagulated. In fact, it is oftentimes injurious to add lime for that purpose. It is necessary, however, that lime be used and the slime coagulated for the purpose of rapid and clean filtration. In fact it is almost an absolute condition precedent that every particle of slime be completely coagulated in order to get the most rapid filtration and a clear solution suitable for good precipitation.

Experiments to Determine the Effect of Temperature and Excess of Alkali Upon Settling

For the purpose of illustrating the factors governing the coagulation of slime by means of lime, I have carried out some experiments using varying degrees of heat in filtration and varying amounts of lime excess. I have also made some further experiments in the care and slacking of lime, which I shall take up later. For the purpose of these experiments, I took a sample of ore furnished by the Creston Colorado company of Minas Prietas, Sonora, Mexico, which was completely oxidized and silicious in character, containing a high percentage of original slime. This ore was ground in a tube mill until it all passed a 200-mesh screen.

The following experiments were made on pulp containing 2 of solution to 1 of ore by weight: The first sample of slime was allowed to settle one hour when 18 per cent. of partly clear solution was obtained at a temperature of 70 deg. F. Only the natural salts of the ore were in this solution, which was acid in reaction. To the second sample of slime a solution of properly slacked lime was added making 2 of solution and 1 of ore by weight, with the solution carrying 1½ lb. excess lime per ton. After thorough mixing, the sample settled and gave 10 per cent. clear solution in one hour. This is only a little more than half the amount that water gave.

In the next series of tests the purpose was to find out what effect varying degrees of heat would have on the settlement of slime. In these the same Creston Colorado slime was used with a pulp consistency of 2 of solution to 1 of ore in weight. The excess of lime in each case was ½ lb. per ton of solution.



HENDRYX AGITATOR-FILTER USED IN TESTS

In the first sample 18 per cent. of the volume had settled clear in one hour at a temperature of 70 deg. F.; in the second, 24 per cent. of the volume had settled completely in one hour with a temperature at 90 deg. F., and in the third with the temperature at 120 deg. F., 30 per cent. had cleared up in one hour.

Conclusive experiments from freezing to boiling points have not been carried out, but I would expect little, if any, settling at freezing point, and the maximum settling of the slime as the boiling point was approached.

In the next series of experiments to determine the effect of a large excess of lime on settling, the same character of ore was used with all the conditions the same as in the preceding series, except that the excess of lime was raised from ½ to 1½ lb. per ton of solution.

The first sample settled only 10 per cent. of its volume in one hour with the temperature at 70 deg. F.; the second sample settled 12 per cent. of the total volume at 90 deg. F. in one hour, and the third sample 18 per cent. of the volume at 120 deg. F. in one hour.

These experiments indicate that a large excess of lime hinders the settling of the slime, while an increase of temperature greatly aids settlement.

The next series of tests was made to see what effect heat would have on the filtration of slime, using a filter cell of the Hendryx type. This cell is composed of an open frame, with a canvas covering and a layer of cocoa matting between the two canvas sides. Vacuum was not used in these tests, gravity alone sufficing.

In the three tests, the excess lime was ½ lb. per ton of solution and the pulp was 2 of solution to 1 of ore by weight. The amount of pulp used in each test was the same, with all conditions identical except a variation in temperature. At 70 deg. F. the solution filtered at the rate of 8¼ lb. of solution per hour per square foot of canvas per hour. At 90 deg. F., or a raise of 20 deg., the rate was more than doubled, the flow of solution reaching 18 lb. per square foot of canvas per hour, and at 110 deg. F. filtration was made at the rate of 24¾ lb. per hour per square foot of canvas. In other words, with the temperature increased 40 deg., the rate of filtration was increased just three times.

Proper Alkalinity, Choice and Care of Lime

In the next part of this paper I shall deal with the selection of the proper alkalinity, the choice of lime and the necessary care in the handling and use of lime.

The question as to the most economical and satisfactory neutralizer must depend almost entirely on the ore which is being treated. Only by making comparative tests as to the percentage of extraction, the consumption of cyanide and the cost per ton of ore for neutralization can this be determined intelligently. Moreover, the effectiveness of precipitation is also too often influenced by the character and quantity of lime used.

Some ores show an appreciable advantage in extraction, by using sodium hydroxide in conjunction with lime, thereby obtaining an increased extraction and a less consumption of cyanide. A sample of ore from Black Hawk, Colo., gave an extraction of 71.0 per cent., with a loss of 4.1 lb. cyanide per ton, using both lime and sodium hydroxide as neutralizers. Where lime alone was used, the extraction was lowered to 50.7 per cent., and the consumption of cyanide increased to 6 lb. per ton of ore. In this case, the use of 1.5 lb. sodium hydroxide per ton of ore raised the extraction 12 per cent. and lowered the loss of cyanide 1.9 lb. per ton of ore.

*Abstract of paper read before Colo. Scient. Soc., Nov. 7, 1908.

†Metallurgist with Hendryx Cyanide Machinery Company, Denver, Colo.

In the choice of lime and the necessary care in its handling and use there seems to be an almost utter disregard. Rarely any thought is given to the choice of the lime. Many operators class all lime as good lime and let it go at that. In one mill that I have in mind, where a large tonnage of ore was treated it was discovered that fully 33 per cent. of the consumption of cyanide was due to the impurities and cyanicides in the burned lime itself.

The cost of treating ore by the cyanide process is increased probably more by the unintelligent handling and use of lime than by any other item. Many operators today allow their lime to become partially air slacked before using it. After standing exposed to moisture and air, it is then fed in with the ore and drowned with an excess of cold solution.

For purpose of illustration I have taken a Missouri lime, thoroughly calcined. The first sample of this lime was exposed to the air until it became partially air slacked. Then 0.25 lb. was boiled with 1 lb. of water for five minutes; after that the soluble calcium hydroxide was washed out by decantation with a large excess of cold water. The residue after drying amounted to 12.5 per cent.

Another sample of 0.25 lb. of the same partially air-slacked lime with 10 lb. of water at 65 deg. F. was allowed to stand for three days with occasional stirring. The soluble calcium hydroxide was then washed out with an excess of cold water. After drying, the residue amounted to 35 per cent. of the original amount.

The conclusion arrived at from these two tests shows that fully 35 per cent. of the weight of the lime is lost by allowing it to become partially air slacked and then attempting to slack the balance by means of a large excess of cold water.

For the purpose of comparison the next tests were made on lump lime ground to pass a ⅛-in. hole. In the first case 0.25 lb. of lime was placed in 20 lb. of water at 65 deg. F. and allowed to stand for three days with occasional stirring. The soluble hydrate was then removed with an excess of cold water and the residue dried. This residue amounted to 25 per cent. of the whole amount.

In the second case 0.25 lb. of crushed lump lime was mixed with 1 lb. of water. In four minutes the whole mass had reached the boiling point, due to chemical action, and had become almost thoroughly converted from the oxide to the hydrate. There were no lumps or grains left unslacked. The chemical action was practically complete, and a rich, thick paste was the result.

Settlement and filtration tests were then made on the limewater taken from the partially air-slacked lime, the cold-water slacked, and the hot-water slacked. The pulp in each case was 3 of solution to 1 of ore, and the temperature was 70 deg. F. The partially air-slacked lime caused the slime to settle 115 c.c. in a 500-c.c. cylinder, or 23 per cent. in one-half hour. The same solution filtered at the rate of 22 lb. of solution per square foot of canvas per hour in a Hendryx filter by means of gravity.

The cold, water-slacked lime produced a settlement of the slime of 190 c.c. in a 500-c.c. cylinder, or 38 per cent. in one-half hour and a filtration of 23.3 lb. of solution per square foot of canvas per hour in a Hendryx filter by means of gravity.

The hot, water-slacked lime caused the slime to settle 215 c.c. in a 500-c.c. cylinder, or 43 per cent. of the whole volume in one-half hour and filtered at the rate of 23.75 lb. of solution per square foot of canvas per hour. The properly treated lime caused the solids to settle almost double the amount that the air-slacked does, and also to filter somewhat faster.

From the foregoing results the question of the proper coagulation of the slime by means of calcium hydroxide is very important when we come to either the settlement or filtration of ores. Moreover, the application of heat is beyond a doubt economical and beneficial.

The Effect of Heat and Motion on the Solution of Gold

In the second part of this paper, I shall take up the effect of heat and motion on the dissolution of gold from ores. Quite a complete line of experiments was carried out by T. H. Plunkett, of Toronto, Canada, on the rate of dissolution of particles of gold ranging from 70 to 800 mg. in weight, by means of percolation, agitation, and agitation and heat. A particle of gold weighing 70 mg. was dissolved completely in 72 hours by percolation. A particle of the same size was dissolved in 16 hours by agitation and another of similar size in 10 hours by means of agitation and heat. However, such sized particles of gold would not reach the cyanide tanks in practice, but would be caught by amalgamation at the start.

It has been a common belief among cyanide men that the richer the ore, the longer the time of treatment necessary. Perhaps this is true in the usual methods of percolation, but if the pulp is thoroughly agitated, it is not necessarily true, as the following tests show:

A sample of white quartz with all the gold free that assayed $2500 gold per ton, was pulverized to 200 mesh, and the coarse gold removed by amalgamation. The tailings after amalgamation assayed $725 per ton. With an excess cyanide strength of 0.75 lb. per ton of solution and constant and thorough agitation for a period of only nine hours, the tailings were reduced to $1.60 per ton. These results are not difficult to explain when we consider the fact that all the particles of gold remaining after amalgamation were exceedingly small and not any larger than if the ore had assayed only $25 instead of $725 per ton; the cyanide solution was dissolving each and every particle of fine gold during the period of nine hours.

Another advantage of quick treatment is clearly shown in a test made on some 20-mesh tailings from the Ajax mine in New Mexico. These tailings contained a small percentage of iron sulphides. When this ore went into the leaching tanks it assayed approximately $28 gold per ton. After being percolated for six weeks only $1 per ton of ore was recovered. A sample of tailings from the top of the tanks was taken which went $18.40 per ton. Without regrinding, this sample was agitated in a Hendryx agitator for a period of eight hours. The tailings then went $9.60, representing a saving of 47.8 per cent. of the value of the tailings after six-weeks leaching. Another sample was then reground to 150 mesh and readily yielded 93.4 per cent. after an agitation lasting four hours.

The fact that the gold had not been recovered by percolation was accounted for by several different reasons, until an examination and an assay of each foot of tailings in the leaching tanks had been made. It was then discovered that the gold had re-precipitated. The assays showed an increase of value ranging from the top of the tank to the bottom.

Moreover, quick treatment by means of agitation effects a considerable saving in cyanide consumption, especially where there is a considerable amount of sulphides. A lot of ore furnished by the Star of the East Gold Mining Company, consisting chiefly of iron sulphides gave an almost complete extraction at 100 mesh in six hours by means of agitation and heat (90 deg. F.), with a loss of 1.35 lb. cyanide per ton of ore. This same ore yields a somewhat less extraction when percolated for six days, and the consumption of cyanide ranged from 0.50 to 0.75 lb. for each succeeding day after the first. The continual decomposition of the sulphides will and does produce a loss of chemicals, varying with the time of treatment.

Effect of Viscosity on Settling

In discussing Mr. Bishop's paper, Charles W. Comstock said that the increased rapidity of settling at the higher temperatures might be explained by the decrease in viscosity of the water with increase of temperature. If this is the true cause, the observed volumes of clear solution in Mr. Bishop's experiments should be nearly inversely as the coefficients of viscosity at the temperatures of the observations. The coefficients of viscosity deduced from the experiments of Poiseuille, and expressed in dynes per square centimeter, are given in the following table:

TABLE I.

Temp. in Deg. Centigrade.	Coefficient of Viscosity, N.
0	0.01723
10	0.01268
20	0.00978
32	0.00748
50	0.00532
70	0.00388

Mr. Bishop's experiments were made at temperatures of 70 deg., 90 deg. and 120 deg. F. I have used 20 deg., 32 deg. and 50 deg. C. as nearly equivalent, and have tabulated below the results of his observations together with the reciprocals of the coefficients of viscosity, giving also the relative values with the results at 20 deg. C. as unity:

TABLE II.

Temperature, Degrees Centigrade.	$\frac{1}{N}$		Percentage of Clear Solution.			
			0.50 Lb. Excess Lime.		1.50 Lb. Excess Lime	
	Actual.	Relative.	Actual.	Relative.	Actual.	Relative.
20	102.2	1.000	18	1.000	10	1.000
32	133.7	1.308	24	1.333	12	1.200
50	188.0	1.840	30	1.667	18	1.800

It will be noticed that the agreement between the reciprocals of the coefficients of viscosity and the observed speeds of settling is sufficiently close to justify the inference that the whole effect of the increase in temperature is the decrease in viscosity. There are, of course, some irregularities which call for explanation. It is known that, other conditions remaining the same, the solution of certain salts, notably potassium sulphocyanate and potassium chloride, decreases the viscosity of the solution below that of pure water, while the solution of salts of other metals (excepting only rubidium and cæsium, which do not occur in sufficient quantities to be worthy of consideration in this connection) increases the viscosity of the solution. A change in the temperature may change the relative amounts of potassium and other salts in the solution and thus produce an increase or a decrease in viscosity which must be superposed on the change due directly to temperature. This would appear to be a sufficient explanation of the irregularities in Table II.

Antimony Mines of Italy

Antimony ores are found in many parts of Italy, in addition to the better known locality at Limina, near Messina, in Sicily. There are important mines in Tuscany, where the Cettine di Cotorniano operates in a massive deposit of stibnite in Triassic dolomite; the Pietratonda and Casale di Pare mines at Campagnatico find the stibnite mixed with a chalcedonic gangue extending through Eocene limestones.

Each of these three Tuscan mines has its smeltery. The one at the Pietratonda mine consists of four furnaces for making oxide, and two reverberatory furnaces for reducing the oxide to metal. This plant went into operation in 1906 and is capable of yielding 2000 tons of antimony per year. The ore is easy to treat, since it contains nothing but stibnite and quartz.

At Casale di Pare, the silicious gangue rock is fissured, so that subterranean water has altered the stibnite into oxides and oxysulphides, with stibnite remaining intact only in the denser zones. The smeltery at this mine has three oxide furnaces, with reverberatories for reducing to metal.

According to *l'Echo des Mines* the old process of burning the ore and liquating the stibnite was not found satisfactory with these Tusean ores, which carry only about 12 per cent. of antimony, but the present method, which consists of smelting the ore with coke in a furnace with abundant air blast and settling the oxides in a series of chambers, works satisfactorily. The difficulty at Casale di Pare is the presence of the oxides, which are fusible at only high temperatures, requiring special means to insure the necessary amount of air blast.

In Sardinia there is a mine at Carcinargius, now connected with the port of Corallo by a new 5-km. road, and another mine operating its own furnaces at Suergiu.

The Premier Diamond Mine

Special Correspondence

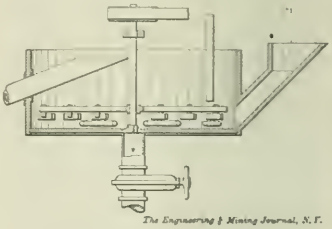
The production of the Premier Diamond mine in the Transvaal for the year ended Oct. 31, 1908, amounted to 2,078,825 carats, an increase of 188,838 carats over the previous year. The number of loads of dirt washed was 8,058,844. The yield per load was 0.258 carat. The value of the diamonds recovered was £1,536,719, equal to a value per carat of 14s. 9d., and a value per load of 3s. 9d. The cost of production per load washed was 1s. 10d.

The directors report the termination of the contract with the Diamond Syndicate, which disposes of the De Beers output, and the opening of offices in London for the sale of the Premier stones. The sales have so far been satisfactory, and the directors say that they look upon the future of the trade as reassuring and that, while the market has not as yet been restored to its former buoyancy, they anticipate a fair demand during the current year. The prices realized by the company are on an average lower than heretofore, a result not entirely due to lower markets, but partly to a slight deterioration in the quality of the finds. The company states that it will not attempt, any more than it has in the past, to increase sales by lowering prices, but to maintain a policy of working on a scale commensurate with the size and capacity of the mine. At the general meeting of the company, held in February, no secret was made of the determination of the directors to fight De Beers.

By diamond buyers the news that the monopoly has broken down will be welcomed, although those with stocks on hand cannot fail to be alarmed at the possibility of a heavy fall in the price of the stones, which the uncontrolled production may bring about.

The Sanders Flotation Process

In U. S. Patent 011,077, Feb. 2, 1909, Walter M. Sanders describes an apparatus for his flotation process. It consists of a tank, preferably of cylindrical form, with a feed hopper leading below the normal



SANDERS FLOTATION APPARATUS

liquid surface. A solution inlet pipe is placed either in the tank or in the hopper, depending on the ore to be treated. A vertical shaft in the center of the tank rotates an agitator, the blades of which are arranged to impart a whirling motion to the solution. This whirling motion is designed to assist in raising the valuable mineral particles to the center of the tank and to cause a slight cavitation at the center of the surface, which causes the particles which have been elevated to pass at once to the overflow pipe. The tailings are discharged through a pipe in the center of the tank's bottom. A steam pipe is used on the bottom of the tank to keep the solution at an even temperature.

The Electric Smelting Company will install at Ludvika, Sweden, two furnaces for smelting iron by electricity and two for making steel, of the type designed by Dr. Eugene Haanel, of the Mines Department, of Canada.

The Coal-mining Industry of Montana

A Review of Each Property with Scale of Day Wages and Schedule of Mining Rates. Each Pound of Powder Produced 2.81 Tons of Coal

BY J. P. ROWE*

The coal industry of Montana for the year just past has been important from several standpoints. During 1908 the United States Geological Survey has had several parties in the field in eastern and northern Montana working in the purely lignite beds of these sections of the State. Several new mines have been opened, including the new West Side or Sunset mine at Red Lodge; the Chicago, Milwaukee and Puget Sound property, or Republic Coal Company, at Roundup, was greatly improved and developed; the Amalgamated plant, at Belt, closed their coke ovens; the Amalgamated property at Storrs, was practically idle during the entire year. In the realm of labor an agreement was entered into between the mine owners and unions until October, 1910. Carbon county is now the leading county in the State in the production of coal, with Cascade a close second.

In discussing the coal industry in this paper the counties will be taken in alphabetical order, and also the same order for the companies operating in each county.

Carbon County

The Barrett Brothers mine, located near Joliet, with Thomas Barrett, manager, operated 108 days with three pick miners, and produced for shipment 471 tons of coal, and sold to local trade and employees 502 tons. This mine has good promise, but during the past year nothing but development work was done. The Bear Creek Coal Company, located at Bear Creek, and managed by H. S. Hopka, worked 177 days; employing 72 pick miners, 7 inside and 15 outside day-hands, 1 machineman, 34 unloaders, producing for shipment 71,099 tons of coal, and sold to local trade and employees 520 tons; also using at the mine 1814 tons. This property is fast pushing the development work, and during the past year installed a 150-kilowatt electric generator and one 8-ton motor for haulage. The company is now working two seams, Nos. 2 and 3. No. 2 seam developed the first serious fire, by spontaneous combustion, in the Bear Creek field. All of the Bear Creek mines are dry, and a fire by spontaneous combustion is feared at many of the other properties. The fire in the Bear Creek mine is still alive but is not doing much damage. The coal is being undermined by means of mining machines, of the electric-cutting bar type, and consequently much dust is produced.

The Bituminous Coal and Coke Company's operation is located at Coalville, and is managed by Willis Todd. During

INTERIOR OF LIGNITE MINE AT MILES CITY

COAL OUTCROP ON YELLOWSTONE RIVER

TIPPLE AND MINE OPENING NEAR HAVRE, MONTANA

COKE AND COKE OVENS AT ELECTRIC, MONTANA

the past year 60 pick miners, 28 inside and 24 outside day-hands were employed, working 209 days and producing for shipment 21,689 tons of coal. This property is driving a double-entry system and recently installed an electric fan which has proved unsatisfactory. The mine will soon be lighted by electric lights and other important improvements will be installed within the next 12 months.

The Bridger Coal and Improvement Company, of Bridger, is managed by George Hough, and is one of the oldest mines in Carbon county. This mine was worked 200 days during the past year, employing 40 pick miners, 20 inside and 20 outside day-men, and produced for shipment 25,425 tons of coal, and sold to local trade and employees 2293 tons, besides using 5334 tons at the mine. This plant outside was practically rebuilt, new machinery was installed and work was commenced in sinking a new slope. This mine and the Spring Creek Coal Company, at Lewistown, are the only mines in the State operated by the longwall method.

The International Coal Company, of Bear Creek, managed by H. Rosetti, operated its mine 171 days during the past year, with 78 pick miners, 9 inside and 19 outside day-men, and produced 23,400 tons of coal for shipment, and sold to local trade and wasted stock coal to the amount of 4010 tons. No. 3 seam was developed during the past year and is worked by means of an inclined plane from No. 3 bed to another landing, and from this landing the coal is run to the tipple by means of another inclined plane. This mine, in every way, is in splendid condition.

The Kilborn and Weber property, at Fromberg, managed by George Kilborn, employs 17 miners, 2 inside and 2 outside day-men, and during the year 1908 produced in all over 12,000 tons of coal. The mine is now ventilated by means of a furnace, but a fan ventilator will be installed some time during the year 1909. During the past year the slope was sunk deeper, a new boiler and new hoisting engine was installed, and bunkers large enough to handle all of their production were built.

The Montana Coal and Iron Company's plant is situated at Bear Creek, and is managed by W. W. Worthington. The company employs 16 pick miners, 5 inside and 4 outside day-men, and produced, during 1908, 21,810 tons of coal for shipment, and sold to local trade and employees 144 tons. This company installed a box-car loader, an electric fan for ventilating purposes, and made several interior changes during the past year. The mine is in good condition and the company is making preparations for a large output for the coming year.

The Northwest Improvement Company, of Red Lodge, the largest producer in the State, is now operating two properties at Red Lodge, which are managed by C. C. Anderson. The West Side, or Sunset mine, is the new property, and the main entry or slope is driven in the No. 1½ seam. As yet no great amount of coal is being mined from this mine, but development work in the shape of opening up entries, driving rock tunnels from one seam to another, etc., is being pushed. The mine, however, is being opened with a view to permanency. The slopes, airways, and manways are all being well made, and all timbering and drainage arrangements are being constructed with a view to the concentration of work. The East Side, or old mine, is now working seams Nos. 1½, 2, 4, 5 and 6. The coal mined from these beds is hauled through and out of the entryways or slopes of seams Nos. 1½, 2 and 4. From these entryways all of the coal is dumped over the one dump or tipple.

During the year just closed, there was reported a production for shipment of 550,527 tons of coal, sold to local trade and employees 11,272 tons, and used at the mines 40,534 tons, or a total output for the year of 602,333 tons. The number of men employed is as follows: 520 pick miners, 193 inside and 150 outside day-men, or a total of 863 men, over 25 per cent. of all of the men employed in the coal-mining industry of Montana. The number of days this mine was worked last year was 273.

The West Side, or Sunset mine worked 166 days, with 60 pick miners, 40 inside and 51 outside day-men, 1 machine-man, and produced for shipment 32,343 tons of coal, besides 11,900 tons which were sold to local trade and used at the mine.

Under former management the old mine at Red Lodge was mined with the sole purpose of showing a big output, regardless of the amount of coal left remaining in the territory mined; therefore, most of the large coal pillars were allowed to remain untouched. The present management is now pulling these pillars, especially in the fifth east, and it is quite dangerous work. No. 4 slope has been driven by the present management to the seventh level east and fifth level west. Entries have been driven and rooms turned off of these contribute a considerable portion of the coal produced in the east side property. The sixth level east was pushed both ways from a slope driven from about room 52, fifth east entry, and the ventilation current is returned from the sixth east through the fifth east. There is more or less gas given off in the fifth west and seventh east, and several explosions have occurred, resulting in a number of men being burned. In general, the mines of this company are in good condition, and a large output is being planned for 1909.

The Smokeless and Sootless Coal Company, of Bear Creek, is managed by James Brophy, who reports having operated the mine 240 days with 10 pick miners, 5 inside and 5 outside day-men, producing for shipment 6340 tons of coal. The mine was idle 30 days on account of a strike and 30 days on account of car shortage. The company made many improvements during 1908, such as a new tipple, put in new scales, made better roads, better dwellings for the miners, and put in a new power plant and water supply.

The Washoe Copper Company, at

TIPPLE AND NEW SPIRAL SEPARATORS, RED LODGE, MONTANA

PART OF THE BEAR CREEK COAL COMPANY'S RECENT IMPROVEMENTS

Washoe, managed by F. W. C. Whyte, of Anaconda, operated their mine 187 days during the year, employed 90 pick miners, 27 inside and 18 outside day-men, and loaded for shipment and sold to local trade and employees 72,862 tons. Improvements in the shape of track scales, fan, tipple and box-car loader were installed during the year just closed. The company has completed a rock slope through Nos. 1 and 2 seams, and a large output is expected during 1909.

Cascade County

The Amalgamated Copper Company, operating coal mines at Belt, is managed by F. W. C. Whyte, of Anaconda, and until recently made most of the coal mined into coke. This company reports working the mine 243 days during 1908, and employed 37 pick miners, 90 inside and 55 outside day-men, 34 machinemen, and 77 loaders. The amount of coal mined during the year was 186,289 short tons. Owing to the June floods this property was idle almost the entire month.

The Cottonwood Coal Company, at Stockett, is the largest single producer in Cascade county, and the second largest single producer in the State. This property is managed by James Pearson and during 1908 the mine was worked 204.5 days. The number of men employed is 98 inside, and 111 outside day hands, 106 machinemen, and 148 loaders. The output for the year was 421,013 tons for shipment, sold to local trade and employees 2463 tons and used at the mines 9690 tons.

Everything is first class in this mine and it is remarkable that with the number of men employed by this company, not one fatal or serious accident happened during the past twelve months. The system in vogue in this property is classified labor. The machinemen undermine the coal, which is done with puncher mining machines; these machinemen are followed by another set of men who drill the holes necessary for blasting down the coal—this is done by means of air drills; another set, or shooters, are employed to charge the holes and tamp and shoot down the coal; a lumberman is employed to keep secure a certain number of places; a tracklayer to keep the road laid up in his allotted number of places; and loaders are employed to separate the refuse from the coal and load it out. Practically the only improvement done at this property for the past year was the extension of the rope-haulage system on the north side of the mine.

The Louis Dahn mine is a small property at Sand Coulee. The mine was worked 100 days with 6 pick miners, 1 inside and 2 outside day hands, and produced about 4000 tons of coal. The Gerber Coal Company is located at Sand Coulee and is managed by Ed. Gerber. This property was worked 171 days during the year, employing 11 pick miners, 12 inside and 10 outside day hands, with 6 machinemen and 8 loaders. The mine yielded 26,269 tons of coal for shipment and 2863 tons were sold to local trade and used at the mine. This latter mine is in fairly good shape regarding ventilation, timbering and drainage in the working places. No special improvements were made during the past year.

NORTHERN PACIFIC PLANT AT RED LODGE, MONTANA

The Lakeside Coal Company, managed by R. W. Wilson, has just begun operations in the property formerly worked by the Sand Coulee Coal Company. The present company has drained some of the workings of water by means of a tunnel. Ten pick miners, and 1 inside and 2 outside day-hands are at present employed at the mine. Much is expected of this property during 1909. A new tipple has just been finished and many other minor improvements have been made. The Nelson-Jenks Coal Company, at Sand Coulee, is managed by John Pierce, and was operated 196 days during the past year. The company employs 50 pick miners, 50 inside and 15 outside day-hands; 15 machine-men and 50 loaders. The mine produced 111,178 tons of coal for shipment, sold 597 tons to local trade and employees, and used 1837 tons at the mine. A small mine fire was found in this mine during the past season. In general, conditions are good at this property.

The Fred Schmauch mine, or the old Lewis mine, at Belt, is managed by Frank Calone, and is one of the small producers of Cascade county. The property was worked 290 days, employing 6 pick miners, 2 inside and 1 outside day-men and produced 2485 tons of coal for shipment, also 2583 tons for local trade. The only improvements for the past year were new chutes for loading the coal. There are many minor properties in this county producing from 200 to 2000 tons of coal annually, but as most of them are merely holes in the ground, they can hardly be considered as mines.

Choteau County

The Havre Coal Company, near Havre, is managed by F. F. Bossnot. This mine was worked 250 days, employing 10 pick miners, 2 inside and 2 outside day men, and produced for shipment 3067 tons of coal and sold to local trade and employees 5113 tons. This mine is the largest producer in Choteau county, and furnishes all of the fuel for Havre, a thriving little city, and the surrounding country.

The Macton Coal Company, of Big Sandy, is managed by F. F. Thompson, and worked 154 days during 1908, producing 2422 tons of coal. Many improvements were made during the past year, such as new scales, a new tipple, making roads, building dwellings for the miners, installing a water system and power plant. This mine will, without doubt, be a large producer during 1909.

The Milk River Coal Company, of Chinook, is another fair producer of lignite in Choteau county, and during 1908, the mine was worked 150 days, with 8 pick miners, 2 inside and 2 outside day-men, producing 3740 tons of coal. There are several other small producers in Choteau county, but as most of them simply supply the neighborhood with fuel, no mention of them is made.

Fergus County

The Spring Creek Coal Company, of Lewistown, is the largest property in this county. R. W. Stone is manager and the mine was worked 270 days during 1908. The mine has increased in size to a considerable degree during the past year or so, and the company now employs 70 pick

miners, 17 inside, and 13 outside day-men, and 2 machinemen. The mine produced 38,318 tons of coal for shipment in 1908. The improvements made during the past year are as follows: New boiler and boiler-house; new wash-house and escapement shaft (this latter was sadly needed). The only opening to the surface was surrounded with buildings that would have caused trouble to the mine in case of fire.

The Spring Creek mine is the second property in the State to be worked by the longwall method, and at the present writing, this method is successful. There are many other mines now in operation in Fergus county, but none are large producers.

Gallatin County

The Northwestern Improvement Company, at Chestnut, managed by C. C. Anderson, of Red Lodge, with Mr. Forsyth as resident superintendent, worked but 75 days with full force during the past year. This mine has been one of the chief sources of coal for the Northern Pacific locomotives for the past few years. It has never been, however, a paying proposition. Besides working 75 days with 106 miners, 24 inside and 24 outside day-men, as full force; 225 days were put in with 3 miners, 4 inside and 13 outside day-men. The total production for the year was 25,653 tons. Many new improvements were made during the year, such as sinking the main slope and airway 425 ft. below the second level, and the installation of a new electric pump.

Park County

The Anderson and Evans property, located at Chimney Rock, is managed by John Anderson, and is one of the best mines in the Trail Creek field. The mine was worked, during the past year, 242 days with 33 pick miners, 4 inside and 8 outside day-men, producing in all 21,639 tons of coal. The Maxey mine is located at Chimney Rock and is managed by Wm. Maxey. The mine was worked 211 days with 27 pick miners, 3 inside and 22 outside day-men. The output for the year was 15,250 tons.

The following improvements were made at the Maxey mine during 1908: The opening of a new pair of entries on the surface to split a block of coal between the old mine and the one on the incline. The tipple remodeled and new revolving screens installed. A new system of water works was completed and several good houses for miners and their families were built.

The Montana Coal Company, of Electric, is now the only mine in the State that has its coal coked. The property is situated at the extreme southern part of the State, near the Yellowstone Park, and the coal beds have been greatly metamorphosed. Edward A. Bartl is manager and Wm. Dickinson is chief chemist. During the past year this mine was worked 300 days with 85 pick miners, 114 inside and 109 outside day-men. The production was 65,015 tons of coal which made 29,482 tons of coke. There were built, during 1908, three lines of aerial trams to convey the coal from the mines to the ovens; No. 1 line being 4500 ft. long; No. 2 line, 8000 ft. long, and No. 3 line, 7500 ft. long. Other improvements were made, such as a complete renewal of the power plant; telephone and signal lines were rebuilt; also 5 miles of coal flume were constructed; five boilers set, and one steam and one electric hoist installed. This mine, at Electric, is in good condition and has been working more days than any other mine in the State. The coke ovens are located three or four miles from the mines. All of the coal is fine when mined and is washed before going to the coke ovens.

PORTAL OF TUNNEL, NELSON BROTHERS MINE AT SAN COULEE, MONTANA

The Trail Creek Coal and Land Company is located at Chimney Rock and is managed by Hirst Beever. The mine was worked 198 days during the past year with 20 pick miners, eight inside and seven outside day-men, producing in all 5728 tons of coal. No improvments of any importance were made in 1908.

Yellowstone County

The Republic Coal Company, at Roundup, is managed by W. W. Taylor, and is on the main line of the Chicago, Milwaukee and St. Paul railroad. The mine was operated 290 days last year with 36 pick miners, 14 inside and 17 outside day-men. The total output was 30,348 tons. The improvements were a new tipple, new hoist, new boilers, new hoisting engine, new blacksmith and carpenter shop, and side tracks. At present the company is sinking two shafts, one to be used as a hoist and the other as an airway. The mine has considerable water with which to contend, but so far this has been easily handled. A new fan for ventilating purposes is now being installed and everything is being put in shape for a splendid output for 1909.

Coal Production and Powder Used

An interesting feature of the Montana coal production to many coal miners and coal-mine operators is the following collected statistics regarding the use of explosives and the amount used per ton in the various coal mines of the State. This data is for the year 1907, but it varies but little for 1908 and other previous years:

Kilborn and Weber, reported production, 10,162 tons; powder used, 25,000 lb., equal to 0.65 ton with 1 lb. of powder. Red Lodge reported 466,860 tons of lump and nut, 245,825 lb. of powder, which would be equal to 1.9 tons with 1 lb. of powder. International Coal Company reports 10,025 tons production, and 1200 lb. of powder used, which is equal to 8.4 tons with 1 lb. of powder.

The Bridger Coal and Improvement Company's production was 54,441 tons, while 15,000 lb. of powder were used; this is equal to 3.6 tons with 1 lb. of powder. Smokeless and Sootless Coal Company reports 5.8 tons of lump to 1 lb. of powder.

Stockett produced 2.6 tons of coal with 1 lb. powder. Nelson-Jenks Coal Company produced 2 tons coal with 1 lb. of powder. Stainsby-Latham Coal Company shows 2 tons coal with 1 lb. of powder. Ed. Gerber's reports show 3 tons gotten down with 1 lb. of powder. Matthew Richardson, 2 tons with 1 lb. of powder. Anaconda Copper Mining Company, 3 tons of coal with 1 lb. of powder. Frederick Schmauch & Co., 1.5 tons of coal gotten down with 1 lb. of powder. Millard mine, 4 tons with 1 lb. of powder. I will forego publishing a complete list of all the mines in the State, however, my general average for the entire State, not counting the mines that produce coal without the use of powder, is 2.81 tons of coal produced for every 1 lb. of powder used.

Quality and Cost of Powder Used

The powder used in the coal mines of Montana is generally black blasting powder, running in the grades of F, FF, FFF, etc., and is furnished where the coal is mined with machines by the company. However, pick miners in all parts of the State furnish their own powder.

Black powder costs on an average of $2.40 per keg; giant powder, 20c. per lb. "Three X" caps cost 75c. per 100; "Four X" caps, 80c. per 100; "Five X" caps, $1 per 100. The fuse that is used in many places to fire the blast is 75c. per 100 ft. Most of the blasts are fired by means of fuse. Some miners, however, use needle and squibs.

Scale of Day Wages

The following wage scale has been adopted for the employees of coal mines in Montana by an agreement between the Montana Coal Operators' Association and the United Mine Workers of America, District No. 22, for the year commencing Oct. 1, 1908, and ending Sept. 30, 1909:

"It is definitely understood that this agreement is based on an 8-hour day; an 8-hour day means 8 hours' work at the usual working place, exclusive of ½ hour for mid-shift lunch, 6 days per week, when required by the operators, Sundays and legal holidays excepted.

"However, this does not prohibit engineers, rope-riders and motormen from working the time necessary to hoist and lower men, and in no case shall they work more than 10 hours, but all such hours worked over 8 shall be paid for at the rate of an 8-hour basis."

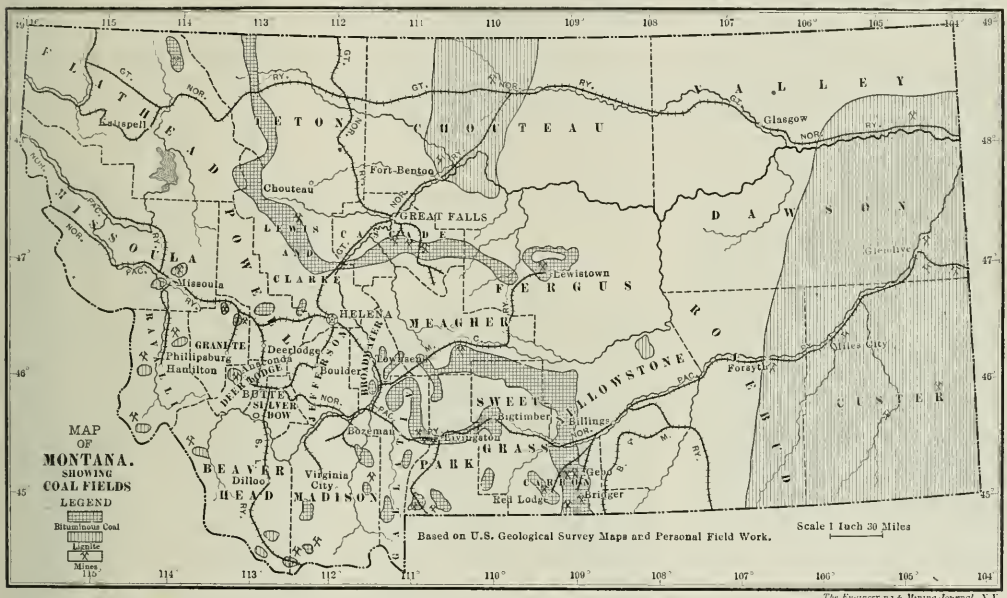
SCALE OF DAY WAGES, OUTSIDE.

	Per Day.
Engineers, 1st class	$4 00
Engineers, 2d class	3.50
Water tender	3.35
Fan fireman	3.35
Blacksmiths	3.75
Blacksmiths helpers	2.75
Carpenters	3.75
Car repairers	3.50
Car repairer's helpers	2.75
Machinists, 1st class	4.00
Machinists, 2d class	3.50
Coal inspector	3 00
Drill boys, minimum	1.75
Firemen	3 15
Head brakeman	3.15
Other brakemen	2.75
Rope-cutters, when so specially engaged	3.15
Drivers	3.00
Head dumpers	3.00
Teamsters	3.00
Head brakerman	3.75
Other brakermen	2.75
Boys on picking tables, minimum	1.50
Boys on breaker, minimum	1.50
Jigmen	3.25
Other washermen	2.75
Greasers	2.30
Oiler and wiper	3.00
Cokemen	2.75
Timber-framer	3.00
Box-car shoveler	3.00
Larry car operator	2.85
Motormen	3.50
Outside labor, not classified	2.75

	Per Month
Barnman, in charge of more than 15 head stock	95.00
Barnman, in charge of less than 15 head stock	80 00
Assistant barnmen	70.00

SCALE OF DAY WAGES, INSIDE.

	Per Day.
Miners	$3 75
Timbermen	3 75
Timbermen's helpers	3 25
Tracklayers	3 75
Tracklayers' helpers	3 25
Bratticemen	3 75
Shooters or shot-firers	3 75
Machine-runners	3 90
Machine-runners' helpers	3 40
Drillers	3.75
Drillers' helpers	3 25
Machine repairers	4 00
Pipe foremen	3 75
Pipemen	3 25
McGinty repairer, rope splicer	3 75
Drivers	3.60
Motormen	3 50
Inside engineer	3.25
Parting men and connection men	3.25
Rope-riders	3.40
Rope-riders, main rope	3 75
Greasers	2 25
Fan turner—boy	2 25
Boy couplers on partings	2 25
Pulley repairers	3 75
Trappers	1 60
Pick carriers	2.25
Bucker boys	2.35
Barnmen	3.50
Pumpmen	3 75
Inside labor, not classified	3.25



Scale of Mining Rates and Local Provisions

Red Lodge

Mining Rates

Veins Nos. 4 and 5—per ton of 2000 lb. mine-run, 62c. Vein No. 2—per ton of 2000 lb. mine-run, 66c. Veins Nos. 1, 1½ and 6—per ton of 2000 lb. mine-run, 74c. Crosscuts in entries and rooms, $1.60 per yd. Entries driven by hand, $3.25 per yd. Room turning, $10 per room.

Local Provisions

Lump coal delivered to miners, $2.25 per ton. Mine-run coal, delivered to min-

ers, $2 per ton. Washed coal Nos. 1 or 2 delivered to miners, $1.75 per ton. In all pillar work where track is moved or replaced, it shall be classed as shift work. There shall be a board at foot of all entries for the convenience of miners to note material needed at working places. When veins Nos. 5 and 6 are worked together and the intervening rock becomes 6 in. or more in thickness, the local officers and the company officials will fix a rate of compensation, or rock shall be lifted at the day rate.

STOCKETT

Mining Rates

Sec. 1. Machinemen, 2c. per sq.ft.; machine-helpers, 1.75c. per sq.ft., for all places over 12 ft. wide. Machinemen, 3.1c. per sq.ft., and machine-helpers, 2.5c. per sq.ft. for all places 12 ft. wide and under. In deficient places machine-runner and helper to be made up to average day rate for such class of work. The mine committee and pit boss to decide what is a deficient place.

Sec. 2. Drillers working as partners, price per coal hole, 12½c. each; price for sump hole, 32½c. each; price for lifting bottom holes, 32½c. each. Drillers who are working with helpers, 14c. per coal hole, and helpers 11c. per hole. The same conditions to apply to drillers and drill-helpers in making up deficient places as for machinemen and helpers.

Sec. 3. Loading coal, dry work, 24c., and wet work, 25c. per ton of 2000 lb. run-of-mine. No loader shall load coal in rooms, pillars or entries farther than 10 ft., and loaders shall keep all rock 9 ft. from the face; where more than the average quantity of rock exists, the company shall furnish men to clean such places.

Local Provisions

Ground rent, per year, $8. Coal at cleaner, per ton, $2.

SAND COULEE

Mining Rates

Sec. 1. Machinemen, 2c. per sq.ft.; machine-helpers, 1.75c. per sq.ft. for all places over 12 ft. wide. Machinemen, 3.1c. per sq.ft. and machine-helpers, 2.5c. per sq.ft. for all places 12 ft. wide and under. In deficient places, machine-runners and helpers are to be made up to average the day rate for such classes of work. The mine committee and pit boss to decide what is a deficient place.

Sec. 2. Drillers working as partners, price for coal hole, 12½c. each; price for sump hole, 32½c. each; price for lifting bottom holes, 32½c. each; price for lifting bottom holes, 32½c. each; drillers who are working with helpers, 14c. per coal hole, and helper, 11c. per hole. The same conditions apply to drillers and drill-helpers in making up deficient places as for machinemen and machine-helpers.

Sec. 3. Loading coal, dry work, 24c., and wet work, 25c. per ton of 2000 lb. run-of-mine. No loader shall load coal in rooms, pillars, or entries farther than 10 ft., and loaders shall keep all rock 9 ft. from the face; where more than the average quantity of rock exists, the company shall furnish men to clean such places.

Sec. 4. Pick mining, 75c. per ton of 2000 lb. run-of-mine.

Sec. 5. Yardage in entries, $3 per yd.; crosscuts in entries, $3 per yd.; crosscuts between rooms, 12 ft. wide, $1.50 per yd.; room turning, $8.

All places driven over 12 ft. wide and under 18 ft. to be paid at rate of 1.50 per yard.

Local Provisions

Screened coal, per ton delivered, $2.50. Ground rent, per year, $8.

At other mines the scale of mining rates varies according to the local conditions that exist. The foregoing rates, however, are fairly typical of the schedules that exist in all of the other important districts of the State.

Determination of Tin and Antimony

BY EDGAR B. VAN OSDEL*

The following scheme has proved satisfactory in the analysis of alloys such as type metal or of solutions containing only tin and antimony. Arsenic, if present, would naturally be found with tin and antimony when their sulphides are dissolved in ammonium polysulphide. But it can easily be removed by precipitation as ammonium magnesium arsenate.

The solution must be free from all oxidizing agents such as nitric acid, potassium chlorate, etc., and should contain a reasonable excess of hydrochloric acid. If oxidizing agents are present they can be decomposed and removed by boiling with excess of hydrochloric acid. From 15 to 20 grams of iron wire are added and the solution boiled for a sufficient length of time to precipitate all the antimony. If the solution becomes too much concentrated, more water and hydrochloric acid must be added.

When the antimony is all precipitated, the tin will be entirely reduced to stannous chloride. Filter quickly, washing with cold distilled water; the filtrate is now ready for titration with standard iodine. Place the funnel and filter containing the antimony in an Erlenmeyer flask, sprinkle about a gram of potassium chlorate on the precipitated antimony and pour on slowly, enough hydrochloric acid to take it into solution.

Wash with hot water if convenient and add a generous excess of hydrochloric acid. Boil hard until all chlorates are decomposed and no odor of chlorine remains. Add enough cold water to insure that the acid present is less than one-third and allow the whole to become cold. Then add from three to five grams of potassium iodide and titrate immediately; with sodic thiosulphate. Antimonic chloride is reduced to antimonious chloride and iodine liberated and can be titrated with starch indicator.

The main idea of this scheme is from Sutton's Volumetric Analysis and as here developed has given excellent satisfaction. The standard can be obtained from metallic antimony direct or from the copper standard; 126 copper or 120 antimony liberate 254 iodine, hence the copper standard is to the antimony standard as 63 is to 60.

*Professor of chemistry, McMinville College, McMinville, Ore.

New Diamond Mines in South Africa

SPECIAL CORRESPONDENCE

Apart from the New Jagersfontein Company, which produces diamonds of a finer average quality than any in South Africa, and which is closely allied to the DeBeers Consolidated, the two most important diamond mines in the Orange River colony are the Voorspoed and the Roberts Victor—both comparatively new discoveries. The latter mine, in spite of the purity of its stones, has proved a great disappointment, but the former is undoubtedly developing into a concern which, owing to its large "pipe" area, will hold a position of significance in the diamond world. It is noteworthy that both these mines, like the Premier in the Transvaal, are being equipped with direct-treatment plants in place of the floors for natural weathering of the "blue ground" employed at Kimberly. At the Voorspoed, Gates crushers are followed by grinding pans—a novel feature—and then ordinary rotary washers, from which the tailings are reground and rewashed. The capacity of the machinery is 8000 loads, of 16 cu.ft. each, in 24 hours. It is difficult to compare the relative merits of the direct crushing and the flooring processes without dealing carefully with the physical characteristics of the ground treated, but a benefit appealing with particular force to the controllers of new diamond mines lies in the greater facilities provided by a crushing plant for demonstrating the producing capacity of the mine to nervous and expectant shareholders, with the least possible delay.

Concrete mortar blocks are generally allowed to set at least three months, but at Redjang Lebong mine the reinforced-concrete mortar blocks could only be allowed 30 days for setting. These have been used for some time without showing any weakness in the concrete.

Water Losses at Broken Hill*

By T. H. Palmer[1]

While there is the constant fear of water famines hanging over the Broken Hill mines, and in view of the engineering difficulties, great cost, and length of time required to establish a supplementary supply, it is interesting to inquire whether the mines can do anything toward reduction in consumption, and whether such reduction in consumption will represent a profitable investment for capital so expended.

In starting, it is well to remember that our early concentrating methods were copied from processes found suitable for countries having an abundant water supply, where it would be folly to spend capital on water-saving appliances, and where, in some instances, it is unnecessary even to return the mill water for further work. Our limited conditions of water supply make such methods wasteful in the extreme. Radical changes, however, cannot be made suddenly, but only by degrees. This is why we still find on most of the mines numerous instances of water losses that have not yet been completely obviated. Nevertheless, so much has already been done to improve matters, that to go further demands close investigation. The purpose of this paper is to make an inquiry into the subject, and to attempt to arouse keen consideration and healthy discussion among those interested.

The number of ways in which water losses can creep into mine work is almost incredible. Water is used in such a large number of operations, and for such diverse purposes, that, unless the greatest care is exercised in design and supervision, waste is almost sure to occur. Although in a short paper like this I cannot hope to do more than treat the subject in a rudimentary manner, I hope that, by pointing out the chief causes of loss, the means of correction will readily suggest themselves.

I will consider the losses under three headings: boiler water, or all water used for steaming purposes; mill water; casual water, or all water used that does not come under the other two headings.

Boiler Water

Losses of boiler water can be subdivided under three heads: (a) In its conversion to steam; (b) in its distribution of steam to engines; (c) after it is exhausted from engines. All losses occurring under (a) or (b) increase the coal consumption.

In its conversion to steam there are losses due to leakages and blowing off. In a well attended boiler plant, however, leakages are likely to be trivial, but the quantity blown off depends almost entirely upon the quality of the feed water. At Broken Hill this loss is considerable. About half of this blow-off water can readily be saved and used in the concentrating mill, but probably considerable of the original feed water escapes in the vapor form, and it would not pay to recover this. Those mines which condense a considerable portion of the exhaust steam and return it to the boilers have a proportionately smaller amount of blow-off loss.

In the distribution of steam to engines, leakages and condensation are likely to occur in the pipes. Especially with high-pressure steam, leakages are very difficult to keep entirely under control. Occasionally, however, through irregular work, or, perhaps, negligence, the safety valve will blow off. The greatest loss usually arises from condensation in the pipes, which is considerable with long lines, or where effective superheating is not in vogue. If steam traps are used it is seldom one notices any attempt to collect the water for further use.

After it is exhausted from engines is where the most serious of all the boiler water losses occur.

Two rival condensing methods are in use: one surface condensing, the other atmospheric condensing. The surface-condensing method attempts a saving of fuel as well as of water, but fails as a water saver, since water losses in the cooling tower are greater than the quantity condensed. Moreover, the variations in climatic conditions, coupled with the high cost of water, make it necessary to have a much larger plant in Broken Hill than at more favored places. A surface-condensing plant, if designed to suit winter conditions, would prove highly profitable during the cold weather, but would be quite inadequate for the summer months. If designed large enough for the hottest day, the capital cost is too great to permit of adequate interest being made out of the saving of fuel—at least from the point of view that a mining company reckons. Additional objections are: The constant expert attention necessary; the risk of failure; its unsuitability for winding engines, pumps, compressors, and other intermittent steam units.

Atmospheric condensing aims only at a saving of water from the exhaust steam of engines that is pure and suitable for the boilers. The plant consists of a series of tanks built of galvanized corrugated iron, through which the steam passes, and finds a large area of cooling surface to condense on. The plant is cheap to install, costs nothing to operate, needs no attention, and the cost of upkeep is small. The exhausts of all steam engines can be turned into it. It is a method that has many advocates at times of water famine, and under ordinary conditions is far more profitable than its rival, surface condensing.

Mill Water

The losses of mill water may be subdivided into four classes: irregularities due to neglect; leakages; evaporation; and in the products.

Irregularities occur more frequently than one would imagine, and loss due to neglect is large enough to deserve mention. There are innumerable ways in which this can happen, of which stoppages of return pumps, elevators, and other machinery are usually the most serious. Sometimes the storage tanks are allowed to overflow. In order to reduce such losses catchment tanks of large capacity are required, and should be connected with the suction of the mill return pumps.

Leakages, where seen, are usually corrected, and do not form a serious proportion of the mill losses. It is the unseen leakages that are liable to be important factors. It is likely that the old concrete floors are cracked in a number of places, which let the water through, and these are not suspected, being covered over by dirt and slime. It is impossible to estimate losses from this cause.

Evaporation must play quite an important part in mill losses. There are a very large number of wetted surfaces. Exposed timber, floors, launders, and all woodwork are porous, and suitable for rapid evaporation, and, with tables and vanners, present numerous surfaces. The low temperature of concentrating mills in hot weather is indicative to some extent. I have often tried to gage this loss, but my computations are very rough. Nevertheless, I believe that, on a very hot day, fully 15 gal. of water are evaporated for every ton of ore treated. The only way to reduce this loss would be to limit the circulation of air, and that would affect the lighting. Moreover, the loss is only large in the summer months.

The water entangled with the products represents a continuous loss that can be estimated and is found to be large. Concentrates and coarse tailings in trucks are usually allowed to stand on the mill floors for some time to drain before being disposed of. These products usually go out with from 8 to 12 per cent. of admixed water, equal to, say, 18 to 24 imperial gal. of water per ton of ore treated. To reduce this loss, and to save handling expenses, some of the mines have erected draining vats and conveyers, by which about half of the above-mentioned loss is saved. In the slimes and vanner tailings the loss varies greatly at the different mines, but is always very high. In most cases the slime is allowed to flow to its destination, where the water is clarified in pits and returned for further use. Losses of water occur by soakage, evaporation, and by breaks in the dams, and are very great. This method is very costly in loss of water, pumping costs, upkeep of

*Abstract of a paper read before the Scientific Society of Broken Hill.

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pits, and area occupied by the pits. I am inclined to think that thorough unwatering with mechanical disposal will be found more economical, provided a dumping site can be found within reasonable distance of the mill.

Casual Water

By casual water I mean water used for all purpose other than for boilers and in ore treatment; it includes that used in the change house, offices, surface standpipes, fire service, etc., and for water jets underground. Men are very wasteful in the change house, and often use many times more water than they require from a prevailing spirit of extravagance. If this water can afterward be used profitably in the mill, such extravagance does not matter much, but otherwise it is an item in the costs, and can be kept within control by reducing the pressure in the mains. Standpipes about the surface are apt to be a source of great annoyance and waste. Men like to run off 40 or 50 gal. of warm water on a hot day, so as to finally get a cool mouthful. Any inventive mind can rectify this waste. In the mine the use of water jets with the rock drills is apt to be abused. I have often seen the holes being bored dry, and the jet turned into the ore chute. Water for the jets is usually seepage caught at various levels, and made to do work on its way down to the pumps. No doubt there is some waste, but not much, and this is usually a matter of little importance.

To show how much can be done in the direction of water savings, the consumption at the Junction North mine was recently over 200 gal. of mine water and over 200 gal. of fresh water per ton of ore treated. Now it is 150 gal. of mine water and 40 gal. of fresh water per ton of ore. I hope to reduce the consumption still further, so as to use about 90 gal. of mine water and 4 or 5 gal. of fresh water per ton of ore. The fresh water will then only be used in the offices and change house.

Water Saving at the Junction North Mine

There is a liberal water supply available in the underground workings of the Junction North mine, and the policy has been to make this sufficient for all requirements, so that the company will be entirely independent of all outside water schemes, and safe for periods of water famines, in addition to the saving of costs that will come about. The water contains 673.36 grains of solids in a gallon, or 0.9619 per cent. by weight, as follows:

	Grains per Gal.	Per Cent
Silica	1.47	0.0021
Oxides of iron and alumina	2.24	0.0032
Calcium sulphate	111.12	0.1587
Magnesium sulphate	155.44	0.2220
Zinc sulphate	67.52	0.0965
Sodium chloride	306.89	0.4384
Loss on ignition	14.42	0.0206
Unaccounted for	14.26	0.0204
Totals	673.36	0.9619

This water is quite suitable for milling purposes, but could not be used in the Babcock & Wilcox boilers. But, owing to the fact that 78.7 per cent. of the solids are soluble in very strong solutions, it was deemed suitable for Lancashire boilers. The magnesium sulphate was not thought likely to cause priming if only a limited amount of power was demanded. Accordingly, a very suitable arrangement has been made, and is now in use, by which the boilers use only mine water for the make-up feed supply.

To accomplish these results a very complete system of atmospheric condensers has been installed to deal with the exhaust steam from every engine on the mine. There are 38 atmospheric condensing tanks coupled together in three systems. Each system has a wrought-iron breakdown tank, or feed-water heater, to take the impact of the exhausts. The condensed water gravitates to the boiler-feed tanks, and the Babcock & Wilcox boilers are fed exclusively with it, so that blowings off and cleanings are reduced to a minimum with that type. Mine water to represent the "make-up," amounting to nearly 20 per cent. of the total feed water in hot weather, is fed to two Lancashire boilers, which have been retained for operating the winding engine and No. 2 compressor. In these boilers there is a fair amount of sediment and scale formed. Blowings off and cleanings are needed frequently, but the whole is an economical and reliable arrangement, not only from a water point of view, but a reduction is already noted in the coal consumption by reason of the cleaner condition of the Babcock & Wilcox boilers. Although only lately set to work, it is evident that quite 80 per cent. of the original boiler-feed water will be saved in the hot weather, and this represents in cash a saving of more than 100 per cent. per annum on capital outlay after allowing liberally for repairs and depreciation. Eight of the tanks have been in use for over 18 months, and, except for a little soldering, have cost nothing for repairs. It is only fair to mention that the surface plant is so distributed that the mine possesses singular features in favor of the system by which the exhausts from all engines can be collected economically. In the mill a number of details are being given a trial in order that water losses will be reduced to a minimum. On the surface a drainage system of pipes is about to be put in, by which waste water will be collected from offices, change house, concentrates bins, and will be led to a boiler and economizer blow-off tank, from which it will be returned to the mill.

The *Queen. Gov. Min. Journ.* places the value of the output of the copper mines of New South Wales for 1908 at £302,812. This is £224,062 less than in the previous year.

Mineral Production of Germany

The production of metallic ores—other than iron—in the German Empire for the years 1907 and 1908 is reported as follows, in metric tons:

	1907	1908.
Gold and silver ores	8,279	7,654
Copper ore	771,227	727,384
Lead ore	147,272	156,842
Zinc ore	698,425	706,441
Manganese ore	73,105	67,693
Various ores—tungsten, etc	7,997	8,718
Arsenic ore	4,878	6,081
Pyrites	196,351	219,455
Other sulphur ores	1,010	411

A considerable decrease in copper ore, and small increases in lead and zinc ores are the chief features of the statement. The figures are taken from *Glückauf*, being an advance statement from the Imperial Statistical Office.

Nonmetallic Products

The nonmetallic production—other than coal—is as follows, in metric tons:

	1907.	1908.
Graphite	4,033	4,844
Asphalt	126,649	89,009
Petroleum	106,379	141,909
Rock salt	1,285,138	1,327,453
Kainit	2,624,412	2,589,804
Other potash salts	3,124,956	3,300,635
Kieserit, glauber salts, etc.,	5,503	6,505
Boracite	114	128

There was a gain in potash salts, but a decrease in several of the minor products.

Metallurgical Products

Metals and other products of metallurgical works were as follows, not including iron and steel, which are given elsewhere:

		1907.	1908.
Gold	Kg.	4,682	1,758
Silver	"	386,933	407,833
Copper	Tons	32,473	30,329
Lead,	"	146,596	169,418
Zinc	"	208,195	216,490
Arsenical products	"	2,904	2,822
Sulphur	"	176	810
Sulphuric acid	"	1,393,398	1,385,740
Copper sulphate	"	5,284	7,117
Zinc sulphate	"	5,145	5,310
Iron sulphate	"	14,033	15,738
Metallic pigments.	"	4,469	3,936
Miscellaneous	"	6,684	7,230

Gold and silver include metal from foreign ores. Under tin there are given 5838 tons in 1907, and 6375 tons in 1908 of tin manufactures, as well as 1812 tons in 1907 and 2266 in 1908 of tin salts. These were made from imported ores and metal. Copper in 1908 included 328 tons black copper, the rest being refined metal.

Potassium and Other Salts

The production of potassium and other salts in commercial form was as follows, in metric tons:

	1907	1908
Salt	665,116	665,413
Potassium chloride	473,138	508,622
Magnesium chloride	32,891	29,775
Glauber salts	80,347	72,667
Potassium sulphate	60,292	55,755
Potassium-magnesium sulphate	33,368	33,149
Magnesium sulphate	41,105	42,976
Aluminum sulphate	59,473	54,122
Alum	4,290	3,802

On the whole the production of potassium salts, of which Germany has almost a monopoly, was fairly well maintained last year.

A Blast Furnace of Oval Section*

At the recent meeting of the Iron and Steel Institute in the Middlesbrough district in England, visiting engineers were much interested in No. 5 blast furnace of the Newport Iron Works, recently built. The peculiarity of this furnace is its form, which is oval, not circular, the design being the patent of Francis Samuelson and William Hawdon. The aim of the inventors was said to be to obtain a large output with a lower initial cost, and a more economical operating cost.

Requirements of a Furnace for Large Production

The three essentials in a plant for large makes are: The necessary area in the melting zone of the furnace, or at the level of the tuyeres, where the oxygen of the air blown in is brought in contact with the fuel which, of course, produces the necessary heat to smelt the ore; capacity of blowing engines, by which is understood the necessary volume and pressure of blast; and sufficient stove capacity to heat up the volume of air to the required temperature.

American pig-iron makers obtain the first essential by increasing the diameter of the well of the furnace at the tuyeres to get the larger area at the melting zone. This, of course, has necessitated a corresponding increase in the power of the blowing engines, in order to obtain the necessary blast pressure to penetrate the additional mass of ore in the well of the furnace. It is well known that if the mass is not thoroughly penetrated by the blast, a center cone remains unmelted, which not only adds materially to the consumption of fuel, but prevents the making of good iron.

Cost of High Blast Pressure

This increased pressure is the principal and most serious matter for consideration. Increased capacity, as regards dealing with the volume of air for increased makes, is necessary in both blowing engines and stoves. The stoves, to withstand the higher pressure, have to be more strongly built, and are, therefore, more costly. But the most costly item, and the one which it was sought to avoid in the oval furnace, is the enormous strength requisite in the blowing engines, which, of course, increases with the pressure of blast required, and because of the additional strength required to withstand the higher pressure, the air mains and adjuncts are also more costly. A blast pressure of 5 to 6 lb. per square inch was usual under the older designs; one of 12 to 15 lb., or even more, is common with the new design adopted in American practice.

*Abstract of article in *Iron and Coal Trades Review*, London, England.

The oval furnace built by Messrs. Samuelson at Newport is blown by the old blowing engines, and works on a pressure of 6-lb. blast with very great regularity, while the results, both as regards make and fuel consumption, are highly satisfactory. The furnace, which is making Cleveland iron, averaged over the three months ending with May last, an output of 1344 tons per week, the best four weeks averaging 1447 tons per week. The installation of this furnace required no alteration in the existing plant.

It is obvious that an engine giving 15-lb. per square inch pressure of blast requires about two and one-half times the horsepower of an engine blowing 6-lb. blast pressure, in addition to which the boiler capacity must be proportionately greater. Blowing engines made for such high pressures are costly units, and require considerable labor and attention in repairs. Hence, well on to 50 per cent. of the horsepower required for the production of the higher pressure of blast is saved in an engine of lower pressure, and this power becomes available for generating electricity, or for other purposes—a great advantage where there are steel works in connection with the blast furnaces.

Construction of the Furnace

The inventors claim that the adoption of their oval furnace, whether in an old or new plant, is productive of this valuable saving of power in the blast. The accompanying views show, in Fig. 1, half cross-sections of the furnace at two points; in Fig. 2 a half sectional elevation, and in Fig. 3 a cross-section at the tuyeres. It will be seen from these sections that the oval well on its minor axis is much narrower than a round furnace would be. The distance, therefore, from tuyere to tuyere is less, and consequently a lower pressure of blast penetrates the material in front of the tuyeres and at the melting zone in the furnace. With a round furnace of the same area, the diameter is necessarily large, and consequently there is a greater distance from tuyere to tuyere. Therefore, a greater pressure of blast becomes necessary.

Fig. 1 shows how girders are placed both round the shell and vertically, to strengthen the oval form. The pressure

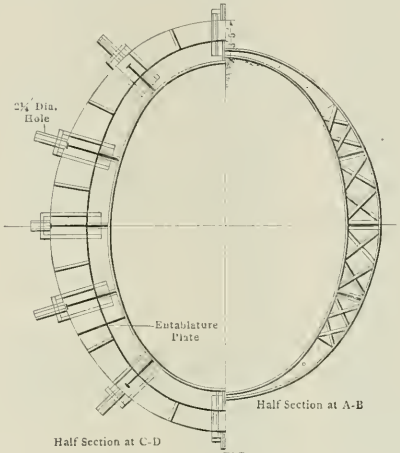


FIG. 1

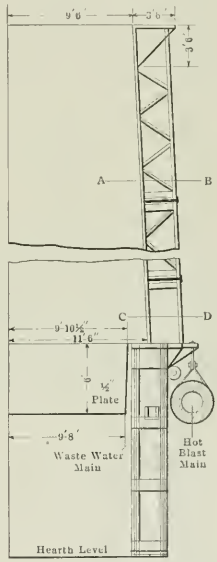


FIG. 2

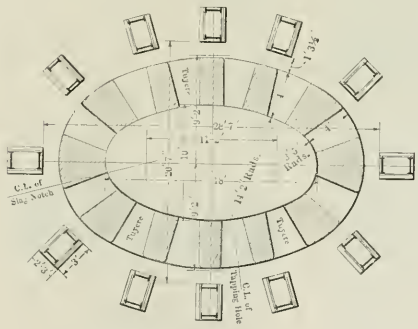


FIG. 3

OVAL SECTION BLAST FURNACE AT MIDDLESBROUGH

of materials inside the furnace, without this support would tend to bulge out the sides of the oval. These girders are composed of 9-in. beams at the ends, and increased to 4 ft. by 7½ in. deep lattice girders of the sides. The charging bell is oval, giving an equal distribution of materials at the top of the furnace, which is maintained throughout the melting process.

Results from the Furnace

A certain amount of doubt was expressed by experts as to whether the oval would work with as great regularity as the circular form, but this has apparently been quite set at rest by the very regular working of the furnace in question, which has since its erection, given less trouble than almost any other furnace at Newport works. It is also said by the builders and owners that while the make of the furnace is large, the iron is also more regular in quality than that from the old furnaces at the same works. This regularity is an advantage which must be appreciated by all furnace operators.

Apparatus for Surveying a Bore-Hole

In a recent issue of *Annales des Mines de Belgique*, Jean Florin describes the construction and operation of a novel device for determining the strike of the strata and the direction of a bore-hole at its bottom. The merits of the apparatus are that all clock motions and other complicated mechanisms are avoided, that it does not need to be built with the strength necessary to withstand great pressure, that its operation is simple, its cost small, and its accuracy perfect.

In brief, it consists of a brass box, filled with water, in which is suspended by rubber bands *i*, a simple photographic camera *a*, below which are a magnetic needle *b*, a phosphorescent disk *c*, and the interchangeable soft lead disk *d*. Holes *e*, around the top of the box, protected by shields and wire gauze, allow the box to fill with water while excluding light and dirt.

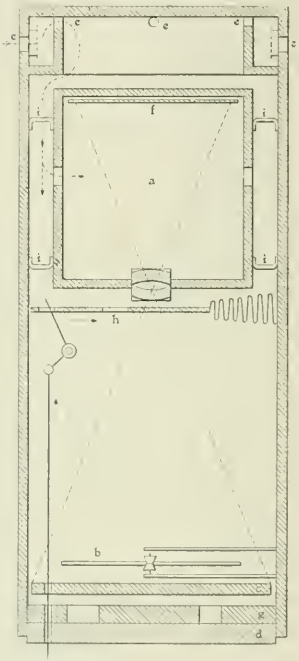
The photographic camera is a metal box *a*, inside the top of which can be placed a round frame carrying a sensitized celluloid plate *f*. This is so placed as to receive the image of the magnetic needle and certain reference marks on the phosphorescent disk. The lens has a focus of about 4 cm., and is ground with special reference to the refraction between glass and water. In front of the lens is the shutter *h*, which is operated by pressure on the end of a rod which projects down through the bottom of the outer box.

The magnetic needle is supported freely, its vibrations not being restrained at any time. Immediately below the needle is the copper disk *c*, coated with a substance, containing calcium sulphide, insoluble in water. On the disk are also drawn black lines to serve as reference marks.

At a short distance below this is a disk of phosphorus bronze *g*, of a sufficient thickness to stand some battering, through which are bored four holes of different sizes. These holes serve as points of reference to assure that the lead disk does not move while the apparatus is in operation; other reference marks allow the bronze disk to be placed always in the same position. At the very bottom is a disk of soft lead intended to receive on the outside an impression of the stump of the core, and on the inside an impression of the four holes in the bronze disk.

Preparing the Apparatus for Use

To prepare the apparatus for use, the



SECTION OF INSTRUMENT FOR SURVEYING BORE HOLES

phosphorescent plate is first excited by a flash from a short piece of magnesium ribbon; the illuminating power will last for four or five hours. The disk is then replaced and the bronze and the lead plates are firmly secured. The sensitized plate is then put in, in a dark room, the top is closed, and the entire apparatus is filled with water, care being taken to remove all air bubbles. If the temperature of the water encountered in the bore-hole is likely to be higher than the melting point of the gelatine on the sensitized plate, before putting the plate into position it can be treated with a 5-per cent. solution of formaldehyde, which makes the gelatine insoluble and yet does not interfere with the exposure nor the development.

Having freshly broken off the core and marked it distinctively by a blow from a chisel bit, the brass box is lowered on the end of the drill rod. The weight of the rods causes the desired impressions to be made on the lead, and at the same time the shutter of the camera is opened. The magnetic needle soon comes to rest, and an exposure will generally take 20 to 30 min. On drawing up the rods the shutter closes.

The data given by this operation are an impression of the bottom of the hole, on the under side of the lead disk and on the upper side, the marks of the four holes, which orient the lead disk with respect to the camera. On the sensitized plate, after development, are seen the image of the needle and of the black marks on the phosphorescent plate. From these data the strike of the strata and the direction of the bottom of the hole can be ascertained.

Although the author does not mention it, it would appear quite feasible, by supporting the camera box in such a way that its axis should always be vertical, to ascertain the deviation of the hole from the vertical by noting the distance that the center of the needle appears to be offset from the center of the developed plate. The use of a phosphorescent illumination also appears to be a decided improvement over any kind of electric lighting.

Prices of Lake Iron Ores

The average prices of Lake iron ores in Cleveland in early days are given in an interesting historical article in the *Marine Review*. For the year 1857, the average selling price of ore per ton was $8; in 1858 it was $6.50; in 1859 it was $6; in 1860, 1861 and 1862 the average was the same each year, or $5.25 per ton; in 1863 it was $7.50; in 1864 it was $8.50; in 1865 it was $7.50; in 1866 it was $9.50; in 1867 it was $10.50; in 1868 and 1869 it was $8.25; in 1870 it was $8.50; in 1871 it was $8; in 1872 it was $9; in 1875 it was $7; in 1876 it was $6.75; in 1877 it was $6.50; in 1878 it was $5.50; in 1879 it was $6.25; in 1880 it was $9.25; in 1881 it was $9; in 1882 it was $9, and in 1883 it was $6.25 per ton.

The Rhodesian Chamber of Commerce has asked the government to appoint a medical commission to investigate sanitary conditions among the Kafir laborers employed in the mines. These appear to be improving, as the average death rate fell from 73.18 per 1000 in 1907 to 48.78 in 1908. The principal diseases prevalent among the Kafirs are pneumonia and scurvy.

Electric Mine Signaling

An ingenious method of shaft signaling by electricity, as adopted at two of the shafts of the Grand-Hornu company, is described in a recent issue of the *Annales des Mines de Belgique.* Alternating currents, of 110 volts and 25 cycles, are used at both places; this permits a simpler construction of the bells than when a direct current is used. The system is so designed that a signal rung from underground will sound both at the landing floor at the surface and in the hoisting room, and also so that signals can be sent from the landing floor to the hoisting room and to the underground station.

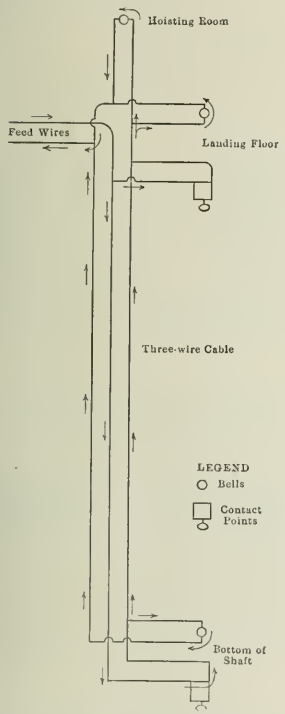


FIG. 1. WIRING SYSTEM AT NO. 9 SHAFT GRAND-HORNU COMPANY

At No. 9 shaft all the hoisting is done from the one level. At the bottom and at the landing floor are placed a bell and a contact point and at the hoist is a bell, but no contact point; they are all inclosed in cast-iron boxes, tinned to prevent rust. The cable has three 1-mm. copper wires, in an iron casing attached to the timbers in the shaft.

The arrangement of the wiring is shown in Fig. 1, in which the arrows point the direction of the current while a signal is being given from the bottom. It is seen that the bell at the bottom rings at the same time as the others. All three bells can also be rung by making contact at the landing floor.

At No. 7 shaft hoisting is being done from both the 550- and the 710-m. level. To avoid confusion in the hoisting room and at landing floor, the bells connected with one level are made of bronze and those connected to the other level are made of steel; by this means two different tones are produced. The wiring is also arranged so that a signal given from one level is not heard on the other level, thus avoiding unnecessary confusion. In Fig.

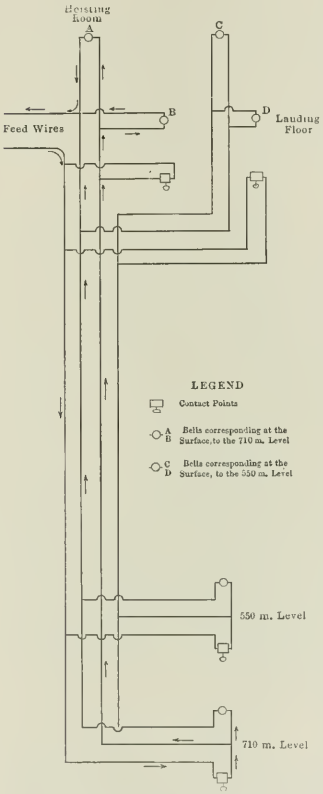


FIG. 2. WIRING SYSTEM AT NO. 7 SHAFT, GRAND-HORNU COMPANY

2 the arrows show the direction of the current at the moment the operator on the 710-m. level is giving a signal; his own bell rings with the others.

The signals are given in the same code as with a bell operated by rope, but it is also possible to use a system based on long and short strokes.

It is announced by *l'Echo des Mines* that an agent of the Carnegie Steel Company, while searching for manganese ores in India, discovered a valuable deposit of tungsten ore in the Central Provinces, near Nagpur.

The Sturtevant Ring Roll Mill

A new crushing roll has recently been introduced by the Sturtevant Mill Company, of Boston, Mass. This roll consists essentially of a massive outer ring, with a concave inner face, which revolves vertically. Within this outer ring revolve three rolls with convex faces; these are pressed by springs against the concave inner face of the outer ring. They are usually adjusted to crush at about 20,000 lb. pressure. When the machine is in operation the inner face of the outer ring is covered with a 1-in. layer of material to be crushed.

The outer ring is bolted to a massive head which is revolved at about 75 r.p.m. by its horizontal shaft. There are no shields for the prevention of wobbling, the massive construction being ample provision against this fault. The whole front of the mill opens like the massive door of a safe, swinging the rolls and their parts outside and exposing the whole interior. The outer ring alone is left inside; thus it is easily accessible for examination or replacement. On closing the door the three inner rings and all their parts swing into place, the adjustment of the pressure being controlled by a screw on the outside of the door. Provision is made for holding the inner roll away from the outer ring.

Material to be ground is supplied by an automatic feeder to the middle of the concave outer ring, by way of a chute. The inner rolls do not come in contact with the outer ring, but work on the layer of material, gradually forcing the fines off of both sides of the track. The mill takes material direct from a rock breaker in 1½ in. or smaller size.

The first award of a prize for discovery or invention under the will of Aeneas McCharles, who left a fund of $10,000 for that purpose, will be made this year by the board of governors of Toronto University, Toronto, Canada, the amount being $1000. It will be open (1) to any Canadian who invents or discovers any new and improved process for the treatment of Canadian ores, or minerals, after such process has been proved to be of special merit on a practical scale; or (2) for any important discovery, invention or device that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; or (3) for any marked public distinction achieved in scientific research in any useful practical line.

A sanatorium for patients suffering from miners' phthisis (*Aust. Min. Stand.*, Dec. 23, 1908) is to be erected on the Rand. The mines propose to allot £13,000 for its erection, and the government is to be asked for material support.

The Diamantina District of Minas Geraes

By G. W. Lindsay*

Diamonds are found in Brazil in three separate districts: (1) In the state of Bahia, near the east coast of Brazil; (2) in the northern part of Minas Geraes; (3) in the far interior, in the states of Goyaz and Matto Grosso. The Bahia district has produced comparatively few diamonds of the finest quality and is noted chiefly for the production of carbonados, or black diamonds, used in diamond drills. By far the greater proportion of the world's supply of carbonados comes from this field. The diamond-producing district in Goyaz and Matto Grosso is as a whole practically unprospected. Its great distance from civilization, and the absolute lack of transportation facilities make it of no practical importance at present.

The chief source of Brazilian diamonds is what is known as the Diamantina district, situated in the northern part of the state of Minas Geraes, about 500 miles north of Rio de Janeiro. This field is a narrow strip from 20 to 40 miles in width extending from the headwaters of the Jequitinhonha river, down this stream for about 200 miles.

Discovery and Early Production

This field was worked for gold as far back as 1670. In 1729 diamonds were discovered in the streams and for many years the Crown of Portugal exploited this district on a large scale, importing negro slaves for labor. When Brazil became an independent empire the work was continued under the direct protection of the state. During this period the output of the district reached its maximum, about 150,000 carats annually.

For about a century and a quarter Brazil produced nearly 90 per cent. of the world's supply of diamonds. In the latter half of the last century the output of this region suddenly decreased, until in 1890 only about 1000 carats were taken out. This was due to several causes, chief among them being the exhaustion of the more easily worked placer deposits, the loss of the slave labor, etc. Since 1890 the output has slowly increased, until in 1905 about $200,000 worth of diamonds were sent out. American companies have recently obtained large concessions in this region, and with the application of modern machinery and methods it is expected that this district will again take rank as an important diamond-producing field.

Source of the Diamonds

The original source of the diamond-bearing ground in this district was apparently a number of "pipes" or funnels, through which the diamondiferous clay was forced up to the surface. These pipes are thought to be similar to those which are being worked at present in South Africa. If they should prove so, they will undoubtedly become the chief source of diamonds in this district. At present this class of deposit is undeveloped, and its value is more or less conjectural.

From these primary deposits the diamonds were scattered all over the district, being found in a sheet of conglomerate which apparently at one time overlaid the entire region. Scattered through the district many small patches of this conglomerate are still found in place on the hill sides. It is a deposit ranging in thickness from 2 to 6 ft., consisting of coarse water worn gravel firmly cemented together. It is worked to some extent by the natives, and in some instances might yield largely on the application of modern machinery and methods.

Production from Placer Workings

The greater part of this conglomerate has been washed down into the Jequitinhonha and its tributaries by the excessive tropical rainfall, forming a series of exceedingly rich placer deposits. It is from these placers that practically all of the diamonds produced thus far have been taken. The method formerly employed was to dam the stream, carry the water off by means of ditches or rough flumes, and dig out and wash by hand the bed of the river thus laid bare.

With thousands of negro slaves to supply the needed labor, it was possible to work the smaller streams and even the Jequitinhonha itself for some 30 miles from its headwaters, by this crude method. But as the smaller streams were worked out this method became more and more expensive and difficult, until on the freeing of the slaves it was abandoned altogether. Since that time no attempt at mining on a large scale has been made in this district until the last year or two.

Diamond-washing Dredges

Several American companies have obtained concessions on the Jequitinhonha, and two modern gold dredges, adapted to diamond saving have been already installed. The larger of these dredges is of the standard endless bucket-line type, with 3¼-cu.ft. buckets and a digging capacity of from 1800 to 2000 cu.yd. per day. The process used in recovering the diamonds is simple. The gravel dug up is carefully sized in a series of trommels, and the gravel from one-sixteenth to three-fourths of an inch in size is jigged. The diamonds are sorted out from the jig concentrates by hand. The sand is run over gold-saving tables in the ordinary manner, no attempt being made to save any diamonds it may contain. These river placers usually run from 5 to 15c. per yd. in gold besides their diamond values.

The diamonds from this field are of the first quality and color, and the average size of the stones is also good, though in Africa many individual diamonds have been found much larger than any yet discovered in Brazil.

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Iron and Coal in Germany

The official report of the iron-ore production in Germany for the full year, as published in *Glückauf*, gives the totals mined as follows, in metric tons:

	1907.	1908.
Elsass-Lothringen	14,107,518	13,281,589
Luxemburg	7,492,870	5,799,280
Other districts	6,096,740	5,152,487
Total	27,697,128	24,233,356

In 1908 Elsass-Lothringen furnished 54.8 per cent. of the total output, and Luxemburg 23.9 per cent.

Pig Iron Production

The official statement of pig-iron output is as follows, in metric tons:

	1907.	1908.
Foundry iron	2,048,592	2,102,375
Direct castings	71,377	71,466
Forge iron	900,239	696,373
Spiegel and other alloys	931,140	837,067
Bessemer (acid) iron	478,011	422,448
Thomas (basic) pig	8,428,334	7,657,884
Scrap, cinder, etc	17,556	17,708
Total	12,875,159	11,805,321

This statement differs slightly from that of the German Iron and Steel Union, heretofore published, which is based on current reports from furnaces.

Finished Iron and Steel

The forms in which iron and steel products were put upon the market are reported as follows, in metric tons:

	1907.	1908.
Castings (second smelting)	2,553,446	2,306,678
Wrought (puddled) iron	617,900	491,318
Crucible steel, all forms	40,443	26,306
Steel ingots	670,882	7,690,186
Blooms, billets, etc	1,980,195	1,899,228
Finished steel, all forms	8,736,010	8,125,749

The forms given for steel are those in which the metal was sold by the works where it was made. The steel ingots, blooms, etc., were worked into finished forms at mills which do not make their own steel.

Coal Production

The production of coal in the German Empire is given as below in metric tons:

	1907.	1908.
Coal	143,185,691	148,537,517
Brown coal (lignite)	62,546,671	66,746,057
Total	205,732,362	215,283,574

The total increase in 1908 was 9,551,212 tons, or 4.6 per cent. Brown coal, or lignite, was 30.4 per cent. of the total in 1907, and 31 per cent. last year

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The directors of the Mount Bischoff Tin Mining Company, Tasmania, have declared the 383d dividend of 5s. per share The amount of dividend is £3000, which brings the total paid by the company up to £2,160,000.

Locus of Vadose Ore Deposition

By Charles R. Keyes*

By reason of their direct practical bearing upon the local occurrence of orebodies according to definite lines of geologic structure the results of recent investigations in the Ozark region have proved to be of exceptional interest to the mining industry. For the first time in the history of the development of the region no definite data appear for quantitative considerations. The principles involved have, moreover, a much wider than local application.

The principal lead and zinc deposits of the Ozark region are strictly vadose accumulations. In the main the orebodies correspond to the enrichment zone of normal fissure-veins. Otherwise there is no resemblance between the two classes of orebodies. There is, in reality, no zone of impoverished oxidized ores above, nor of a normal low-grade orebody beneath. Moreover, the general migration of ore materials has been in a lateral direction rather than merely downward, as is usually the case. In this general side-movement the direction and interference of ore movement has been controlled very largely by local geologic structures. Among the latter the basin, trough, or syncline has been the leading type.

The general association of the workable ore deposits of the Ozark region with basins appears far more significant than a first glance might suggest. It seems to make small difference what is the origin of these basins. They may be formed by true synclines, in flexed strata by old erosion-troughs along planes of unconformity, by warpings of impervious strata, by cross-folds in structural troughs, by solution cavities, by underground waterways dammed by débris, by faulting, by dike-intrusions, by lack of local erosion in sloping strata, or even by other features. The principal point to be considered is that the introduction of these structures gives rise to an impounding of the underground waters; and a production, on new lines, of all of the old conditions of permanent groundwater-level.

Sulphatic waters passing into or through such subterranean ponds invariably deposit some of their metallic salts as sulphides just as they do in the enrichment zone of normal fissure-veins. How the precipitation takes place is, in the present connection, immaterial. It may be through means of the mingling of different currents, the presence of organic matter, the association of carbonaceous materials, or the presence of decomposing sulphides. In this zone and under impounding conditions there are usually present at all times an abundance of adequate reducing agents.

In the Southeast Missouri Lead district the localization of the orebodies appears to be influenced chiefly by the character of the Pre-Cambrian troughs eroded out of the much older granites. The Central Missouri district presents true structural troughs, or synclines, as the controlling feature, although subterranean channelways now filled with sandstones and bituminous shales or clays have occasioned minor orebodies. Both synclines and faults have produced basin conditions in the Northern Arkansas district. In the Upper Mississippi Lead district synclines alone of the original geologic structures are the determining factors.

Conditions are complex in the Southwestern Missouri Zinc district. That they appear more complicated in this area than in other districts may be due partly to the fact that this district has received more detailed study than any of the other fields. The great Springfield-Joplin syncline pitching westward down the slope of the Ozark dome clearly explains many of the former puzzling features connected with the distribution of the orebodies. The cross-arches long known in the vicinity of Galena, Joplin, Webb City, Carthage and other places are thought to be of first importance in ore-localization. Close-patterned warping of the strata has been suspected ever since the detailed large-scale topographic maps of the Carthage, Joplin and other quadrangles were first constructed by the Missouri Geological Survey more than a decade and a half ago. Although not so accurate as it might be, but still presenting the broader features fairly well, the late publication by the U. S. Geological Survey showing the underground contours of the Grand Falls Chert surface, displays in a remarkable manner the relationships of the orebodies and the basins.

Orebodies in large solution cavities, particularly along the master-lines of jointing, and in dammed underground waterways, are also of common occurrence in the Joplin district. Corrosion-channels in the plane of unconformity at the base of the Coal Measures do not at present appear to exist. So far as personally known the débris-sandstones and shales usually found in this connection are not depositions of Carboniferous age at all. All appear to be fillings of very recently formed underground channelways that have caved in or filled up without the roofs giving away. As such there must be seldom any real relationship between the pre-Coal Measures drainage-lines and the orebodies.

The Ozark region is a field in which some of the structural features mentioned are not at first sight easily determined. The general dips of the strata are so small, the flexing so slight, the warping so close-patterned that it has been only through the application of the most recent and refined methods of investigation that the actual proofs of some of the former deductions were secured. The delicacy of the standard of measurement may be judged when it is stated that warping or flexing of less than a dozen feet may give rise to basins holding the largest of orebodies. The principles involved are perhaps best considered by referring first to examples of other regions where with the same vertical values, the lateral components are infinitely smaller and the angles much higher.

In the Joplin district the profile of the Grand Falls chert, along a line passing through the principal mining camps, brings out several important features. The leading orebodies are seen to be located in the troughs due partly to the close-patterned warping and partly to definite parallel-flexing. The ridges of Galena, Joplin, Webb City, and Carthage, for example, are true anticlines trending nearly northwest. They are the cross-bars of the Springfield-Joplin syncline which pitches nearly due west. The orebodies are thus seen to have definite relationships with the local geologic structures. It seems very probable that the retreating margin of the impervious Coal Measures shales has had an important influence in impounding the underground waters by raising the groundwater level. There is good reason for believing that this has been the direct cause of the localization of many of the orebodies of this district. As the inclination of the groundwater surface is not as great as that of the strata there would be raised at once, at the point where the groundwater-level intersected the basal plane of the Coal Measures formation, a formidable barrier, or dam, which would impose extensive impounding conditions. The Joplin district appears to be just such an area.

In the Central Missouri mining district the series of parallel synclines imparts conditions similar to those of Joplin with the Coal Measures not far away. The orebodies appear to be confined entirely to the bottoms of the structural troughs. With this conception of the field systematic prospecting should make this area a very much more important mining district than it now is.

The general structural conditions in the Southeastern Lead district are also similar to those in the Southwestern area. Corresponding to the warped surface is the uneven erosion surface of the unconformity-plane at the base of the Cambrian rocks. Instead of porous zones, caused by brecciated cherts and limestones, are the porous dolomites. The ores are "disseminated" through particular beds in place of being formed in irregular brecciated zones or into "runs" along underground channels filled with debris. The

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profile of the Grand Falls chert would then answer, with no essential modification, for a generalized cross-section of the Southeastern Lead field. Only the surface in the Southeast would be an unconformity-surface instead of a warped stratigraphic plane.

Throughout the entire Ozark region the locus of strictly vadose ore deposition thus appears to be wholly dependent upon local and definite geologic structures.

The Institution of Mining and Metallurgy

SPECIAL CORRESPONDENCE

The annual general meeting of the Institution of Mining and Metallurgy was held recently, when a report of the council for the past year was read, together with an address from the incoming president, Edgar Taylor. The report of the council records a satisfactory year. The membership at the close of the year 1908 was 1799, as compared with 1625 at the corresponding date in 1907, there being, therefore, a net increase in the roll of 174 members. The principal award of the institution, the gold medal, was awarded to Dr. James Douglas, in recognition of his services in the advancement of the educational, technical and commercial interests of mining and metallurgy, and of his contributions to technical literature. Previous recipients of this award, which is the highest honor the institution confers, have been John Stewart Macarthur in 1902, Hennen Jennings in 1903, Prof. Hilary Bauerman in 1906, and Sir Archibald Geikie in 1907. Regret was expressed that Doctor Douglas was not able to be present to receive the award in person. It was remarkable that not one of the recipients of medals or prizes was present—a circumstance indicative of the world-wide activity of the members of the profession.

The gold medal presented annually by the Consolidated Goldfields of South Africa was awarded to H. L. Wilkinson, of Melbourne, Australia, for his paper on the "Deep Leads of Victoria, or the Cainozoic Buried Auriferous River Deposits."

The institution takes great interest in educational work, giving several post-graduate scholarships as well as arranging post-graduate courses on some of the principal mines of the world for selected students of the leading mining schools. As many as 16 post-graduate courses were arranged during the year, of which eight were on South African mines, two on Indian mines, four on Australian mines, one at the Tomboy, Colorado, and one at the Ouro Preto in Brazil.

With a view to keeping the colonial members and those who live in foreign countries in closer touch with the work and aims of the institution, the council has been enlarged by electing a number of members living abroad under the title of corresponding members of council.

The presidential address of Edgar Taylor, a member of the well known firm of John Taylor & Sons, was devoted to describing the advances that have been made in recent times in the methods of mining, touching principally on the work below ground. Mr. Taylor called attention to the fact that the papers read at the meetings hardly did justice to this branch of mining work, and expressed the hope that in the coming session papers would be forthcoming, describing the mining methods and equipment on some deep and up-to-date mine. He wound up an interesting address by reminding the members that, while mining was to some extent a speculative business and would on that account always continue to attract capital, it was the duty of professional mining engineers to reduce the speculative element as much as possible "and to make Nature disgorge her wealth at the least possible expense, and with the utmost benefit to the treasure seekers by adapting to the best advantage the most scientific methods and the most skilful appliances placed at their disposal by the ingenuity of man for the attainment of that object."

The Delaware & Hudson Company

This company owns and operates an extensive estate in the anthracite coal region of Pennsylvania. It also owns a system of railroads extending from its coal properties eastward and northward to the Hudson river at Albany and Rondout, and northward into Canala. Unlike most of the anthracite carriers, the company operates its coal mines directly and not through a subsidiary corporation. The report is for the calendar year 1908.

The coal statement for the year is as follows, in long tons:

	1907.	1908.	Changes.
Coal on hand Jan. 1.	141,645	374,984	I. 233,339
Coal mined.... ..	6,623,508	6,526,871	D. 96,637
Coal bought..... ..	382,478	287,329	D. 95,149
Total.....	7,147,631	7,189,184	I. 41,553
Coal sold.....	6,772,647	6,835,402	I. 62,755
On hand, Dec. 31..	374,984	353,782	D. 21,202

The earnings of the company's railroad lines from the transportation of coal in 1908 were $9,081,664, or 45 per cent. of the total.

The relief fund for the benefit of employees of the coal department shows receipts of $10,443. The benefits paid were $17,828, and the balance at the close of the year $2782. The company contributed $8725 of the receipts.

The earnings and expenses of the Coal Department were as follows:

	1907	1908.	Changes.
Gross earnings.	$23,184,766	$23,847,117	I. $662,351
Expenses. .	22,227,284	22,994,000	I. 766,716
Net earnings.	$ 957,482	$ 853,117	D. $104,365

Expenses include taxes, which were $292,302 in 1908. The expenses were 95.9 per cent. of gross earnings in 1907, and 96.4 in 1908. The gross earnings in 1908 were $3.49, and the net earnings $0.125 per ton of coal sold, against $3.42 and $0.141 in the previous year.

The report says: "The collieries and washeries of the company were operated to their full capacity throughout the year, producing 6,526,871 tons of anthracite coal out of a total of 64,665,914 produced in the region. At the close of the year there were in the several storage plants 353,782 tons. The Coal Department expenses include construction and betterments amounting to $650,283. Taxes of the Coal Department for the year 1908 show an increase of $76,578.

"The earnings from coal freight traffic show a slight increase, due to the placing by the company of an increased tonnage of its coal in markets securing to its railroad lines a longer haul. . . .

"Early last year an amicable arrangement was made between the United States Attorney General and the anthracite coal-carrier corporations to test the constitutionality of the so-called Commodity clause of the Hepburn act, amending the Interstate Commerce act passed July 29, 1906, which statute attempted to forbid railroad corporations from transporting in interstate commerce any commodity mined, produced or owned by such carrier corporation, or in which it had any interest direct or indirect. In September last the statute in question was declared invalid by the United States Circuit Court for the Eastern District of Pennsylvania. From this decision an appeal was taken by the Attorney General to the United States Supreme Court, which appeal has been argued and is still under advisement by the court."

A discovery of the tungsten-bearing mineral scheelite in the western part of the Moose river gold district of Nova Scotia is described in the *Report of the Department of Mines* for 1008. The mineral first found was tungstite, or tungstic ocher, in the shape of a boulder. Scheelite float was found in a nearby brook and investigation displayed a belt 200 by 1200 ft. containing in all 14 veins with an aggregate width of about 50 in. Three other tungsten discoveries have been made previously in the province

Mexican mint reports for the fiscal year, 1907-8 in the *Boletin de Estadistica*, Aug., 1908, show the following: The amount of metal used for coinage was 16,407,978.38 pesos in gold, and 5,834,230.10 in silver; the export was valued as 19,806,879.62 pesos in gold, and 66,545,525 in silver. The sum total reported at the mint during the year was valued at 108,684,613.45 pesos.

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The Porphyry Copper Mines

During the last four or five years the mines of copper disseminated in porphyry have been amply discussed. Their fruition has been slow because they have been developed on an unparalleled scale. However, some of them have now become productive, one of them is paying dividends, and we can begin to see more clearly how the estimates are going to be borne out. In the first place let us call attention to the fallacy of referring to these as "low-grade mines." As compared to a mine like the Poderosa, that we mentioned recently, which yields ore of 30 per cent. copper, they are indeed of low grade, but as compared to those of Lake Superior they average well. Their ore is capable of cheap mining; the first metallurgic process to which they are subject, viz., milling, is the cheapest of all methods of treatment, and when their mineral undergoes the more costly smelting, the bulk has been so greatly reduced that the cost referred to the crude ore is not very much. The real low-grade mines are those like the Granby, whereof all the ore must be smelted.

Of the porphyry mines that have reached the productive stage, Nevada Consolidated is the shining light. With respect to grade of the ore, facility of mining, excellence in concentration, and performance of the smelter it appears that the engineering estimates are going to be verified, including that of a production-cost of 7c. per lb. (direct-operating expense). Its neighbor, Cumberland-Ely, is also doing well, but has so much smaller ore reserves that it can hardly be considered in the same class.

At Bingham, the Utah Copper Company has become a large producer, already paying dividends, which will doubtless be increased even at the present price for copper. This company is certainly to be pronounced a success. Its management has always been conservative in its public expression of expectations and what it has indicated has been approximately achieved. Yet, it has probably fallen a little bit short of what was really expected; not as to tonnage of ore, but rather as to cost of production. However, the Utah Copper Company is unquestionably a cheap and profitable producer.

The Boston Consolidated has been greatly disappointed as to the grade of its ore and consequently the cost of production, besides by the beginning of steam-shovel mining at a place where the ore was unexpectedly high in iron. In order to supply the mill it became necessary on the spur of the moment to develop an underground mine. The feat of its management in opening such a mine in a few months so as to produce a large tonnage of ore was a marvel. The Boston Consolidated is a large property, which has a great tonnage of ore of about 1.5 per cent. copper, but it is now estimated that the cost of production will be 10½c. per pound.

Porphyry mines have become the fashion, as witness the numerous recent flotations. To mention some of them there is the Ohio (nearing the productive stage), the Miami (a wonderful development), the Giroux, the Ray Consolidated and adjoining it the Ray Central, and latest of all the Inspiration (near the Miami). In Chile there is the Braden Copper Company. It will be several years before all of these become productive, but sooner or later they are undoubtedly going to swell the production of copper.

The Conservation of Resources

The addresses at the recent meeting of the four engineering societies ought to dispel some of the illusions as to what may be done in the way of conserving our natural resources. Instead of statesmen, writers and dreamers, we had there a gathering of practical engineers. Dr. Douglas effectively punctured the idea that we are wasting our mineral resources by careless mining and smelting, which some conservation commission or amiable bureaucracy is going to show us how to correct. Dr. Raymond with his characteristic pungency pointed out the dangers of legislative conservation, the tendency of governmental agencies to seek additional power, and the bad record of the Federal Government in some things of this character that it has undertaken. Mr. Baker, editor of *Engineering News,* talked with real sense when he pointed out our enormous fire loss as a waste that can and ought to be reduced. This is on the line the JOURNAL has previously argued.

Attention should first of all be directed to make the best use of, and prevent the waste of, property that has been created. Let the propaganda be directed to reduc-

ing the waste by fire, vermin, disease, accidents and general carelessness. The Government itself has an excellent opportunity to lead and show the way by reducing extravagances in its own affairs. Among minor matters it might cease undertaking to teach us how to gasify coal, operate gas engines and burn coal under boilers without smoke, and otherwise multiplying unnecessarily the standard, but long existing, literature of engineering. The matter of economy in production may safely be left to the engineers of the country. Government officials can no more show them how to improve their methods of mining and smelting, extracting coal, etc., than they can teach their grandmothers to suck eggs. However, the movement toward conservation serves a real purpose, that we belittle in no way, by calling the attention of the public to the fact that it is wasteful and that our natural resources are not unlimited.

The Ultimate Consumer

We have been hearing a good deal lately about the "ultimate consumer." The phrase appears to have caught the popular fancy. The ultimate consumer is a good person to bear in mind, but there seems to be more or less doubt as to his connection with the markets. Some seem to think that the only interest of the ultimate consumer is in the prices of such things as he purchases directly, such as tea and coffee and articles of wearing apparel.

It is far from easy to trace to the ultimate consumer the consumption of such an article as copper, which may be sold in the first place to a hydroelectric company. However, no matter how tangled the skein may be, it is certain that in the end the ultimate consumer foots the bill for every article of consumption and that all the revenue that supports our Government, and builds a Panama canal, and carries on other improvements, eventually comes out of his pocket. The ultimate consumer may fancy that he has little or no concern as to a rise in price for a crude staple, like rubber for example, but nevertheless, it affects him sooner or later. Thus, as to rubber, the price of overshoes may remain the same, but the manufacturer will coat them less thickly with gum, they will then wear less long, and in the long run the ultimate consumer will have to buy more of them, which will be an increase in his cost of living.

The Tennessee Purchase

At the annual meeting of the United States Steel Corporation this week, a stockholder brought up in a critical way the purchase of the stock of the Tennessee Coal, Iron and Railroad Company by the Steel Corporation. His criticism was not based upon the policy of acquiring that property, but rather on the point that in doing so the Corporation might be held to have subjected itself to penalties under the Sherman law. This was doubtless inspired by the recent discussions in the United States Senate over the transaction in question, and the action of Mr. Roosevelt in intimating that no attempt would be made to apply that law to this individual case. The report of the Senate committee, which was doubtless prepared chiefly with an eye to political effect, was the moving point.

In his answer to the criticisms in question, Judge Gary stated practically nothing new, unless we may accept as news the statement that the Steel Corporation had been considering such a purchase for some time before it actually took place. That, however, is simply a confirmation of what was previously general report and understanding. Few who had anything approaching to knowledge of the conditions doubted that the ownership of the Tennessee property would eventually gravitate to the Steel Corporation. Doubtless the transaction would have been delayed for some time, had not financial conditions presented the opportunity which they did for the sudden closing of the business.

Judge Gary, in speaking of the transaction, sought to minimize its importance. He stated that it added only 2½ per cent. to the capacity of the Corporation for producing finished steel. This is doubtless true, since the steel output of the Tennessee company had attained only to a small proportion of its total business and was comparatively a new part of that business, but it added largely to the capacity for producing pig iron and at a low rate. The main point in the transaction, however—as was remarked at the time it took place—was the acquisition of the very large reserves of iron ore which were controlled by the company. The Tennessee managers for years had followed the policy of acquiring such reserves, partly in provision for their estimated future needs and partly also to anticipate and prevent the successful organization of a rival company in its own territory. This policy has been successfully carried out, and it was so much in line with that of the Steel Corporation that the opportunity was one not to be neglected. The ore deposits of Alabama are by far the largest existing anywhere outside of the Lake Superior region, and their control prevents the future organization of a strong rival in Southern territory. Doubtless a great industry will in time be built up in Birmingham, as the demand which can be conveniently supplied from that center increases. It will, however, be supplementary to and controlled by the Steel Corporation. At present the Gary plant is the center of new activities and probably Birmingham will have to wait.

THE PRICE PAID for the Raritan refinery by the International Smelting and Refining Company was $6,500,000, part in cash, part in stock. The capacity of the works is 300,000,000 lb of copper per annum. The cost of building such a works is about $2,250,000, exclusive of the land, which at Perth Amboy is fairly expensive. It is fair to say in this case that $4,000,000 represented profitable contracts, good will, etc. The earning capacity of the works is said to be $1,000,000 per annum, but that seems to be putting it rather high.

THERE ARE MANY mining districts in which water is a costly commodity, where careful means have to be introduced to economize it. One of these is Broken Hill, New South Wales. The article by Mr. Palmer, elsewhere in this issue, gives some remarkable figures respecting small water consumption in mining and milling. At the Junction North mine he has reduced the quantity to 1900 lb. per 2240 lb. of ore, and expects to get down to 950 lb. of water per 2240 lb. of ore.

REPORTS ARE NOW becoming more frequent of copper mines that are being closed to make necessary repairs, or are letting a part of their furnaces go out of blast "while copper continues so low," etc. This manifests the beginning of a natural restriction of production by the elimination of those mines whose cost has been proved to be higher than 13c. per lb. of copper, with little or no prospect of farther economy

Mining Laws and Lease System in Wisconsin Zinc District

By J. E. Kennedy*

Mining legislation enacted in Wisconsin is decidedly meager. The only laws in the statutes today regulating mining were passed in 1860 and in 1872, when lead ore was practically the only "mineral" mined in the State. Any general terms specifying the number of men required to work, the number of days of work required per year and the amount of rent to be paid to the landowner constitute a good lease. A verbal lease is equally as binding as a written one, which is an exception to the general law that any transfer of interest in land shall be void unless in writing. Furthermore, a verbal lease as well as a written one is transferable to third parties, an instance of which occurred recently at Mifflin, Wis. In the absence of a written lease, the usages and customs among miners govern and the taking of rent by the landowner constitutes renewal of lease. In the State of Illinois, however, a verbal lease is not binding, as was decided a few years ago by a test case.

Rules Governing Mining Rights

The Wisconsin law of 1860 declares that, when there is no contract between the parties or terms established by the landlord to the contrary, the following rules and regulations apply to mining contracts and leases for the digging of ores and minerals:

"(1) No license or lease, verbal or written, made to a miner shall be revocable by the maker thereof after a valuable discovery or prospect has been struck unless the miner shall forfeit his right by negligence such as establishes a forfeiture according to mining usages.

"(2) The discovery of a crevice or range containing ores or minerals shall entitle the discoverer of the ores or minerals pertaining thereto, subject to the rent due his landlord, before as well as after the ores or minerals are separated from the freehold; but such miner shall not be entitled to recover any ores or minerals or the value thereof from a person digging on his range in good faith and known to be mining thereon until he shall have given notice of his claim; and he shall be entitled to the ores or minerals dug after such notice.

"(3) Usages and customs among miners may be proved in explanation of mining contracts to the same extent as usage may be proved in other branches of business."

In the case of Sobey vs. Thomas, 39 *Wis.* 317, it was declared that "the statutes governing the rights of miners apply *only* when there is no contract fixing the rights of the parties." Decision in the case cited also declared that "lease of exclusive right to work a certain range does not convey the exclusive right to work a vein on another portion of said tract, between which and the former no connection exists within the said tract, although, since the lease, a connection between them has been traced by a circuitous course through adjacent land of another person."

Conflicting Claims

In case of conflicting claims, the Wisconsin statutes provide the court with authority to "continue any action to enforce a claim or grant any necessary time for the purpose of allowing parties to prove up their mines or diggings;" in which case the court may appoint a receiver to whom the ores or minerals raised by either party, pending the dispute, shall be delivered, such receiver paying any rent or other necessary expenses therefrom. This law aimed to correct claim-jumping, a common practice in the early days of lead mining. The custom prevailed that the right to mine a certain tract, crevice or range was retained, in the absence of the miner himself, by the presence of his windlass. The claim-jumper had only to substitute his own windlass and display greater physical prowess in order to displace the proper owner.

"A license to mine upon lands is irrevocable after a valuable discovery or prospect has been struck by the licensee, though no actual entry has been made under the lease." Tipping vs. Robbins, 64 *Wis.* 546. Thus, if *A* has obtained license to mine the adjoining lands of *B* and *C* and has made a valuable discovery on the land of *B* his license to mine upon the land of *C* cannot be revoked by *C*.

"A written conveyance of the right to dig for ore on a certain described range does not create a property or estate in the land; it is a mere license to dig and search for the mineral." Gillett vs. Treganza, 6 *Wis.* 342. Therefore, *A* has no interest in ores mined by *B* after *A* has forfeited his rights according to the provisions of his lease or according to the usages and customs among miners.

Lessee's Fraud—Forfeiture of Rights

"Any miner who shall conceal or dispose of any ores or minerals for the purpose of defrauding his lessor of his rent or who shall neglect to pay any rent on ores or minerals raised by him for three days after the notice thereof and claim of such rent, shall forfeit all right to his mines, diggings or range; and his landlord, after such concealment or after three days have expired from the time of demanding rent, may proceed against him to recover possession of the mines or diggings before a justice of the peace as in the case of a tenant holding over after the termination of his lease as provided by these statutes; and in case a miner shall neglect to work his mines or diggings according to the usages of miners, without reasonable excuse, he shall likewise forfeit his mines or diggings and his landlord may proceed against him in like manner to recover possession of the same." *Wis. Stat.* 1860 *Sec.* 5 *ch.* 260 and 1872 *sec.* 4 *ch.* 117.

Right of Waterway

Sections 1650-53 of the Revised Statutes of Wisconsin grant the right to every corporation, company or person engaged in mining to conduct water away from their shafts or levels, over or below the surface of the land of adjoining landowners. Commissioners are to be appointed whenever the parties in dispute cannot agree as to damages. Appeal may be taken from decision of commissioners to the Circuit Court and land may be taken after the award has been allowed and filed.

Safety Restrictions

No laws regulating mining methods nor aiming to secure greater safety are in force in Wisconsin. A bill creating the office of mine inspector was introduced in the legislature at Madison four years ago, but failed to become a law.

General Provisions of Leases

There are only one or two instances where verbal leases are in force in Wisconsin at the present time. The ordinary written lease is permanent provided certain conditions are fulfilled by the lessee. The customary rent or royalty paid today in the Wisconsin zinc district is one-tenth of the gross receipts from ores mined. A few leases require one-ninth and a limited number require only one-twelfth. The usual rent paid for lead diggings in the early days was one-eighth; often, however, a provision was made to the effect that one-eighth rent be paid on ore found above water and one-tenth on that found below the water level. A few leases today require one-eighth rent to be paid on lead and one-tenth on zinc ore. Except in one or two instances the lessee pays the cost of hauling of ore to railway, ore buyers in this district usually purchasing the ore f.o.b. cars. It is the exception, rather than the rule, that a cash bonus is paid to landowners to obtain a lease. Most of the leases in force require the lessee to work at least four men nine months or more each year.

*Platteville, Wis.

According to the *Torg. Prom Gazetta*, there were 64 dredges at work in the Urals and the Yenisseik district, Russia, in 1908. Of these 25 were in the Urals. Fairly detailed reports have been received of the working of 46 of the dredges, the production of which was 52,467 oz. of gold.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machine

I have read with interest the recent articles in the JOURNAL under the above heading and note that the opinion seems to prevail that our present methods and machines either are not absolutely reliable or that mill men have not yet made sufficiently accurate experiments to teach them definitely whether the methods or machines or both are at fault.

The greatest inaccuracies are liable to occur in the coarsest sizes. The reasons for this are clearly stated by Mr. Church. (1) An inherent defect in all automatic, mechanical sampling machines treating mixed coarse and fine ore due to the fact that as the sampler scoop comes under the stream of ore a certain period of time ensues before there is sufficient opening, between the near side of the sampling scoop and the far side of the ore spout, for the coarse ore to pass into the scoop, and when the scoop is passing out of the ore stream the diminishing space between the far side of the scoop and the near side of the ore spout also prevents the coarse ore from entering the sampler, yet fine ore is passing into the scoop during the whole period; (2) the ore in sliding down chutes or passing through the samplers is retarded but this retardation is not the same on fines and coarse so that there is a tendency for the two to separate and introduce another error.

These two arguments seem logical and appear to prove that in sampling ores where the coarse and fine sizes are liable to carry different values, we cannot be certain that the sample obtained is representative of the lot of ore handled. The remedies so far proposed deal with the method of taking the sample, the frequency of cut and the proper handling between machines; but it seems to me that the greatest error is due to the construction of the sampling machines now on the market, and the discussion of a new design might lead to the result we are trying to obtain.

Some time ago I was called upon to design a concentrating plant for the separation of stibnite from a quartz and slate gangue. Owing to the greater brittleness and softness of the stibnite compared with the quartz, the fine ore had a much higher mineral content than the coarse material. The first crushing was to 2½ in. and the sampling would have to be done after this crushing. Realizing the inaccuracies which were liable to obtain with any of the samplers then on the market due to the first reason above mentioned I set out to design a new machine. My efforts resulted in a very simple machine. The idea is so simple that possibly it may have been used before but as far as I know it is original.

The machine consists of two endless sprocket chains carried on sprocket wheels. On these chains are carried one or more buckets attached to the chain as is usual on steel-pan conveyers. These buckets, which it should be remembered are few in number, can be dumped at any point by means of a tripper. On the return or under side of the conveyer the bucket is inverted so that material spilling from above could not enter and vitiate the sample. The buckets can be of sufficient capacity to suit the plant, but are made a little larger than necessary so as to prevent spilling. By varying the speed of travel of the chain and the number of buckets the proper frequency of cut can be obtained.

The travel of the buckets is in the same direction as the flow of the ore in the ore chute above it. The buckets are made wider than the ore chute to prevent the ore spilling. On the front of the bucket is a hinged lip extending the width of the bucket and ½ in. longer than the largest size. As the travel of the chain brings the bucket under the ore spout two flat guides engage the lip and force it down against the top of the bucket, putting two springs in compression and forming a cover over the front of the bucket for a distance of 3 in. in its length and its entire width. The guides stop at the end of the ore spout.

As the front of the bucket passes the end of the ore chute into the ore stream, the lip forms a flat extension of the bottom of the ore chute until released from the guides, when it is instantly forced into an almost vertical position and the stream of ore flows into the bucket. The lip helps to prevent spilling. It is readily apparent that both coarse and fine will be caught by the bucket in the same proportion as they existed in the ore stream. It is also apparent that as the bucket leaves the ore stream it will cut coarse and fine alike.

The sample is held compactly in the bucket and can be delivered into an ore bin by a very short spout. This would eliminate the distance the ore has to fall through such samples as the Vezin or Snyder, and the overturning of the bucket would mix coarse and fine so thoroughly that they could not separate in the short space to the ore bin or next crusher. The effect of retardation would, therefore, be of little importance.

This device need take up no more headroom than other samplers, would take no more power, has the advantage of cheaper first cost and the chain can be of any length desired, transporting the sample to any convenient place for further treatment. The device is not patented and I offer it for discussion.

D. F. HALEY.

West Gore, Hants Co., Nova Scotia.

Direct vs. Alternating Current for Mine Work

In the JOURNAL of March 6, 1909, there is an abstract of a paper on "The Use of Electricity as Applied to Coal Mining," by W. B. Spellmire, of the Allis-Chalmers Company, in which, among other matters, the question of direct *vs.* alternating currents for mining work is discussed. Mr. Spellmire appears to be of the opinion that alternating currents are to have it all their own way in mining work. I think there is considerable doubt as to that. It is quite true that for some time past three-phase alternating currents have been making steady way in mines, for two reasons: the absence of the commutator necessary with continuous-current motors, and the greater ease with which large quantities of power can be transmitted over long distances.

During the last 30 years, which really covers the period of the practical application of electricity to general commercial life, the alternating current has had a checkered career. During at least two important portions of that period, the alternating current has apparently been the form of electricity that was applicable to anything and everything, and then shortly afterward the alternating current has been in disgrace and risen again, Phœnix-like, a short time later.

I think the later and more important development of the use of alternating current is due to America and the great use that has been made there of very high pressures to deliver large quantities of power over long distances. On this side, when we installed electric trams many years after you had had them running, we followed your lead exactly in pressure and everything else. There are signs, however, that the continuous current may recover its position. M. Thury has been working

quietly at Geneva and has done much useful work with continuous currents at very high pressures. He has constructed a continuous-current machine to work at 25,000 volts.

M. Thury has returned to the arrangement that was suggested for long-distance transmission in the very early days of electricity, viz., the connecting of generators in series, instead of in parallel. In this method additional power is obtained when required by connecting additional machines in series. On light load under this system one generator, for example, will be running, and as more power is required, the single machine running may be speeded up until it is at its maximum. Then a second machine is switched *into* the circuit and adds its pressure, which again may be low at first and gradually increased as the demand for power increases. This may be followed by a third machine, and so on.

Consumption is supplied in exactly the same way, by switching motors *into* the circuit, instead of switching them *across* the circuit. The arrangement, of course, requires some knowledge and experience, but with the general spread of knowledge of electricity this should not be a serious matter. Any kind of power, for any purpose, can be obtained at any part of a mine, for instance, by switching in a motor and causing it to drive a generator that furnishes the current in the required form. Where the motor can be applied to perform the actual work itself it is switched in and the pressure it is taking regulated, instead of the current.

This arrangement has several important advantages. One is that it requires only two cables instead of three, as required with three-phase apparatus which constitute the greater number of alternating-current power plants. There is also avoided the troublesome conditions that arise with alternating currents owing to the development and changes of magnetism in the neighborhood of the cables. I think it would be at least as simple when once the arrangement is understood, to work in mines with continuous currents on these lines as with the parallel system.

I note also that Mr. Spellmire states that direct-current generators cannot be built to operate at higher than 600 volts. On this side continuous-current generators have already been built up to 3000 volts, and I think if a sufficient demand arose, with improved methods of manufacture, improved materials of insultation, etc., higher voltages could be obtained. The great trouble in producing either continuous-current generators, or continuous-current motors at high pressures is the insulation of the commutator. With high pressures the commutator assumes very large proportions and the insulation becomes a serious matter.

SYDNEY F. WALKER.

Bath, England, April 8, 1909.

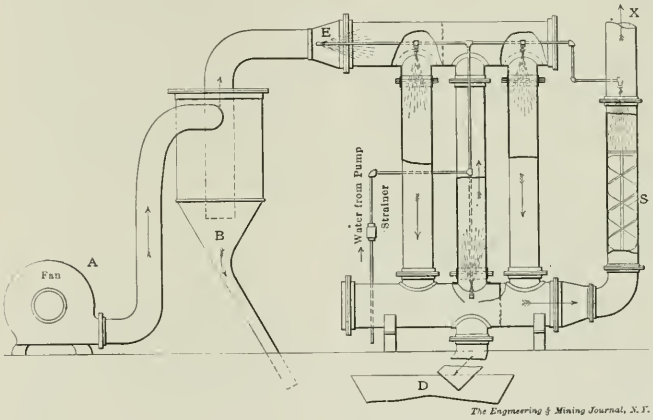
Collecting Precious Metal Dust

Various means have been devised for collecting or reclaiming the precious metal dust in mills where the ores are crushed dry and a description of the accompanying illustration may, therefore, be of interest to those engaged in this particular branch of metallurgical work. In the illustration, *A* represents one of the fans exhausting the dust from the mill or elsewhere, and discharging the same through pipes to the air separator *B*.

The heavier portion as it enters this separator drops to the bottom and then spouts to the proper machine for further treatment. The separator *B*, does its work satisfactorily as far as it goes, but only takes care of the coarser and heavier particles and without further apparatus much valuable dust would go to waste. The dust collected in *B* contains some of the richest portions of the ore, occasionally weighing as much as 135 lb. per cubic foot.

The dust collector proper is made of metals suitable to the requirements and is equipped with a number of spray nozzles of special construction through which water under about 50 pounds pressure is forced. The ore dust is forced in by the blower and enters at *E*. In passing up and down the different compartments it is moistened by the water discharged through the spray nozzles, which contain a spiral that gives the water a rotary motion. This has the effect that on entering, the water is thrown into a very fine spray which completely fills the different dust collector pipes in which nozzles are installed and as the dust passes through the spray, it is collected and drops to the bottom whence it is flushed to the sealed tank *D*.

When this material is to be subsequently concentrated on vanners or tables, sufficient water is added in the steel tank *D*, to make a wet pulp that will easily run to the table or vanner floor. To be sure that none of the valuable dust escapes with the surplus air at the outlet *X*, a sheet-iron spiral *S*, is installed as shown in the illustration. Above this spiral is also another spraying nozzle. These spray nozzles and dust collectors are manufactured by the Schutte & Koerting Company, of Philadelphia, Penn.



COLLECTOR FOR PRECIOUS METAL DUST

Coal Mining as an Investment

The editorial on "Coal Mining as an Investment" in the JOURNAL of March 27, 1909, was read with great pleasure because the public has been served with articles in the magazines, such as the *World's Work*, etc., warning them that a mining investment is purely speculative and, therefore, unsafe; that on investment that pays more than 5 or 6 per cent. per annum is a safe investment.

In a section like the South, where opportunities are many and capital scarce, the rate of interest paid by many legitimate and perfectly safe investments is much higher than 5 or 6 per cent., and the business of mining when properly conducted will pay at least 20 per cent. upon the investment.

It will not be long until even in this section coal land will be so high in price that it will be impossible to buy it without, in a large measure, discounting the future, but to those who have bought or will buy now the investment should be very attractive, and to those who undertake this problem in an intelligent way, namely, by obtaining competent advice and assistance, there need be no risk at all in the undertaking of mining coal.

E. M. JONES.

Chattanooga, Tenn., April 12, 1909.

Mining Conditions in Turkey

SPECIAL CORRESPONDENCE

The momentous political change that has recently taken place in Turkey invites attention to the mineral resources of that country, which, in spite of their acknowledged abundance, have in the past been but poorly exploited. Corrupt officialdom, unfavorable mining laws and the absence of roads have all contributed to prevent mining from becoming a prosperous industry. Except at mines situated near the coast, the necessary machinery for working could not be installed, owing to transport difficulties. The introduction of electrical machinery has been prohibited, except under very special circumstances, while the admission of explosives has always been a matter of the greatest difficulty and expense. Under these conditions it is not to be wondered at that capitalists have been shy of investing in mining undertakings.

Under the altered form of government reforms may be looked for which cannot fail to lead to a rapid development of the country's minerals. Regular and reliable statistics of the mineral production are unfortunately not available. In Cuinet's great work there is much valuable information, but the book is somewhat out of date. From time to time British consular reports have described the mines of certain districts. One of the most important of these is that published in 1903, entitled, "Mining Industries and Forestry in Turkey," which deals with the districts of Smyrna, Aleppo, Damascus, Beyrout and the Lebanon, Adana, Erzerum, Trebizond and Uskub. The general tone of these reports is pessimistic, and little encouragement is given to capitalists to take up mines, owing to the unfavorable conditions prevailing. As an example of these reports, that by Consul Barnham, upon the mines of the Aleppo Vilaget, may be quoted: "It is no grateful task," he says, to write of mines and mining operations in this district, for although the mineral wealth is great, I do not remember that any concession worth mentioning has even been granted. . . . . The minerals of which the locality is more or less defined are coal, iron, silver, copper, chrome ore, boracite, antimony, sulphur, fuller's earth and petroleum."

At one of the iron mines in his district the ore was carried on horseback, a day's journey, to be smelted at a place where timber was available, in spite of the fact that there was an occurrence of coal in the immediate neighborhood of the mine.

A Rich District

Another consular report, that by the British consul at Uskub in Macedonia, quoted in Noll Buxton's paper, "Balkan Geography and Balkan Railways," in the September number of the Royal Geographical Society's *Journal* of this year, is written in the same strain. He says: "The province of Kossovo possesses all the latent possibilities of very real prosperity, but political conditions at present frighten capitalists and paralyze industry. There are mines of every description in the province and the mineral wealth is said to be comparable with that of the Transvaal, but owing to the great difficulties of transport and the insecurity of the country, few mines have been exploited up to the present, but concessions are now being more eagerly sought after. Gold, silver, copper, iron, chrome ore, lead, antimony and manganese, besides coal (lignite) have all been found in considerable quantities and fresh discoveries of lodes are continually being made. A British company will this year start working a silver-lead mine near Kratova, which is believed to have very good prospects; it was worked by the ancient Greeks and is one of the mines mentioned by Herodotus. The chrome mines near Kalkandelen cannot yet enter into competition with the New Caledonian chrome mines, owing to the excessively costly transport of the mineral to the coast. Coal mines are plentiful, as at Kalkandelen, Prisren, Yeniky, etc., but the quality does not appear to be very satisfactory."

No Department of Mines

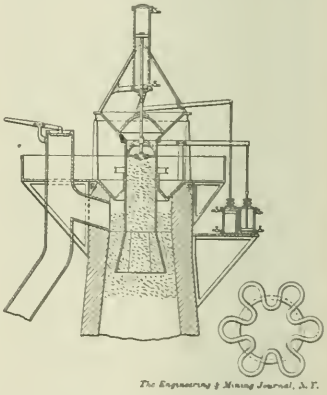
One reason for the general ignorance and uncertainty as to the extent of the mineral resources is that there is no government geological survey. That the country contains many valuable mineral deposits is, however, indisputable. There have been considerable exports of chrome iron ore, of emery and of borax, while antimony, copper, lead, coal and manganese have also been produced on a smaller scale. As regards the mining law, mining concessions are held either under an Imperial concession or *firman*, or under a prospecting license. The formalities necessary for obtaining a *firman* are very severe, and as it is only with this title that the rights to a mining property are secure, it is not surprising that capitalists have avoided the country.

A report by the German Consul General at Constantinople, published in the *Oestereichishe Monatschrift für der Orient*, May, 1905, "Das Minenwesen in der Turkei," contains some interesting criticism, mostly of an unfavorable character, on the mining law of Turkey, and gives reasons for the backward condition of the mining industry.

Whether the new regime will alter all this remains to be seen. There cannot, however, be any doubt that under a liberal and well administered mining law, capital for developing mineral property in Turkey would flow into the country to the great advantage of the national finances. Taking into consideration the urgent need there is of increased revenue, it seems scarcely possible that this most promising method of strengthening the finances will be neglected. A point in favor of the expansion of mining enterprise is the railway development that has taken place in recent times, both in European and Asiatic Turkey. The country is rapidly becoming more accessible and the work of exploration much simplified. Security of tenure and the removal of official obstruction are the principal needs of the country to encourage mining enterprise. What is required is the formation of a strong department of mines, with a competent staff of mining engineers; and what is now a neglected industry, may soon become of great commercial importance.

A Proposed Blast Furnace

Joseph E. Johnson, Longdale, Va., proposes (U. S. patent 906,717, Dec. 15, 1908) a blast furnace having at the top of the stack above the ore hopper a mantle



THE JOHNSON BLAST FURNACE

carrying a conical fuel hopper ending in a vertical cylindrical chute flaring at the bottom and designed to feed the coke or fuel separate from the stock and to have it descend in a column inside of that formed by the stock. Above the mantle and fuel hopper is mounted a steam cylinder with a pusher which fits into the cylindrical body of the fuel chute, and presses on the upper surface of the fuel. The lower portion of the fuel chute is a frustum of a fluted cone whereby the fuel is discharged in a column having flutes within the body of the ore or stock.

The *Queen. Gov. Min. Journ.* places the total gold output of New South Wales to the end of 1908 at 13,258,703 oz. fine. The yield recorded for 1908 was 223,702 ounces.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

CASTINGS—Mold for Making Castings of Aluminum and Aluminum Alloys. Earl Blough, Parnassus, Penn., assignor to Aluminum Company of America, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. Nos. 915,727 and 915,728; Mar. 23, 1909.)

COAL AND COKE

COAL-CUTTING MACHINES — Improvements in, or Relating to Chain Coal-Cutting Machines. Herbert Clough, Sheffield, and William C. Mountain, Gateshead, Eng. (Brit. No. 4966 of 1908.)

COKE—Improved Means for Preventing the Breakage of Coke Discharged from Coke-Ovens. Brodie Cochrane, Gosforth, and Robert Peel, New Brancepeth Colliery, Eng. (Brit. No. 19,280 of 1908.)

COKE-OVENS—Improvements in and Relating to the Building of Horizontal Flued Coke-Ovens. Arnold Lupton, London, and Thomas H. Riley, Sheffield, Eng. (Brit. No. 8926 of 1908.)

COKE-OVENS—Improvements in, or Connected with Charging Apparatus for Coke-Ovens. The Coke Ovens and By-Products Co., Ltd., and Stephen Newcombe, London. (Brit. No. 6224 of 1908.)

COKE-OVENS—Improvements in, or Connected with Coke-Ovens. The Coke Ovens and By-Products Company, Ltd., and Stephen N. Wellington, London. (Brit. No. 6047 of 1908.)

COKE-OVENS—Improvements in, or Connected With Coke Ovens. Harold W. Seymour, Leeds, Eng. (Brit. No. 1409 of 1908.)

COPPER

DESULPHURIZING—Apparatus for Desulphurizing and Sintering Ores. Arthur S. Dwight, Joliet, Ill., and Richard L. Lloyd, Cananea, Mexico, assignors to Fred Bennitt, trustee, Joliet, Ill. (U. S. No. 916,395; Mar. 23, 1909.)

ROASTING—Apparatus for Roasting and Sintering Ores. Arthur S. Dwight, Joliet, Ill., and Richard L. Lloyd, New York, N. Y., assignors to Fred Bennitt, trustee, Joliet, Ill. (U. S. No. 916,394; Mar. 23, 1909.)

ROASTING—Process of Roasting and Sintering Ore. Arthur S. Dwight, Joliet, Ill., assignor to Fred Bennitt, trustee, Joliet, Ill. (U. S. Nos. 916,396 and 916,397; Mar. 23, 1909.)

GOLD AND SILVER

CYANIDATION — Improvements in Apparatus for Separating Cyanide, Alkaline and Other Solutions from Slimes, Sands and the Like. Communicated from Innes, Proctor & Hayles, Tarkwa, Gold Coast, West Africa. (Brit. No. 11,008 of 1908.)

PLACER MINING—Apparatus for Mining Gold at the Bottoms of Flowing Streams. Leander F. Gilman, Sacramento, Cal. (U. S. No. 916,859; Mar. 30, 1909.)

IRON AND STEEL

DRY-AIR BLAST—Improvements in Drying Blast for Metallurgical Furnaces. Frank W. Harbord, London. (Brit. No. 4424 of 1908.)

HARDENING AND TEMPERING—Composition of Matter to be Employed for Hardening and Tempering Steel. Barnabas J. Casterline, San Diego, Cal. (Brit. No. 3652 of 1908.)

HARDENING AND TEMPERING—Process of Hardening and Tempering Steel. Barnabas J. Casterline, San Diego, Cal. (Brit. No. 3651 of 1908.)

MANUFACTURE—Direct Process of Manufacturing Iron and Steel. Thomas J. Heskett, Brunswick, and Montague Moore, Melbourne, Victoria, Australia. (U. S. No. 917,475; Apr. 6, 1909.)

TIN

DETINNING — Process for Preparing, Smelting and Utilizing Various Products Containing Tin, Particularly the Metallic Sponge and Slime Obtained in the Electrolytic Removal of Tin from Tinplate Scrap. Hans Rennicke, Rhelnau, Germany. (Brit. No. 16,428 of 1908.)

MINING—GENERAL

BLASTING—Improvements in and Relating to Blasting Fuses with Double Action. Jean Harle, Rouen, France. (Brit. No. 16,774 of 1908.)

COMPRESSING AIR—A New or Improved System of and Improvements in, or Connected with Means for Compressing Air for Use in Subterranean Mines. Samuel M. Mavor, Mile-End, Glasgow, Scotland. (Brit. No. 3038 of 1908.)

COMPRESSING AIR—Method or Process of Compressing Air. William K. Richardson, Leavenworth, Kans. (U. S. No. 916,019; Mar. 23, 1909.)

HAULAGE—Improvements Relating to the Electrical Operation of Haulage and Winding Gear. Henry A. Mavor and Mavor & Coulson, Ltd., Mile-End, Glasgow, Scotland. (Brit. No. 1450 of 1908.)

RESCUE WORK—Improvements in Means Adapted for the Assistance of Miners Entombed in Cases of Disaster in Coal Pits, Mines and Subterranean Passages. John S. Hastie, London. (Brit. No. 6496 of 1908.)

ORE DRESSING

CONCENTRATOR — Mineral-Concentrator. Charles O. Michaelsen, Omaha, Neb. (U. S. No. 917,337; April 6, 1909.)

CONCENTRATOR-TABLE SUPPORT. William L. Card and Frank S. Card, Denver, Colo. (U. S. No. 917,247; Apr. 6, 1909.)

CRUSHING—Improvements in Machines for Crushing or Disintegrating Ore and Other Substances. Frederick T. Watts, Bulawayo, Rhodesia, South Africa. (Brit. No. 12,676 of 1908.)

GRINDING MACHINERY—Improvements in Machinery for Grinding or Crushing Ore, Rock, Cement and the Like. David Honeywood and Garratt Payne, London. (Brit. No. 25,497 of 1907.)

GRINDING MACHINERY—Improvements in, or Relating to Grinding or Crushing Machinery. George Elliott and George Oxley & Sons, Sheffield, Eng. (Brit. No. 4607 of 1908.)

ORE-CONCENTRATOR. Samuel K. Behrend, Denver, Colo. (U. S. No. 916,257; Mar. 23, 1909.)

SEPARATION—Improvements in Means for Separating Comminuted Ores or Other Solid Matter from Liquids. Alexander J. Arbuckle, Belgravia, Transvaal. (Brit. No. 17,756 of 1908.)

SEPARATOR—Centrifugal Ore-Separator. Philip F. Peck, Chicago, Ill. (U. S. No. 917,120, 917,121, 917,122 and 917,123; Apr. 6, 1909.)

METALLURGY—GENERAL

CALCINING, DESULPHURIZING, AGGLOMERATING AND SINTERING ORES and the Like. Francis D. Weeks, Salida, Colo., assignor to Ohio and Colorado Smelting and Refining Company, New York, N. Y., a Corporation of Colorado. (U. S. No. 916,903; Mar. 30, 1909.)

MINING MACHINERY AND APPARATUS

AERIAL TRAMWAY. William S. La Shells, Berkeley, Cal., assignor to Klamath River Gold Mining Company, Benicia, Cal., a Corporation of California. (U. S. No. 916,335; Mar. 23, 1909.)

BLASTING — Electrical Shot-Firing Machine for Mines. Walter B. McLarty, Wilburton, Okla., assignor of one-half to Jeff T. Boucher, Wilburton, Okla. (U. S. No. 916,476; Mar. 30, 1909.)

BRAKING APPARATUS—Improved Construction of Apparatus for Braking or Spragging Mining Trams, Street Trams, Road and Other Vehicles. John A. Noel, Cardiff, Wales. (Brit. No. 23,155 of 1908.)

CONVEYERS—Improvements in Conveyers Specially Applicable for Transporting Coal or Other Minerals and Constructed With or Without Perforated Plates, Bars, or Grids, for Grading the Coal or Other Minerals. Cuthbert Burnett, Durham, Eng. (Brit. No. 7369 of 1908.)

MINE-CAR STOP — Automatic Mine-Car Stop. Uhel U. Carr, Pittsburg, Penn. (U. S. No. 917,540; Apr. 6, 1909.)

MINE-DOOR-OPERATING DEVICE. John M. Sausser, Osnaburg, Ohio. (U. S. No. 916,027; Mar. 23, 1909.)

PUMPS—Improvements in, or Relating to Centrifugal Pumps for Delivering Liquids. James T. Rossiter, Chiswick, Middlesex, Eng. (Brit. No. 24,499 of 1908.)

PUMPS—Improvements Relating to Rotary Pumps. Horace M. Hodgson, London and the Bryan Donkin Company, Ltd., Chesterfield, Eng. (Brit. No. 16,098 of 1908.)

ROCK-DRILL—Internal-Combustion Rock-Drill. Lewis L. Scott, Joplin, Mo. (U. S. No. 915,893; Mar. 23, 1909.)

SAFETY APPLIANCES—Improvements in Safety Appliances for Mines. Samuel G. Bennett, Chesterfield, Eng. (Brit. No. 2889 of 1908.)

SAFETY APPLIANCES—Improvements in Safety Appliances for Removing Mine Props. Reginald Higginbottom, Thurnscoe, and Owen Murphy, Goldthorpe, Eng. (Brit. No. 6539 of 1908.)

SAFETY LAMP—An Improved Miners' Safety Lamp. Harry B. Buckley, Batley, Eng. (Brit. No. 10,371 of 1908.)

SAFETY LAMPS—Improvements in, or Connected with Miners' Safety Lamps. Harry B. Buckley, Batley, Eng. (Brit. No. 10,372 of 1908.)

SAFETY LAMPS—Improvements in, or Relating to Brushes for Cleaning the Gauzes of Miners' Safety Lamps. John C. Best, Morley, Eng. (Brit. No. 13,510 of 1908.)

SAFETY LAMPS—Novel or Improved Glasses for Miners' Safety Lamps. John T. Stobbs, Stoke-on-Trent, Eng. (Brit. No. 7546 of 1908.)

METALLURGICAL MACHINERY AND APPARATUS

FURNACES—Improvements in Furnaces. Marcus Ruthenburg, Lockport, N. Y. (Brit. No. 12,408 of 1908.)

METALLURGICAL FURNACES—Improvements in Metallurgical Furnaces. Louis S. Hughes, Joplin, Mo. (Brit. No. 16,521 of 1908.)

RABBLES—Improvements in Rabbles for Ore-Roasting Furnaces. Arthur V. Leggo, St. Kilda, Victoria, Aust. (Brit. No. 19,469 of 1908.)

RETORT-FURNACE — Improvements Pertaining to the Firing of Retort or Muffle Furnaces by Means of Producer Gas. Ernst Schmatolla, Berlin, S. W., Germany. (Brit. No. 10,155 of 1908.)

REVERBERATORY FURNACES—Improvements in, or Relating to Reverberatory and Like Furnaces. Communicated from Ernst Schmatolla, Berlin. (Brit. No. 3394 of 1908.)

REVERBERATORY FURNACES—Improvements in Reverberatory Smelting Furnaces. Alva D. Lee, Gila Bend, Ariz. (Brit. No. 11,259 of 1908.)

SMELTER—ORE-SMELTER. Ezra A. Mathers, Philadelphia, Penn., assignor of one-half to Daniel H. Harner, Philadelphia, Penn. (U. S. No. 916,176; Mar. 23, 1909.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Etienne A. Ritter is examining mining properties at Red Cliff, Colorado.

A. E. Drucker is making a study of the ore treatment in the Kolar goldfield, Mysore, India.

H. T. Pemberton, general manager of the Bartlett mines, Gowganda, has gone to New York.

James B. Davies has resigned his position as superintendent of the Plymouth Coal Company.

Henry Watson, chemist and metallurgist for Goldsmith Brothers Smelting and Refining Company, has gone to Europe.

Frederick H. Morley left Denver April 15, for Prescott, Ariz., to inspect mining property in the Bradshaw mountains.

George D. Reid, of Denver, Colo., is engaged in the examination of mining properties in the Seven Devils district of Idaho.

William Henry Keller, has opened an office in Charleston, W. Va., as consulting electrical engineer in mining practice and equipment.

John B. Hobson has returned to Victoria, B. C., after having spent the winter in California. He will shortly proceed to Cariboo.

John T. Fuller, general manager of the Arkansas Diamond Company, of Little Rock and Murfreesboro, Ark., is in New York, buying machinery.

D. W. Brunton, Denver, Colo., is now in New York City on business and will sail for Europe on April 24. He expects to be absent about six weeks.

J. W. Skeele, general sales agent of the Lehigh Valley Coal Company, has been elected vice-president of the company. He will continue in charge of the sales department.

James P. Walsh has been elected vice-president of the Pittsburg Coal Company, in place of W. R. Woodford, resigned. Mr. Walsh has been connected with the company since its organization.

D. C. Thomas has resigned his position as a district general superintendent of the Pittsburg Coal Company, and has been appointed general superintendent of the United Coal Company.

Dr. Milton L. Hersey, of Montreal, has returned from Germany, where he went in connection with the sampling of 100 tons of Crown Reserve silver ore purchased by the German government.

Ivan E. Goodwin has removed from Rapid City, S. D., to Seattle, Wash., where he has opened an office, in partnership with C. E. Bogardus, for testing ores and engineering materials.

Robert H. Engle, formerly with the Trenton Smelting and Refining Company, is now at 649 Hamilton avenue, Trenton, N. J., where he has opened an experimental laboratory.

J. A. Garcia has been appointed general superintendent of the Brazil Block Coal Company in charge of operating and engineering departments in Illinois, and the Clinton district of Indiana.

Theodore Gross has been appointed resident manager for the United States and Mexico, of the London Venture Corporation, Ltd., and will have his office in the City Investing building, 165 Broadway, New York.

Dr. W. F. King, Canadian astronomer and boundary commissioner, has left Ottawa, for Washington, to arrange with Dr. O. H. Teddman, American boundary commissioner, for the resumption of boundary survey work.

Horace G. Nichols, manager of the Ymir mine, British Columbia, has arranged to have his new slimes-treating process used in connection with the stamp mill being installed at the Jewel gold mine, Boundary district of British Columbia.

Paul S. Couldrey, who excepting during an interval spent in Western Australia, has been in charge since 1902 of the mines at Rossland, B. C., of Le Roi No. 2, Ltd., of London, has been notified by cable from London, that his services are required in another field.

Rector L. Lee, who has been in Peru during the last year, as assistant superintendent at the Peruvian Mining, Smelting and Refining Company's smelter, at Rio Blanco, has returned to the United States on account of the closing of that plant. His address will be Provo, Utah.

Obituary

George Nissen died suddenly in New York, April 15, aged 62 years. He was born in Hamburg, Germany, and came to New York in 1867. Since 1882 he had been connected with the metal trade in New York, for some years as an independent operator, and later as a member of the Pope Metals Company.

Amzi Lorenzo Barber died at Ardsley, N. Y., April 17, aged 64 years. Mr. Barber is best known for his work in starting and building up the asphalt industry in this country. At different times he operated largely in this country, in Trinidad and in Venezuela. At the time of his death he was president of the A. L. Barber Asphalt Company.

Societies and Technical Schools

Massachusetts Institute of Technology—On April 14 the Mining Engineering Society listened to a lecture on rescue work by W. E. Mingramm, of the Drager Oxygen Apparatus Company, of New York. It was practically illustrated by sets of apparatus.

Michigan College of Mines—The annual class-day exercises, closing the 23d year of the college, were held at the college gymnasium, Houghton, Mich., on April 13. The address was delivered by Isham Randolph, of Chicago, who took "Reminiscences of Forty Years of Engineering Service" as his subject.

Montana Society of Engineers—At the meeting in Butte, March 13, a letter from a member was read on "Mining Operations in Korea and China," giving a clear account of labor and financial conditions in those regions, and caused much discussion and comment. The letter was accompanied by many photographs.

American Electrochemical Society—At the annual meeting at Niagara Falls, May 6-8, the first day will be devoted to the electrometallurgy of iron and steel. Papers are expected from Robert Turnbull, Paul Girod, Dr. A. Kjellin, Ernesto Stassano, Remo Catanio, Ch. A. Keller, Gustav Gin, Henry D. Hibbard, F. A. J. Fitzgerald, P. McC. Bennie and Jos. W. Richards.

Salt Lake City Young Men's Christian Association—The Chemistry and Metallurgy class arranged this spring for a series of lectures by competent speakers. The list for April included the following: "Geology of Utah", by Fred J. Pack; "The Bingham Mines," by Louis Gates; "Park City Mines", by P. L. Williams, Jr.; "Milling and Concentrating." The May program is as follows: 4. "Copper Smelting", by E. P. Matthewson; 11. "Lead Smelting", by A. H. Richards; 18. "Mining Law", by Frank B. Stephens; 25. "Mining Stocks", by W. H. Tibbals.

American Society of Mechanical Engineers—The society will hold its spring meeting in Washington, May 4-7. Professional sessions will be held at which papers on the conveying of materials, gas-power engineering, steam turbines, the specific volume of saturated steam, oil-well pumping and various other subjects will be discussed. During the convention President Taft will hold a reception for the members at the White House. The War Department will give a special exhibition drill of the troops at Fort Myer. At the same time, if the conditions are favorable, an ascension of a dirigible balloon will be made and probably also that of an aëroplane. An address will be given by Rear-Admiral Melville, past-president of the society, and former engineer-in-chief of the navy, the subject being "The Engineer in the Navy." This address will be made the occasion for the presentation to the National Gallery of a portrait of Rear-Admiral Melville presented by friends and admirers. It will be received for the National Gallery by Dr. C. D Walcott, secretary of the Smithsonian Institution.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Goldfield, Toronto, Mexico, London, Johannesburg

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 16—Some legal tangles are developing in the sale of the Keane Wonder mine, Inyo county. The property was to be sold this week to satisfy a mortgage given to the Frances Mohawk Mining Company to secure a loan of $200,000. A suit has been filed by a stockholder charging the management with fraud and asking an accounting for the benefit of the stockholders and forbidding the foreclosure sale.

A suit is being tried in Shasta county to foreclose a mortgage on the Brunswick mine near French Gulch. B. F. Rossi, of that place sold the mine to H. D. Lacey, of New York for $60,000, of which $40,000 was paid in cash and a mortgage was given for the balance. Lacey resists the foreclosure of this mortgage, alleging that his agents, who bought the mine for him, charged $20,000 commission illegally. The case has not yet been decided.

Mining developments in Nevada county have been quite exciting of late, several properties showing up extremely rich ore. From the Central Consolidated, rich ore is being taken out at a depth of 400 ft. The channel in the Jenny Lind gravel mine has been cut and is found to be satisfactory. The Pittsburg Potosi-Gold Flat property is being opened near Nevada City and the old Nichols mine is being reopened. The old Ben Franklin mine is yielding good ore.

The Alaska mine at Pike City, Sierra county, is well known as the wettest quartz mine in the State. The mine has produced phenomenally rich ore at times, but again and again have the levels been flooded, and even when the men could work, it has been a difficult job to keep the water within bounds. Finally a great flood closed the mine for years.. About four years ago new people undertook to unwater the mine with new pumps, electric power, etc., and it was only last week that the job was entirely completed after many difficulties and interruptions. They have resumed sinking the shaft at a point about 30 ft. below the 440 level, which was the bottom when the mine was finally drained.

During the last month there was quite a boom in the Humbug district of Siskiyou county, four miles west of Yreka, where the richness of the ore in the Inyo mine first called special attention to the district. A hundred or more claims were located within a few weeks, and now comes the discovery that the railroad company owns most of the ground. Some of the claims located are on open ground, but railroad ownership of the rest of the section will prevent further locating of claims and further active development. There has been no deep mining done in that region, though a few mines have been yielding good ore. That from the Inyo claim is rich and is being sacked and shipped.

There is considerable activity at present in the section of the Argus range, Inyo county, below Wilson cañon. Rich gold strikes have been made near the towns of Custer and Monster, lying close together. Some of the ore is free-milling, but some will have to be smelted. The old mill from Wilson cañon is being taken in and will soon start up. In this camp there is plenty of water near the surface and timber is found within easy distance. There are now several hundred men in the district, and numbers of prospectors are going in.

Up in Plumas county a lot of miners are doing prospecting under difficulties. In the Brush creek section, sloping down to the north fork of the Feather river, about eight miles from Crescent, in Indian valley, a miner a short time since found rich specimen ore. He took some of it to Reno, Nev., where it was exhibited in a show window. This attracted so much attention that mining men in automobiles left for Plumas county and bonded the claims. Now a number of people are trying to locate claims on top of 12 ft. of snow.

Butte

April 16—President Anderson, of the Panhandle smelter, at Ponderay, now closed down as the result of action instituted against the company by the Greenough brothers, has recently given out a statement to the effect that the alleged over-issue of stock, which was the basis for the suit, is a mistake. President Anderson states that about 800,000 shares of the company's stock were sent on from Winnipeg, Canada, for transfer and new certificates were issued in lieu thereof, but by some misunderstanding the old stock was held by attorney E. C. MacDonald instead of being turned in for cancellation.

George W. Craddock has brought suit in the district court at Missoula against the Buffalo Mining Company for the sum of $134,500. The action is brought to recover the value of 134,500 shares of the company's stock of which plaintiff claims to be the owner. The plaintiff claims that the company refuses to issue the stock to him and he is suing for its market value.

The State railroad commission is now in session at Helena and has under consideration complaints of coal operators against the rates established by the railways in the State. The operators in the Bear creek district are the principal complainants, maintaining that the rates which they are compelled to pay prohibit them from competing with the operators in the Red Lodge district. The railroads have raised the point that the commission has no jurisdiction to establish joint rates and this phase of the situation may find its way into the courts, should the commission overrule this contention.

The Amalgamated Copper Company has recently declared a quarterly 50c. dividend, payable May 31, and the Boston & Montana company a quarterly dividend of $2 and $1 extra per share. Much interest has been manifested in the recent rise of quotations on the stock of the East Butte company. It is rumored that the company, through William A. Paine, has secured an option on 700,000 shares of the treasury stock of the Pittsmont Copper Company, and also an option on a large portion of the 300,000 shares now outstanding. The Pittsmont property, with its operating smelter and its ground developed to a depth of 1500 ft., would enable the East Butte Company to become a large producer.

Denver

April 16—In the Cripple Creek district the Vindicator Consolidated Gold Mining Company, whose dividends paid to date amount to $1,980,000, has decided to pass the next quarterly dividend owing to the fact that they have passed through a zone of unusually low-grade ore, and that a payment had to be made of nearly $12,000 in taxes. It is stated, however, that the ore is increasing in value again, and that the usual dividend will probably be paid next quarter. The report of the Doctor-Jack Pot Company gives the total receipts of the company at $42,824, and net profit over disbursements $33,003. The annual report of the Findley Consolidated Mining Company gives total receipts for the year at $188,868; net profits over disbursements, $37,403. It was stated that owing to the installation of improved mining machinery the cost of mining the ore was reduced from $14 to $9 per ton. The annual report of the Work company shows a total of $49,302 received, and an expenditure of $56,841, making a loss for the year ending March 31 of $7538. The Mary McKinney mine, under lease to the

Western Investment Company, is credited with a production in March of 25 cars of ore of a gross bullion value of $24,000.

The Portland Gold Mining Company has paid its second quarterly dividend for 1909 of 3c. per share, amounting to $90,000, making a total received by the stockholders to date of $8,317,080. News comes to hand that in prospecting the old workings at the 300 level of the Jerry Johnson, an orebody has been opened which for 30 ft. in width is being shipped as broken, the values running from $20 to $30 in carload lots, 12 cars having been sent out during the first half of April.

In Leadville, the Yak tunnel has penetrated the Fortune ground in South Evans gulch, and will soon pass the New Monarch and Cleveland shafts, and will drain the country adjoining it. It is stated that in the South Evans Gulch district there is great activity, and a number of properties are shipping; among them the Valley shaft is credited with a steady production of 40 tons of lead sulphides per diem, and the Favorite and Tenderfoot, south of Cleveland, are both shipping regularly. The greatest benefit that this tunnel enterprise will confer on Leadville and the mining interests of the State generally, is the draining of the Resurrection mine and the opening up of the immense low-grade orebodies which had to be abandoned some time ago.

Salt Lake City

April 17—The stock of the Utah Copper Company has recently been listed on the New York Stock Exchange. The annual report for the year ending Dec. 31, 1908, states the gross copper production for that year was 43,873,918 lb. The average price applying to sales of copper for the 18 months preceding was 13.2c., while the average cost per pound was 8.85c., this price being based upon the net pounds of copper resulting after smelter deductions and including all expenses of transportation, refining and disposition of metal. During the period covered by the report, $4,005,018 were spent on improvements at the Garfield mill and power plant.

Quarters are being prepared for the new Utah Stock and Mining Exchange in the Atlas block, and it is expected that the first call will be made before the end of the month. The following governing board has been announced: David Keith, president, David Evans, B. F. Grant, Ezra Thompson, Windsor V. Rice, J. D. Murdoch and F. J. Westcott, of Salt Lake; John P. Creer, of Payson, and Joseph Berry, of Provo.

The Alta district is to resume shipping this week. The roads are being cleared of snow and as soon as they are ready for steady hauling the Columbus Consolidated will send out a heavy tonnage from the big orebody recently discovered on the fourth level below the tunnel. Manager Jacobson states that this orebody will average 30 ft. in width and is believed from present development to be of shipping grade for over 200 feet.

Goldfield, Nevada

April 13—The production of the Goldfield mines for the week ending April 10 was as follows: Consolidated 3850 tons, valued at $173,250; Combination 630 tons, at $28,350; Florence 850 tons, at $21,250; handled by Western Ore Purchasing Company 850 tons, at $255,000; Nevada Reduction Company 750 tons, at $30,000; total production valued at $507,850.

Indianapolis

April 19—Representatives of the Rock Island Coal Company, have consummated a deal by which 30 coal mines and a large acreage of coal lands in Indiana and Illinois, separated by the Wabash river, are under its control.

The Dering merger, which was in the Rock Island interests, several weeks ago offered the Dering 14 mines and some others to the Steel Corporation, and the sale was about to be perfected when, it is said, H. C. Frick overruled his associates and declared the deal off. This led to the appointment of a receiver for the Dering company. The receiver, however, discovered that the Steel Corporation was withholding payment of $213,000 for coal sold to the Illinois Steel Company, which the court, during the past week, ordered the two steel companies to pay.

It is now predicted that, as a result of the deal just perfected for its land and mines, the Dering receivership will be dissolved. The deal includes the leasing of the Dering mines to the Brazil Block Coal Company on terms that will give better value to the Dering stock and bonds.

Jackson Dering has opened offices in the Old Colony building, Chicago, and will be in charge of the general business of the combine now controlled by the Rock Island people.

Toronto

April 17—The Board of Conciliation, appointed under the Lemieux act to adjust the differences between the Dominion Coal Company and its employees has reported to the Department of Labor at Ottawa. The difficulty is due to the existence of two rival labor organizations, the Provincial Workmen's Association, a purely Canadian body, and the United Mine Workers, an international organization. It was asserted by the employees, and admitted by the company, that it had discriminated against the members of the United Mine Workers, and refused to receive committees from that body. A majority report, signed by Judge Wallace, of Halifax, held that the company was justified in refusing to recognize international unionism, and could not be expected to deal with two unions at one time. The report goes fully into the question of international unionism, contending that the United Mine Workers are practically a foreign organization, as the bulk of its members and the principal executive officials are resident in the United States. It is urged that American labor difficulties might lead to complications in Canada. If, through labor troubles in United States, a market were opened up there for Nova Scotia coal, pressure would be brought to bear on the Nova Scotia miners to prevent the export of coal. Strong exception was taken to a provision of the constitution, under which the officials may, at any time order a suspension of work in any district, if it is considered in the interests of the union—a power which no foreign body should be able to exercise over the industrial interests of Nova Scotia. The coal company is, therefore, considered as fully justified in refusing to recognize a union that could exercise so dangerous a power.

Daniel McDougall, representing the employees on the board, submitted a minority report condemning the company for discriminating against and refusing to recognize the United Mine Workers union, insisting that it was not a foreign, but an international body, and urging its recognition by the company.

The effect of the investigation and the disagreement of the board will probably be to intensify rather than to reconcile the differences between the company and its workmen.

Mexico

April 16—It is generally believed that the Mexican government will back up the long proposed railroad projected from Gutierrez through Sombrerete and Chalchiutes to Durango. The road is very much needed by the mining camps in western Zacatecas. This road was projected by the Robert S. Towne interests a year ago. The National Railways (the merger) has authorized the expenditure of 12,000,000 pesos on improving the Central division and widening the Interoceanic between Mexico City and Vera Cruz to standard gage. The Mexican Southern, an English company, is completing the recently acquired Oaxaca-Taviche road and extending the Tlalacula branch from Oaxaca, also recently acquired, to Tula with the expressed intention of extending it to the Tehuantepec line. The Pan-American line from the Tehuantepec road along the coast to the Guatemalan boundary has recently passed to the control of the United Fruit Company interests, already owners of railroads and mines in Costa Rica and Guatamala. The Oaxaca Coal and Iron Company, concessionaires of coal and iron lands in southern Mexico, has a project for a railroad from Puebla to the Pacific and it is expected

that European capital will be secured to carry out the plan. An English syndicate is considering the proposed road from Comacho to the Mazapil copper district and then east to connect with the National line. This project has a guarantee from the state of Zacatecas. These railroads together with the other projects in northern Mexico, and the extensive Harriman extensions in Sonora and on the West Coast, promise to have a wide influence on the general business conditions of Mexico, and particularly to extend greatly the available fields for mining.

The Federal government is inquiring into the question of local support in the building of wagon roads and it is likely that some general policy to better the present deplorable condition in this regard will result. In many cases the local authorities not only do not contribute to the building of needed roads and their maintenance, but assert the right to collect a toll on such roads built by private interests. A notable State road has just been completed from the end of the Central line at Balsas, Guerrero, to Chilpancingo. This is over a rugged country and the new road is now opened for traffic. Automobiles will be used by the Oaxaca Coal and Iron Company to reach Tlaxalco, Oaxaca. The road is being repaired and the former two-days' trip on horseback will be cut to a few hours. Generally the transportation conditions of the country are improving, although slowly.

After lengthy negotiations, two of Col. W. C. Greene's standard enterprises have been acquired by a strong Canadian company headed by Dr. F. S. Pearson, of Toronto. They are the Sierra Madre and Pacific railroad running, southwest from Ciudad Juarez, to Nuevas Casas Grandes, and the Sierra Madre Land and Lumber Company, holding a vast tract of timber land in western Chihuahua. The Cole-Ryan interests were concerned in the railroad property by reason of a loan against it, and it was thought that for a time the property would fall to their hands. It is not given out on what terms the properties were acquired by the new owners. A bond issue of $3,000,000 is solicited in Scotland for extensions and improvements and it is announced that the new company will not only extend the Sierra Madre road to connect with the Chihuahua & Pacific and then to the Pacific coast, but will also be interested in the projected road from Chihuahua to Monclova, Coah. The name of the new company is the Mexico Northwestern Railway Company organized under the laws of Canada, capital $40,000,000.

London

April 15—The Palmarejo & Mexican Goldfields Company, Ltd., is raising fresh capital in order to erect a new mill and to carry on development work on lines laid down by E. T. McCarthy, who was recently called in to advise the directors. The old plant, which was giving a poor extraction, has been shut down. It is anticipated that with a modern plant the extraction can be raised from 62 to over 90 per cent., and that the costs can be cut down nearly one-half. The new expenditure required, according to Mr. McCarthy, is £116,000. A sum, however, exceeding this is to be raised, namely, £175,000 by the creation of 700,000 new shares at 5s. each from which it appears that the company has debts to liquidate.

Recent development work in the mine has been satisfactory and there is a large quantity of ore in sight, estimated at 1,435,000 tons containing on an average 18 oz. silver. It is estimated that ore worth 13 oz. of silver will yield a fair profit. It has been decided to erect the new mill on the Zapote site and not at Palmarejo, on account of the abundance of water at the former place. The arrival of the Kansas City & Orient railway within easy distance of the company's property will benefit its development and allow work to be started on some of the outlying mines upon which prospecting work has given promising results.

The report of the Anglo-French Exploration Company, Ltd., has been issued. This company is largely interested in the eastern section of the Witwatersrand goldfield and has benefited by the favorable developments of the district. The largest shareholdings of the company are in the East Rand Proprietary mines, the New Kleinfontein Company, and the Van Ryn Deep Company, all of which have recently appreciated in value. As evidence of the improved state of affairs in the mining industry of the Transvaal, it may be noticed that a valuation of the holdings of the company at the end of the year, together with the cash or equivalent of cash, showed a surplus over the paid-up capital of the company of about £333,000, as compared with a surplus of about £63,000 at the corresponding period of the previous year.

A dividend of 10 per cent. on the ordinary shares in addition to that on the preference shares was declared, and a balance of £42,475 was carried forward to this year. The directors have appointed Edward J. Way consulting engineer to the company to date from Oct. 1 last.

The report draws attention to the steady progress that has been made during the last two years and anticipates a large increase in the gold production and the profits in the future. The recent development work in the deepest mines has been most encouraging, and a considerable reduction in the cost of working through consolidation of mines and through the greater efficiency of labor has been secured, so that the anticipations of prosperity in the future seem justified. If there is a weak spot in the situation it is with regard to the adequate supply of native labor to meet the heavy demands that the opening of new mines and the extensions of old ones will make. But so far the natives have responded to an unexpected degree to the calls made and while this question is, no doubt, a factor upon which future expansion chiefly depends, there are at the present time no signs of a labor famine.

Johannesburg

The stope-drill competition, organized by the Chamber of Mines and the Transvaal government, has already been fruitful of promising results. The surface elimination trials commenced at the University College on Feb. 14, and nine types of machine have already been tested. The speed honors have so far fallen to a German hammer-drill, called the Westphalia, which is automatic and very light (65 lb., including its independent cradle). On actual drilling time, one test with this drill showed 4.996 in. per minute, and another 3.421 in. per minute, or on total time, 2.675 and 1.944 in., respectively. The Westphalia is not economical in air consumption, using 224 and 299 cu.ft. per foot drilled in the two tests, as compared with 193 cu.ft. by the Flottmann, another hammer-drill which did very good work. The average speed of the Flottmann was 4 in. per minute on drilling time, and 2.18 in. on total. These preliminary trials, to be followed in due course of time by the critical test of durability in mine work, have proved that a great mechanical advance has been made during the past year by the inventors and manufacturers of small drills. The Konomax, Waugh and Chersen, of which great things are expected, have not yet been tested.

The question of maintaining gold reserves, for the purpose of equalizing monthly output declarations, has already been discussed in the JOURNAL from different standpoints. The firm adopting the practice most freely has been the Wernher-Beit-Eckstein, so that the defense made by Lionel Phillips, head of the group in South Africa, in his presidential address before the Chamber of Mines, bears special significance. He claimed that the reserve was created "so that the declaration of a regular monthly return, based upon the value of ore reserves, according to assay plans, could be maintained. The practice of keeping reserve gold under such conditions is highly desirable, as it tends to present speculative fluctuations in the value of securities, which annoy the genuine investor; and it certainly shields directors from the unpleasant accusations incident upon rises and falls in market quotations." Mr. Phillips pointed out, however, that in large producers, drawing ore from a great many points, the yields average themselves, and that in future the retention of reserve gold may thus become less necessary.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

Southern Steel Company—This company's properties were sold at bankrupt sale at Birmingham, April 12. They were bought for $5,111,000 by W. W. Miller, of New York, acting for the reorganization committee. Notice was filed that the purchasers must care for pending litigation against the company.

Alaska

VALDEZ

Kennecott Mines—A snowslide occurred recently killing three men, among them being James Gray, a mining engineer, from England.

Copper River Railroad—Cordova is the center of much activity, as the railroad is open to the rapids on Copper river, and trains are carrying immense quantities of supplies to the front, which are being freighted up the river. River steamers made in Seattle and shipped knocked down have been shipped north for operation and will connect with the railroad.

Bonanza—The Morgan-Guggenheim syndicate, which controlled the Bonanza mine in Alaska under the name of Alaskan Copper and Coal Company has acquired minority holdings of H. O. Havemeyer estate, Norman Schulz and others. The Morgan-Guggenheim syndicate is now building the Copper River railroad in Alaska, which will reach this property.

Arizona

GILA COUNTY

Arizona Copper—A new floor is being placed in the concentrator preparatory to the installation of Deister tables.

Inspiration—Capitalization, $10,000,000; par value $10. Development work on Clipper, Caraval and Americus claims, 2300 ft. Property consists of 23 claims, or about 300 acres. Adjoins Miami on the west. A low-grade copper property, and ore is said to be ideal for concentrating. Wm. B. Thompson, president; Geo. E. Gunn, general manager, and Henry Krumb, consulting engineer.

Superior & Boston—The capital is to be increased from $2,000,000 to $2,500,000, par value $10; this is to add to the working capital, and pay for the Collins-Doyle group of claims.

Eureka—At the 600 level a crosscut encountered 10 ft. of good copper ore.

GRAHAM COUNTY

Shannon—The Greenlee group of claims is to be worked under option by the Shannon company.

PIMA COUNTY

Helvetia—C. C. Prindle, president, states that the daily shipments to Globe are 50 tons of 5-per cent. copper ore.

PINAL COUNTY

Imperial—About 800 tons of ore are being shipped daily to the Southern Arizona Smelting Company.

Arkansas

PKIE COUNTY

Arkansas Diamond Company—The property is near Murfreesboro. Fifteen men are employed in proving the ground. An experimental plant will be installed to handle 150 loads of ore per day. Orders are being placed for machinery and a large plant will be erected within the next 12 months.

California

AMADOR COUNTY

Eclipse Extension and Last Chance—Sold by the sheriff for delinquent taxes to A. V. Mandenhall, of Oakland.

BUTTE COUNTY

Butte Creek Consolidated Dredging Company—The new dredge has been completed, the power line connected and work has commenced.

CALAVERAS COUNTY

Challenge Group—This group of mines, comprising the Wabash, Fraction and Challenge, near Mokelumne Hill, owned by Casey, Davidson & Robinson, is now to be developed. During assessment work a blind vein was discovered which carries good values.

Flour Sack—A rich pocket of gold-bearing quartz and "black metal" was encountered recently.

PLUMAS COUNTY

Northern California & Nevada Consolidated Mining Company—J. D. Murray, one of the owners, has made a discovery of high-grade ore in a wide vein. Preparations are being made to install the first unit of a large mill.

SHASTA COUNTY

The Yuba Construction company has launched the hull of a new dredge at Horsetown, 10 miles from Redding. There have been three dredges built at this place, two of which were burned and the third was taken apart to be rebuilt. The new dredge will shortly be put in operation.

Carnegie Mine Company—The Clipper group of copper mines, near Copley, has been sold to this San Francisco company. The group includes the Clipper, Old Judge, Little Blossom and Ridge mines in Backbone district.

Mammoth—The smeltery is running at full capacity, treating about 1700 tons of charge per day, and producing copper at the rate of about 30,000,000 lb. per annum.

SIERRA COUNTY

Sixteen-to-One—The ore continues to be abnormally rich. The extent of the pay shoot is still unknown. E. H. Wilson is manager.

SISKIYOU COUNTY

At the Gardner & Weed four crews are at work in the upper and lower mines at Quartz Valley. Wright & Fletcher, of Oro Fino, are running their hydraulic mines full blast with an abundance of water.

Modoc—The recent find in this mine has attracted considerable attention to that part of the county. A number of the locations there are now being prospected.

TRINITY COUNTY

Headlight—This old mine, near Trinity Center, has been sold to New York men at a stated price of $100,000; a partial payment has been made.

Enterprise—An important strike is reported.

Oriole—A. L. Paulsen has purchased the remaining half interest in this mine, on Indian creek, he already owning the other half.

TUOLUMNE COUNTY

U. S. Grant—Walter Cole is superintendent. A 1000-ft. tunnel is being run to tap the vein.

App—One of the best shoots of ore ever found in this old mine at Quartz has been found on the 1300 level The ledge is about 13 ft. wide and some of it is specimen rock. The mine is owned by W. A. Nevills.

Black Oak—The mill at Soulsbyville, which has been running on old dumps, has been closed down temporarily. Good paying ore has recently been found in the

old workings which have been unwatered by S. A. Knapp and associates.

TULARE COUNTY

Green Butte—Development work is now going on in this copper property, two miles east of Portersville. Some ore will shortly be shipped to the Selby smelter.

YUBA COUNTY

Boston Consolidated—This company has been organized to work the claims on the Whittle place at Brown's Valley, adjoining the Dannenbroge and Pennsylvania mines. W. H. Allison, Charles Himes, C. L. Maseman and Louis Pierrat are the incorporators.

Colorado

LAKE COUNTY—LEADVILLE

New Monarch—The work of sinking and cutting stations on the Cleveland shaft is nearly completed. The stations are 9x12 ft., in one of which a pumping plant has been erected while the other will be used for unloading and hoisting. Regular shipments continue from the Winnie shaft.

Carbonate Hill—During the winter months, the Morning and Evening Stars and the Waterloo were the most active producers. The Yankee Doodle, Big Chief and Excelsior will soon begin active operations, work already being in progress on the Pyrennes property.

Sugar Loaf—The success which the Dinero and Bartlett tunnels have attained has marked the Sugar Loaf district as one of the most promising sections. Both of these properties are ore-producing. As soon as the weather permits work will be resumed on several other properties in this locality.

Coronado—Regular shipments of a good grade of iron ore are being made from the new portions of the Coronado property. A large body of this ore is in sight, and it contains a fair amount of silver.

Favorite—This property in the South Evans district is at present undergoing extensive development work, and shipments will soon be renewed.

Volley—A good grade of lead ore is being taken from this shaft. The gold content in the ore makes this locality practically independent of a fluctuating metal market. The drainage facilities afforded by the Yak tunnel promise to make the South Evans gulch one of the most active sections of the Leadville district.

OURAY COUNTY

Camp Bird—A strike of high-grade ore was recently made on this property, a 3-ft. vein being cut that was officially reported as assaying between $200 and $300 per ton.

TELLER COUNTY

Work—At the recent annual meeting the following directors were elected: J. A. Connell, Marion Stark, W. R. Watterton, E. E. Quentin and H. C. Hall. The mine is being operated by leasers. The company owns the Little Clara claim which some months ago produced a large amount of ore. Marion Stark, of Colorado Springs, is manager of the property.

Gold Dollar Consolidated—A dividend of ½c. per share amounting to $12,500, has been declared. The mine is under lease to the Union Leasing Company, which is shipping a large amount of ore. The property is situated on the east slope of Beacon hill.

Idaho

SHOSHONE COUNTY

Ajax—Lead carbonate and galena deposits were encountered recently.

Indiana

CLAY COUNTY

The joint meeting of the miners and operators of the Block coalfield was held April 15. The meeting adjourned to a future date without accomplishing much. There are a number of matters of considerable importance to be settled. The charge against several mine bosses with having sold rooms to miners is one of the things causing trouble. The feeling against the foreigners is strong because it is claimed they have been favored by the bosses in the distribution of the work. President Morganthaler, of the miners' union, has called out the men in the Mary mine of the Otto Creek Coal Company, where trouble arose over installing machines.

GREENE COUNTY

Black Hawk Coal Company—This company's operations at Jasonville have been resumed after a three months shut down during which time repairs and improvements were made. The company announces that the orders received and booked are sufficient to keep the mine running for a year.

Shirley Hill—Mine No. 1, near Linton, has closed down until the demand for coal gets better. This mine has been worked more than any other mine in the Linton district for the past year.

VANDERBURG COUNTY

Coroner Laval has returned a verdict in the case of the mine explosion at the Sunnyside mine on March 20, in which six miners lost their lives. The coroner held that the explosion was caused by a "windy" or "illegal" shot. This, with coal gas and dust blown into the air was responsible for the loss of life.

Speck Mining Company—This company composed of 100 citizens of Evansville, has elected the following officers: President, Philip Speck; secretary-treasurer, William Swarmstedt; directors Peter Walrath; J. S. Beeler, M. M. Hags; M. L. Buckley and H. W. Flentke. The capitalization is $1,000,000.

VERMILLION COUNTY

The Dering mines in the Clinton field have been at work steadily this week whereas they had worked very irregularly before the change in management. The outlook in the Clinton field for steady operation at all the mines is regarded as the brightest in two years. There are three companies in this field—the Brazil Block, the Oak Hill and the Clinton Coal companies. The Clinton company operates three Crown Hill mines, employing 800 men, and none of these mines has been idle more than five days since last December. This company has recently bought large tracts of coal land adjoining the present holdings, and plans are being made to sink one or two new shafts soon. The Oak Hill company has let a contract to Charles Walter & Co., to sink one of its mines to the third or lower vein. The mines of this company have been operated a little over half-time. The Derings have six mines in operation in this field.

Louisiana

The Standard Oil Company, of Louisiana has been granted a charter in Louisiana with a capital of $5,000,000. It will construct a $2,000,000 refinery and run pipe-lines from Louisiana and Texas and compete with the Guffey Company in shiping southern oil north.

Maryland

ALLEGANY COUNTY

Consolidation Coal Company—At Ocean mine No. 2 recently, 17 cars broke loose from a trip which was being hauled up the slope. The cars jumped the track and knocked out several sets of timbers, causing a bad cave, which blocked the slope for several days.

Michigan

COPPER

Elm River—Crosscutting continues both ways from the bottom of the exploratory shaft, at a depth of 200 ft. from the surface. Some copper-bearing formations have been exposed, but nothing of a commercial value.

Oneca—Preparations are being made to begin diamond-drill operations as soon as the weather conditions will permit. Drilling will be started on line with the strike recently made at the New Baltic property.

New Baltic—Two drilling outfits are being erected to put down a series of holes. Trenching has been temporarily suspended, due to the spring breakup, and will be resumed as soon as the surface water disappears. A favorable-looking

formation was opened recently and is believed to be the northern extension of the Baltic lode.

Franklin—Report for the year ending Dec. 31, 1908, shows: Assets, $420,754; liabilities, $127,698; balance of assets, $293,056. Surplus, $192,261, as compared with a deficit of $42,180 for 1907. Rock stamped, 342,596 tons; refined copper per ton of rock stamped, 10.82 lb.; refined copper produced, 3,703,421 lb. Total cost per ton of rock stamped, $1.573.

Mohawk—Report for year ending Dec. 31, 1908, shows total working expenses at the mine including smelting, freight and general expenses, $1,085,590; construction, $21,796; mining profit, $298,574. Total assets, $712,332; liabilities, $127,732. Rock stamped, 685,823 tons; refined copper produced, 10,295,881 lb.; yield, 15.01 lb. per ton of rock; cost per pound of refined copper, 9.605c. at the mine; smelting, etc., 0.938c. per lb. Total cost, 10.543c. per pound.

IRON—MARQUETTE RANGE

Ohio—This mine, owned by the Buffalo & Susquehanna Company, was the first mine on the range to begin shipments this season. A cargo was shipped to the Marquette docks last week.

IRON—MENOMINEE RANGE

Calumet—Work has been suspended for the present, and the men have been transferred elsewhere.

Dober—Arrangements have been made for increased shipments this season. This is an Oliver Iron Company mine, in the Stambaugh district.

Verona—A number of men are employed in exploration and several bodies of ore have been found.

Victoria—M. A. Hanna & Co., of Cleveland, have acquired this mine from the International Harvester Company. The property is to be opened and thoroughly tested.

Minnesota

IRON—MESABI RANGE

Canisteo—At this mine, on the western end of the range, progress is being made with the large washing and concentrating plant. The plant is near Trout lake and will handle ore from the Holman and Walker as well as the Canisteo. At the last-named mine stripping is being done.

Hull-Rust—The work of stripping on this mine near Hibbing is making steady progress. It is claimed that the orebody already proved is the largest on the range.

Lincoln—Work for the season is well started on this mine at Virginia, owned by the Jones & Laughlin Steel Company.

Longyear Lake—This mine, owned by the Euclid Iron Company, is in the Chisholm district. It is operated partly by shaft and partly by open pit.

Silver—M. A. Hanna & Co., owners, have the stripping well advanced, and so much of the orebody is uncovered that large shipments will be made this season.

IRON—VERMILION RANGE

Section 30—This mine near Ely is now in the hands of George A. St. Clair, of Duluth, and operations will be resumed to test its value. There are two shafts, one down 300 ft. and the other 700 ft. Both are to be sunk deeper.

Montana

BUTTE DISTRICT

Butte Coalition—The Rarus and Tramway mines are steadily increasing their output and have recently shipped as high as 1700 tons a day. The great amount of development work which has been carried on in the Tramway and Minnie Healy mines for the past year has reached a stage where the orebodies are now ready for working and it is expected that there will be a gradual increase in production from now on. The Tramway shaft has passed the 1700-ft. mark and a crosscut is now being driven from the Rarus to connect the two mines at that depth.

Nevada

ESMERALDA COUNTY

Goldfield Consolidated—A large orebody was encountered last week on the Lucky Boy claim assays from which average $75 per ton across its entire width of 10 ft. The ore was encountered in a drift on the 300-ft. level of the Red Top company workings. Shipments from the Hampton stope were resumed on April 14 at the rate of one carload per day.

ESMERALDA COUNTY—BLAIR

Nevada Bay State Oil Company—The drill is now working at a depth of about 950 ft. A stratum of black sand heavily impregnated with oil was encountered at 915 ft., but the formation directly beneath was so hard that operations were suspended pending the arrival of heavier casing.

ESMERALDA COUNTY—BONNIE CLARE

Bonnie Clare Mining and Milling Company—This company has undergone a reorganization, and plans are being made to again operate the property.

ESMERALDA COUNTY—RAWHIDE

Rawhide Queen and Coalition Estates—Malcolm Macdonald and his assistants expect to complete the examination of these properties next week.

NYE COUNTY—BULLFROG

Diamond Queen—A 30-ton shipment was made from the Culver-Hargrave lease last week which was settled for at the rate of $95 per ton. The company is at present driving a crosscut from the 100-ft. level of the new shaft to tap the orebody 75 ft. distant.

Montgomery Shoshone—This property shipped 15,000 oz. of bullion April 6, making a total production for March of 29,000 ounces.

Aurora Bullfrog—Ore that assays $20 per ton was encountered in the shaft. A station will be cut at the 300-ft. level and laterals run to pick up the vein at that depth.

NYE COUNTY—PIONEER

Bullfrog Pioneer Leasing Company—Ore running from $12 to $15 per ton was encountered in what is known as the Office tunnel, 500 ft. from the main shaft. The ore bins at Springdale, the railroad shipping point, are now completed, and with the new hoist in commission a production of 100 tons per day will be attempted.

Rickard Lease—The new 25-h.p. hoist was placed in commission last week, and the three-drill compressor will be in operation by the middle of the month. Good pannings are reported in the bottom of the shaft, now 75 ft. deep. Work will continue in the shaft at the rate of 4 ft. per day.

Mayflower—Favorable reports come from both the mine and mill. Four power drills are being added to the underground equipment. A system of development work has been adopted which will take six to eight months to carry through. The property has been surveyed and divided into lease blocks.

NYE COUNTY—JOHNNIE

Johnnie Consolidated—The output for March was $16,000. The showing on the 700-ft. level is reported as better than anything heretofore found on the property, one shoot of ore being 18 ft. wide.

NYE COUNTY—TONOPAH

Tonopah Extension—A continuation of the work on the 400- and 700-ft. levels is the only development work going on in this property at present. The west drift on the South vein shows a decided improvement and bunches of good ore are exposed in the breast. The work now being performed is the blocking out of a large tonnage to be available on completion of the mill.

MacNamara—The shaft was sunk 28 ft. during the past week, being now 606 ft. deep. Five feet of good milling ore are exposed on the 200-ft. level in the stope from the west drift. On the 275-ft. level, two stopes have been connected exposing an average width of 7 ft. of good ore for a distance of 50 ft. Shipments for the week amounted to 350 tons.

Midway—Work was resumed early last week after a shutdown of five days caused by an accident to the boiler. Several stringers of ore have been encountered on

the 635-ft. level, which are being drifted upon with encouraging results.

West End—A large amount of work is being done on the 200- and 400-ft. levels, and several good oreshoots have been opened. Two hundred tons of ore were shipped during the week.

WHITE PINE COUNTY

Cumberland-Ely—Production in March was 1,450,000 lb.; shipments, 1,636,171 lb. Recent figures are said to show a cost of production of 7.85c. per lb., delivered at New York, crediting railroad and smelter earnings against copper cost.

Nevada Consolidated—Production in March was 1,750,000 lb.; shipments, 2,168,088 lb. The net cost of copper delivered at New York is figured recently at 7.03c. per lb., crediting railroad and smelter earnings against copper cost. The Steptoe Valley smelting works now has three reverberatory furnaces in operation.

New Mexico

GRANT COUNTY

A strike of high-grade ore was made on the Ridgewood claim, about a mile and a half southeast of Sylvanite, and adjoining the Gold Hill property on the south. The strike was made practically at the surface. The rich streak is from 12 to 15 in. thick. Sylvanite has been quiet for the last few weeks, and this new find has created a good deal of excitement. About half a ton of this ore has been sacked for shipment, and men are to be put to work at once saving all the high-grade.

SOCORRO COUNTY

Billings Smelter—J. A. Lowe, manager of the Pan-American Federal Smelting and Refining Company, states that the old smelter will be remodeled and enlarged to 750 tons per day.

Oregon

JACKSON COUNTY

Cascade Coal—A bed of bituminous coal, reported to be of good size and quality, has been encountered in the Sunnyside mine on the Broadbent property, near Medford.

BAKER COUNTY

Humboldt—A mill is being erected by John Arthur, lessee of this property in the Mormon basin mining district.

Pine Creek—All the old claims are operating and several new placers have been opened up in the Burnt creek district.

Pennsylvania

ANTHRACITE COAL

North Mahanoy Colliery—All efforts to extinguish the fire which recently started in this colliery, near Pottsville, have failed. In order to prevent the fire from spreading to the adjoining St. Nicholas and Shenandoah collieries, it has been decided to wall up the workings and fill the mine with water. The colliery is owned by the Reading company.

South Dakota

LAWRENCE COUNTY

Elliptic—The development work is being watched with much interest on account of the exploration of the deep formations. It has installed an excellent new diamond-drilling equipment to replace that hitherto in use.

Globe and Gilt Edge Maid—On April 6 these mining properties were sold at sheriff's sale. The former mill is a metallurgical fiasco; the latter a dry crushing mill well situated to handle a large tonnage economically, though handicapped by a few constructional drawbacks and rather low-grade ore.

Tennessee

Tennessee Copper Company—Walter Lewisohn states that the contract with the United States Agricultural Corporation is now closed. The Tennessee Copper Company has already received $500,000 in cash, and will receive $1,000,000 before the end of July. The agreement between the Tennessee Copper Company and the United States Agricultural Corporation, whereby the latter acquires all the acid output of the former, stipulates payments as follows: $1,500,000 preferred stock of the Agricultural Corporation, of which $500,000 has already been paid in cash (the stock having not yet been issued), and of which $1,000,000 is to be paid Jan. 1, 1910; $825,000 in common stock, to be paid over to the Tennessee Copper Company upon issuance; $1,000,000 cash payable during May and July, this year; and $1,000,000 cash and $250,000 in preferred stock to reimburse the Tennessee Copper Company for improvements and additions to that extent made to the sulphuric plant.

Utah

BEAVER COUNTY

Majestic Mines—In the new silver-lead orebody on the 500-ft. level of the Harrington-Hickory, it is stated that the north drift is in about 60 ft. and the south drift about 30 ft., and as yet the walls have not been encountered. This is said to be the best showing of silver-lead ore that has been found on the property in recent years.

Moscow Bonanza—D. H. Ferguson, superintendent of the Cedar-Talisman, has taken a lease on this property adjoining the Burning Moscow.

Leonora—The tunnel is now in over 200 ft. in very promising territory. The tunnel is to develop a group of 11 claims in the Star district in the vicinity of the Cedar-Talisman, Mowitza, etc.

Beaver Carbonate—A large body of low-grade ore has been encountered on the 700-ft. level, about 100 ft. farther east than where the first ore was opened on this level. D. C. Williams is in charge of the mine.

Deer Trail—Development work has been in progress all winter on this property near Marysvale. A good grade of gold bearing ore has been opened up and numerous improvements are contemplated during the summer.

SALT LAKE COUNTY

Utah Copper Company—During March upward of 7000 tons of ore were milled per day, production being estimated at between 4,500,000 and 5,000,000 lb. of copper. This is the first month when the company has had all 12 sections of its Garfield mill in operation.

Boston Consolidated—During March, 10 of the 13 sections of the mill were in operation. Ore milled was 53,100 tons, producing 2750 tons of concentrates, containing 1,105,000 lb. of copper. The eleventh section will go into operation during April. The Porphyry mine in March produced about 300,000 lb. of copper.

United States Smelting, Refining and Mining Company—Internal difficulties in this company have been settled by the purchase of the stock of R. D. Evans, amounting to about 100,000 shares, which has been taken over by the Winslow faction. The transaction involved about 60,000 shares of common and 40,000 shares of preferred stock. The price is said to have been somewhat above the recent quotations.

Utah Consolidated—The report for the operations of 1908 shows that 248,215 tons of ore were treated, producing: copper, 10,648,243 lb.; silver, 265,284 oz.; gold, 23,440 oz. The net profits for the period are given at $326,312. The company carries a reserve for contingent liabilities of $452,435 and the profit and loss surplus is $1,256,952.

Washington

KITTITAS COUNTY

Skookum Copper—Construction work is progressing on the big concentrator in the Cle Elum district, and it is expected that this plant will be turning out concentrates by the middle of the summer.

OKANOGAN COUNTY

Gold Dust—A deposit of good copper ore was recently encountered on one of the lower levels.

Dry Gulch—E. M. Cammon has opened a 4-ft. vein of low-grade copper ore, three miles east of Oroville.

Canada

BRITISH COLUMBIA

Among recent company incorporations filed at Victoria are the following: The Slimes Treatment Company, Ltd., to ac-

quire the metallurgical patents granted Horace G. Nichols, of Ymir, B. C., for treating slimes or sands from which the valuable contents have been extracted by cyanide from gold and silver ores, and generally for recovering the solutions from pulp and extracting the solid contents from mill tailings. The Tyee-Swayne Copper Mines, Ltd., to acquire certain mineral claims adjoining Lynn creek, New Westminister mining division, B. C., and to have said claims mined and managed by the Tyee Copper Company, Ltd. The authorized capital of each company is $100,000.

BRITISH COLUMBIA—SLOCAN

Lucky Jim—Work has been resumed at this lead-zinc mine, situated on the Kaslo-Sandon railway line. Arrangements are being made to ship ore, much of which contains a large proportion of zinc.

Slocan Star—The Byron N. White Company has shipped some high-grade silver-lead ore from the Hidden Treasure claim of its Slocan Star group. The Consolidated Mining and Smelting Company of Canada, Ltd., opened a body of valuable ore on its Richmond-Eureka property, and its Eureka No. 5 tunnel has been driven through one corner of the Hidden Treasure claim, in ore all the way. The White Company is driving on the vein in its Slocan King claim at a depth on the dip of vein of 650 ft. below the above-mentioned ore shoot on the Eureka.

BRITISH COLUMBIA—SIMILKAMEEN

Daly Reduction Company—The spring thaw has caused water to flow in the flume from Twenty-mile creek, so power is available for the stamp mill at Hedley and the stamps are dropping again.

Golden Zone—A shaft is being sunk in good ore. This mine is in Hedley camp.

Yale Mining Company—Work has been resumed at the Nickel Plate mine, near Hedley, after the winter shut-down.

NOVA SCOTIA

Nova Scotia Steel and Coal Company—The bill now before the Nova Scotia legislature to enable this company to effect a financial reorganization, which provides for the redemption of the company's preferred stock at $120 per share, has been amended owing to the objections of the shareholders to being forced to accept that figure, leaving the holders of preferred stock at liberty to fix their own price.

ONTARIO—COBALT DISTRICT

Bailey—This company has cancelled the lease, under which the north half of the property has been worked by the Cobalt Central mines, from April 1, and will shortly begin diamond drilling on a large scale to prove several veins which look well on the surface. Arrangements are being made for the installation of a large plant and buildings to accommodate a larger force of men. Power will be obtained from Ragged Chutes on the Montreal river.

Beaver—The engine house was destroyed by fire on April 5. Operations were resumed, the company obtaining a supply of power by arrangement with the Temiskaming.

Cobalt Treasure—At a meeting on April 7, in Toronto, terms were arranged for an amalgamation between the Cobalt Treasure and the Paymaster; giving the consolidated company 63 acres and a capitalization of $2,000,000. A shaft is down on the property 110 ft. J. Trethewey is president and G. H. Schlund, Cobalt, secretary.

Alexandra—A vein encountered at the depth of 160 ft. as a narrow stringer has widened at the 170-ft. level and shows good silver contents. A new calcite vein 6 in. wide, has been found on the surface.

Ore Shipments—Shipments of ore from Cobalt for the week ended April 10 were: Crown Reserve, 118,340 lb.; Cobalt Central, 43,490; City of Cobalt, 109,000; Kerr Lake, 40,360; La Rose, 324,540; Nipissing, 128,880; O'Brien, 64,170; Right of Way, 283,000; Silver Queen, 62,865; Temiskaming, 120,000; total, 1,294,653 pounds.

YUKON TERRITORY

The new reduction plant of the Yukon District Gold Mining Company, Ltd., at Conrad, is in successful operation, and producing concentrates which are shipped to Tacoma.

Mexico

CHIHUAHUA

Alvarado—Boston capitalists are operating the mine under a 15-year lease. Plans are being made to handle 1000 tons per day.

DURANGO

Velardeña—One copper and three lead furnaces are in operation. Ore is accumulating, and another furnace will be blown in soon. There is a general improvement in the camp.

MEXICO—EL ORO

Esperanza—The last dividend makes the returns to shareholders 410 per cent. upon the capitalization of $2,250,000. Recent installations of machinery and improved mining methods have made this property more profitable than ever before.

El Oro—Report for March: Mill No. 1 ran 31 days, mill No. 2 ran 30 days; ore crushed, 26,331 tons, yielding $214,740; working expenses $118,490; expenditure on development $23,121; total $141,611; profit $73,129; profit on railway $4000; total profit $77,129; expenditure on permanent improvements $1000.

Mexico Mines—Report for March: Mill ran 23 days, crushed 6524 tons of ore, yielding $76,020; expenses $32,700; expenditure on development $8600; total $41,390; profit $34,630; expenditure on permanent improvements $1000.

OAXACA

Natividad—The differences between the two factions have been settled by a compromise. Dr. Carlos Fenelon has been chosen president in place of Antonio Allende.

Victoria-Tapada—Three carloads of boilers and supplies have arrived for the new mill.

SONORA

Creston-Colorado—Two hundred and fifty tons of ore per day are crushed. Since 1902 this property has paid its shareholders $3,387,000.

Africa

TRANSVAAL

The gold production in March is reported by cable at 608,000 oz. fine; an increase of 42,782 oz. over February, and of 33,509 oz. over March, 1908. The gain was due to the greater length of the month, the daily average having decreased from 20,186 oz. in February to 19,613 oz. in March. For the three months ended March 31 the total output was 1,677,160 oz. fine gold in 1908, and 1,788,331 oz.—or $36,964,802—in 1909; an increase of 111,171 oz., or 6.6 per cent.

Asia

INDIA—MYSORE

Kolar Goldfield—Gold production in March is reported at 46,284 oz. bullion, being 4125 oz. more than in February. For the three months ended March 31 the total was 135,869 oz. bullion in 1908, and 135,805 oz. in 1909; a decrease of 64 oz. only. The bullion reported this year was equal to $2,526,391, or 122,225 oz. fine gold.

Australia

NEW SOUTH WALES

Gold production in March was 7645 oz.; for the three months ended March 31 it was 55,752 oz., or $1,152,394 in value.

New Zealand

Gold exports in March were 41,485 oz. bullion in 1908 and 40,044 oz. in 1909; decrease, 1441 oz. Exports of silver, 89,038 oz. in 1908, and 204,008 oz. in 1909; increase, 114,970 oz. The gold bullion reported this year was equal to $809,307, or 39,154 oz. fine gold.

The Mines Department reports that gold exports in January were 59,072 oz. bullion in 1908, and 35,956 oz. in 1909; a decrease of 23,116 oz. The bullion reported this year was equal to $709,823, or 34,341 oz. fine gold. Exports of silver were 111,207 oz. in 1908, and 44,426 oz. in 1909; a decrease of 66,781 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 21—The coal trade in the East remains quiet as far as bituminous is concerned. The only marked incident is found in the fact that West Virginia mines are bidding more actively for business and low prices have been made for Pocahontas and New River coal, f.o.b. Newport News and Lambert's Point. It is said that there is to be a readjustment of rates on West Virginia and Pennsylvania coals.

The anthracite situation shows nothing new this week. The operators' committee, the appointment of which was noted last week, has made no report as yet, and probably will make none for several days. The miners have intimated their determination not to accept the terms offered by the operators, but it is quite possible that a change may come after the meeting which is to be held April 22. The situation is unchanged, but there are no indications that the operators will give way.

In the West, steam-coal trade continues to show a slight improvement, which is comparatively steady, although not marked. It is noticeable throughout Indiana and Illinois that while mines are restricting shipments for the present, they are preparing for a large trade. The opening of the Lake trade is temporarily held up by the controversy over rates to Lake ports. There were some fears of a strike on Lake vessels, owing to the insistence of the Lake Carriers' Association on the open shop; but it looks now as if this would not seriously interfere with shipments.

Lake Coal Rates—The different railroads concerned have anounced the following rates to Lake Erie ports on Lake coal, effective May 15. The rates are given in cents per ton, the third and fourth columns showing the differential, compared with the Pittsburg district, as a base:

	Rates Old.	Rates New.	Differential Old.	Differential New.
Pittsburg	88.00	88.00	.....	.....
Ohio	85.00	85.00	— 3.00	— 3.00
Fairmont, W. Va.	96.75	100.00	+ 8.75	+12.00
Kanawha, W. Va.	97.00	106.25	+ 9.00	+18.25
New River, W. Va.	113.00	121.25	+25.00	+33 25

Immediately after the publication of these rates a number of West Virginia operators applied to the United States district courts for West Virginia and secured a temporary injunction restraining the railroads from filing or enforcing the new rates, with April 23 fixed as the date for arguing the case.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 10, short tons:

	1908.	1909.	Changes.
Anthracite	1,451,137	1,404,832	D. 46,305
Bituminous	9,329,117	9,750,218	I. 421,101
Coke	1,970,634	2,749,239	I. 778,605
Total	12,750,888	13,904,289	I. 1,153,401

The total increase this year to date was 9 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, two months ended Feb. 28, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	3,118,618	661,092	3,779,710
Buff., Roch. & Pitts.	897,383	68,626	966,009
Buff. & Susqueh'na	263,853	48,023	311,876
Penn. lines, N. Y. C.	1,288,447	14,936	1,303,383
Pitts. & L. Erie	1,014,213	687,195	1,701,408
Norfolk & Western	1,836,520	428,914	2,265,434
Ches. & Ohio	1,883,543	75,007	1,958,550
Total	10,302,577	1,983,793	12,286,370
Total, 1908	9,527,201	1,222,594	10,749,795

Total increase this year, 1,536,575 tons, or 14.3 per cent. In addition the Baltimore & Ohio carried 154,302 tons anthracite in 1908, and 163,824 in 1909; increase, 9522 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, two months ended Feb. 28, short tons:

	1908.	1909.	Changes.
Hocking Valley	413,856	471,013	I. 57,157
Toledo & Ohio Cent.	176,082	174,988	D. 94
Baltimore & Ohio	293,984	172,327	D. 121,657
Wheeling & L. Erie	420,151	406,647	D. 13,504
Cleve., Lorain & Wh.	397,779	283,800	D. 113,979
Zanesville & Western	215,286	206,456	D. 8,830
Toledo Div., Pen. Co.	317,879	308,205	D. 9,674
L. Erie, Alliance & Wh.	190,226	177,751	D. 12,475
Marietta, Col. & Clev.	12,577	6,882	D. 5,695
Total	2,436,820	2,208,069	D. 228,751

The total decrease shown this year was 9.4 per cent.

Coastwise shipments of coal from leading Atlantic ports, two months ended Feb. 28, long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York	2,332,397	1,610,236	3,942,633	65.0
Philadelphia	274,750	690,443	965,193	16.9
Baltimore	28,429	536,707	565,136	9.3
Newp't News	.....	373,631	373,631	6.2
Norfolk	.....	217,312	217,312	3.6
Total	2,635,576	3,428,329	6,063,905	100.0
Total, 1908.	2,884,787	3,489,836	6,374,623	.....

Total decrease this year, 310,718 tons, or 4.9 per cent. New York includes all the New York harbor shipping points.

Coal shipments by water from Seattle and Tacoma, Wash., two months ended Feb. 28 were 112,654 tons in 1908, and 43,223 in 1909: a decrease of 69,431 tons.

Coal tonnage passing Lock No. 3 on the Monongahela river was 777,335 tons in February; for the two months ended Feb. 28 it was 1,705,739 tons.

Coal receipts at St. Louis, two months ended Feb. 28, were 1,339,952 tons in 1908, and 1,203,135 in 1909; decrease, 136,817 tons.

New York

Anthracite

April 21—Current trade continues steady and it is not at all affected by strike rumors. For prepared sizes business is good, many taking advantage of the April discount. No announcement has been made yet as to the discount in May, but something is expected daily. Steam sizes are still rather scarce.

Prices are $4.25 for lump and $4.50 for egg, stove and chestnut f.o.b. New York harbor points. For small steam sizes prices are nominally: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Advances are asked by commission merchants.

Bituminous

Trade on the Seaboard continues slow. Contracts are dragging and it looks as if a considerable number—much more than usual—would go over until after May 1. The trade has been rather demoralized in New England territory by offers of West Virginia coal at low prices and by reports as to the intentions of the new Virginian railway to cultivate Eastern trade. The far East, accordingly, seems to be holding back, although it is known that consumers' stocks are low.

Along the Sound, trade is only fair and orders are rather irregular. New York harbor is the same as it has been for some time, buyers apparently watching for chances to get cheap coal. Fair grades of steam coal can be had at $2.35@2.40 f.o.b. harbor points, and some speculative coal has sold as low as $2.20.

All-rail trade continues fair. Transportation is rather slow, although car supply is good; and there is some delay in tidewater deliveries.

In the Coastwise vessel market there is a temporary scarcity of boats, which is due to foggy and stormy weather holding vessels at Eastern ports. Rates from Philadelphia are unchanged. From New York cargoes have been taken at 60c. to points around Cape Cod, and 70c. to Lynn and Saco.

Birmingham

April 19—The coal market in Alabama shows no improvement. The production is about the same it has been for the past

four months. Coal miners complain as to the unsteady work. There have not been many mine workers leaving the district so far, the anticipation being that there is soon to be a change for the better. Coke ovens are doing well, as coke is being stacked up and there is a little better demand for the product. Coal quotations are down, but this has not proved much inducement in securing business.

Chicago

April 19—Quiet conditions of buying and selling continue in the coal market. Wholesalers and retailers alike are selling small lots, the weather conditions and the caution among consumers being dominant on the market. Fine coals continue to increase in demand and will grow in popularity as warm weather advances. Little demurrage coal is on the market.

Illinois and Indiana lump brings $1.75@2.25; run-of-mine, $1.65@1.75, and screenings, $1.40@1.60. There is some overshipment of the best grades of Illinois lump.

Eastern coals are in good condition generally, smokeless being free from demurrage evils and selling at $3.20@3.45 for lump and $3.05@3.15 for run-of-mine. Hocking Valley is in somewhat too plentiful supply, with prices 10 or 15c. under the $3@3.15 standard quotations. Youghiogheny at $3.15 for gas lump and Pittsburg No. 8 at $3.85, remain steady, though Pittsburg occasionally has demurrage troubles and consequent low sales.

Cleveland

April 20—The spring weather has stopped domestic coal-trade activity. Some Massillon coal is selling at $2.25@$2.30 for lump and $2.15 for run-of-mine, both at mines. Steam-coal sales are better than they have been, but without much improvement in prices, which may be quoted around $1.35 at mine for lump, $1.10 for run-of-mine, and 55@75c. for slack.

It does not appear likely that the attitude of the unions will interfere with Lake shipments. The controversy over the new rates from the mines will have some effect in delaying shipments.

Indianapolis

April 19—Master in Chancery Edward Daniels, in addition to offering for sale by virtue of a decree of the Federal Court on May 1, at Bloomfield, Ind., a large amount of mining property belonging to the Indiana Southern Coal Company, will also, on the same day, sell to the highest bidder at the court house in Sullivan, Ind., the following property belonging to the Southern Indiana Coal Company: The Gilmore, the Shelburn, the Alum Cave, the Forest Park, the Cummings, the Indiana Hocking, the Citizens, the Rainbow, the Bunker Hill, the Richmond, and the American mines, together with adjoining tracts of coal land and timber land. The proposed sale is creating much interest and the number of bidders promises to be large.

Pittsburg

April 20—Lake shipments are limited, as few of the large boats are ready to go into commission. The Hanna interests are sending out considerable tonnages and, as they are buyers of the surplus product of the Pittsburg-Buffalo Company, that concern is operating its mines almost to capacity. The railroad mines in the Pittsburg district are being operated at between 50 and 60 per cent., but all of the river mines are going. While efforts are being made to hold the price at $1.15 for mine-run coal at mine, the bulk of the sales during the past week have been at $1.10 and less. Slack is quoted at 55@60c. The rivers were navigable during the closing days of last week; some coal went to lower ports and a number of empty coal boats and barges were returned.

Connellsville Coke—There are no signs of improvement and ovens are being closed. Furnace coke has sold down to $1.40 for prompt shipment and foundry spot at $1.85; and it is possible that a lower price would be accepted. On contract foundry coke is quoted at around $2 and for second half, $2.10, could be done, although some producers are naming $2.25 as the minimum price for late shipments. On contract, furnace coke is quoted at $1.60@1.75, and it is understood these prices would be taken for delivery in the third quarter, but not for the entire second half.

The *Courier* gives the production for the week in both regions at 233,718 tons. The shipments amounted to 8679 cars as follows: To Pittsburg district, 3579; to points west of Pittsburg, 4358; to points east of Connellsville, 742 cars.

Foreign Coal Trade

British Coal—Exports of fuel from Great Britain, with coal sent abroad for the use of steamships in foreign trade, three months ended March 31, long tons:

	1908.	1909.	Changes.
Coal	14,211,160	13,914,097	D. 297,063
Coke	280,955	270,145	D. 10,810
Briquets	378,612	338,915	D. 39,697
Total exports	14,870,727	14,523,157	D. 347,570
Steamer coal	4,704,209	4,520,902	D. 183,307
Total	19,574,936	19,044,059	D. 530,877

The total decrease in coal sold for consumption beyond the limits of the United Kingdom was 2.7 per cent.

Welsh Coal Prices—Messrs. Hull, Blyth, & Co., London and Cardiff, report current prices of coal as follows, on April 10: Best Welsh steam, $3.54; seconds, $3.42; thirds, $3.30; dry coals, $3.48; best Monmouthshire, $3.12; seconds, $3.06; best small steam, $2.46; seconds, $2.16. All per long ton, f.o.b. shipping port.

German Coal Trade—Imports and exports of fuel in Germany, two months ended Feb. 28, metric tons:

Imports:	1908.	1909.	Changes.
Coal	1,357,177	1,136,541	D. 220,636
Brown coal	1,364,119	1,101,213	D. 262,906
Coke	84,163	100,223	I. 16,060
Briquets	31,439	30,606	D. 833
Exports.			
Coal	3,138,626	3,511,347	I. 372,721
Brown coal	4,043	4,553	I. 510
Coke	664,031	531,077	D. 132,954
Briquets	272,279	203,951	D. 68,328

Coke exports this year included 4716 tons to the United States.

German Coal Production—Coal production in German Empire, two months ended Feb. 28, metric tons:

	1908.	1909.	Changes.
Coal	25,221,866	23,562,253	D. 1,659,613
Brown coal	11,106,716	10,892,060	D. 214,656
Total mined	36,328,582	34,454,313	D. 1,874,269
Coke made	3,634,541	3,428,731	D. 205,810
Briquets made	2,936,120	2,876,673	D. 59,447

Of the briquets reported this year 2,263,870 tons were from brown coal, or lignite.

Iron Trade Review

New York, April 21—The iron and steel trades continue to improve and, though the gain is somewhat irregular, there is marked activity in several lines, while in others there is a perceptible advance. It is to be noted that at the annual meeting of the Steel Corporation yesterday, Judge Gary expressed himself hopefully and noted a considerable improvement over the December quarter.

Structural steel is the most active section of the market and large orders for bridges and buildings continue to be placed. Building material of all kinds is very active and the aggregate tonnage placed has been large. There has also been an active trade in bars. It is reported that prices have been cut to secure some large orders and that there is sharp competition for the business which is coming forward. Sheets also have been active, though not quite to the same extent as bars and structural steel; nevertheless a fair business has been done. The American Steel and Wire Company has announced a reduction of $2 per ton on wire and wire products. This was generally expected, but the cut is less than had been anticipated.

Rail orders are coming in slowly. There have been reports that a reduction in prices of steel rails was under discussion, but it is not possible to ascertain anything definite on this point. The Lackawanna Steel Company has taken a contract for 15,000 tons of rails for Cuba. The Grand Trunk Pacific has placed its large orders for rails in Canada, 22,000 going to the Algoma Steel Company at Sault Ste Marie and 15,000 tons to the Dominion Steel Company at Sydney.

In pig iron, sales in the West have not been large but an increasing quantity of foundry iron is reported taken in Eastern territory. There is also a better demand for basic pig. Southern iron has secured the majority of the foundry orders and the furnaces there being fairly well supplied with orders for the present, are holding prices a little more firmly.

United States Steel Corporation—At the annual meeting, April 19, the directors whose terms then expired were all re-elected as follows: William Edenborn, Henry C. Frick, William H. Moore, Norman B. Ream, James H. Reed, Charles Steel, P. A. B. Widener, Robert Winsor. Alfred Clifford was also chosen a director to succeed James Gayley, resigned.

Baltimore

April 20—Imports for the week included 21 tons spiegeleisen and 1125 tons ferromanganese from Great Britain; 13,150 tons manganese ore from India; 5150 tons iron ore from Cuba.

Birmingham

April 19—The pig-iron market condition in the Southern territory is looking up. The quotations are firm around $11.50 per ton, No. 2 foundry. If there is any iron being sold now under that price very little is being said about it. The shipments out of the district and the home melt require considerable iron and there is not a great accumulation. While no large sales have been made in the last few days there have been a few orders taken in and a number of inquiries received that give encouragement.

The steel plant of the Tennessee company, at Ensley, will produce something like 1000 tons of rails a day on an export order this week. Other orders are said to be in sight which means that there may be no necessity of shutting down the big plant.

The trustees of the Quinn Furnace Company, which owns a 75-ton charcoal furnace at Attalla, Ala., sold the property this week at public outcry. There were no incumbrances on it. The Shelby Iron Company has one furnace in operation making charcoal iron.

Chicago

April 19—Sales of pig iron are increasing, with the general betterment of business and the realization by melters that prices are not likely to go lower. But improvement is as yet spasmodic; it shows waves of activity and dullness. The best index of market conditions seems to lie in prices. Southern iron now holds firmly to $11; on some sales it is $11.50. Birmingham, these prices representing $15.35 and $15.85, Chicago, respectively. Occasionally a large purchase is made for current needs and those of the third or fourth quarters, but for the most part business continues to be of the small-lot, quick-delivery variety.

The average consumer of pig iron is having his confidence quietly restored. But he will not as yet invest heavily in the future. His needs as regards Northern iron are steady, but small, and Northern remains constant at $16.50@17. Lake Superior charcoal, with a steady demand and well-regulated supply, is firm at $19.50.

Sales of iron and steel products continue to show a fair increase. Coke is stationary, with light sales, the best Connellsville bringing $4.70@4.85, Chicago.

Philadelphia

April 21—Pennsylvania makers have begun to find customers for small lots of iron for early delivery. All efforts to secure long contracts have failed. Southern makers are evidently shading still farther; a number of recent orders here have gone South, two or three to Virginia furnaces. The local demand is perceptibly better, but the sales are small and for pressing requirements. Generally speaking, the tone of this market is better.

Steel Billets—The usual hand-to-mouth business is reported, with prices tending to a lower level.

Bars—Mill trade less active than a week ago. Stores report a moderate improvement in retail demand.

Sheets—The sheet mills have succeeded in gaining considerable business for early summer delivery, but at buyers' prices.

Pipes and Tubes—All kinds of pipe work are doing better.

Plates—The balance of uncompleted work at most mills is getting rather low. Local demands just at present cut a small figure.

Structural Material—A large amount of work has been placed in Pennsylvania mills, the bulk of business for Eastern construction requirements going to mills in the western end of the State. An improvement is noted within a week in demand for local building needs.

Scrap—Millmen and others have made purchases of heavy scrap. Foundries are making inquiries. Scrap dealers are feeling better.

Pittsburg

April 20—Favorable prospects are still indicated in the iron and steel trade by increasing orders for nearly all lines of finished products. These orders are for small tonnages, but the aggregate is large and production at a number of plants in the Pittsburg and surrounding districts has been greatly increased. The Carnegie Steel Company is operating more mills at its Homestead and Duquesne works than last week. New business in wire and wire products is still confined to small tonnages as the expected readjustment in prices by the American Steel and Wire Company has not been announced. In the meantime other producers are said to be seriously shading current quotations, particularly in nails. The National Tube Company continues to book new orders for merchant pipe and is running its plants in the Pittsburg district at around 80 per cent. Spang, Chalfant & Co. have taken an order for 20 miles of 12-in. pipe. As announced two weeks ago, the Republic Iron and Steel Company will build a large tube plant. Details were officially given out during the past few days. The works will be built by the Haselton Steel Company, which was formed by interests connected with the Republic company, and the pipe concern will be operated as a subsidiary company. Additional pipe mills are to be built by the Youngstown Sheet and Tube Company.

In tinplate contracts at current prices are being made for delivery all year, but in sheets present prices will not be accepted for delivery beyond July 1. Rail buying continues slow. Reports that a reduction in the price of steel rails is under consideration are not credited here.

The structural-steel trade is quiet owing to the great irregularity in prices. Some new business has been offered and rejected by fabricators on account of the extremely low rates named. There are several good contracts being held up because of the uncertainty regarding prices. Prices in plates and steel bars are weak, as considerable shading has been done lately. It is reported that the Steel Corporation took a large contract for plates from a concern that had been supplied by the Jones & Laughlin Steel Company by naming a low price. In retaliation, it is reported, the Jones & Laughlin company has been quoting steel bars $2 per ton under the established rate.

Pig Iron—No sales of any consequence have been made for over a week. Quotations, which are purely nominal, are as follows: Standard bessemer, $14.75@15; malleable bessemer, $14.50; basic, $14.25@14.50; No. 2 foundry, $14@14.25; gray forge, $13@13.25, all f.o.b. Valley furnaces.

Steel—There are reports of shading of the established price of $23, Pittsburg, on bessemer and open-hearth billets, but shipments are on sliding-scale contracts. Merchant-steel bars are quoted at 1.2c., but sales are being made at 1.1c., but not for delivery beyond July 1. Plates are still quoted at 1.3c., but this rate is not firmly maintained.

Sheets—The sheet market continues satisfactory, and prices are firm. It is not possible to contract beyond July 1 for sheets at present prices. Black sheets are quoted at 2.25c. on large tonnages, and 3.25 for galvanized, No. 28 gage.

Ferro-manganese—The market is stronger owing to a couple of large sales for delivery in the West. The latest quotation is $45 Pittsburg.

Foreign Iron Trade

German Iron and Steel Trade—Exports and imports of iron and steel and of machinery in Germany, two months ended Feb. 28, metric tons:

	Exports.	Imports.	Excess.
Iron and steel.....	556,903	59,368	Exp. 497,535
Machinery.....	46,087	6,852	Exp. 39,235
Total.....	602,990	66,220	Exp. 536,770
Total, 1908.....	609,604	93,653	Exp. 515,951

Decrease in exports this year, 6614 tons, or 1.1 per cent.; in imports, 27,433 tons, or 29.3 per cent. Imports of iron ore for the two months in 1909 were 1,050,580; exports, 438,749 tons. Imports of manganese ore, 48,373; exports, 370 tons.

German Steel Syndicate—Sales of the German Steel Syndicate for the two months ended Feb. 28 were 224,743 tons billets and other half-finished material; 325,928 railroad material; 256,156 shapes, plates, etc.; total, 806,827 metric tons, an increase of 3223 tons over last year.

Metal Market

New York, April 21—The metal markets generally show little change since our report of last week. Some improvement is noted, but it is of gradual nature.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1909..	$21,252,462	$ 5,161,648	Exp. $16,090,814
" 1908..	1,447,206	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,024	Imp. 13,437,021
Silver:			
Mar. 1909..	5,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,369	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,656	" 1,755,631

Exports from the port of New York, week ended April 17: Gold, $550,100, chiefly to Brazil; silver, $856,016, to London and Paris. Imports: Gold, $181,093; silver, $23,947, from Central and South America.

Foreign trade of the United States, three months ended March 31, as valued by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports.....	$ 515,459,899	$ 421,967,296
Imports.....	258,863,772	355,649,324
Excess, exports.....	$ 256,596,127	$ 66,317,972
Add excess of exports, silver.....		4,020,712
Add excess of exports, gold.....		25,820,357
Total export balance.....		$ 96,159,041

The gold and silver movement is given in the table at the head of this column.

Gold—The price of gold in the open market in London was unchanged at the usual level. The Bank of France, after a suspension of buying for several weeks, this week took all the Transvaal gold arriving. In New York $250,000 were taken for export to Amsterdam and $500,000 for Brazil.

Platinum—Dealers' prices are unchanged at $23@24 per oz. for refined platinum; $26 for hard metal and $19@21 for scrap. Business is improving a little and sales are much better than at this time last year.

Silver—Owing to China and speculative buying silver has had quite a sharp advance. While the buying has not been aggressive, it is estimated up to the present time for the year shipments of over £925,000 have been consigned to China; and it is worth while noting that this amount in 3½ months is larger than the total shipment to China in 12 months of any year since 1900.

SILVER AND STERLING EXCHANGE

Apr.	15	16	17	19	20	21
New York....	51 1/8	50 7/8	51 3/8	51 1/8	51 1/8	51 7/8
London.. ...	23 7/16	23 7/16	23 5/8	23 9/16	23 11/16	23 7/8
Sterling Ex..	4.8770	4.8770	4.8770	4.8775	4.8770	4.8765

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 7:

	1908.	1909.	Changes.
India.... ...	£ 2,136,538	£1,159,600	D. £ 985,938
China.....	501,400	925,600	I. 424,200
Straits.....	78,270	82,800	I. 4,530
Total.....	£ 2,716,208	£2,159,000	D. £ 557,208

Imports for the week, £4000 from the West Indies and £110,000 from New York; £114,000 in all. Exports, £1000 to Egypt and £55,600 to India; £56,500 in all.

Copper, Tin, Lead and Zinc

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
15	12⅞ @13	12½ @12⅝	57¾	29¾	4.15 @4.20	4.07½ @4.10	4.85 @4.87½
16	12⅞ @13	12½ @12⅝	57½	29¾	4.15 @4.20	4.07½ @4.10	4.87½ @4.90
17	12⅞ @13	12½ @12⅝	....	29⅝	4.20	4.10	4.90 @4.92½
19	12⅞ @13	12½ @12⅝	57¼	29½	4.20 @4.25	4.10 @4.15	4.92½ @4.95
20	12⅞ @13	12½ @12⅝	57¼	29¾	4.20 @4.25	4.10 @4.15	4.92½ @4.95
21	12⅞ @13	12½ @12⅝	57½	29⅝	4.20 @4.25	4.10 @4.15	4.92½ @4.95

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market has been quiet and featureless since April 14. The European buyers are well covered and on that account are not placing orders for the time being. Some business is being done in the home market from day to day, but the transactions are not large. Lake copper has been freely sold at 12⅞c. for good ordinary brands, while some special brands have fetched 13c. All of the selling agencies are freely offering electrolytic copper at 12¾c. delivered, 30 days, equivalent to a little less than 12⅝c., cash, New York, and most of them make concessions of a few points to consummate business. The close is unchanged at 12⅞@13c. for Lake copper; 12½@12⅝c. for electrolytic copper in ingots, cakes and wirebars. The average of the week at which business in casting copper has been done is 12⅜@12½ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14¼c. base, carload lots at mill.

The volume of business on the London Metal Exchange in standard sorts has dwindled down considerably, and the market has been slightly reactionary. The close is barely steady at £57 2s. 6d. for spot, £57s. 17s. 6d. for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 800 tons.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@75.

Exports of copper from New York and Philadelphia for the week, 3897 long tons. Our special correspondent gives the exports from Baltimore at 1482 tons copper.

Stocks of copper in England and France on April 15 are reported by Messrs. Henry R. Merton & Co., of London, at 52,190 tons, an increase of 840 tons over March 31. The stocks include 8500 afloat from Chile and Australia.

The North Butte company in 1908 produced 36,929,028 lb. of copper, for which it received an average of 13.33c. per lb. This copper is sold by the United Metals Selling Company and is paid for on the basis of the average sales of that company during the third month following receipt of the ore. The North Butte was shut down during January and February, 1908. The quotational average for the 10 months corresponding to its settlements was 13.31 cents.

Tin—The London market has ruled somewhat firmer throughout the week. The favorable statistical position is given as the cause of the strength, but some talk about levying a duty on tin in this country, which resulted in speculative purchases of prompt material from this side, has, no doubt, added its share toward the advance. London closes at £136 12s. 6d. for spot, £134 15s. for three months, and the domestic market at about 29⅝ cents.

Arrivals of Bolivian tin in Europe in March are reported at 19 tons bars and 3100 tons concentrates; the whole equivalent to 1879 tons metal.

Lead—The inquiry for this metal from consumers continues to broaden, and a good-sized business has taken place from

day to day. Prices have gradually advanced and the market closes firm at 4.10 @4.15c. St. Louis, 4.20@4.25 New York.

The London market is soft and the close is cabled at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—Galvanizers have placed large orders, due to an improvement in their business, and also in anticipation of the pending tariff legislation. On account of the uncertainty of an adequate ore supply, due to this tariff legislation, smelters have been very cautious in disposing of their metal and prices easily advanced. The close is firm at 4.92½@4.95c. St. Louis, 5.07½@5.10 New York, for prompt and early deliveries, but sales for future delivery have been made as high as 5c., St. Louis.

Quotations for spelter in New York April 15 were 5@5.02½c.; 16, 5.02½@5.05c.; 17, 5.05@5.07½c.; 19 to 21, inclusive, 5.07½@5.10 cents.

The London market is steady, good ordinaries being quoted at £21 12s. 6d., specials at £21 17s. 6d. per ton.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Upon application of Alton B. Parker, acting on behalf of the Trust Company of America, trustee for the bondholders, J. O. Rogers had been appointed receiver for the Lanyon Zinc Company. The petitioners declared that $1,783,000 of the company's bonds are still outstanding, on which there has been a default of interest amounting to $483,000, part of it due since 1905. This company was organized in 1899, was greatly over-capitalized, and never has been able to make a respectable showing on its stock, but up to a few years ago, succeeded in paying interest on its bonds. It is said that the receivership will not interrupt the operation of the company.

Other Metals

Antimony—There has been more buying than for several weeks, the activity being due to the expectation that a duty will be imposed on the metal. Prices are higher, 8½c. per lb. being paid for Cookson's; 8¼ for Hallett's and 7⅞@8c. for U. S. and other brands.

Aluminum—No. 1 ingots are still 22@24c. per lb., base price; wire, 31@32c. and sheets 33@34c. base. Business has been moderate, with no special features.

Quicksilver—Business has been rather quiet. New York quotations are lower, at $44.50 per flask of 75 lb. San Francisco nominal, at $44 for domestic and $42 for export. London price is unchanged at £8 7s. 6d. per flask, with 5s. less asked by second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Joplin, Mo., April 17—The highest price reported paid was $41.62 per ton, the assay base ranging from $38 to $39 per ton of 60 per cent. zinc, with some ore high in iron selling on a base of $40. Zinc silicate sold at $17.50@19.50. The average price, all grades, was $36.50. Lead sold as high as $58 on a base ranging from $56 to $57. The average price, all grades was $54.90 per ton.

The upward move in spelter had an immediate effect on the ore market, already on a nervous tension, and prices were advanced all along, from the cheapest silicates to the best blende ore. There was an average gain in price of 60c.; some ore purchased for next week's delivery was advanced as much as $2 per ton.

SHIPMENTS, WEEK ENDED APR. 17

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,863,200	1,274,080	$127,436
Joplin	2,138,360	439,890	52,724
Galena	603,770	154,970	15,683
Miami	596,020	195,700	15,215
Duenweg	612,590	41,680	12,008
Alba-Neck	549,780	.....	10,720
Spurgeon	342,970	117,950	8,506
Oronogo	248,950	126,660	7,201
Prosperity	248,950	75,030	6,592
Granby	423,110	11,000	5,200
Badger	358,080	21,050	6,062
Aurora	354,730	.....	5,398
Carthage	212,260	.....	4,138
Sarcoxie	235,310	.....	3,914
Quapaw	143,010	.....	2,336
Zincite	92,190	.....	1,752
Carl Junction	56,970	3,000	1,222
Stott City	40,370	.....	747
Everton	42,000	.....	420
Totals	12,159,330	2,461,110	$288,373
Sixteen weeks	179,417,860	39,627,190	$3,978,258

Zinc value, the week, $220,788; 16 weeks, $3,211,336
Lead value, the week, 67,685; 16 weeks, 766,922

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	35.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.76	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Lead continues to advance a little each week, and the upward price has put upon the market several million pounds of reserve ore this month.

Platteville, Wis., April 17—This week the base price paid for 60 per cent. zinc ore was $38.50 per ton; this was the highest price paid this week. For 80 per cent. lead ore, $51 was paid; one choice car brought $53 per ton.

SHIPMENTS, WEEK ENDED APR. 17

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	370,270	68,480	165,100
Hazel Green	393,300	.....	.....
Benton	250,880	59,700	.....
Cuba City	161,400	.....	.....
Livingston	120,000	.....	.....
Galena	88,000	.....	.....
Strawbridge	52,100	.....	.....
Rewey	47,000	.....	.....
Total	1,582,650	128,180	165,100
Year to Apr. 17	29,843,524	907,460	2,736,650

In addition to the above there was shipped to the American Zinc Ore Separating Company, 111,140 lb. and to the Joplin Separator Works, 417,390 lb. zinc concentrates.

Chemicals

New York, April 20—The market is quiet, with little change from last week's report.

Copper Sulphate—No large sales reported. Prices unchanged at $4.60 per 100 lb. for carload lots, and $4.85 per 100 lb. for smaller parcels.

Arsenic—Quotations for white arsenic are 2⅞@3c. per lb. Sales about 50 tons for the week.

Nitrate of Soda—Current sales are light. Prices are a shade lower, at 2.12½@2.15c. for both spot and futures.

Mining Stocks

New York, April 21—A slight reaction early in the week brought about some liquidation. Aside from this, the general stock market has been strong throughout the week. Prices have held up well, especially in the industrial stocks, United States Steel being a leader in the movement. At the close of the week the Steel strength was helped by the hopeful statements made at the annual meeting on April 19.

A sale of Homestake, of South Dakota, was recorded, at $94.50 per share.

The directors of the Amalgamated Copper Company, on April 15, declared the usual quarterly dividend of ½ per cent. This action was generally expected.

On the Curb the course of the general exchange was followed rather closely. Early in the week there were some declines in the copper stocks, but these were recovered. At the close prices are a little irregular, but generally strong. Nevada Consolidated was the most active stock and realized a good advance.

It may be noted that the market was sustained throughout by a good buying movement on London orders.

Boston, April 20—The mining-share market has been one of specialties and as a rule price changes are without significance. North Butte made a low record at $66.25, which represents a decline of over $20 from the high of the year. Amalgamated shows slight net change as the result of the week's operations.

Boston banks have the largest amount of deposits in their history, some $197,-100,000, which is certainly not a bear argument so far as the stock market is concerned.

The real feature has been U. S. Smelting, Refining and Mining. As a result both the common and preferred shares are much higher, the former $6.75 at $46.75 and the latter $2.50 at $47. Late discords in the management have been dispelled by the acquirement of R. D. Evans' holdings of some 60,000 shares of common and 40,-000 shares of preferred at an average price of $50 per share for each. The late weakness in Utah Consolidated is now made clear by announcement of the resignation of James Phillips, Jr., from the board of directors. He is succeeded by Sidney Chase of this city.

Southwestern Development has been the Curb feature, advancing from under 20 to 90c. during the week. Speculation has been very active in this issue. Davis-Daly displayed a firmer tone on the final payment of the $2 assessment.

STOCK QUOTATIONS

NEW YORK Name of Comp.	Apr. 21 Clg.	BOSTON Name of Comp.	Apr. 21 Clg.
Alaska Mine	.40	Adventure	8½
Amalgamated	76½	Allouez	38¼
Anaconda	45¾	Am. Zinc	‡25¼
Balaklala	22⅛	Arcadian	4¾
British Col. Cop.	6⅝	Arizona Com	42½
Buffalo Mines	‡3½	Atlantic	10½
Butte Coalition	24¼	Boston Con*	11⅝
Colonial Silver	¼	Calumet & Ariz	100½
Cons. Ely Mining	7⅞	Calumet & Hecla	605
Davis-Daly	6½	Centennial	‡30¼
Dominion Cop.	4¼	Copper Range	78
Douglas Copper	2¼	Daly-West	10⅜
El Rayo	2¾	East Butte	16⅝
Florence	3½	Franklin	16
Foster Cobalt	.30	Greene-Can	10⅜
Furnace Creek	.11	Hancock	10¾
Giroux	8	Isle Royal	23¾
Gold Hill	⅛	Keweenaw	3¼
Goldfield Con	8¼	La Salle	14
Granby	96	Mass	9⅛
Greene Gold	¼	Michigan	12
Greene G. & S.	7	Mohawk	61
Guanajuato	1¾	Nevada	20
Guggen. Exp.	179	North Butte	67½
Hanapah	15	Old Dom	‡12⅝
Kerr Lake	7⅞	Old Colony	48
McKinley Dar	99	Old Dominion	52
Miami Copper	14⅞	Osceola	129
Miemac	¾	Parrot	33¾
Mines Co. of Am.	⅛	Quincy	88
Mitchell Mining	⅝	Rhode Island	14¾
Mont. Shoe C.	1⅝	Shannon	6¼
Nev. Utah M. & S.	2½	Superior	41
Newhouse M. & S.	2⅞	Superior & Bost	15¼
Nipissing Mines	10⅝	Superior & Pitts	13⅛
Old Hundred	⅜	Tamarack	70
Silver Queen	.40	Trinity	14¾
Stewart	⅛	U. S. Smg. & Ref	45
Tennessee Copr.	40⅞	U. S. Smg. & Ref. pd.	46¾
Tri-Bullion	⅛	Utah Con	40⅛
Union Copper	1⅛	Victoria	‡4⅝
Utah Apex	6¼	Winona	5
Utah Copper	43⅞	Wolverine	143
Yukon Gold	4¼	Wyandotte	‡2½

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem	38¼
Am. Smelt. & Ref.	88¾
Am.Sm. & Ref., pf.	105¾
Colo. Fuel & Iron	38
Federal M. & S., pf.	182
National Lead	88½
National Lead, pf.	104
Pittsburg Coal	10¾
Republic I. & S.	22¾
Republic I. & S., pf.	74¾
Sloss-Sheffield	‡75
Standard Oil	670½
U. S. Steel	52
U. S. Steel, pf.	114¾
Va. Car. Chem.	47½

BOSTON CURB	Low.
Ahmeek	160
Black Mt.	1 1/16
Chemung	18½
Globe Con	4¾
Helvetia	2½
North Lake	‡7¾
Ray Central	2 7/16
Ray Con	13¾
San Antonio	10¼

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	Apr. 17	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.04
Center Cr'k	1.80	1.50
Cont.C.&C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cont. Oil	105.00	100.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON	Apr. 21		
Name of Com.	Clg.		
Dolores	£1	58	0d
Stratton's Ind.	0	3	1½
Camp Bird	1	3	9
Esperanza	2	17	0
Tomboy	1	1	3
El Oro	1	4	9
Oroville	0	11	6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Apr. 21.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.23
Belcher	.46	St. Ives	.14
Best & Belcher	.42	Triangle	.02
Caledonia	.19	BULLFROG STOCKS	
Challar	.08	Gibraltar	.04
Comstock	.23	Homestake King	.03
Con. Cal. & Va.	.65	Mont. Shoshone C.	1.75
Crown Point	.53	Tramp Cons	.05
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.11	Bonnie Clare	19 8½
Hale & Norcross	.20	Lee Gold Grotto	...
Mexican	.85	Nevada Hills	1.18½
Ophir	1.20	Nevada Smelting	1.00
Overman	.15	Nevada Wonder	.70
Potosi	14	Nevada-Utah	2 75
Savage	.24	Penn-Wyoming	.03
Sierra Nevada	.23	Pittsburgh S. Pk.	.60
Union	.39	Rawhide Cal'l'n.	...
Utah	.02	Round Mt. Sphinx	.12
Yellow Jacket	.69		
TONOPAH STOCKS			
Belmont	1.00		
Extension	.48		
Golden Anchor	...		
Jim Butler	.15		
MacNamara	.50		
Midway	.32		
Montana	.65		
North Star	.03		
Tono'h Mine of N.	7.12½		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.13½		
Blue Bell	.04½		
Booth	.20		
Columbia Mt.	.13		
Comb. Frac	1.08		
Con. Red Top	.07		
Cracker Jack	.04		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.04		
Goldfield Daisy	.42½		
Great Bend	.17		
Jumbo Extension	.17		
Kendall	.06		
Lone Star	.06		
May Queen	.04		
Oro	.11		
Red Hill	.12		
Roanoke	...		
Sandstorm	.13		

COLO. SPRINGS	Apr. 16
Name of Comp.	Clg.
Acacia	.05¾
Black Bell	....
C. C. Con	‡ .03½
Dante	.06⅝
Doctor	.08⅛
Elkton	.63
El Paso	45½
Findlay	.16
Gold Dollar	.10
Gold Sovereign	‡.03
Isabella	.22
Jack Pot	.06⅝
Jennie Sample	.07⅜
Jerry Johnson	‡.05¾
Mary McKinney	.37⅞
Pharmacist	‡.03
Portland	.87¾
Un. Gold Mines	.06¾
Vindicator	.62½
Work	.07

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Apr. 15	May 7	$0.01
Blue Wing, Ida	May 8	June 5	0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Crown Point, Nev	Apr. 18	Apr. 28	0.10
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Exchequer, Nev	May 5	May 26	0.05
Imlay, Nev	Apr 6	Apr. 28	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Rexall S. & C., Utah	Mar. 26	Apr. 25	0.01½
Savage, Nev	Apr 8	May 6	0.10
Sierra Nevada, Nev	May 4	May 25	0.10
Union Con., Nev	Apr. 8	Apr. 30	0.10
Utah, Nev	May 6	May 27	0.03
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15
Yerington Gold, Nev	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.116	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.668
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.698	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.654	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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Modern Silver-Lead Smelting at Laurium, Greece

The Mines Supply a Self-Fluxing Mixture Carrying 11 Per Cent. Lead. Twelve Castilian Furnaces Supplanted by an American Blast Furnace

BY HENRY F. COLLINS*

The metallurgical treatment of the ores found in the mines of Laurium, including the smelting of lead ores, was briefly summarized by me in an article published in the JOURNAL, Feb. 23, 1905. Since the date of my visit, the comparatively low tenor of the ores in lead and the high volatilization losses always experienced with the old-fashioned Spanish type of blast furnace have induced the French Laurium Mines Company to radically reform its methods and modernize its smelting works.

The total quantity of material smelted annually at the works of the French company, is about 90,000 tons, of which from 7000 to 8000 tons are galena concentrates, carrying about 50 per cent. lead, the remainder being oxidized ores with an average of 10 to 11 per cent. lead and considerable amounts of zinc and alumina. From a metallurgical point of view the most favorable feature of the ores available is that they contain high proportions of the carbonates of lime and iron with some manganese, so that it is easy to obtain a self-fluxing mixture, barren flux never being required.

VARIOUS ORES OF THE DISTRICT

Analyses of some of the principal ores of the Laurium district were published in my article in the JOURNAL, Nov. 10, 1904, from which the accompanying table is taken. The deposits of lead ore in the Camareza section of the district include both galena and oxidized ore, oxidized ore predominating. The gangue is generally calcareous or ferruginous—occasionally, however, silicious; the principal associated minerals are calcite, limonite, aragonite, selenite in very fine crystals, a little calamine, and occasionally small quantities of various copper minerals and the rare minerals, adamite, serpierite and buratite.

The ores of Souréza in the southern part of the district are chiefly galena (with some lead carbonate) and zinc carbonate, in a gangue of calcspar and fluorspar—sometimes as much as 30 per cent. of the latter—with very little iron or silica. In bulk they run about 10 to 12 per cent. lead, with an average of 10 oz. silver per ton. In view of the considerable percentage of galena, it is somewhat remarkable that the ores contain no blende, the 10 to 12 per cent. zinc present being all in the condition of carbonates.

In the Plaká portion of the Laurium district, both carbonate and sulphide ore are found together with manganese and manganiferous iron ore. The mixed sulphide ore resembles that of Leadville rather than that of Broken Hill, in that the proportion of iron pyrite is considerable. In some of the Plaká ore the carbonates of iron and manganese predominate over the quartz, while the galena is found practically free from blende and pyrite. An average composition for large masses of this ore would be 10 per cent. lead, 12 per cent. zinc and 15 per cent. iron, in the form of pyrite, in a gangue of quartz and calcite which is generally more or less mixed with chalybite and carbonates of manganese. The better grade of sulphide ore is smelted direct, but the zinky silicious and more pyritous sulphide ores are first concentrated.

The smelting furnaces were formerly of the old Spanish type, circular masonry furnaces, 4 ft. 6 in. in diameter provided with 4 water-cooled tuyeres, and furnished with blast at 6 to 7 oz. pressure; the column of charge extended at most only 9 ft. above the tuyere level. There were 12 of these furnaces and each smelted about 25 tons of charge per day with a fuel consumption of 17 per cent. by weight of coke. The loss of lead by volatilization was 2 to 2½ per cent. of the charge, or from 20 to 25 per cent. of the total quantity of lead present. Owing to the low temperature of the smelting zone, the slow rate of smelting, and the high reduction, great trouble was experienced through accretions both in the hearths and in the shafts of these old-fashioned furnaces.

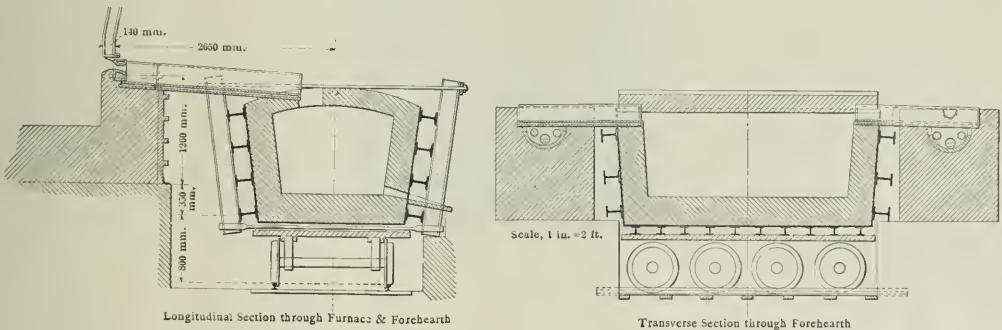

FIG. 1. SECTIONS THROUGH FOREHEARTH AND FURNACE OF FRENCH LAURIUM MINES COMPANY, LAURIUM, GREECE

THE NEW BLAST FURNACE

The new furnace is of the American type, now standard for large installations all over the world, and handles from 250 to 300 metric tons per day. It measures

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ANALYSES OF LAURIUM ORES.

	Souréza Carbonate Lead Ore.	Camareza Earthy Carbonate.	Camareza Calamine. 1st Class	Camareza Calamine. 2d Class	Plaká Heavy Sulphide.	Plaká Carbonate Gangue.	Plaká Calcined Manganiferous Iron Ore.
	Per Cent.	Per Cent.	Per Cent	Per Cent.	Per Cent.	Per Cent.	Per Cent.
SiO_2....	3.40	8.64	7.12	9.75	2.96	11.92	7.20
Fe.	2.16	20.91	5.54	14.00	27.22	37.30	37.10
Mn	2.25	5.69	1.08	0.40	0.58	4.47	14.33
Al_2O_3..	0.25	10.70	3.68	7.60	7.32	3.20	.....
CaO ...	19.42	2.20	8.33	10.00	5.71	0.70	tr.
MgO ...	0.25	0.10	0.40	0.30	0.10	.....	.....
Zn	11.96	2.40	50.80	38.35	13.35	4.46	1.40
Pb	9.75	6.45	0.60	tr.	9.35	11.85	0.80
Cu	.....	0.08	0.01	0.05	0.02	.....	*nil*
Cd	.....	.....	0.18	0.07	.....	.....	.....
As.....	0.10	4.00	1.12	2.70	tr.	.....	*nil*
S	0.22	1.30	0.11	0.35	23.65	1.27	1.66
CaF_2...	25.96	*nil*	*nil*	0.06	.....	.....	.....
CO_2....	.....	16.00	.....	.....	.....	.....	.....
P	.....	.....	.....	.....	.....	.....	0.06
H_2O....	.....	.....	.....	.....	.....	.....	0.90
Ig. Loss	24.80	.....	.....	.....	.....	.....	.....
Ag.....	0.031	0.0152	.....	.....	0.0075	0.0185	.....

156x44 in. at the tuyeres and 20 ft. 4 in. from tuyere level to feed floor, and was built by the Colorado Iron Works Company, although certain important alterations in details have been made on the spot subsequent to the delivery of the furnace. Fig. 1 shows longitudinal and transverse sections of the forehearth, the former also showing part of the furnace. The crucible rests upon the usual sheet-steel bottom plate and is enclosed in mild steel plates with strengthening I-beams, the ribbed cast-iron plates supplied originally for the short ends of the curb having to be replaced almost immediately. The crucible is built as usual of firebrick, inside which is a lining of a special chrome-magnesia brick containing 3 parts of burnt magnesite to 1 part of chromite, this being necessary on account of the speiss made here rapidly corroding all ordinary firebrick, whether silicious or basic, having, however, but little effect on those made of the above mixture.

The water jackets are of mild steel plate 5/16 in. thick outside and on the fire side 7/16 in. thick. They are 7 ft. high, the water space measuring 4 in. in width. There are in all 8 side jackets and 2 end jackets; the two central side jackets on each side of the furnace are provided with 3 tuyeres and the two outer ones with 2 tuyeres each, making altogether 10 tuyeres on each side provided with convenient independent tuyere-valves. As at first sent the tuyere pipes were fastened into the jackets like boiler flues in the usual way, namely, by expanding against the orifice cut in the inner jacket plate and beading over the edges, but trouble was experienced from leakages, and recently welding the end of the tuyere pipe to the inner jacket plate by means of the oxy-acetylene blowpipe, has been adopted, an improvement which has resulted in the elimination of all leaks.

Fig. 2 shows side by side the inner plate of two jackets one of which has the tuyere pipes "beaded" in the usual way, the other having been welded by means of the oxy-acetylene blowpipe. Sea water is used for cooling and saline deposits are entirely avoided by circulating a quantity of water sufficient to keep the temperature of the effluent at or below 50 deg. Centigrade.

Structural Features

The brickwork forming the furnace shaft is supported on brick arches turned from abutments formed of L-shaped steel castings, bolted to the tops of four mild-steel columns and strengthened mutually by means of heavy tierods running both longitudinally and transversely. Upon these arches the shaft is built as usual of ordinary red brick with a one-brick lining of firebrick, the total thickness tapering from 3 ft. to 2 ft. 8 in. at the top.

FIG. 2. OLD AND NEW TUYERES

Above the feed floor, connection is made with a fixed hood and chimney supported from the roof of the furnace building by means of a movable charging hood running on wheels transversely to the longer axis of the furnace and provided with four counter-balanced doors on each side. These are opened by the side-dumping charge cars in the act of delivering their contents and close automatically. The ore charge is trammed in 8 small side-dumping cars holding 600 kg. each, or a total of 4800 kg., half of which is dumped from each side of the furnace. The coke charge of 624 kg. is trammed in 4 side-dumping cars of double the length of the ore cars so that each opens two of the furnace doors in the act of delivering its contents. Like the ore charge it is dumped simultaneously from both sides of the furnace. Doubling the weight of the charges has been tried but has not given satisfactory results, the amount of accretions appears to be increased and the working becomes irregular.

Blast is supplied by either of two Root's blowers, each of which can deliver 10,500 cu.ft. of air against a pressure of from 35 to 40 oz. The blast enters the furnace through 20 tuyeres, measuring 4½ in. in diameter but provided with thimbles of 3½ in. interior diameter; each tuyere has the usual Davis slag-escape and a separate brass tuyere valve. The blast-gate on the bustle-pipe is operated by means of a chain and a weighted safety-valve opens automatically as the gate-valve closes.

Continuous Slag Flow

Special attention may be directed to the arrangements for handling matte and slag, one interesting feature of which is the employment of a forehearth having a constant flow of slag without a trap spout. The whole of the molten products leave the furnace at one end through a tapping jacket, made of high-grade phosphor-bronze with 98 per cent. copper and the minimum aperture of which is 2¾ in. in diameter. Exactly opposite the center of this aperture a long water-cooled plug is held in glands hanging from fixed supports in such a way that it can be pushed in or drawn out at pleasure, thus restricting or enlarging the area of the annular ring left between its rounded point and the tapered hole in the tap-jacket through which the molten products of the furnace issue. The plug is a steel tube with rounded point made of wrought-copper. The details of its construction may be seen in Fig. 4.

By entering or withdrawing the plug, irregularities in the slag-flow caused by variations in the speed of smelting or in the pressure of blast are controlled with great exactitude, so that neither do the tuyeres become slagged, nor is there any escape of blast at the slag-spout. It seems probable that only a fusible lead slag of nearly monosilicate composition could be successfully handled in this way, and that difficulties might be experienced in handling the more viscous bisilicate slags used in copper smelting with this ingenious appliance which, however, answers perfectly under the conditions prevailing at Laurium.

The forehearth, shown in Fig. 1, is rectangular, its longest axis being placed crosswise at right angles to that of the furnace. The casing measures 10 ft. x 6 ft. 6 in. x 4 ft. 6 in. deep, and is lined with one course of the chrome-magnesia brick similar to those used for the crucible; the capacity of the forehearth is approximately 30 tons of slag. The molten products issuing from the tap jacket enter the forehearth by means of a

water-cooled copper spout, 7 ft. 6 in. long, made in two pieces as indicated in the longitudinal section, Fig. 1, details of its construction being shown in Fig. 3. The cast-iron spouts at first adopted, even when lined with magnesia brick, became readily perforated by the hot matte and speiss. The present construction of thick copper plate, with no joint or rivet on the surface exposed to heat, is found to be necessary in order to avoid perforation and possibility of leakage with consequent liability to dangerous explosions.

Handling the Furnace Products

The matte and speiss are tapped together from the forehearth usually once in 24 hours and run into one of two tap-pits placed at the side of the furnace opposite to the lead well. The slag may leave the forehearth by either of the two water-cooled spouts on opposite sides, and falls into a cast-iron launder where it meets a stream of water issuing under pressure from a flattened nozzle, the whole of the cooling water from the furnace and tap-jackets, etc., being also utilized in this connection.

The slag is broken up by the powerful stream into granules, the largest particles of which do not exceed 2 mm. in diameter; the average being only 1 mm. Each launder discharges into a sheet-iron hopper, capable of holding 8 tons, and furnished at the point with a flat slide valve moved by a rack and pinion. These hoppers take alternately the whole stream of slag and water, the latter overflowing at one side while the slag accumulates. When one is full the stream is diverted to the other, and the first is allowed to drain for 5 or 10 minutes by means of a perforated section at the bottom immediately above the valve after which the valve is opened by means of a hand-wheel on the pinion shaft and discharged into a wagon holding 8 tons. Two men per shift suffice to handle the slag from the furnace when smelting 300 metric tons per day, besides breaking up and loading all the matte and speiss produced.

The lead overflows from the lead well of an Arent's siphon-tap into one of two steel drossing pots holding 2500 kg. In these it is drossed and tapped at intervals into the usual half-circle of molds on wheels. The accompanying table shows the composition of some of the furnace products. Two partial analyses of shaft accretions are here given but comparatively little trouble is experienced with them since adopting this type of furnace.

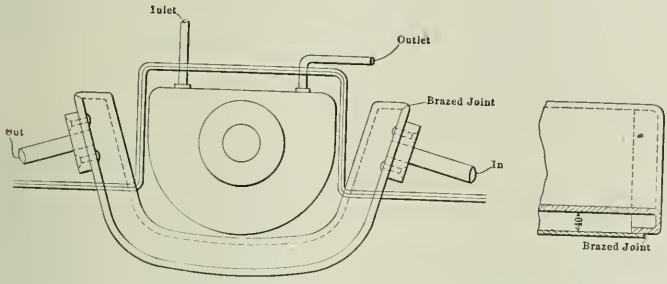

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FIG. 3. TAP JACKET AND SPOUT OF LAURIUM LEAD FURNACE

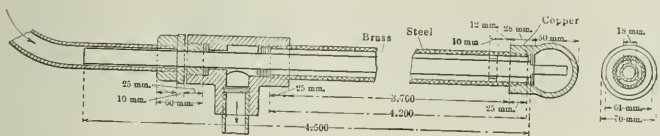

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FIG. 4. SLAG-CONTROLLING DEVICE AT LAURIUM, GREECE

ANALYSES OF LAURIUM FURNACE PRODUCTS.

	Work-lead.	Speiss.	Shaft Accretions A	Shaft Accretions B	Slag.
	%	%	%	%	%
Pb	97.38	3 00	16.90	16 00	0 80
Bi	0.09				
As	0.40	33 00			
Sb	1.60				
Cu	0.38				
SiO_2					
Fe		50 00			25 20
Al_2O_3					23 24
MnO					11.38
CaO					2.88
MgO					17.33
Zn					traces
S			32.25	57 05	9 87
Ag	0 1500	0 0150	12 23	2 73	0 78
Au	0.0004				0 0010

Report

with them since adopting this type of furnace.

With a fuel consumption of 13 per cent. of coke, the furnace puts through from 275 to 300 metric tons per 24 hours of a self-fluxing charge carrying about 11 per cent. lead, of which 90 per cent. is recovered. The somewhat aluminous and zinky slags contain from 0.7 to 0.9 per cent. lead. The whole of the work around the furnace takes only 36 men per 24 hours or 12 per shift, namely, 4 on the lower floor and 8 on the charging floor. The labor cost amounts to only 24 to 26 c. per metric ton of material handled. The substitution of this modern furnace for the old type formerly in use has resulted in great savings in every direction, particularly as regards loss of lead, labor cost and fuel consumption.

For the details here given and for the accompanying drawings, I am indebted to L. Guillaume, chief engineer in charge of the ore-treatment plants of the French Laurium Mines Company and to whose initiative is due the installation of this modern plant, as well as the credit for the successful results obtained.

Direct Cyaniding on the Rand

Special Correspondence

To omit amalgamation altogether in treating Witwatersrand gold ores seems to be a revolutionary step, but it is now seriously proposed. H. H. Johnson, manager of the Village Deep, has won credit by publicly advocating the introduction of a direct-cyaniding, non-amalgamating system of gold recovery for the Rand. From a somewhat different standpoint the idea was put forward by the Denny brothers some years ago. To indicate how strongly the proposal has taken root, it may be mentioned that experiments are now proceeding at the Wemmer mill to prove the economy of the abandonment of the copper plates, while the Bantjes plant has been designed to include shaking tables only below the tube mills and to allow for their omission altogether, if trials elsewhere prove successful. Mr. Johnson's scheme, which is destined to be warmly criticized, involves the retention of gravity stamps, to each 10 of which will be installed a mill of the Chilean type. The mortar boxes will be fitted with screens of ¾-in. mesh, and the Chilean mills 200 to 300 mesh. Tube mills will be used below the latter, so that apart from the rock breakers there will be three distinct units for ore reduction. Chilean mills have been tried on the Rand without success, but Mr. Johnson claims that their failure was due to the wrong class of work to which they were put—on coarse rock from the crushers or concentrates from the stamps.

Legal Status of Works Producing Noxious Gases

Different Phases of the Smelter Smoke Problem in the United States; Expert Damage Board Suggested. Domestic and Foreign Legislation

BY CHARLES BASKERVILLE*

Every individual has the right to have the air distributed over his properties and habitation in its natural condition, that is, free from all artificial impurities.[1] In fact it may be stated that no one has the right to interfere with the distribution and amount of pure air which flows over another's land any more than he has to interfere with his neighbor's soil.[2] This right is strictly a natural one, and every use of property that causes an unwarrantable impregnation of the air with foreign substances to the detriment of another, is a nuisance, and actionable as such.[3] The air must be as free and pure as can be reasonably expected.[4]

Based largely on the preceding, it is laid down broadly as a general rule in law that any act, omission or use of property which results in polluting the atmosphere with noxious or offensive gases or vapors, thereby causing material physical discomfort and annoyance to persons residing in the vicinity,[5] or injury to their health or property,[6] is a nuisance.[7] This rule has been supported by decisions in Delaware,[8] Illinois, Kentucky,[9] Missouri, Pennsylvania, Texas and Wisconsin.

What Constitutes a Nuisance

The question as to what degree of impurity imparted to the atmosphere by one in the use of his property constitutes a nuisance, is one of fact, and is determined by the jury from the circumstances of each case.[10] Injury is, of course, a question of compound facts. No precise tests may be given that are applicable to all cases. In the consideration of the surrounding circumstances of a case, the character and nature of the gas complained of is of prime importance,[11] and the times and periods of the generation of the gas, or the constancy and frequency of the annoyance, the extent of the injury or inconvenience caused,[12] and the nature of the business, its location,[13] management and manner of construction,[14] must all be taken into careful consideration.

To illustrate the last condition, a manufacturing business may be a nuisance because it is located in a residential or populous part of a city or county, whereas it should be located in a more remote locality:[15] or a nuisance may arise merely from the faulty construction of a plant or from the negligent or improper manner in which the business is conducted and the works kept.

Although diminution in value is the proper element of damages and in some cases the actual measure of the nuisance,[16] yet it has been ruled in New Jersey[17] that mere diminution of the actual or rental value of a property is not sufficient to make a business a nuisance. According to common law, a sensible injury is only a visible injury,[18] and in general it may be stated that injuries must not be dependent upon scientific tests to discover.[19] Theoretical injuries furnish no ground for abatement,[20] and an injury to property must be irreparable to cause a court of equity to interfere to abate.[21]

Various State Decisions

It has been ruled in Connecticut[22] that a manufactory which produces such unwholesome odors that the workmen of a neighboring manufactory are prevented from working therein, is a nuisance; and it has been given as a decision in Iowa, Kentucky, Massachusetts, New York, Texas and Vermont, that a noxious trade may be a nuisance even in a remote locality, providing it is located near a public highway and inflicts serious discomfort on people passing by. However, it has been ruled in Tennessee that such odors or gases must be really dangerous to public health and not merely offensive to certain individuals.

Odors which are carried a great distance by the wind and which are "unpleasant and objectionable," according to a decision handed down in North Carolina[23], is not sufficient ground for the interference of a court. Odors or gases must work some substantial annoyance or some material physical discomfort to maintain an action; this point is well supported by precedents. It has been decided in South

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[1] Walter vs. Selfe, *English Law and Equity Reports*, 4, 15.

[2] Saville vs. Kilner, *Law Times*, 26, 277.

[3] Duncan vs. Hayes, *N. J. Equity Reports*, 22, 26; *Wood on Nuisances*, 1, 677.

[4] Buckenstine's Appeal, *Penn. State Reports*, 70, 102; Rhodes vs. Dunbar, *idem*, 57, 275.

[5] Material discomfort to an adjoining property owner and his family, although there is no pecuniary loss, is a nuisance (Kirchgraber vs. Lloyd, *Mo. Appeals Reports*, 59, 59). It is not necessary that an owner should be driven from his dwelling; it is enough that the enjoyment of life and property has been rendered uncomfortable (Fish vs. Dodge, *American Decisions*, 47, 254; Catlin vs. Valentine, *idem*, 38, 567; Barnes vs. Hathorn, *Me. Reports*, 54, 124; Peck vs. Elder, *Sandfords N. Y. Reports*, 3, 126.) It is not necessary that the smell is unwholesome; it is enough that it renders enjoyment of life and property uncomfortable (Davidson vs. Isham, *N. J. Equity Reports*, 9, 189; Brady vs. Weeks, *Barbour's Supreme Court Reports*, New York, 3, 157; Catlin vs. Valentine, *Paige's N. Y. Chancery Reports*, 9, 575).

[6] Use of a process in burning brick by which noxious gases are generated and wafted on the adjoining land, injuring and destroying the crops, is a nuisance such as will support an action for damages (Fogarty vs. Junction City Pressed Brick Co., *Kas. Reports*, 50, 478; *Pacific Reporter*, 31, 1052). Fact that injury is only occasional is immaterial (Campbell vs. Seaman, *N. Y. Reports*, 63, 568; *American Reports*, 20, 567.) In Ohio it has been ruled that if the discharge of noxious gases over a property is continuous and substantially injurious to the health and property, a perpetual injunction should be granted (McClung vs. North Bend Coal and Coke Co., *Ohio Circuit Court Reports*, 9, 259; *Weekly Law Bulletin*, 31, 9). In Pennsylvania the operation of lead-smelting works may be restrained by injunction when they emit poisonous or offensive fumes and vapors causing injury to adjoining property and danger to health (Appeal of Penn. Lead Co., *American Reports*, 42, 534).

[7] For general rule, see *Thompson's Encyclopedia of Law*, 21, 692. For cases in point of rule, see *Cen. Digest*, subject *Nuisance*, sections 164-69.

[8] See State vs. Wetherall, *Harrington's Del. Reports*, 5, 487. It was ruled that smells need not be injurious, but merely offensive to the senses.

[9] In the case of Ashbrook vs. Commonwealth (*Ky. Reports*, 64, 139; *American Decisions*, 89, 616), it was ruled that it is alone sufficient that the odors are detrimental to comfort.

[10] Burnham vs. Hotchkins, *Conn. Reports*, 14, 318; People vs. Davidson, *Cal. Reports*, 30, 379.

[11] Stowe vs. Miles, *Conn. Reports*, 39, 426; Commonwealth vs. Miller, *Penn. State Reports*, 139, 77; Mulligan vs. Elias, *Abbott's N. Y. Practice Reports*, n.s. 12, 259.

[12] Stowe vs. Miles, *loc. cit.*; Dittmann vs. Repp, *Md. Reports*, 50, 516.

[13] In the case of Roessler & Hasslacher vs. Doyle (*Atlantic Reporter*, 64, 156), it was ruled that the character of the neighborhood may be considered in determining the kind and degree of annoyance which will be regarded as a nuisance, and that it will not relieve the person who caused the annoyance from liability if the existence of the nuisance is proved.

[14] Fay vs. Whitman, *Mass. Reports*, 100, 76; Pennoyer vs. Allen, *Wis. Reports*, 56, 502; Evansville & C. R. Co. vs. Dick, *Ind. Reports*, 9, 433; People vs. Detroit White Lead Works, *Mich. Reports*, 82, 471; *Northwestern Reporter*, 46, 735; Poynton vs. Gill, *Rolle's English King's Bench Reports*, 2, *Abr.* 140.

[15] Rex vs. White, *Burrow's English King's Bench*, 1, 333; Commonwealth vs. Rumford Chemical Works, *Gray's Mass. Reports*, 16, 231; Smith vs. Phillips, *Philadelphia Reports*, 8, 14; Hole vs. Barlow, *Common Bench Reports*, 4, 334, Fertilizer Co. vs. Malone, *Md. Report*[s], 73, 268.

[16] Houghton vs. Bankhard, *Law Times*, 3, 266.

[17] Ross vs. Butler, *N. J. Equity Reports*, 19, 274; see also Rhodes vs. Dunbar, *Smith's Penn. Reports*, 7, 275.

[18] Tipping vs. St Helen Smelting Co., *English Common Law Reports*, 116, 608.

[19] Salvin vs. The North Brancepeth Coa Co., *Law Times*, 31, 154.

[20] Dorman vs. Ames, *Minn. Reports*, 12, 451.

[21] Wolcott vs. Melick, *N. J. Equity Reports*, 11, 204; Neil vs. Gallagher, *Legal Intelligencer*, 31, 388; also Rhodes vs. Dunbar, *Penn. State Reports*, 57, 274.

[22] Brown vs. Illius, *Conn. Reports*, 27, 84.

[23] Duffy vs. E. H. and J. A. Meadows Co., *N. C. Reports*, 131, 31; *Southeastern Reporter*, 42, 460. In this connection, see Rex vs. Neil, *Carrington and Payne's English Nisi Prius Reports*, 2, 485; Sampson vs. Smith, *Sim and Stuart's English Vice-Chancery Reports*, 8, 272.

Carolina[24] that where the plaintiff has sustained injury from the escape of noxious gases from the defendant's factory and also injury from other causes, the defendant is not relieved from liability for the injury he has caused.

Dust, smoke and cinders, even when accompanied by noxious gases, are not nuisances *per se,* but amount to nuisances, whether accompanied by noxious gases or not, if they cause injury to neighboring property to such an extent that its value is diminished, or if they so pollute the air as to cause inconvenience materially interfering with physical comfort and the enjoyment of the property (California, Connecticut, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania and Tennessee)[25]. If smoke and its accompanying gases cause sickness or injury to health, an action for damages lies, even though the fuel producing the nuisance is necessarily used[26].

A Ducktown Suit

In the suit of the Ducktown Sulphur, Copper and Iron Company vs. Barnes *et al.,*[27] where smoke and noxious gases from a smelting works injured the property and endangered the health of the adjoining landowners, the action for damages lay, even though the business was being carried on in a suitable locality, with the most improved appliances,[28] and furnished employment to nearly the whole community. It was decided that it is no defense to an action for damages that there were similar establishments in the neighborhood before the plaintiff moved there[29]; and that it is no defense that the works could not be operated without giving rise to noxious vapors. It was decided that the owner was entitled to recover all the damages sustained without reference to the incidental benefits or advantages to the land by reason of the market it afforded for timber and garden products.

The decision in the preceding would seem to indicate that no prescription can be pleaded for a nuisance,[30] and that neither its collateral benefit to the community[31] nor the good intent of the projector is a defense. It would appear that it is alone sufficient to sustain a conviction that the comfort of the community is impaired. However, the findings in some recent cases in Montana in part conflict with the aforesaid decisions and stand out in sharp contrast.

Some Montana Decisions

In the suit of Hugo Magone vs. the Colorado Smelting and Mining Company *et al.,* in which the plaintiff sought $20,000 damages and a permanent injunction for alleged damage to his land and crops through the action of tailings and tailings-waters, the prosecution attempted to demonstrate the cause of the damage by chemical analyses. The defense was based on the fact that the water carried mere traces of possible poisonous salts in solution, and that the soil, which was poor black alkali in nature, was not properly irrigated. Although damages amounting to $1700 were awarded the plaintiff, the injunction was refused on the principle of the "greatest good to the greatest number."[32]

One of the most extensive suits ever heard was the one brought by F. J. Bliss vs. the Anaconda Copper Mining Company and the Washoe Copper Mining Company. This suit involved the question of fumes, and was brought for a perpetual injunction. During the case, it was brought out that the Anaconda company pays more than half of the taxes of Deer Lodge county, where its smelter is located; about one-third of the taxes of Silver Bow county, where its mines are located; and with associated companies they are the principal tax payers in nearly every part of Montana. It was shown that the company had erected a stack 300 feet high and that, before the erection of this stack when they used several smaller stacks, claims for about $340,000 were settled.

The injunction was refused for the same reason as in the preceding case. The amount of damages fixed by the master in chancery was small. A further hearing in the case has been ordered to ascertain if there is not some means of reducing the amount of arsenic in the flue dust, in order that a specific rule may be made which will afford future relief.[33]

The Contra Costa Case

In Contra Costa county, California, where an ordinance was recently passed to regulate the distribution of noxious gases by smelting plants, the board of supervisors of the county have granted the companies involved 60 days time to install apparatus and appliances to prevent the nuisance. County ordinances of a similar nature may yet solve the problem in affected parts of the country, especially in the Western States. City ordinances usually afford little relief[34].

The doctrine that an industry or business erected in the vicinity of similar establishments could not become a nuisance in that locality, or that any exceptions should be made in favor of a business lawful in itself and useful in its results, that is otherwise clearly a nuisance, excepting for the fact of location and usefulness, is generally considered to stand out of the pale of recognition of modern authority and to be entitled to no weight outside of Pennsylvania[35]. However, some jurists, particularly in the western smelting districts where a broader view must necessarily be given to the matter, have rendered decisions which would seem to be contrary to this general rule.

Other Locality Considerations

In the case of Dittman vs. Repp, the Supreme Court of Maryland held that in determining the question of nuisance from smoke or noxious vapors, reference must always be had to the locality. For instance, a party dwelling in a city in the midst of crowded commercial and manufacturing activities cannot claim the same quiet and freedom from annoyance that he might rightfully claim in the country.[36] When the population moves up to a nuisance which was previously in solitude, then as a general rule the nuisance must recede. It must, however, be reasonably offensive.

On its first introduction, gas was declared to be deleterious to the health of the community, and in some localities steam railways were at one time so offensive to particular local authorities, that attempts to prosecute them as nuisances were not infrequent.[37] Grievances of prosecutors in such cases as pertain to damaging gases in particular are often sentimental or speculative—just as they were at the time when the use of gas as

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[24] Frost vs. Berkeley Phosphate Co., *S. C. Reports*, 42, 402; *Southeastern Reporter*, 20, 280.

[25] Hyatt vs. Myers, *N. C. Reports*, 71, 271; Bareham vs. Hall, *Law Times*, 22, 116; Reg. vs. Waterhouse, *idem*, 26, 761; Ward vs. Lang, *Jurist*, 35, 408; Jones vs. Powell, *Palmer's English King's Bench Reports*, 539; for Penn. ruling, see *Pittsburg Reports*, 3, 79. In New York, the Appellate Division has recently laid down the law that where the public benefit of the alleged nuisance is greater than the injury to private individuals, there shall be no conviction for maintaining a public nuisance. Under this decision, a company may use soft coal in a crowded portion of New York City or Brooklyn, thereby distributing soot and smoke without being amenable to the criminal law. Civil suits may be brought by property owners, however.

[26] *Hutton's Reports, English Common Pleas*, 135.

[27] *Southwestern Reporter*, 1900, 60, 593.

[28] On this point, see Pinckney vs. Evans, *Law Times*, 4, 147; Waterworks Company vs. Potter, *Hurlstone and Norman's English Exchequer Reports*, 7, 160.

[29] See similar rulings in the cases of Hurlburt vs. McKone (Conn.), *Atlantic Reporter*, 10, 164; and Powder Co., vs. Tearney (Ill.), *Northeastern Reporter*, 23, 389.

[30] For other decisions supporting this, see Drew vs. Hicks, *Pacific Reporter*, 35, 563; Mulligan vs. Elias, *loc. cit.*; and Rhodes vs. Whitehead, *Tex. Reports*, 27, 304.

[31] See in this connection the following cases: People vs. Horton, *Hun's N. Y. Reports*, 5, 516; State vs. Kaster, *Ia. Reports*, 35, 221; Works vs. Junction R. R., *McLean's Federal Reports*, 5, 425.

[32] *Report Proc. Am. Min. Cong.* (Denver), October, 1906, 251.

[33] The Engineering and Mining Journal, Jan. 30, 1909, p. 265.

[34] Let us take the regulations of the Health Department of the City of New York, as an example. According to the Sanitary Code of this Department, Section 96, no person shall cause, suffer or allow offensive or noisome gases or odors to escape or be discharged to the detriment or annoyance of any person not therein engaged. Civil actions for the penalty of $250 only are allowed (Section 1262, *Greater New York Charter*), and it requires a delay of one month in the issuing of an order to arrest a violator, during which time the nuisance continues. When the same is finally abated, the defendant to the action suffers no penalty and pays merely the costs. Jacobi (*Journ. Am. Med. Assn.*, 49, 815), in commenting on this section of the health code, remarks that the "laws, as usual, appear to be made not for the people but for their enemies."

[35] *Wood on Nuisances*, 1, 726.

[36] *Md. Reports*, 50, 522.

[37] *Wharton's Criminal Law*, article "Nuisances."

a fuel was regarded as a nuisance—without due regard to the substantiality of the "nuisance."

Popular Misconceptions

Persons engaged in agricultural pursuits in manufacturing districts invariably have impressions of the destructive action of the waste gases resulting from fuel combustion, etc., upon vegetation, but these are generally founded on observation and tradition. There are many instances of sympathetic juries having fostered these impressions, basing their awards on miscellaneous general evidence and not upon scientific examination. In such cases, too much reliance is often placed on the appearance of individual trees and of isolated trees. Poor soil, exposure to wind, especially dry wind, water supply, insects, and fungi, all produce morphological conditions in vegetation which lead to the gravest misapprehensions in the minds of rural folk, and oftimes accusation of fumes and gases as the cause results, either wrongfully or on *a priori* grounds Ordinary testimony based upon odor alone should as a rule carry little weight.[39]

It is well known that the present sociological and political ideas which obtain in the rural communities, and certain abuses of the centralization of capital on the part of corporations have resulted in injuring the chances of the latter in suits of this nature. While it is true that certain corporations conceal their processes of manufacture, the nature and amount of materials used and the output of product, as well as employ other precautions in order to render the recognition of damage done by fumes more difficult, yet many instances are known where gardens are purposely set out with expensive flowers unsuited to the climate, just to profit by the damages for destruction by "noxious gases," and manufacturers are not protected from such malicious actions.[39]

Expert Board To Assess Damages

Some time since I made the suggestion with the aim of justice in mind that complaints of this nature be settled by a commission composed of three experts in such matters, one being selected by each of the parties and the third being chosen by these two;[40] or two of the experts may be appointed by the court, and a third selected by these two. Such a board of experts could investigate the facts of the case scientifically on the spot, and if damage has been done fix the amount and warn the offenders that a recurrence will bring forth more severe penalties. Negligence on the part of the manufacturers would cease, as well as annoying and expensive interruptions of business. Honest manufacturers would welcome such a change. It is recognized that such settlements would not be looked upon with particular favor by the legal fraternity, but it is interesting to note a recent case brought against the Mammoth Copper Company, in Shasta county, California, was settled by an arbitration board composed of three horticulturists, both parties to the suit having agreed to abide by their decision.[41]

In this connection it may also be remarked for the benefit of those who have not had occasion to investigate the matter, that there is not entire uniformity nor definiteness of statement in the codes of our several States in regard to the contamination of the air or the pollution of streams; cases have been described and citations given to substantiate this assertion. When such contamination becomes wretchedly bad from any cause whatever, protests sometimes check the wrong and secure legislation. The continued pressure of unsubsidized publicity often encourages direct action in these matters.

Cases of Federal Jurisdiction

When a manufactory in New Jersey generates gases which are complained of in New York or when smelter fumes produced in Montana or Tennessee affect the vegetation in a neighboring State, it becomes a Federal matter. In the latter case, we have also the same indefiniteness of statement in our laws.

General rules based upon precedents and not specific regulations obtain; the rule of action is not clear and there is a tendency toward a too technical construction of the law. Some have asserted that there is no need for legislation until there is a demand for it but the law of equity is not the outcome of specific needs and abuses of justice, but is rather contingent upon anticipated conditions; and manufacturers, as well as citizens, desire just protection. As in criminal law, it is to be deplored that cases may be lost in lower courts on judicial rulings which, in other similar cases, are afterward reversed by higher courts.

A Federal decision of great import was handed down in the case of the State of Georgia vs. the Tennessee Copper Company and the Ducktown Sulphur, Copper and Iron Company. The United States Supreme Court held that a State has the right to protect its forests and that a company can be enjoined from operating its smelting works in such a manner as to cause damage to property in a neighboring State. It was held that a State has the right to protect its citizens when their property is subject to damage by operations in another State.

The interest involved in the United States is sufficiently great and distributed to make it appear advisable for the Department of Agriculture to extend its operations and investigations in this field, coöperate with the similar departments in the States, formulate reasonable legislation, and recommend the enactment of a uniform and definite law. In such an event the Government officials would undoubtedly receive the cordial support and encouragement of the owners of the industry. Such has been the case in England where there is in force a law defining what amounts of waste gases may be permitted in the air.

Foreign Legislation

A brief discussion of the foreign laws of importance may not be out of place in this connection. According to Lord Derby's alkali act, the sulphate works of England were not permitted to discharge more than 5 per cent. of the hydrogen-chloride gas produced. This clause was later altered to forbid more than 0.464 gram of HCl per cu.m. With regard to the sulphuric anhydride, the Alkali Works Amendment bill of 1901 prohibits the discharge of more than 4 grains of SO_3 per cu.ft. of residual gas. The result of these laws has been a notable diminution of the amount of acid gases allowed to escape from works—a result not achieved by numerous prosecutions.[42]

Until the beginning of 1907, the lead and copper smelting works in Great Britain were at liberty to discharge their fumes into the air as long as no objections were raised by persons nearby. Now these smelters are included in the new alkali works regulation bill. However, according to Walker,[43] the method of dealing with the existing smelting works is left somewhat elastic by the act. Contrary to the American law, the gaseous output could not be restrained up to 1907 if the population moved up to the works. This is exemplified by the history of Swansea, Wales. In Prussia, in the granting of concessions for new works it is enacted that the amount of sulphuric anhydride in the waste gases should not exceed 5 grams in one cubic meter.[44]

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[39]Concerning the importance of disregarding this sort of testimony, see Gloystine vs. Kentucky Commonwealth, *Southwestern Reporter*, 33, 824; and Walter vs. Selfe, *English Law and Equity Reports*, 4, 15.

[39]It is a general rule that any impregnation of the air with unnatural substances is a nuisance, irrespective of the nature and character of the property affected. See Cooke vs. Forbes, *Law Reports*, 5, *Equity Cases*, 166; Gullick vs. Tremlett, *Weekly Law Reports*, 2, 358. In the case of Campbell vs. Seaman (N. Y. *Reports*, 63, 568; *American Reports*, 20, 567), it was held that articles of luxury come under the protection of the court as much as articles of necessity. The judgment of the Supreme Court was affirmed by the Court of Appeals. Every man has the right to cultivate on his land such products as he chooses. See Broadbent vs. Imperial Gas Company, *De Gex, Macnaghten and Gordon's English Chancery Reports*, 7, 436; Miller vs. Marshall, *Murphy's Reports*, 5, 28.

[40]*Am. Fertilizer*, 14, 12.

[41]The Engineering and Mining Journal, Sept. 21 1907, p. 561.

[42]See Fletcher, *Journ. Soc. Chem. Ind.*, 11 120; Carey, *Idem*, 21, 214.

[43]The Engineering and Mining Journal June 15, 1907, p. 1134.

[44]Concerning the regulation of sulphur cases in Germany, see the "*German Civil Code*," articles 832, 906, 1004 1011, 1017, 1027, 1065 and 1031; concerning the regulations controlling industrial plants, see "Gewerbeordnung" article 147, II; and for a review of the smelter smoke status in Germany, see Gradenwitz, The Engineering and Mining Journal, Aug. 17, 1907 p. 311

Uniform Federal Law Impracticable

An objection which has been urged against the regulation of the amounts of acid gases discharged into the air is this, that it is not practicable to establish a permissible amount of noxious gas which may be emitted for *all parts* of a country owing to geographical and meteorological conditions.[45] This is indeed well founded.

Other important questions to be considered in the formulation of a Federal law, such as referred to, are the enforced selected location for smelting works, etc., preferably on plains or level portions of the country, with due regard to winds, and the advisability of enforcing the adoption of tall stacks and chimneys by all works generating noxious gases. In regard to the first, it has been suggested that smelting companies be given the right to condemn land within a certain radius of their works, especially if they were located before the advent of a definite number of people. Such a bill passed the legislature of Utah but was disapproved in 1907 by Gov. J. C. Cutler on the ground that such a measure bore the marks of class legislation. The Utah bill provided for the condemning of land within a radius of four miles from a smelter in counties of less than 75,000 people.

As to the second question, the assumption that higher chimneys will diminish the amount of damage done by allowing the acid gases to become more dilute before reaching the vegetation is not realized, according to the experience of many industrial concerns. Notwithstanding the fact that unquestionable benefits are derived from dust chambers and the contrivances associated with high stacks, and the fact that the adjacent vegetation is not so much injured from a high as from a low stack, there is considerable damage wrought by gases from high stacks, as remote vegetation is reached by smoke, etc., which would not be otherwise affected.[46] In damp, heavy air, fumes heavier than air fall rapidly to the ground, and when the wind blows the gases sink gradually, but hold together for considerable distances, so that no unusual dilution is effected by such means.

Reclaiming Devices

In conclusion, the main solution of the "fume question" and "air pollution" would seem to be in the enforced use of waste-reclaiming devices by the enactment of a Federal law regulating the amounts of waste gases to be permitted to pass into the air. In England the enactment of similar laws laid the foundation of the great chloride of lime industry, and the subject has received merited attention since 1863; in fact, one might say since 1836, the year in which Gossage solved the problem of hydrochloric acid condensation.

In Germany, after extensive experiments in 1848 the furnaces in the smelting districts were remodeled and the volume of the dust chambers increased. This proved advantageous to the smelters, as the following shows: the Freiberg Smelting Works paid 55,000 marks for damage in 1864 and but 4793 marks in 1870, after installing means of condensing the acid gases.[47] In our own country it is encouraging to note that some manufacturers and smelters have at last begun the installation of waste-recovering contrivances—surely a decided step toward the solution of a great national industrial problem, however novel and radical such devices may appear. One large concern, the Tennessee Copper Company, contemplates the production of 300,000 tons of tower acid per annum from the gases delivered from its smelting furnaces, and no fear of trouble in disposing of the product is entertained by the officials.

[45] Haselhoff and Lindau, "*Die Beschädigung der Vegetation durch Rauch*," 1903, 394.

[46] Reuss, "*Rauchbeschadigung in dem von Tiele-Winkler'schen Forstreviere Mystowitz-Kattowitz, Insbesondere Ermittlung, Bewerthung und Vertheilung des Rauchschadens.*" Goslar, 1893.

[47] Ost, *Zeit. f angew. Chem.*, 20, 1689.

The Fuel Question in California

Special Correspondence

Rather an odd thing is happening in the matter of use of fuel for manufacturing, milling, etc., in California. Before the advent of oil as fuel, either wood or coal was used. At mills in the interior wood was largely used and also at mine furnaces. In the cities and towns manufacturers used coal. During a shortage of coal here shippers began to send in large quantities of coal from Australia and British Columbia and the market is now much overstocked because the cargoes continue to arrive, notwithstanding there is plenty of coal on hand. The result is that coal prices have dropped. Meantime the prices for fuel oil have much more than doubled and this in the face of the fact that there is an overproduction. Large quantities are being shipped abroad, as much more is produced than can be used on the Pacific coast. Still the oil continues to be used though the coal prices have fallen, and those of oil increased. A few years ago oil was bought from producers in the valley at 19c. per barrel by the large companies which distribute it. They did not add a very much higher rate for consumers and thousands of people put in oil-burning plants, giving up the use of coal entirely. The liquid fuel was cheaper, cleaner, did away with firemen, and permitted the user to regulate his desired heat closely. People have now got used to it and do not want to change back to coal again. And now the big companies owning the pipe lines, and distributing the oil, have raised the prices three or four times as high as when men originally put in oil plants. Quartz mills throughout the State have big oil tanks to keep their supplies and have their boiler furnaces arranged for oil. They do not want to change any more than manufacturers do. All of this is fine for the big oil companies. Still some men are about changing. An instance in point is of one man who formerly bought 500 tons of coal monthly and for the past four years has been using oil. Now he is trying to make contracts for coal again, fearing that oil will go still higher in price, when it will cost him more than coal for his purposes.

The largest quicksilver mine in the State installed a fuel-oil plant, with tanks, etc., and hauled the oil in 45 miles by team. The increase in price has made this company go back to the use of wood again. The mine is in a forest reserve, and the company buys from the forest service all the wood it needs. The foresters mark the trees and the company cuts the wood, paying stumpage to the Government. The arrangement is found to be satisfactory and cheaper than the oil at present prices. It is acknowledged that the oil for roasting the cinnabar ores was an ideal fuel, because the heat could be graduated to a nicety, there was no smoke and the ores were roasted in the manner desired. With the wood, more men are necessary to feed the furnaces and the roasting is not accomplished so well. It seems, from these statements, that the people in California are in a sort of transition state in the matter of fuel. If the price of oil is still farther increased many will undoubtedly go back to using coal.

In sampling metals (*Aust. Min. Stand.*, Dec. 9, 1908) they should never be filed, as the abrasion of the file will add enough iron to the samples to affect the assay for that metal. This is true even of spelter, which is comparatively soft. Samples of metals and alloys should be obtained by drilling whenever possible. If the specimen is too small for drilling, it should be chipped with a sharp cold-chisel.

A shipment of 2500 tons of manganese ore from Caledon, South Africa, to Antwerp is reported by the *South African Trade Journal*. No further shipments will be made until the results of the treatment of this first cargo shall have been ascertained. In addition to its resources in ore of this quality, the mine is said to contain abundant ore of lower grade.

The *Queen. Gov. Min. Journ.* estimates the coal produced in New South Wales during 1908 at 9,147,025 tons, valued at £3,353,093, exceeding that of the previous year by 489,101 tons and £430,674 in value, and establishing a new record. In the course of 10 years the output has more than doubled.

The Coast District of British Columbia

SPECIAL CORRESPONDENCE

An interesting report, recently issued[1] by the Geological Survey of Canada, covers that portion of the coast of British Columbia lying between the international boundary and the mouth of the Powell river on Malaspina strait, including Burrard inlet, Howe sound, Jervis inlet and the adjacent islands. The greater part of this region had not been previously examined geologically. The present report is of a preliminary character, exploration being conducted only when the formations were of economic importance. The rocks of this region are largely of igneous origin, representing a great range from acid to basic in composition, and from volcanic surface flows to deep-seated plutonics—rocks of aqueous origin having a comparatively small distribution. The principal areas of economic importance are those occupied by the Paleozoic rocks, the mineral deposits occurring in them or along their contacts. The prospector has to contend with many difficulties in this coastal belt, the whole country being extremely rugged and difficult of access, while rock slides, a luxuriant forest growth and dense underbrush below the 4000-ft. level conceal the contacts and mineral outcrops. In most cases the discovered mineral deposits of value are so situated that economic methods in mining and transportation are feasible. Surface or aërial tramways may connect the mines with tidewater, and from there transportation is afforded to the smelters. The principal metallic ores are those of copper and iron.

MINERAL AREAS OF THE COAST DISTRICT

The report gives a detailed description of the known mineral areas grouped with reference to the inlets and islands. Lynn Creek camp, Burrard inlet, is about eight miles north of North Vancouver, and comprises an area of about five square miles, in which about 35 claims have been staked. The ores consist of zinc-blende, chalcopyrite, pyrite, pyrrhotite, molybdenite and magnetite, which occur as irregular bodies along shear and fracture zones in the schists. The preliminary work done on these claims consists of stripping, small open cuts and tunnels, but in no case has sufficient work been done on any location to prove its value. On the Kemptville claims two veins of almost pure zinc-blende 2 ft. and 3 ft. wide, respectively, have been discovered, and on Angel claim No. 3 small bodies of yellow copper have been opened up. While some of the orebodies may prove of sufficient size to make them commercially important, in any case, owing to the cost of mining and transportation, it will be necessary to amalgamate the several interests to insure successful results.

BRITANNIA MINERAL ZONE

The Britannia mineral zone is situated on the east side of Howe sound, 23 miles from the entrance. The associated rocks belong to the Britannia group, consisting of conglomerates, quartzites, carbonaceous slates and quartz-sericite schists, with intercalated sills and masses of hornblende porphyrites and quartz-syenite porphyries. They have a width along shore of 1½ miles and extend inland for more than 8 miles. The mineralized zone lies almost wholly in the quartz-sericite series. Iron and copper sulphides were deposited simultaneously with the development of the schist, during the eruptive after-action produced by the intrusion of the granite. A concentration took place in parts of the zone and lenses of massive chalcopyrite with quartz were formed in parallel arrangement along the strike of the schist. These lenses range from an inch to several feet in width and are the source of nearly all the clean ore. About 70 claims have been staked along this zone and adjacent to it. The principal groups are controlled by the Britannia Copper Syndicate, Ltd., the Empress Mining Company, and the Goldsmith Copper Company. The Britannia Copper Company had mined and shipped up to Jan. 1, 1907, a total of 168,396 tons, of which 42,552 tons were shipping ore, and 65,844 tons concentrating ore, producing 12,612 tons of concentrates. The ore is essentially low grade and about 60 per cent. has to be concentrated before shipment for smelting. The company has an extensive plant, well equipped for the economical handling of the ore. At the mine the rock is first crushed at the head of the tramway and passed on a conveyer, where clean ore and waste are picked off. The Riblet automatic aërial tramway, 16,800 ft. long, connects the mine with the concentrator and shipping dock at the beach. The Britannia West Copper Company, whose claims also produce a low-grade ore said to carry appreciable values in gold and silver, were also installing a concentrating plant and building a tramway to the shore.

BOWEN ISLAND AND SEECHELT

The Bonanza mine on the southwest slope of Mount Gardiner, Bowen island, where a tunnel has been driven in for 300 ft., yields ore composed of pyrite, zinc-blende and galena, which carries also gold, silver and lead. On Jervis inlet deposits of pyrrhotite, chalcopyrite and arsenopyrite, were found in several places, and some claims had been staked. Assays gave no traces of gold or silver

On Seechelt inlet, about three miles inland from the east side of the head of Salmon arm, at an elevation of 4500 ft. above the sea, the Granite Mountain Copper Company has 18 locations. The country rock is granite and the ore occurs in fissure veins which are nine in number varying in width on the surface from 3 to 25 in. The ore is massive bornite with a little chalcocite and cuprite in quartz gangue. An assay of massive ore gave 0.4 oz. gold, 35 oz. silver and 53 per cent. (wet) of copper. Should development prove the orebodies to be extensive, an aërial tram could be built to Salmon arm for the transportation of ore.

TEXADA ISLAND

On Texada island, which lies in the Strait of Georgia, its southeast end being 80 miles north of Victoria and 47 miles from Vancouver, copper has been mined for over a decade and the output has been characterized by a high percentage of copper with good gold and silver contents. The magnetite deposits have been known since the early sixties, but development work has been desultory and comparatively little ore has been shipped. The island is 30 miles in length and its maximum width is 6½ miles. The western half of the island is more or less mineralized throughout, and has been nearly all staked at one time or another. The ore deposits occur in the Texada group and along the contact of that group with the Marble Bay limestone formation. In the Texada group the ores are found along shear and fracture zones in the basic eruptive rocks, and comprise galena, zinc-blende, chalcopyrite and pyrite, carrying, as a rule, small amounts of gold and silver. The veins are from 2 to 4 ft. wide, in one case 12 ft., and from 20 ft. to over 300 ft. long. Of the contact deposits the most considerable are the occurrences of magnetite and copper on the property of the Puget Sound Iron Company, and those of copper at Van Anda. The former, situated on the southwest side of the island, outcrop along the southern flanks of a ridge parallel to the shore, occurring over an area of one mile in length by half a mile wide. About 15 distinct bodies are exposed along the contact of limestone with granite and the greenstone. The most important deposits are known as the Texada, Paxton and Lake mines. The ore of the Texada, where considerable development work has been done, is a coarse crystalline magnetite, which is locally impure from impregnations of copper and iron pyrites, some of the ore having carried as high as 3 per cent. copper.

A tunnel over 300 ft long passed through 74 ft. of magnetite. At the Paxton the orebody is 320 ft. long, with a width of 240 ft., and a hight of 92 ft The Lake mine, one mile east of the Texada, has an orebody nearly 200 ft. long, 50 ft. wide and 70 ft high in one locality Little has been done in exploting other de-

[1] Preliminary Report on a Portion of the Main Coast of British Columbia and Adjacent Islands included in New Westminster and Nanaimo districts. By O. E. Leroy; pp. 56, illustrated; paper; 9¾x6½ in. Geological Survey of Canada, Ottawa, 1908. King's Printer.

posits beyond delimiting their boundaries superficially. Much of the ore now exposed would have to be roasted to free it from sulphur. Regarding the variable amounts of copper disseminated through parts of the orebodies it will probably be found that judicious selection would prevent the copper content in the roasted ore becoming high enough to vitiate materially the product for cast iron or steel. Several analyses are given showing iron contents of the ore ranging between 65.71 and 69.85 per cent. The total amount shipped probably does not exceed 20,000 tons, the greater part of which was smelted at Irondale, Wash. The deposits present good facilities for economic mining, principally by a system of quarries and tunnels. Closely associated with the magnetites is a series of copper deposits consisting of chalcopyrite and a little carbonate, occurring as small irregular bodies along the contact of the limestone with the chlorite schist and magnetite. Over a dozen bodies have so far been discovered and some of them worked out. It is stated that over $10,000 worth of ore has been mined.

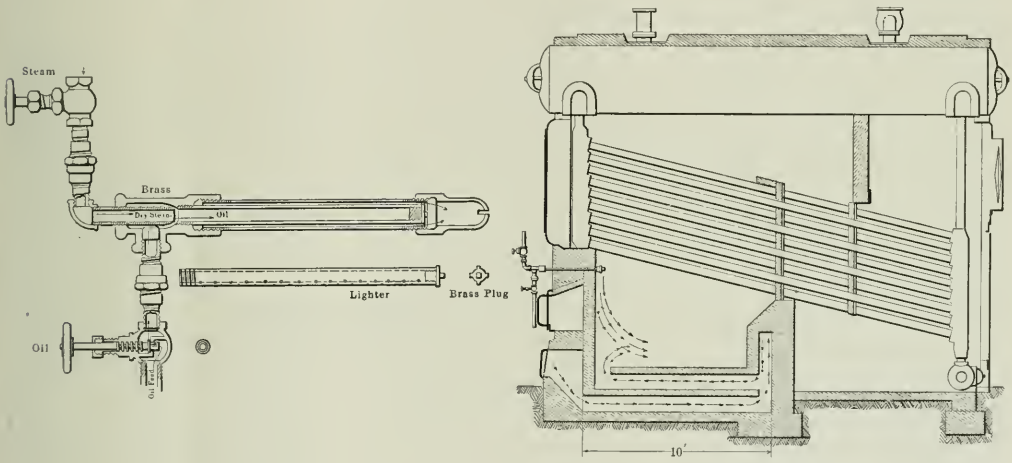
The ore deposits which occur wholly in the limestone have their chief development in the vicinity of the town of Van Anda. The three principal mines are the Copper Queen, Cornell and Marble Bay, of which the latter has been most extensively developed. It is owned by the Tacoma Steel Company, which holds about 1500 acres in the western part of the island. The mine is 771 ft. deep and the orebody from 260 ft. to the present workings has varied in length from 70 to 105 ft., and in width from 5 to 45 ft. The ore is bornite with subordinate chalcopyrite and a little pyrite, pyrrhotite and molybdenite and is throughout essentially high grade, carrying good values in gold and silver. About 13,000 tons are mined and shipped annually. The mine is well equipped with a modern plant. At the Cornell mine the ore near the surface was rich, the product between the surface and the 160-ft. level being valued at $270,000; some of the ore yielding 1.25 oz. of gold to the ton.

Quarry and Lime Production

There are a number of quarries along the coast which furnish building stone and scrap for concrete and road metal. The limestones of Texada island are generally pure and when burned furnish a lime of excellent quality. The Tacoma Steel Company has two kilns on Limekiln bay on the northwest end of the island, which have an output of about 120 bbl. of lime per day. Very pure clays are found on the north arm of the Burrard inlet, at the head of Howe sound on the east side and on Anvil island. On West Thornmanby island a fine, pure clay occurs, which, on drying, produces a fine powder, which makes a good natural powder for metal polishing.

The Tres Hermanas District

The Tres Hermanas mountains, south of Deming, N. M., and 10 miles north of the Mexican boundary line, were the scene of considerable activity in the early mining days of that State, lead being the principal metal produced at that time. In 1904, attention was attracted to a heavy, white, massive or crystallized material occurring plentifully in the old lead workings. This material was found to consist of carbonates and silicates of zinc. The zinc ores include large quantities of the unusual mineral willemite (the pure anhydrous silicate of zinc), smithsonite (zinc carbonate), hydrozincite (basic zinc carbonate), and calamine (hydrous zinc silicate). Shipments of the zinc ore were made to smelters in the Mississippi valley in 1905, but in 1906 and 1907 little activity was apparent. A geologic examination of the north end of the Tres Hermanas district was made during the field season of 1908 by Waldemar Lindgren, of the U. S. Geological Survey.



DETAILS OF WITT CRUDE-OIL BURNER AND AN INSTALLATION IN A NOISELESS FURNACE

Noiseless Furnace for Burning Crude Oil

The accompanying illustration shows an arrangement of a boiler furnace fitted with a Witt crude-oil burner which protects the flues of the boiler from the direct flame, preheats the air supply and produces a noiseless fire. The air is admitted through flues below the fire-box leading to the bridge and returning directly under the oil burner. The burner is placed directly under the tubes, but since the heated air enters at the bottom of the combustion chamber, the flame is not local but the fire is distributed throughout the furnace.

The *Marine Review*, of Cleveland, Ohio, reproduces some figures as to Lake rates on iron from a report made 25 years ago. The contracts made in the winter of 1882 were at the rate of $1.40 per ton from Escanaba to Cleveland and $1.75 to $2 from Marquette. The total amount landed at Cleveland that year was 2,900,431 tons. In the winter of 1883 contracts were made for bringing ore from Escanaba to Cleveland at $1 to $1.10 per ton, and from Marquette at $1.15 to $1.25; the closing prices were at $1.40 to $1.50 from Escanaba and $1.75 to $2 per ton from Marquette. The total amount brought down in 1883 was 2,300,351 tons.

Mines of the Lordsburg District, New Mexico

By J. L. Wells*

The renewed activity in the Lordsburg mining district may make of interest a review of the mines of this southwesterly portion of New Mexico. The Lordsburg district comprises two mineral sections, locally known as the Virginia and the Pyramid districts. The principal mines are situated from 2½ to 9 miles southwest from the town of Lordsburg, which is on the Southern Pacific and the Arizona & New Mexico railroads. An able article by Prof. Fayette E. Jones, with an accompanying map of the district, was published in the Journal, Sept. 7, 1907, outlining the history of the camp and describing the ore deposits. Since the notes were taken for the article referred to considerable development work has been done in the district.

The principal properties being developed are the Eighty-five, Miser's Chest, Bonney, Last Chance, Nelly Bly and Robert E. Lee. All of these mines give encouragement from this development, the most favorable results being shown on the Eighty-five and the Nelly Bly, where the most work was done. On the Eighty-five property during 1908 there were completed 200 ft. of shaft from the main tunnel level on the Emerald vein, and two levels were developed disclosing a vein from 4 to 12 ft. in width. A second level, which is 200 ft. below the tunnel level, is approximately 400 ft. below the surface of the vein at its outcrop on the mountain.

From these workings on the Emerald vein there were shipped during 1908, about 1000 tons of ore. The ore from this vein is highly silicious, carrying from 60 to 90 per cent. silica, 0.1 oz. gold, 3 oz. silver, and 3½ per cent. copper. In the lower levels the vein matter is softer and native copper is found as well as several varieties of copper ore. The ore of the Superior mine to the southwest is of higher grade, but is supposed to be an extension of the Emerald vein. The ore of the Atwood and of the Eighty-five mine is also highly silicious and of approximately the same grade as the Superior ore.

There were about 7500 tons of ore shipped from this vicinity during 1908, this tonnage coming mainly from the Superior, Eighty-five, Atwood and Bonney mines. These ores were shipped to the Copper Queen reduction works, at Douglas, Ariz., and were used principally for converter lining. Among the other mines of this district, which have not been operated during the last year, are the Aberdeen, Nelly Bly, Last Chance & Clara Sutton, Venus group and Robert E. Lee. The Nelly Bly and the Robert E. Lee are adjoining mines and each has produced high-grade copper-silver ore. The Nelly Bly resumed operation the first of this year. The Last Chance & Clara Sutton has also resumed and is sinking the main shaft which is at present about 300 ft. deep. The surface ore of this mine contained principally silver, but copper is now becoming a factor. The mine has produced over $100,000 worth of ore.

The Venus group has been considerably prospected over the surface to a depth of from 10 to 180 ft. The main shaft on the Venus claim is 308 ft. deep, and there are several hundred feet of drifts and crosscuts. There are two veins included in this development which, as far as have been disclosed, are from 50 to 100 ft. apart on the Venus property, but diverge as they pass to the southwest into the Last Chance property. The east vein which is the stronger of the two is almost vertical. It averages over 6 ft., as developed, and at the 225-ft. level it is 10 ft. wide.

The west vein dips to the east at an angle which would indicate that the veins will be joined together at a depth of 500 ft. It averages 4 ft. in width and the principal development has been done on this vein. From it there have been over 5000 tons of ore milled by the pan amalgamation process, the high-grade ore being shipped to the smelters. The principal metal in these veins is silver, with small amounts of gold, copper and lead associated. The mine has produced over $200,000 from these workings.

There are two other well defined veins on the property, which have been developed in different places to depths from 40 to 180 ft.; one of these carries more copper and gold than the Venus and the other a higher average silver content. The veins of this group are influenced by a shattered zone and are intersected by numerous small veins and seams which in many cases carry high-grade ore; from one of these intersecting veins in the Venus workings, several tons of ore were taken that sold for $1489 per ton. There remains developed in the Venus workings over 14,000 tons of ore, having it is said an average content of 18 oz. silver per ton.

To the west, between this group and the Nelly Bly and Robert E. Lee, a location was made last year by D. W. Briel and T. A. Lister, on which some exceptionally rich ore was discovered at the surface. The ore carried 6 per cent. copper but ran very high in silver. This vein has not been prospected enough to determine its length in either direction. To the south about nine miles from the Venus group, is an undeveloped district in the vicinity of South Pyramid mountain. Rich silver ore has been discovered in some of the prospects there.

The Aberdeen mine, owned and operated by the Penn Mining Company, has resumed operation and will sink the shaft to the 600-ft. level, with capital now in the treasury, and by those in position to know it is stated that they will probably continue to a depth of 1000 ft. If this plan is carried to completion, the owners will doubtless prove their holdings to be more valuable and also demonstrate, what is much needed in this district, that the mineral deposits are not all on the surface. There has been no deep mining in this district, 400 ft. being the deepest workings, and this depth only in the Eighty-Five, Superior and Nelly Bly. Considerable money has been spent in the district but much of it wasted, through ignorance, in shallow surface work, building mills and buying traction engine outfits.

*Lordsburg, New Mexico.

Evolution of the Gravity Stamp Mill

By Algernon Del Mar*

It is a remarkable circumstance that the ancients who were in many respects first-rate engineers should have overlooked the possibilities of a mechanical device for crushing gold ores. It cannot be that they were lacking in the necessary engineering skill but rather that they could not see the advantage of combining a water wheel with the pestles already familiar to their workmen and thus save the labor and feed of many men. The sole reason must have been that while slaves were cheap machinery was not necessary but when slave labor was no longer available or had become expensive, the crude gravity stamp mills were evolved from methods and appliances long known to the ancients.

The system of gold milling practiced in Egypt in ancient times will be described to show that the next step was easily attainable and required no great amount of adaptability. The quotation is cited from Diodorus Siculus: "When the stone containing the gold is hard, the Egyptians soften it by the application of fire and when it has been reduced to such a soft state that it yields to moderate labor, several thousand of these unfortunate people treat it with iron picks. Those who are above thirty years of age are employed to pound pieces of the stone of certain dimensions with iron pestles in stone mortars until reduced to the size of a bean. The whole is then transferred to women and old men who put it into mills arranged in a row, two or three persons being employed at the same mill, and it is pounded until reduced to a fine powder. (Here we have a stamp mill operated by three persons lifting a heavy pestle presumably of iron and probably with a wooden stem.) At length the masters take the stone thus ground to powder and carry it away to undergo the

*Mining engineer, South Pasadena, Cal.

"final process." The final process was "to wash on inclined tables furnished with two cisterns, all built of stone." Here we have what corresponds to a modern canvas plant. Evidently the amount of ore crushed was too great for slaves to pan, so it was run over tables with a stream of water.

Although we have no description of a gravity stamp mill being used by the Romans it would have been only a short step in evolution to have used mechanical power to lift the heavy pestles used by the Egyptians. From the Hungarian mines there are remains that date from the fifteenth or sixteenth century. The tilt-hammer used in China has been described by Henry Louis.

From the sixteenth century to the time of the discovery of gold in California little improvement was made in the gravity stamp. It was a crude affair consisting of three or four stamps. Each stem consisted of a square wooden beam usually of oak, 12 ft. long and 6 in. square, the shoe of cast iron being inserted in the wooden stem and bound with iron bands and tightly wedged. The mortar was either open, or a wooden box the bottom of which was composed of hard quartz fragments tightly beaten in with heavy iron rams.

Sometimes the screens were of punched iron but more often the discharge was simply over a side of the box which could be moved up and down to alter the fineness of the crushed pulp. The stamps weighed from 150 to 250 lb. and were dropped from 8 to 12 in. about 70 times per minute. The cams and tappets were of wood and the stamps were lifted, without turning, in pairs when the battery was composed of four stamps, and alternately when of three stamps. Even the idea of five stamps and lifting in the sequence that gives the best flow of pulp is of late origin. The oldest mills in California had four stamps in a battery all on one cam shaft. Plumas county has many such mills. It is said that six stamps were sometimes put in a battery and can be seen in Mexico today.

The modern stamp mills of the best type as used in different parts of the world are simply the refinement and perfection of these early types, made possible by the improvements in the materials of which the different parts are made. Our stamp now weighs from 1000 to 1700 or even 1800 lb. and drops from 6 to 8 in. at the rate of 100 to 110 drops per minute.

It was the discovery of gold in California and Australia and the high cost of labor, that made necessary improved machinery for crushing ore and from this necessity the old gravity mill was improved upon until we have the stamp mill in its present state of perfection. The original stamp mills as well as the mortars of the ancients were used simply to break ore that had already been subjected to a preliminary process of communition. It is a curious fact that the stamp mill is gradually reverting to its original use as a crusher for rock of medium size.

When the cyanide process was unknown or in its infancy stamp mills were in general use as amalgamators for it was found that a thorough admixture of mercury with gold in the mortar often saved more gold than when the processes of crushing and amalgamating were conducted separately. With the introduction of the cyanide process and the finer grinding of the ores, amalgamation has to a great extent been given up, so that the gravity stamp mill is gradually occupying the place of an intermediate crusher between the rock breaker and the fine grinder. As a coarse or fine crusher it is excelled by other machines, but as occupying the place described above in the process of winning gold from its ores it has no peer.

As the use of the cyanide process for the extraction of gold increases the purpose of the stamp mill is becoming simply a crushing machine. Its simplification from a battery of five stamps to that of one stamp is taking place at the same time, for it has been found that the single stamp crushes more ore per unit or per horsepower than when more stamps are arranged in the same battery. The amount of labor, however, increases with the single batteries so that especially where labor is high a 5-stamp battery with a narrow mortar will in the end be more satisfactory than five single stamps. When amalgamation is necessary inside the battery a roomy 5-stamp battery is used and not the single unit.

Metallurgical Treatment of Jamesonite Ores*

By G. P. Ives and I. D. Ossa

In the ore from the Black Hills, the jamesonite is associated with quartz, servantite, and sometimes small amounts of galena. This ore occurs in comparatively narrow veins and cuts across the formation of Algonkian schists and slates, and can often be traced for considerable distances. Jamesonite is of value as a commercial source for the metals lead and antimony. Also the gold and silver usually contained may be recovered.

Under the supervision and advice of Prof. C. H. Fulton and Prof. M. F. Coolbaugh, an effort was made to find standard economical methods for the treatment of this rather complex ore.

The ore was crushed to the proper size and roasted to 2 to 3 per cent. sulphur. The roasted ore, properly fluxed, was smelted in a cupola-lead furnace to a lead-antimony alloy or bullion containing also the precious metals. It was found advisable during the operation to form a copper-lead matte, which was done on a small scale, due to the scarcity of copper ore. The lead-antimony alloy was electrolytically refined by the Betts process, and gave a clean and economical separation of lead, antimony, gold and silver.

The ore furnished was of two lots which showed the following composition: No. 1: SiO_2, 66.5 per cent.; FeO, 6.02; CaO, 0.7; Al_2O_3, 5.33; S, 4.1; Sb, 4.2; Pb, 7.95; Zn, 1.5; As, 0.3. No. 2: SiO_2, 35 per cent.; FeO, 3.85; Al_2O_3, 1.3; S, 9; Sb, 17.5; Pb, 32. The first lot of ore was of low grade and could easily be concentrated, while the second lot was smelted directly, mixed with the fines of the mechanical concentration, previously roasted or sintered.

Roasting Jamesonite Ores

The proper temperature for the oxidation of the antimony sulphide seems to be about 350 deg. C. When this temperature is reached, the atmospheric oxygen converts the sulphide into sulphur dioxide and antimony trioxide. In the presence of an excess of air the antimony trioxide is oxidized to pentoxide, and this, combining with some of the trioxide, forms the tetroxide. The presence of an excess of air is an essential point in the roasting of antimony sulphide, for it is necessary to conduct the roasting operation in such a way as to oxidize all the antimony to the tetroxide. The trioxide is volatile at temperatures higher than 350 deg. C. Some part of the trioxide, in the presence of oxide of lead and air forms a lead antimoniate; it seems that there is no formation of sulphate of antimony.

After the oxidation reactions have taken place the temperature is raised, resulting in the formation of lead silicate. This reaction takes place between 700 and 900 deg. C., and the combination is effected without the mixture becoming fluid. At this time, if the temperature is kept constant, the lead silicate starts to fuse, sintering and agglomerating the furnace charge which is taken off.

The 2990 lb. of first-class ore was roasted in a Brückner furnace, using wood as fuel. The furnace took charges weighing 250 lb. each, and the roasting to the sintered state lasted about two hours per charge. The roasted ore, amounting to 2927 lb., was of the following composition: SiO_2, 35 per cent.; FeO, 4; Al_2O_3, 1.36; Pb, 32.5; S, 4.15; Sb, 15.4.

The operation of roasting is necessarily divided into two parts, viz: (1) Roasting at a low temperature with free access of air. (2) Sintering of roasted product at a relatively high temperature.

Smelting

The roasted ore was smelted in a small cupola furnace. The first problem to solve was the calculation of the furnace charge, taking into consideration that it was advis-

*Abstract of a thesis submitted to the faculty of the South Dakota State School of Mines, May 15, 1908.

able to smelt all or very nearly all of the low-grade ore and that the formation of matte was not only advisable but strictly necessary for the proper running of the furnace. It soon became evident that the low percentage of lead in the charge was causing a considerable loss. Therefore, the charge was changed to a typical lead charge.

To start the furnace a cordwood fire was made in the crucible and kept burning for 24 hours. When the well was hot, all ashes were removed and the lead well cleaned. Lead was then put in and the breast closed up with firebrick. Cordwood was charged from the top and ignited through the tuyeres. The tuyeres were set in place and a slight blast turned on. The furnace was charged to three-fourths of its hight with coke; on top of that the blowing-in charge, consisting of 100 lb. of slag and 30 lb. of coke. After the second blowing-in charge was added the first regular charge was added. A blowing-in charge was added every fourth charge for the first four or five hours.

The bullion produced showed the following analysis: Lead, 78.8 per cent.; antimony, 16; copper, 3.5; gold, 3 oz. per ton; silver, 37 oz. per ton. The matte made was of the following composition: Lead, 2.14 to 3 per cent.; copper, 7.30 to 11.97; antimony, 0.56 to 1; silver, 13.68 oz. per ton; gold, 0.24 oz. per ton. The slag made during the smelting operation closely resembles the following: SiO_2, 30 per cent.; FeO, 33; CaO, 18; Al_2O_3, 6. The slag was of the general formula:

$$x\ (RO.\ SiO_2) + y\ (2\ RO.\ SiO_2).$$

It was calculated to correspond to the formula:

$$RO.\ SiO_2 + 6.9\ (2\ RO.\ SiO_2)$$

It is mainly a mono-silicate, the silicate degree being 1.08.

We believe the formation of a slag rather high in silica and lime is most suited for the operation and we suggest a slag of the following composition: SiO_2, 36 per cent.; CaO, 25; FeO, 26; Al_2O_3, 7. This will answer the requirements admirably, either from a purely metallurgical or economical standpoint.

The smelting of jamesonite ore can easily be done in a blast furnace without previous roasting and we firmly believe that losses of antimony will be in this case greatly avoided. While it will be necessary to roast the fine concentrates, the coarse concentrates and first-class ore can be smelted directly, after mixing them in such a way as to form 8 per cent. matte fall. It is desirable to have some copper in the matte and it will, therefore, be necessary to add some oxidizing copper ores or rich copper sulphides. The matte formed can be resmelted to a 30 or 40 per cent. copper matte and shipped to a copper refinery, while most of the lead of the first matte formed may be recovered in the resmelting operation.

The volatilization of antimony in the blast furnaces cannot be lower than 10 per cent. of the antimony in the ore. This may be recovered by passing the fumes to a bag-house. If the ore is roasted, the recovery of the antimony is a little more difficult, due to the fact that the roasting fumes cannot be filtered by the bag-house system.

Electolytic Refining of Lead-antimony Alloy

The Betts process for the electrolytic refining of lead or base bullion is based on the fact that, if in a dilute solution of lead fluosilicate, the impure metal is used as an anode, while a sheet of pure lead is used as a cathode, the electrolyte dissolves the lead of the impure anode and deposits the lead free of impurities on the cathode. The Betts process has been successfully used in three or four electrolytic refineries of this country and has proved more advantageous than the old Parke's process for the desilverization of lead bullion.

The recovery of the precious metals can be accomplished by smelting the final slimes which contain mainly Au, Ag, accompanied by Cu, Sb, Pb, etc., properly fluxed in graphite crucibles, so as to form a "doré bullion" containing certain base metals as impurities. The doré bullion cast in the form of anodes can be electrolytically refined by the Dietzel process or by the Moebius or Balback process. In these processes the electrolyte is a copper-silver nitrate solution, and while they differ in details of arrangement, their efficiency is uniform and extraordinarily high.

U. S. Geological Survey Office at Denver

At Denver, Colo., the U. S. Geological Survey has opened a permanent branch office to facilitate the transaction of its Western work. This office is not only to provide a base of supplies for the large corps of engineers which the Survey keeps in this field, but is also designed to meet the need of the Western public for a source of information less remote than Washington. The office is located in the Commonwealth building, and for the present is under the direction of R. C. Miles, special disbursing agent.

A supply of copies of the publications available for free distribution will be kept on hand, as well as a complete file of the topographic maps, geologic folios, and other publications of the Survey subject to sale. All of these publications will be open to inspection by persons desiring information concerning the subjects treated. Prospective purchasers of maps and folios will be referred to the nearest sales agent, and the free publications will be distributed in Denver to those making application.

The discontinuance of the Denver office over a decade ago was the occasion of much criticism of the policy of the Survey and the reestablishment of the office will be appreciated by Western mining interests.

Le Roi, No. 2

The report of this British Columbia company shows that the year ended Sept. 30, 1908, was the most prosperous year that Le Roi No. 2 Company has yet had. There was a profit on working account of £53,053, after writing off £19,795 for depreciation of machinery and plant and mine development. Dividends to the amount of 6s. per share, absorbing £37,800, have been paid.

The ore shipped to the Trail Smelting Works amounted to 29,648 tons, of an average value in gold, silver and copper of $23.60 per ton. The receipts from the smelter were $535,245, or $18.053 per ton. The average value of the ore was, in gold, 0.9597 oz.; silver, 0.691 oz.; copper, 30.705 lb. per ton. The company also obtained a small revenue from its own concentrating plant, which treated 15,044 tons during the period. The cost of stoping, ore sorting, power plant and diamond drilling is stated to have been $3.60 per dry ton of ore mined. Depreciation of machinery and buildings and mine development cost together $1.71 per dry ton, making the total costs $5.31 per ton.

The mine is now being operated down to the 900-ft. level and the main shaft is to be sunk farther. The most important discovery of the year has been the strike of ore by a diamond drill some 320 ft. below the 900-ft. level, which is believed to be the downward continuation of the south vein of the Le Roi, which is now yielding high-grade ore. The consulting engineers say that as this vein is dipping northward into LeRoi No. 2 ground, the importance of this discovery hardly needs emphasizing, its true significance lying in the fact that below about the 1,200-ft horizon of the Josie the above vein will continue to be the property of the Le Roi No. 2 definitely.

During the current year efforts will chiefly be directed to the development of the property in depth in order to open up and render available the ore now proved by the drill to enter the company's ground at a depth of 1,200 ft. and beyond.

Practically the entire quicksilver production of California is sold by the Eureka Company, of San Francisco. The producers consign their product to this selling agent, which divides its sales *pro rata* among the consignors. The Eureka Company charges 1 per cent. commission and advances 80 per cent on consignments, charging 6 per cent. interest for such advances.

Examination of Gold Dredging Properties

Loose Methods of Sampling Frequently Responsible, but Dredge Builders Often Blamed, When Ground Fails to Yield Expected Returns

BY T. S. RUH

Many dredging properties that are offered to investors are owned or held under option by men who know little or nothing about gold dredging. In most cases this property has been old placer ground abandoned years ago, and often the owner or the man whom he has hired to sample the property is a placer miner. In sampling the property, the placer miner will find the pay-streak, take a few pans of dirt and make his calculations from this. For argument, we will say five pans of dirt yield three cents. Then he calculates that it requires 160 pans of dirt to make a cubic yard. Therefore he argues

$$\frac{160 \times 3c.}{5} = 96c.$$

This he knows is exceedingly high, so, to be "conservative," he cuts his estimate in half. The property may be good for dredging, and the gravel may be rich, but it is needless to say that such a test is absolutely worthless.

If the placer miner will sample this ground from top to bottom, he will very likely have 30 pans of dirt and get perhaps 5c. in gold. Further, to make this test a fair one, he should take into consideration that at least 20 per cent. of the gravel has been thrown out as large stones. Therefore, the correct quantity of material would be 30 pans plus 20 per cent. or 36 pans, and the value per cubic yard will be $\frac{160 \times 5c.}{36}$, or 32c., which would be exceedingly rich ground for gold-dredging purposes in California and good ground in many parts of Alaska. However, this test is in no wise reliable, since probably the sampler has not sunk test shafts or pits, but has sampled open cuts made by the placer miners, who followed the best pay-streaks almost by instinct. Therefore he has not taken an average sample; he simply prospected one of the best places in the property.

GOLD DREDGING GROUND NEAR NOME, ALASKA

If the sampler had sunk a few shafts systematically to bedrock, and then sampled from top to bottom, he would have come pretty near knowing what was in the ground. If the ground is so situated that it is impossible to sink shafts on account of water, then the only other method is to have an experienced driller drill and test the ground. It is impossible to emphasize too strongly the word "experienced" in the above sentence. Of course by "experienced," I mean one *experienced in drilling ground for gold dredging purposes.* An oil driller is worse than none at all.

Of course this costs money; and the average person who attempts to start a gold-dredging proposition does not care to put money into the ground for which he can see no good returns. When he has not sufficient money of his own to install the dredge, he gets in touch with someone who has read something about gold dredging, and who thinks that it is an ideal field for investment—which it is when properly exploited.

The Ordinary Investor

Like the man who obtained the ground, these investors know little about gold dredging, and although they may be first-class business men in another particular line, at the same time they "fall down" when it comes to a question of prospecting the property systematically and finding out what is really in the gravel before they go ahead.

The investor perhaps goes half way across the continent to look at a piece of gold-dredging property, and then will see the miner take pans of dirt from the gravel (as previously described), wash the "sample" and see with his own eyes the gold that is obtained. I have not only seen this, but I have also seen the miner in order to demonstrate the richness of the property sweep up a pan of dust and dirt from a road that crossed the property, take this to the creek, pan it and get excellent results. Of course the miner knows that the wind and the rain had blown or washed away the light

material, but it is ten chances to one that the investor does not know this.

I remember one property at which the men who financed it only took a few pan tests and then proceeded to purchase a gold dredge. They claimed that they had prospected the ground in a very thorough and systematic manner, and had about 40 samples of gold in glass tubes to show for their work.

The dredge that they bought was a good machine and one suitable for the ground. However, these investors placed the dredge where they *guessed* they had the best values, and proceeded to make a pit in which the dredge was erected on the same principle as their prospecting, namely—on a cheap basis. Therefore, they provided a very small pit, thinking that a dredge which could handle 2500 yd. per day would have a pit in a couple of days which would be large enough to suit every possible need. But imagine their surprise when the first day of operation passed, and they had not enough tailings to fill a small chicken house. However, there were other surprises in store since it took at least a month to open up the pit so that the dredge was able to work to its full capacity; and it was almost another month before the dredge had dug down to bedrock on which lay 90 per cent. of the gold.

Therefore, considering the lost time that a new dredge naturally consumes in making adjustments, and the fact that the dredge handled the top material which contained little or no gold, there were two months of operation, and the dredge had not paid working expenses.

In such cases as this the ordinary investor begins to feel very uncomfortable, and thinks that he has a gold brick on his hands. He goes to the dredge builder and states that he knows that the gold is in the ground, that he knows that the dredge has handled a considerable quantity of dirt, and that he also knows that he has not got the money in the bank. Therefore, the only deduction left to him is that the dredge does not save the gold.

Further, at the end of 60 days, the final payment owing to the dredge builders and amounting to 10 or 15 per cent. of the purchase price, or on a dredge costing $80,000 not less than $8000 is due. If the dredge has made working expenses, it has done very well, but no doubt the investor has calculated on taking this final payment out of the ground and therefore has not raised any capital to meet this payment.

Since he has not been able to dig this money out of the ground, he naturally argues that the dredge builders are at fault and he is not going to pay this final payment. Although the dredge may be built in strict accordance with the contract and specifications, at the same time he will be able to drum up some trouble real or imaginary, on which to stand off this payment, and he is not open to any sort of argument.

He still thinks that his ground is worth 50c. per cu.yd., where it is not worth 15c.; and even at 15c. per cu.yd., it is an exceedingly fine investment, but since he has not seen even the 15c., or perhaps 6c., for all the output has been consumed by the first two months' pay-roll, he naturally feels loth to put more money into what on the face looks like a failure. However, if the dredge builders are patient, and do not tie up his enterprise he may work on the next month, and handle say 60,000 cu.yd. with a gross return of $9000, and with a total operating cost of say $2500 to $3000. After this experience the investor becomes a much wiser man.

DREDGING GROUND—WHERE THE OLD MINER STOPPED

Copper Industries of Italy

With the exception of the mines at Montecatini, which yield an ore carrying 20 per cent. copper, the average tenor of the ores produced by the Italian copper mines ranges from 5 to 12 per cent., according to Alfred Greco in *l'Echo des Mines*. In a recent issue he outlines the present state of the copper-mining and consuming industries of Italy.

The most important mines are at Libiola, in Liguria, and at Montecatini, Boccheggiano, Fenice Masselana, Capanne Vecchie, etc., in Tuscany. Cupriferous pyrite is abundant in the neighborhood of the Alps, at Algana, near Novare, at Agordo, near Bellune, and in other parts of Turin. Some of the ore from this district was once used by an electrometallurgical company with a plant at Agordo, but later was employed only for making sulphuric acid. On the northern slope of the Apennines, near Parme and Plaisance, there is an abundance of chalcopyrite, though low in copper.

Until recent years the output of copper in Italy was small, owing to the expensive methods of extraction. The leaching process was introduced in 1880, and first put the industry on an economical basis. The process as applied now consists in crushing, roasting, leaching and electrolytic recovery of the copper. After leaching out the copper sulphate the solution runs into large reserviors and then to electrolytic vats in which the copper is precipitated on cast-iron cathodes, yielding a cement copper containing 80 per cent. Cu. This is then refined in reverberatory furnaces.

The Manhès converting process was first introduced in 1888 by the Compagnie Itallienne Métallurgique de Torreta and electrolytic refining was adopted in 1900 by the same company. A certain amount of foreign raw material is imported, mainly from Coro-Coro, Bolivia, from the Lake Superior district and from Germany. Copper and brass are imported from England, Germany and France. Italy has, however, begun to export copper and brass to Switzerland and Argentina.

The copper industries are now developing on a larger scale, principally under the stimulus of increased naval construction. The most important manufactures are copper and brass seamless tubes, sheets and plates for locomotive fireboxes, bars and wire. There are now five plants for the electrolytic extraction of copper from pyritic ores, two copper refineries, two copper foundries, and six works for shaping and rolling articles in copper and brass.

An American company is reported to be employing 700 men in a mica mine near Kodarina, India, about 250 miles from Calcutta on the East India railway.

Air Economy in Rock Drills

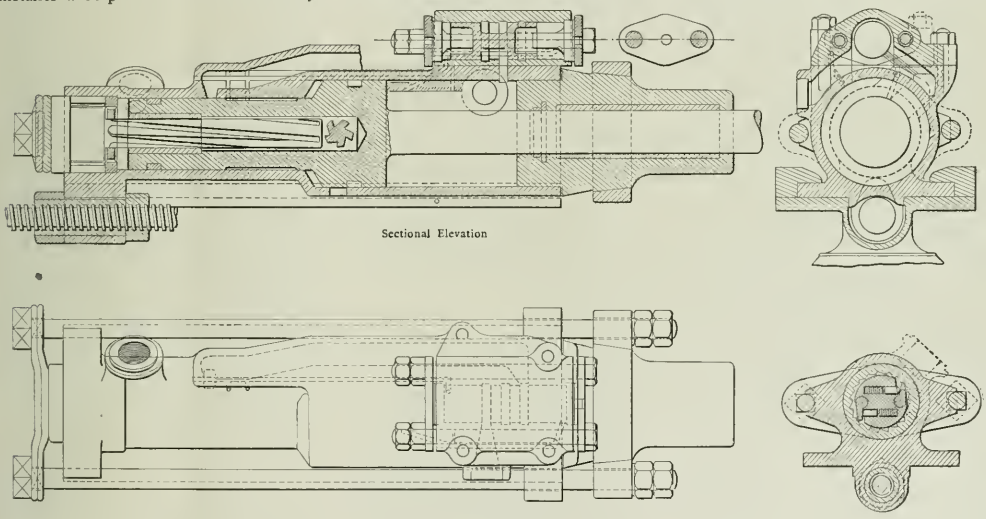
By Alexander West

At a meeting of the Transvaal Institute of Mechanical Engineers some time ago, J. A. MacGeorge contributed an article on "Notes on Small Stope Drills" in which he gave the result of some trials made by him, at the Angelo Deep mine, to ascertain the boring speed and the air consumption of a 3-in. Konomax drill[1] and of a 3¼-in. tappet drill of ordinary design (probably the Little Giant drill). Mr. MacGeorge states in his paper that the tests were made, the air consumption was measured, and the trials conducted the same as in the City & Surbuban mine tests in 1904. The results are given in a table accompanying his paper showing great care and much labor in its compilation, but unfortunately every mistake made in the City & Suburban trials is repeated so that the test has little practical value. It seems a pity that, since these mistakes were pointed out at that time by several engineers, they should have been made again in these tests. The drills were set up so as to drill a vertical hole in a granite block. The air was furnished from a receiver so that by reading the pressure at the start and the end of the test the amount of air used was calculated. The holes were not started before the test runs began, the steel was not accurately centered, nor were the bits of uniform size; consequently the results have little comparative value. Besides, as the holes were drilled vertical the results would have little practical use at least on the Rand for all the holes except those in shafts are drilled only slightly inclined above or below the horizontal. Although 80 runs were made, the results of only 27 runs were given without any explanation of why the others were thrown out.

As will be seen from the accompanying table the two drills were tested at air pressures of 80 lb., 70 lb. and 60 lb. per sq.in. The average depth of hole drilled was only 8 in. for the Konomax and 5 in. for the other drill. The results obtained condemn themselves, for they indicate that a machine drills more quickly at 70 and 60 lb. than at 80 lb. per sq.in. The results would also indicate that a hole can be drilled much faster with a 2⅞-in. bit than with a 2⅝-in. bit. The air consumption indicated is also erratic. The only practical result from the test seems to be that it showed that the Konomax drill at greater than 40 lb. per sq.in. can drill almost as fast in free-boring holes as can the best machines of the ordinary type and uses only 60 per cent. as much air.

MAXIMUM AND MINIMUM EFFICIENCY OF THE KONOMAX AND THE 3¼-INCH PISTON DRILL.

Drill Tested.	Test Number.	Gage Pressure.	Total Time of Run.	Depth Drilled.	Size of Drill.	Total Cubic Inches Removed.	Cubic Feet Free Air Consumed.	Rate of Drilling Per Minute.
		Pounds.	Minutes.	Inches.	Inches.	Cubic In.	Cubic Ft.	Inches.
Konomax....	1	80.70	4.433	9.4375	2⅝	48.7	322.6	2.128
Konomax....	26	80.70	4.583	6.8750	2⅝	37.206	317.1	1.50
3¼-in. drill....	30	80.70	3.000	5.375	2 17/32	29.440	316.0	1.791
3¼-in. drill....	34	80.70	3.333	4.25	2 29/32	22.459	312.4	1.275
Konomax....	2	70.60	4.616	9.0625	2½	43.386	317.0	1.963
Konomax....	27	70.60	6.166	7.625	2 1/16	38.375	320.9	1.236
3¼-in. drill....	15	70.60	2.666	3.50	2 1/16	16.332	326.5	1.312
3¼-in. drill....	31	70.60	3.066	6.375	2 15/16	30.134	318.2	2.079
Konomax....	28	60.50	7.75	8.375	2 9/16	34.273	336.0	1.080
Konomax....	49	60.50	7.10	11.0	2 9/16	40.176	321.4	1.549
3¼-in. drill....	12	60.50	3.816	6.625	2 15/16	27.463	341.4	1.736
3¼-in. drill....	16	60.50	2.500	4.0	2⅝	17.490	329.1	1.60



KONOMAX DRILL

Comparative Value of the Drills in Stoping

But at lower pressures and in difficult holes the ordinary drill can do better and more efficient work than the Konomax, for the increased speed in boring more than counterbalances the increased air consumption. This is shown by a test run by the engineer of the Robinson mine, Mr. McCracken, with holes of an average depth of about 18 in. The holes were drilled at an angle of about 20 deg. from the horizontal and before starting the test to a depth of 7 in. The air pressure was 50 lb. per sq.in., which is about an average of that in use here at many mines. The results showed that an Ingersoll-Sergeant auxiliary-valve machine bored 129.9 in. in 76 min. 21 sec., or 1.708 in. per minute, and the Konomax drilled only 127 in. in 116 min. 18 sec., or only 1.1 in. per minute, the Ingersoll machine thus doing 55 per cent. more work per minute. Tests under working conditions at a certain mine confirm this result. It is known that on this field the Slugger drill can, with high air pressure, drill rock with a smaller consumption of air than any other ordinary drill. This drill has not been compared with the Konomax drill. Owing to low air pressure available the Slugger drill is little used here, however. Fraser & Chalmers are introducing another drill called the Minamax, which is a modified Darlington drill with air used expansively.

[1]The operation of the Konomax drill is described in the Journal, May 23, 1908, p. 1045.

Coal Mining at Hosmer, British Columbia

SPECIAL CORRESPONDENCE

The Hosmer Mines, Ltd., a company closely identified with the Canadian Pacific Railway Company, last December commenced shipments of coal from its mine at Hosmer, in the Crow's Nest Pass district, in southeast Kootenay. The opening of the mine, the erection of buildings, coke ovens and other surface structures, installation of plant and machinery, laying of railway trackage, etc., had been in progress for more than a year previously.

The company owns six sections of coal lands, and two sections of surface on which are located the town of Hosmer and the mine surface works and plant. The known coal seams number 13, varying in dip from 65 to 35 deg., and in thickness from 4 to 30 ft. A main three-compartment tunnel, driven at right angles to the measures, is in about 4500 ft., and has cut nine of the seams. It is expected that the remaining four seams will be intersected within 500 ft. from the present face. The entry is about 600 ft. above the track at Hosmer railway station. Two compartments of the main tunnel are for haulage purposes, and the third for traveling and use as a pipeway. A single compartment parallel tunnel for ventilation is used as a return air course.

Driving of the tunnels was commenced in what are known locally as the Fernie shales, underlying the coal measures, which were reached at 847 ft. The first seam cut is, therefore, the lowest of the series. The coal is bituminous, high in hydrocarbon and consequently an excellent coking as well as steam coal. Much of the product of the mine will be used as fuel for the Canadian Pacific locomotives on its Crow's Nest and other railway lines in the Kootenay and Boundary districts of British Columbia.

The mine is ventilated by a 20x9-ft. Walker fan, driven by a pair of 30x16-in. engines connected to the fan by a rope drive. Steam is supplied by three 80-h.p. boilers. The fan house is of steel and concrete construction and the engine house of brick. Other buildings at the mouth of the mine are concrete lamp house and timekeepers' office, locomotive house for the compressed-air locomotives, and wash houses with baths and lockers for the miners.

The coal is lowered to the level of the tipple by a steam-actuated double-track incline, each track being an independent incline. The mine cars, each of two tons capacity, are lowered in trips of 20 cars; empty cars are hoisted in convenient numbers. Power for haulage is from a pair of 28x48-in. first motion steam engines, with 8-ft. drums fitted with clutches and brakes. Steam for handling these, with reversing gear and throttle, works through cataract cylinders.

Compressed-air locomotives haul the cars from the foot of the incline and dump them into the tipple by means of a cross-over dump. The tipple is equipped with shaking screens to separate the slack for the coke ovens, and picking bands for removal of refuse from the lump coal. Storage bins hold 2600 tons of screened coal, 3000 tons of slack, and 200 tons of refuse. Coal is loaded into closed cars by a box-car loader and into open cars by chutes. The slack is hauled in 7-ton larries to the coke ovens by air locomotives, which also haul the refuse in iron self-dumping cars to the dump.

The coking plant consists of 240 beehive ovens, 12 ft. in diameter and 7 ft. in hight; total capacity about 300 tons of coke per day. Only one-third of the ovens are in use, but others are being started as circumstances permit.

The power-house building is of reinforced concrete with steel floor joists and roof trusses and corrugated-iron roof. Two low-pressure compressors supply air at 100 lb. pressure for rock drills, inside hoisting engines, and other purposes; two high-pressure compressors supply air at 1000 lb. pressure to five compressed-air locomotives. Two 75-h.p. alternating-current generators for electric light for plant and town, are driven by two 125-h.p. steam engines. All the steam engines are fitted with cut-off valves to allow steam to be carried at 120 lb. pressure, cut off early and used expansively. Exhaust steam passes through a 1500-h.p. Hoppes heater, heating the boiler feed water to 200 deg. F. A 10-ton traveling crane facilitates handling of machinery.

The boiler house is of similar wall and roof construction as the power house, but has a cement concrete floor. In it are four 250-h.p. Babcock & Wilcox boilers, with chain-grate stokers, and appliances for the convenient handling of coal and ashes.

The mine buildings in the part of the town reserved for the company's use include a general office, mess-house, three residences for officers, several houses for foremen, large boarding house, 60 houses for miners, and hospital. All buildings are neatly finished and painted, and supplied with water and electric light.

Hosmer lies nearly midway between the Crow's Nest Pass Coal Company's collieries at Coal Creek and Michel, respectively, the mines of which have been in operation for various periods up to 12 years. All development, construction and installation work at the Hosmer mine has been done under the direction of Lewis Stockett, general manager.

The 54-mile double-rope tramway connecting the mines of the Turkestan Coal Mining and Metallurgical Company with Rostowzewo, the nearest station of the Central Asiatic is shortly to be completed.

Report on Cause of Explosion at the Short Creek Mine

The State mine inspectors who made an examination after the explosion at the Short Creek mine of the Birmingham Coal and Iron Company, in Alabama, found that the main entry was ahead of the air, and it is believed that the explosion occurred in what is known as the new slope. The inspectors state that the manner in which the shots were placed, and the quantity of dynamite used in charging the holes leads to the belief that when the shots were fired a large quantity of carbon-monoxide gas was generated and afterward ignited by the flame from one of the shots. It was further stated that the shock of the firing caused fine dust to become suspended in the air, and by being ignited, this element added additional force to the initial explosion. This belief in the activity of dust in this explosion is strengthened by the fact that the explosion was confined to the dry and dusty part of the mine.

Of the sixteen men who were in the mine at the time of the explosion, some were badly burned, and death must have been instantaneous. Other victims were not burned at all, but died from suffocation by inhaling the afterdamp produced by the explosion.

A previous explosion occurred in this mine on October 26, 1908, and six men died of the burns received in this accident. The mine inspector at the time of this first explosion, notified the officials of the coal company that the method of drilling, charging and firing shots in the mine was dangerous, and that all men should be withdrawn from the mine while the shot-firers were exploding the charges. In compliance with the instructions given at the time of the first accident, the mine management has since been busy installing a system of watering the mine, and at the time of the last disaster, the pipe lines were already extended to some parts of the mine, and it is believed that this precaution of sprinkling, prevented the explosion extending over the entire mine, and causing a much larger loss of life. It is stated in conclusion that if former suggestions in regard to the discontinuance of shooting at noon had been complied with, and all shots had been fired at night by certified shot-firers, the probability is that the explosion would not have occurred, and if it had taken place, only one life would have been lost instead of eighteen.

On Dec. 31, 1908, there were 515 blast furnaces standing in Great Britain, of which 310 were in blast and 203 idle. This compares with previous quarters of 1908 as follows: March, 312 in blast; June, 308; September, 301. On Dec. 31, there were five new furnaces under construction, and 70 being relined and repaired.

Welsh Coal Miners Object to Mining Machines

SPECIAL CORRESPONDENCE

For some time past there has been unrest among the coal miners of South Wales owing to disputes as to the rate of wages. At the beginning of March, the situation was so bad that a general strike appeared imminent. Fortunately during the last few days an understanding has resulted between employers and the men at the colliery where the trouble originated, and the situation is for the moment less dangerous. There is, however, a possibility of further trouble taking place in the near future owing to the coming into force on July 1 of the eight-hours bill, which as the title implies, limits the working hours of the men. It is anticipated that when this act comes into place, the employers will demand a reduction in the wage, equivalent to the reduction in the hours worked, a reduction which is likely to be resisted by the men.

The situation is complicated owing to a difference of opinion on the part of the counsel as to the effect of the eight-hours bill on the agreement as regards the rate of wages at present in force. This agreement separates the rate of wages according to the selling price. Having regard to this uncertainty as to the legal position, it is obvious that a definite settlement on the wage question may be difficult to arrange and until some settlement is arrived at the Welsh coal trade will be in a critical position. The coal industry of South Wales is of such great importance that a general strike would be a most serious matter. The district produces somewhere about a fifth of the total coal production of Great Britain and the stoppage of the collieries would paralyze a great many important industries, especially the tinplate and the metallurgical works, besides doing damage to the shipping trade of Cardiff and Swansea.

MINERS REFUSE TO WORK WITH MACHINES

As regards the original cause of the dispute between the owners and the men, some interesting information was given by the chairman of the Powell Duffryn Steam Coal company at the annual meeting of shareholders held during the week. It appears that as far back as October, 1906, the managers of this colliery, which is one of the largest and most uptodate in equipment of all the collieries in South Wales, tried to introduce coal-cutting machinery to work a seam called the Gelli-deg seam. The men, however, refused to work the new machines. "We tried", says the chairman "over and over again to get the men to come in and test their machines, to test what reasonable men could do in the ordinary way of working in the seam with the coal cutters, but they have, unfortunately, refused and have put every obstacle in the way of the working of the machines." The dispute was then referred to a conciliation board, but it was not until last December that a report was made and then it was to the effect that no agreement with the men could be arrived at. The next step was the decision of the colliery owners to shut down the colliery, and after due notice had been given, the colliery was actually closed on March 1. Fortunately the dispute was of short duration, and, as mentioned above, the men and the management have during the last few days come to terms and work has again been resumed.

With regard to the introduction of coal-cutting machinery, the management of the Powell-Duffryn colliery explains that this method of hewing the coal is necessary for working certain of the seams. Unless machines are introduced there will be a waste of coal and the life of the colliery will be limited to a much shorter period than would otherwise be the case. The problem is not confined to this colliery but will have to be faced by other mines in the district. The position taken by the miners is extraordinary, especially as it has been shown that with machines, they would earn wages equal to and perhaps in excess of their present wages which are at the rate of $2.40 a day, a wage which according to English standards is a handsome remuneration for a workingman.

The company has been accused of making huge profits and of grinding down the men. The huge profits are not denied, but it is claimed that they have been won more by the sweat of intellect than the sweat of the workman's brow. At all events, some fifteen years ago, the colliery was practically bankrupt and it is due to the skilful way in which it has been managed, to the introduction of electrical equipment, coke ovens, gas engines, and a plant to recover by-products, which installations have made the mine one of the show places among engineering works in Great Britain, that prosperity has been won. That the men are not imposed upon is evident from the wages that are paid.

The refusal to work machines is altogether unreasonable, and the men appear to have recognized the untenable position they have taken up. It is to be hoped that they will be equally reasonable when the time comes to adjust the wage according to the scale of hours for working, laid down statutorily by the eight-hours bill. The shorter hours will chiefly affect the surface hands who have been accustomed to work nine hours. The underground men working on a tonnage basis will probably find that although working shorter hours, they will be able to get out the same tonnage as formerly and consequently will draw the same pay.

It is only fair to add that the situation has been described from the point of view of the employer. There may be other causes than those mentioned that have produced friction between the owners and the men. There is, however, good reason to believe that the refusal of the men to coöperate with the management in the use of machines is a primary cause of the trouble, and on this point there cannot be much divergence of opinion on the part of the public, as to which side is in the right.

Action of Sulphur in a Gas Coal*

In a general way, about 60 per cent. of the sulphur in coal remains behind in the coke. The amount of gas per long ton of an ordinary Westmoreland gas coal is about 10,750 cu.ft., so that where this coal contains 1.5 per cent. of sulphur we have 0.6 per cent., or 13.44 lb. of sulphur leaving the retorts from one ton of coal. A portion of this passes into the tar, probably over 2 lb. to each ton of coal, leaving in the neighborhood of 11 lb. of sulphur to pass on with the gas. This would give 720 grains per 100 cubic feet.

The great mass of the sulphur leaving the retorts with the gas goes in the form of hydrogen sulphide, the percentage of the sulphur in this form being between 90 and 95 per cent. of the total. The rest is in gaseous sulphur compounds of which the most important is carbon bisulphide. Not all of the so-called sulphur compounds are accounted for by the carbon bisulphide, but the exact constitution of those which remain is by no means certain. Between 80 and 90 per cent. of the sulphur occurs as carbon bisulphide.

The total amount of sulphur which is driven off from the coal is but little affected by the temperature of carbonization, but the form in which this sulphur is in the gas may be profoundly affected by the retort temperature. In a general way as the retort temperature is raised there will be produced more sulphur compounds and less hydrogen sulphide. This has been ascribed to the passage of the sulphur containing gases over the bed of very hot coke, in which passage more than the normal amount of sulphur combines with the carbon to form carbon bisulphide. It is believed by some that the sulphur from the coal is first given off as hydrogen sulphide and that all of the carbon bisulphide formed is a result of the subsequent reaction of the hydrogen sulphide with carbon at a high temperature, the reaction being as follows:

$$2H_2S + C = CS_2 + 2H_2.$$

It may, therefore, happen that in the effort to obtain the maximum yield of gas, and, therefore, economy in the production, an abnormal amount of sulphur compounds is formed.

*Abstract of a report by A. D. Little, chemical engineer, Boston, Mass.

The Wolf-Bohres Electric Safety Lamp*

By R. Cremer

The Wolf-Bohres electric safety lamp, fitted with an osram lamp made especially for the purpose, is supplied according to two designs: one arranged to throw the light downward and the other upward. The osram glow lamp will give an equal light, while using slightly more than half the electrical energy required by a carbon lamp. The lamp is fitted with a single-cell accumulator, affording the advantage of a considerable reduction of the weight of the lamp and a more simple treatment of the accumulator. The average length of burning of a 2-volt osram lamp is 600 to 800 hours, against scarcely 100 hours for a 4-volt carbon lamp.

The lamp is fixed in a strong, air-tight glass globe, mounted on the top of, or below, the accumulator, and accessible from all sides. The pure air inclosed between the glass globe and the glow lamp becomes heated by the burning lamp, and its pressure is thereby increased. Should the glass globe be smashed and the glow lamp injured, then the expanded heated air drives back the outer air of the mine, and will at the same time rush into the vacuum of the lamp, causing the filament of the lamp to be instantaneously destroyed. The circuit is thereby interrupted, and the glow lamp extinguished, before an explosive atmosphere has time to enter and to reach the light. Numerous tests made in explosible mixtures have shown that this lamp is safe, under all known conditions prevailing in mines.

The lamp is closed by means of a magnetic lock, which prevents unlawful opening and thereby producing sparks at the contacts. The top and bottom parts of the lamp are connected by slots and projections; and electric contact is formed by sliding two broad spring plates over the contact bridges of the accumulator. The contacts consist of a metal alloy, on which diluted sulphuric acid has a small and slow effect. The opening of the lamp is effected by withdrawing the iron-locking bolt by means of a magnet.

Description of Accumulator

The single-cell accumulator is inclosed in a celluloid case. The case fits loosely into the lamp body and is easily removed and replaced. The leads to the contact pieces are bedded in and are acidproof. The filling opening is fitted with a three-chambered screw-closing device, allowing any gas developed to escape, but preventing any acid from flowing out when the lamp is held in inclined positions.

The accumulator is connected up to a simple charging device by plugs. The glow lamp is fed by the accumulator and glows for a period of 12 hours per charge, yielding a light varying from 1 to 2 c.-p. The lamp is 10½ in. in hight and weighs, complete, about 4 lb. It is rectangular in shape, and is incased in a tinned sheet-steel body coated with acid-proof paint.

*Abstract of a paper read before the North of England Institute of Mining Engineers.

Electric Colliery Winding in England

By T. Hinton*

The views of English engineers on the subject of electrical winding in coal mines may interest American readers. Several distressing accidents involving losses of life have recently occurred in British collieries during the hoisting of men in the shaft. Taking into consideration the conditions, including the depth of the pit, the high speed of the winding and the fact that the cages pass each other in the shaft with but little room between them, it is wonderful that serious accidents are not more common. As it is, they are frequent enough in England, and of a sufficiently serious character, to justify inquiry into the general methods of winding in use in English mines, as compared with the continental practice. The first great difference is that in England, steam engines are almost entirely used for winding, whereas in other European countries, electric power is much more generally used, both for winding and for all other colliery work.

A few electrical-winding engines are at work in Great Britain, and others are now being installed at new mines in South Wales and other districts; however, on the whole, mining engineers in England are unwilling to make any change from their hitherto prevailing practice. This is not due to the want of information and experience, for English mining engineers have repeatedly paid visits in large parties to the continent to see some of the many electrical-winding plants in use in other European countries. Nothing but praise has been heard from them on their return, but with an exception here and there, nothing farther is done. On the continent on the other hand, almost all the new mines of importance are electrically equipped throughout.

Advantage of Electrical Hoisting

The principal advantage of electrical winding lies in the ease and certainty of control. Steam-winding engines are big, powerful machines, with heavy moving parts, difficult to control. The speed of the engine being low, the cylinders have to be large in diameter in order to develop the power required. Furthermore, in consequence of the slow speed, there is a great variation in the angular velocity of the cranks, and the drum has a varying turning movement, which causes unsteadiness in the ropes. The control of the engine is both difficult and laborious. The driver has a throttle valve, a reversing lever, and a foot brake, all with large and heavy levers to work, and he is kept hard at it for most of his time. The safety of the winding depends entirely on the driver, for no mechanical control gear has been devised efficient enough to be generally adopted. The engineer has to watch the depth indicator, listen to the bell, and work the levers controlling the engine, accordingly.

The engine driver uses his reversing gear as a brake and thus reduces the complication to some extent. Electrical-winding gear, on the other hand, is simple and easy to control. Control is affected by dealing, not with heavy currents in the armatures of the winding motors, but with the small exciting current of the generator field. Dealing with small currents of low voltage, the control gear is light and easily manipulated. Only two small levers are needed, one controlling the winding motor and the other the brake. The direction of the winding is determined by the driver's pulling the control lever either toward, or away from him.

The brake lever and the control lever are interlocked, so that the brakes are released when the winder is started, and they are applied again when the current is shut off. For hoisting men, when a lower speed should be employed than for coal, there is a device which automatically makes it impossible for the driver to exceed a certain speed. Furthermore, a combined depth indicator and automatic safety gear is employed, which prevents the driver from starting too quickly. This device also will automaticaly bring the control lever to the "off" position and will apply the brakes, should the driver by some mischance omit to do so at the end of the wind.

Special Emergency Brake

A special emergency brake is also used, worked by air pressure, which holds the brakes off as long as all is right. Should the pressure fail or the bank be overrun, the emergency brake is automatically applied and at the same time the current is cut off from the winding motor. The certainty and safety of this gear does not depend on electricity, for as long as the electrical equipment is in perfect order, the winding gear can be controlled in the ordinary way. However, should anything go wrong, for instance, the supply of current fail, or should the driver lose his nerve or fall ill, the emergency brake would work at once. It cannot fail, for the power which holds it off is gone and the brake is applied by the force of gravity.

The electrical-winding gear usually consists of a motor generator fitted with a heavy flywheel and one or two motors directly coupled to the drum shaft. With

*87 Atlantic Chambers, Manchester, Eng.

lost, but with the electrical gear much of it is saved, as the power used for acceleration at the beginning of the wind is largely regained during braking. During braking, the winding motor acts as a generator, absorbing the power given out by the moving masses during retardation, and reconverting it into power, which is stored in the flywheel of the motor generator.

Electrical winding is perfectly safe and reliable, but it is somewhat expensive in its first cost. The steam-winding engine has worked satisfactorily for many years, and the accidents have been comparatively few. The English colliery engineers and owners whose pits are equipped with the best modern steam-winding engines, cannot reasonably be expected to discard a valuable plant, unless some special circumstances warrant their doing so, but in the case of new mines, especially where electricity is to be largely used for other purposes, it will pay coal companies to adopt elctrical driving throughout.

Mine Explosions as Related to Earthquakes

By W. A. Spalding*

Supplementing my article published in the Journal, Feb. 20, 1909, page 411, I take the liberty of sending an additional list of coincidences and close approximations of earthquakes and mine explosions, covering the time from July 3, 1908, to March 2, 1909.

In those eight months I note 13 striking cases; four actual coincidences; five approximations within one day, and four approximations within a few days.

SUPPLEMENTAL LIST OF COINCIDENCES AND CLOSE APPROXIMATIONS—EARTHQUAKES AND MINE EXPLOSIONS.

1908.	
July 2—Explosion Rikovsky mine, Russia; 214 killed.	July 3—Earthquake, lower Mexico.
	July 3—Earthquake, southern California.
July 15—Explosion, Pottsville, Penn.; 7 killed.	July 16—Severe earthquake, Chile.
Aug. 3—Mine explosion, Shenandoah, Penn.	Aug. 3—Destructive earthquake, Constantine, Algeria.
Aug. 18—Explosion, Maypole colliery, Eng.; 76 killed.	Aug. 18—Severe earthquake, Eureka, Cal.
Sept. 8—Dickson City, Penn.	Sept. 4, 5—Earthquake, Hawaii.
Nov. 12—Explosion, Badhod coal mine, Westphalia; 322 killed.	Nov. 6—Violent earthquake, Plaren, Germany.
	Nov. 7—Moderate shock, Sabetha, Kan.
Nov. 17—Explosion, Birmingham, Ala.	Nov. 12—Earthquakes in Missouri and in Belgium.
Nov. 28—Explosion, Marianna mine, Penn.; 142 killed.	Nov. 28—Earthquake, Boston.
Dec. 23—Explosions at Trinidad, Colo., and West Brunswick, Eng.	Dec. 21—Two shocks, Montana.
Dec. 29—Explosion, Lick Branch Colliery, W. Va.; 50 killed.	Dec. 28—Great earthquake, Sicily and southern Italy.
1909.	
Jan. 10—Explosion, Zeigler, Ill.; 25 killed.	Jan. 8—Earthquake shock, Messina.
	Jan. 8—Earthquake, western Mexico.
	Jan. 8—Earthquake, Tacoma, Wash.
Jan. 12—Explosion, Lick Branch, W. Va.; 150 killed.	Jan. 11, 12—Three earthquakes recorded at Washington, D. C. Earthquakes in Vancouver, B. C.; Washington and Mexico.
Jan. 14—Explosion, Vizprin, Hungary, 61 killed.	Jan. 13—Northern Italy severely shaken.
Jan. 19—Explosion, Stone Canyon mine, San Louis Obispo Co., Cal.	Jan. 19—Heavy earthquake, Asia Minor.
	Jan. 20—Mt. Colima, Mex.; violent.
	Jan. 20—Earthquake, Smyrna.
	Jan. 20—Earthquake, Sicily.
	Jan. 20—Volcano Laguas, P.I.; active.
Jan. 25—Explosion, Merchants Coal Co., Boswell, Penn.	Jan. 23—Destructive earthquake, western Persia.
Jan. 27—Explosion, Morrissey, B. C., Can.	
Feb. 1—Explosion, Short Creek mines, Ala.; 17 killed.	Feb. 1—Earthquake shocks, Montreal, St. Petersburg and Messina.
	Feb. 2—Slight earthquake, Owensville, Indiana.
	Feb. 2—Severe earthquake, Saghalien Island.
	Feb. 3—Slight earthquake, Montreal.
	Feb. 9—Heavy shock registered at Naples.
Feb. 9—Explosion, Catherine mine, near Yuzovka, Russia.	Feb. 9—Earthquake and eruption at Colima, Mex.
Feb. 16—Explosion, Stanley mine, Newcastle, Eng.; 168 killed.	Feb. 14—Earthquake, Reggio, Sicily.
	Feb. 16—Heavy earthquake, Turkey.
	Feb. 16—Earthquake, Budapest.
Mar. 2—Explosion, South Creek Slope colliery, Port Griffith, Penn.; 2 killed.	Mar. 2—Fresh Outbreak, Colima, Mex. New crater formed. Shocks southeastern Mexico.

*Los Angeles, Cal.

Estimation of Ash in Coke

By Harley E. Hooper*

Some time ago when conducting some tests of coke ovens, I was considerably puzzled by the fact that the ratio of the ash in the coke produced, did not correspond to that in the coal charged into the ovens.

Taking a simple example: Ten tons of coal carrying 5.5 per cent. of ash, was charged in. This produced six tons of coke which, according to the ratio, should have carried 9.17 per cent. of ash, but on analyzing, a result of 11.1 per cent. was obtained. The sample was re-assayed, but practically the same result was obtained. The accuracy of the sampling was then suspected, but a more careful sampling revealed no difference. The columns of coke (beehive) were then sampled in section, but the total gave, approximately, the same discrepancy. Some coke formed in the laboratory way from the same coal, showed a discrepancy, but not to the same extent as that formed on a practical scale.

It was then noticed that the color of the ash from the practical test was darker than that from the laboratory, and this the steam-winding engine the work done in accelerating and retarding the load is latter was again darker than the coal ash. An analysis revealed far more iron and less silica in the ash from the coke than that from the coal; and this and other considerations led me to suspect iron added, through the abrasive action of the coke on the grinding plate. This latter was the ordinary cast-iron plate as used in most laboratories.

A small sample crushed down in a wedge-wood mortar returned, approximately, the calculated ratio of ash, but this method of grinding was out of the question with the size of the samples required to give an accurate coke-oven test.

Withdrawal of the iron from the muller-ground sample by means of a magnet was then tried, but owing to the formation of magnetic oxide of iron in the water quenching of the coke, according to the equation

$$6\,FeS + 6\,H_2O + O_2 = 2\,Fe_3O_4 + 6\,H_2S,$$

this later was withdrawn as well, and returned a low result.

Estimates of Extraction of Iron in Coke and Coal

A series of estimations were then made of the iron in the coke and coal extracted by hydrochloric acid. These results are given below and show clearly that the iron was introduced through abrasion:

Sample.	Crushed to:	Iron, Per Cent.	Equivalent to Fe_2O_3, Per Cent.
Coal	40 mesh	0.107	0.153
Coal	80 mesh	0.121	0.173
Coke (laboratory)	40 mesh	0.86	1.23
Coke (laboratory)	80 mesh	0.98	1.40
Coke (oven)	40 mesh	1.13	1.61
Coke (oven)	80 mesh	1.37	1.96

These figures would, of course, be slightly high, owing to traces of iron oxides (soluble in hydrochloric acid) originally contained in the samples, but judging from the first estimation 0.1 per cent. would more than cover that amount.

The method finally adopted was to crush the coke in the ordinary manner and assay it for *a* ash, and *b* ferric oxide extracted by hydrochloric acid. The percentage of original soluble oxides of iron in the ash had been determined a number of times previously on small samples ground in a wedge-wood mortar, and since it averaged about 3 per cent. (of the ash), this figure, being a minor factor, was used.

An example will serve best to show the method of calculating the result:

Data.

Total ash, got by ignition of coke	10 per cent.	(of the coke)
Ferric oxide extracted by HCL	2 per cent.	(of the coke)
Oxides of iron (originally) in ash	3 per cent.	(of the ash)

Let X = the true content.

then $X = 8 + \frac{3}{100}$ of X

or $X - \frac{3X}{100} = 8$

$X = 8.24.$

From the above it will be seen that in the usual methods of estimating ash in coke an error of about 2 per cent. is incurred and this when dealing in coke in large quantities is a serious item.

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Impressions of a New Ontario Camp—Gowganda

The Silver Minerals Resemble Those of Cobalt but the Veins Occur in Diabase and Not in the Huronian Rocks as at Cobalt

BY H. E. WEST*

That the Cobalt silver mines are now so well known to the mining world is largely due to the railroad facilities connecting it with the several important cities of eastern Canada and the United States. The more recently discovered "Montreal River section," owing to the lack of such railroad communication, is correspondingly less familiar. Particularly is this true of the western section known as Gowganda, which until the first month of the present year was inaccessible except by the canoe route in summer—70 miles from Elk lake, with 18 portages—or in winter over a forest trail 34 miles in length.

The important discoveries by Mann and Reeves were made in the early days of August, 1908. In September there was a rush by way of the Montreal river, when much of the ground in the Gowganda district proper was staked. My acquaintance with Gowganda was made about the middle of December, 1908, when, with a party of eight we made the trip from Elk lake over the newly cut road as far as Long Point, thence by toboggan and "pack-sack" over the unbroken and timber strewn trails to the shores of Gowganda lake.

Difficulties of the Trail

This little journey occupied one week, as we were heavily laden, and the rough portages necessitated unloading the toboggans, packing the freight, doubling back, etc., so that there were days when four miles seemed a fair day's work, and all hands were glad to make camp. At that time there was no provision for shelter on the road, and each night the tent had to be pitched and camp made, an operation, taken together with packing each morning, which consumed a large portion of the short winter's day. We arrived at Gowganda on Dec. 16, and camp was made on the shore of the northwest arm east of the Mann claim.

The impressions of the trail and of our first days at Gowganda will never be effaced from my memory. Our little party seemed alone in its human activities and all around the lake the dark, pine forest crowded to the shore. Not a sound was heard, nor was the welcome smoke of any camp fire seen save our own. The place seemed deserted and lifeless, which for a camp so much in popular favor as Gowganda caused the inevitable early impressions that the district had been much overrated. Occasionally men were visible in the distance, strung out in Indian file across the lake, leaving to spend Christmas outside and looking for all the world like a flock of homing geese against the wintry sky.

On further investigation of the neighboring woods, some men were encountered in isolated camps, but there were comparatively few who spent their 1908 Christmas at Gowganda. What men were coming into the district were heading northward for Obuskong and Diabase lake, while our party went south visiting Hanging Stone, Frying Pan and Elk-Horn lakes. The slush on the ice of this latter lake was so thick that it became impossible to drag our toboggans. We could make but one mile an hour and that with killing work, so that finally the attempt to reach Duncan lake, 25 miles farther by the lake route, was abandoned. A permanent camp was established and others of the party returned for fresh provisions.

It was apparent that no considerable number of men could operate for any period far from their base of supplies, since the carrying power of the party was limited to the capacity of the individuals, the transported supplies lasting two or three weeks at most. This meant the packing in of supplies of consumption rather than those of utility, such as dynamite, steel, etc., thus accounting for the slight development accomplished, or that was in progress at that time.

Wagon Road Opened

When the government road was pushed through to Gowganda lake—and this important feature was accelerated by the energetic action of the several claim holders, whose roads antedated the completion of the government road a month or six weeks—teams were able to haul in supplies in quantities, and it was not long before the entire camp took an entirely different aspect. Labor became more plentiful, clearings were made, log houses put up, roads constructed and camps established. Development, of which practically none had been done previously, was no longer neglected and several shafts were started on promising properties.

Since the opening of the road early in the present year the main object has been to freight in supplies and machinery, so that active work might be instituted and carried on throughout the summer. To this end the leading properties are endeavoring to accumulate a stock of supplies sufficient for nine months—until winter roads are again available. It must be understood that the present road is suitable for winter travel only, as a considerable portion of the lake has been utilized for this route. The matter of a suitable summer road, though under discussion, is still undecided.

Transportation Problem

The question of railroad connections with both Charlton, the present head of the T. & N. O. railroad, and Sellwood, on the Canadian Northern Ontario railroad, is being actively canvassed. There is no question that railroad connection is essential to the opening up of the mines of the Montreal River section. In fact, without a railroad to bring in supplies and transport ore, there is not a mine that can hope to make payable returns.

That road transportation cannot cope with the problem is proven by the fact that, although there were over 600 teams between the railroad at Charlton and Gowganda, no surplus of supplies has yet been collected at the latter point. The demand of the host of prospectors in the woods estimated at 5000 men is equal to the supply of provisions the two roads are capable of delivering. Machinery and mining supplies are moreover engaging a considerable proportion of the available teams. The freight rate from Charlton to Elk lake, a distance of 24 miles, which was until recently 50 to 60c. per 100 lb., has been raised to 75c. or $1. From Elk lake to Gowganda it is $3 per 100 lb. for a distance of 34 miles.

Leaving the question of transportation, it may be of interest to pay some attention to the claims of Gowganda as a mining district. My personal experience of Gowganda, up to March of this year, has been confined entirely to the southern half, and from Gowganda to Elk Horn lakes. As this area, about two miles square, comprises all the better known properties, it will be a guide in estimating the probabilities of this new mining camp as a future producer of silver.

From the Boyd-Gordon on the north to the Bartlett mine on the south, all of the properties on the "ridge" may be included in the prospective list of Gowganda's silver producers. These "ridge" properties include the Mann, the Reeves-Dobie, and the Welsh claims. The Milne, Armstrong Fraction and Crawford claims abutting the "ridge" may also be considered of prospective value. All these properties lie either entirely or partly across the ridge of diabase composing the "backbone" of the peninsula.

*Mining engineer, El Oro, Mexico.

Rock Formation at Gowganda

The rock formation of Gowganda is not dissimilar to that of Cobalt. There are the same coarse conglomerates, angular clastic agglomerates, slate-graywacke and quartzite, all members of the Huronian series, with diabase appearing at the surface in narrow bands, usually striking northwest-southeast. From the frequent change, in parts, of diabase and slate it is not unlikely that diabase may be found the underlying rock in several areas now covered by members of the Huronian series. In Cobalt, this underlying or fundamental rock is Keewatin. At Gowganda I should judge a considerable area of the surface Huronian rock to be underlaid with the intruded diabase. In other words, that in parts the Huronian rocks are superficial and at moderate depth the fundamental rock will be exposed—be that what it may. Rocks of the Keewatin horizon do not appear conspicuous in any part and are absent in the southern half of the district.

Best Veins in Diabase

The striking point of dissimilarity between the Cobalt and Gowganda districts lies in the fact that in the former the conglomerates and graywacke-slates of the Huronian series contain the majority of the proven veins. At Gowganda no deposits of merit have yet been proven except in the diabase rock. Just why this radical distinction occurs—if this be a correct interpretation of surface phonomena—is difficult of comprehension.

So far as proven then the diabase is the favored formation; the coarser crystalline variety, gabbro, is prevalent, in which occur the aplite veins or dikes for which the entire Montreal River section is noted. Aplite, in the textbooks given as a micaless or one mica granite (muscovite), is here perhaps more correctly regarded as a later intrusion of the same magma as the diabase, by differentiation, filling the secondary fissures in the diabase with a light colored rock usually pink from a contained feldspar, from which the darker silicates of the diabase are lacking. Feldspar, quartz and calcite are the main constituents, with "aplitic" texture, forming what is termed the diabase-pegmatite.

The Vein System

Throughout the district the vein system is marked by two sets existing at right angles to each other, one set of veins striking roughly north-south, with the other east-west. More correctly speaking, however, these veins are usually east of north, or approximately northeast, with the other set south of east, or southeast. At the surface in several of the properties mentioned, veins carrying metallic silver are observed. Such veins are in no instance more than a few inches wide. Usually 1 to 2 in. represent the rich silver portion, although between the walls the fissure may measure from 10 to 12 in. The remaining portion carries a certain amount of leaf silver and usually is characterized by "cobalt-bloom." This enrichment may extend also into the walls for a few inches.

So far as developed, there exist no duplicates of the massive native silver veins such as are visible even today at Cobalt, at the Lawson, La Rose, of Temiskaming and Hudson Bay properties. Of course, these latter are phenomena not often met in any part of the world, and it is not necessary that such should exist at Gowganda. There is sufficient evidence of an encouraging nature already exposed. Massive smaltite and niccolite occur, but usually the richer silver veins are sparsely accompanied with these accessory minerals.

The Various Prospects

The deepest development thus far at Gowganda is in the shaft on the Boyd-Gordon claim. This shaft is down about 45 ft. In it are exposed three veins, one of which for an inch or two in width carried native silver. Smaltite is in considerable evidence in the other veins with small silver content. One hundred bags of ore containing from 3000 to 6000 oz. of silver per ton have been bagged during the sinking of this shaft. The shaft is in diabase.

On the Mann claim two shafts are being sunk, the northern one down about 12 ft. and the southern about 25 ft. deep. A vein from 1 to 3 in. wide, carrying in places considerable native silver, is seen against the north wall. All these veins are members of the east-west type. In the Reeves-Dobie claim, except for the credible report of rich surface showing, with some chunks of metallic silver to prove the assertions extant, nothing is at present open to inspection. The Welsh property has, it is claimed, some 50 veins and fractures in the two claims of 70 acres; two of these veins carrying native silver. These claims are trenched at the surface extensively, with a few pits sunk on the first exposure.

Narrow Veins with Enriched Wall Rock

In the four southern blocks of the Bartlett claim exist some excellent surface showings of native silver. I remember one particularly that I saw in December last that was exposed for about 50 ft. In places the vein was 12 in. between the diabase walls, the silver streak averaging from 1 to 2 inches in width carrying probably 3000 to 6000 oz. per ton of ore, the balance of the vein containing leaf silver. The walls doubtless contain leaf silver for a few inches, or possibly a foot from the silver streak.

To the west the vein was seen cutting through the polished glaciated surface of a diabase bluff. Six feet to the south was an intrusive aplite vein about 18 in. wide. Joining the two veins were cracks or joints in the diabase, about ⅛ in. wide and filled with sheets of silver. The appearance was striking and up to the present the most promising exposure I have seen at Gowganda.

All veins are not of these narrow dimensions. In one of the Crawford blocks running into Crawford lake is a vein of calcite fully 6 ft. wide. Beyond a sparse occurrence of chalcopyrite and galena the vein at the surface is thus far barren. It is in the narrow veins with the enriched wall rock that the payable deposits are found.

Development Necessary

With the numerous veins exposed, several of which show native silver in mass and leaf form, all the claims situated on the "ridge," or touching thereon may be considered as possessing bright prospects of being converted into payable mines. Depth is required to prove the persistence of these silver veins in the diabase and depth is that factor, more than all else, that only time and work discloses.

The fact that veins "tight" at the surface open out encouragingly a few feet below proves nothing conclusively. At 100- or 200-ft. depth, facts as to vein enrichment begin to be ascertained. Indications at the surface are favorable. If these are confirmed with developments at moderate depths, profitable silver production at Gowganda is assured.

In addition to the "ridge," another area of diabase extends south of Gordon lake, westward to the Elk Horn lake. Here also are some promising properties in prospect. The Gowganda section possesses many claims on which strong and persistent veins are disclosed. The summer's development, however, is needed to prove just what the pretentions of this section justify. Notable silver discoveries have not been authentically reported up to the present time.

Railroad Connections Essential

Whatever developments may disclose, Gowganda's mines cannot become producers until facilities are obtained to bring in supplies and export ore. Without railroad connections, Gowganda's mines are not capable of profitable production. The mines at most can be developed to the producing stage. This, in most cases, will occupy a year or two's work, and after that period shipments of ore may be expected.

As yet nothing has been determined to solve the much-needed problem of transportation. Schemes are on foot to connect Elk lake with the T. & N. O. railroad at Charlton, and Gowganda with the Canadian Northern Ontario railroad at Sellwood, and also to connect these two centers. Meantime, no definite railroad construction has been decided upon. People criticize the Government's seeming apathy, but many support the conservative view that time is necessary to prove the prospects and justify the building of railroads.

When it is remembered that a large amount of money is being invested in the Montreal river section by capitalists of Canada, America and England, whose calculations are primarily made on obtaining transport facilities (without such it is a difficult matter to ever develop these claims to the producing stage) it seems reasonable for the Government to display no less enterprise, and after a preliminary investigation to energetically provide the means of communication essential to the community.

This argument is further strengthened in view of the considerable revenue the Province of Ontario derives from the numerous phases of the mining industry. The mining community, justly or not, has a decided opinion that many of the sources of revenue are extortions and from the considerable revenue derived it receives an inadequate return.

When a new mining industry is grafted on a province devoted mainly to agricultural and allied interests, it is invariably the case that the mining interests are subordinated to the vested interests. This was amply demonstrated in the early days of Victoria, when the friction between mining and older interests in that colony became so acute that the mining community decided on separation. This movement ended with the deplorable incident of the Eureka stockade—an episode well known to all mining men conversant with Australian history.

Whatever the individual view held on the policy of the Government, I think all mining men who have inspected the Montreal river section will agree that in this section, and especially the Miller and Gowganda districts, are many favorable prospects that promise to become mines. At the same time it is certain that not one of these embryonic mines can become a steady producer of silver without the assistance of the railroad. It would, therefore, seem to be the duty of the Government to provide the means whereby these latent assets can be quickened into life, and increase the silver production of Ontario.

It appears that in the realms of possibility the whole Montreal river section might, within five years, equal the present production of Cobalt, but this must be based on the two assumptions that railroad construction is commenced forthwith and that the development of the mines at depth is not less favorable than at the surface.

According to the government report the estimated number of persons employed in and about the mines of New South Wales during 1908 was 38,780, or 4000 less than in 1907.

According to *Queen. Gov. Min. Journ.*, the value of the tin and tin ore of New South Wales, obtained during 1908, was £205,447

Filtering Gold Slime

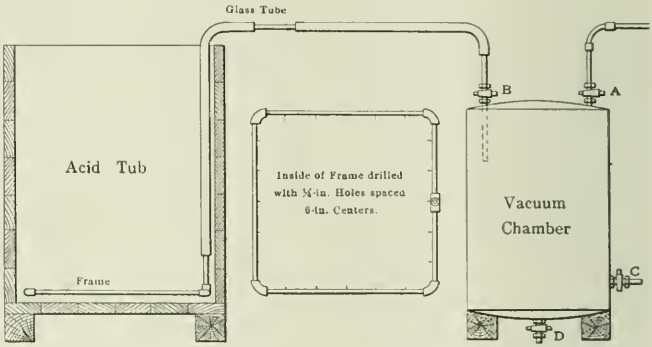
By Eiler Jensen*

In small cyanide plants where a clean-up press is not provided, the filtering and washing of the gold slime after acid treatment of zinc is generally found to be a slow and tedious process, but the following arrangement can be very cheaply installed. It will save much time in the clean-up, and is, in fact, with small plants, a good substitute for a filter-press. The whole operation of washing and filtering can be done in the acid tub, and consists simply of applying the principle of vacuum filtration to the clean-up. The appliances necessary are a filter frame, a vacuum chamber and a vacuum pump.

The frame is constructed of ¾-in. piping, screwed together in the form of a square, with a T-piece let into one of the sides, to which pipe and hose can be fitted; the sides of the pipes toward the center have ¼-in. holes drilled every 6 inches. A filter cloth to fit the frame is made of two pieces of good canvas or cotton duck, between which are two layers of coarsely woven cocoanut matting. The four layers are all held together by a few rows of stitchings, about 3 in. apart. The cocoanut-mat layers are made so as to fit easily inside the frames, the duck being left large enough so that the top and bottom layers can overlap the frame on opposite sides and can be well sewn together all round. This then forms an efficient cell for filtering solution. The frame is made of such size as to fit the bottom of the acid tub with about 2 in. clearance all round.

The vacuum chamber can be conveniently made from a sulphuric-acid drum, fitted with pipe connections as in an accompanying illustration. *A* is a pipe with cock to vacuum pump; *B*, pipe with cock and hose to filter frame; a cock *C* for running out clear acid solution; this should be placed six inches above the bottom of the drum; *D*, cock in center of bottom for cleaning out drum. Pipe *B* is carried down one foot inside the drum, so as to obviate the carrying over of any of the acid solution through pipe *A* to the vacuum pump. Drums with convex ends should be chosen as they can be thoroughly drained when cleaning out.

After the acid treatment is finished, the tub is filled with water, and the contents well stirred, then after the precipitate has settled, the clear solution is decanted off. The remaining gold sludge is well stirred and the frame is put into the tub, and the cocks to the vacuum chamber and pump are opened. The frame should lie horizontally on the bottom of the tub and remain there until all the liquid is drawn off; it can then be lifted from the bottom and placed upright against the side of the tub while sufficient water is run in for washing. The slime adhering to the frame is scraped off, and, together with the rest of the slime in the bottom of the tub, is thoroughly stirred up with the water. The frame is again laid horizontally on the bottom of the tub and the vacuum cocks are opened as before. One washing in most cases will be ample, but can easily be repeated if insufficient. After the liquid is all drawn off, the vacuum is maintained for a time so as to air-dry the slime as much as possible. The slime is then collected from the frame and from the bottom of the tub; with careful scraping very little need be left on either. What is left can, however, be collected by washing and sponging the tub and frame with about half a bucketful of water. The washings can then either be filtered through a small calico filter, or use may be made of the filter frame, by laying it down flat and, with the vacuum on, slowly pouring the washings upon one side of it; when dry the slime is carefully scraped off. If the filtering is slow with only one frame, there is no reason why two or more should not be used.



APPARATUS FOR FILTERING ZINC PRECIPITATE

*Metallurgist, Oroya Black Range Gold Mine, Kalgoorlie, Western Australia.

Note—Abstract of an article in *Journ. Chamber of Mines of Western Australia*, p. 423, November, 1908.

The Mineral Production of Maryland in 1908

By Wm. Bullock Clark*

The statistics gathered by the State Geological Survey, acting in coöperation with the Division of Mineral Resources of the U. S. Geological Survey in Maryland, show clearly the effect of the business depression arising from the difficulties in the money market during 1908. The depression is especially noticeable in the larger industries; some of the smaller ones, like flint and feldspar, sand and gravel, show a satisfactory increase. The statistics collected to date are practically complete with the exception of a few small operators. The total value for the year is $8,591,817 or about 78 per cent. of the normal annual production.

Coal

The production of coal in 1908 amounted to 3,908,120 long tons, the legal standard in the State, or 4,377,093 short tons valued at $5,116,378. These figures show a decrease of 1,031,726 long tons as compared with the production of 1907 and the value has been correspondingly decreased $1,507,319. This is an unusually heavy reduction in the annual production, representing the lowest valuation since 1901. The average price per ton was the same as in 1907, viz., $1.34 per long ton. The coal from the "Big Vein" or Pittsburg seam of the Georges Creek Valley sold at prices from $1 to $1.80 per long ton, the average being about $1.38.

The relative production of coal from the different seams remains about the same, but there appears to be an increasing interest in and development of the "small veins" as the "Big Vein" coal approaches exhaustion in some of the well known mines. The conditions during 1908 were not favorable to the development of new properties in the small-vein coals.

Building Stone

The building-stone industry suffered less during the depression than the coal on account of the increased use of crushed stone for concrete and road construction. The total value of the stone produced during 1908 was $1,045,880, as compared with $1,555,415 in 1907, or a decrease of $509,535. Much of this decrease is directly due to the completion of the construction of the McCall Ferry Power Company's immense dam across the Susquehanna river. The decrease is only temporary since there is every prospect of a greatly increased production next year from the use of crushed stone in the filtration plant of Baltimore and the State roads system recently inaugurated.

*State geologist, Baltimore, Md.

Clay

The production of clay and clay products during 1908 was considerably less than that for 1907. The total production for the year is valued at $1,452,259, or a decrease of $463,979 from the figures of the preceding year. The production for 1908 is somewhat below that obtaining prior to the marked increased demand resulting from the Baltimore fire. The figures given include the brick, tile, pottery and raw clay.

Lime and Cement

The production of lime and cement during 1908 was almost the same as that for 1907, the lack of change being due to the practical extinction of the natural-cement business and the beginning of operations of a large portland-cement plant near Hagerstown. The lime-burning industry remained unaffected by business depression, the reaction in the lime industry usually occurring a year later than with the other mineral products. The value of the production of lime and cement during 1908 was $332,445 as against $334,316 for 1907.

Sand and Gravel

The production of sand and gravel shows a marked increase over that reported for 1907, which is doubtless due to the continued increase in the use of cement and the consequent demand for these products. Most of the sand sold is obtained from the Coastal Plain deposits or by dredging the tributaries of the Chesapeake. In one instance disintegrated crystalline dolomite is employed with success. The total production for 1908 is valued at $402,966 as against $268,048 for 1907.

Flint and Feldspar

The production of flint and feldspar during 1908 was greater than in 1907 but not as great as that of 1906. The total production for 1908 is valued at $104,563 as against $90,860 for 1907. Of this production feldspar represents two-thirds and quartz one-third. The feldspar output is chiefly in ground form as is also true for the quartz.

Ores

The production of the metalliferous ores in Maryland is so small as to affect but little the State's total mineral output. Gold and copper are found in small quantities and there is generally a small production each year of one or both of these ores. The industries based upon them are, however, not well established and the returns frequently are less than the outlay. The iron ore, on the other hand, has been one of the most important metallic products in the State. With the closing down of the Muirkirk furnace there has been a complete cessation of mining the carbonate ores of the eastern counties. This has been offset in part by some revival in the mining of the brown hematite ores in the Piedmont, especially in Carroll and Frederick counties. Most of the deposits are relatively inaccessible, such ore as is mined being shipped to furnaces in Pennsylvania. The total production of all the ores, gold, copper, iron and mineral paint amounted to only $37,758 in 1908 against $37,767 for the same materials in 1907.

Miscellaneous

Under this heading are included talc, soapstone, diatomaceous earth, or tripoli, mineral waters and marl. The production of mineral waters shows an apparent decrease in quantity and value, due in part to closer inspection of the statistics. The value for 1908 being $75,858 as compared with $110,039. The production of the remaining materials is slightly less than $25,000.

Nipissing Mines Company, Cobalt

The president's report April 20, 1909, shows that the record for 1908 is as follows: Shipments of ore, 3505 tons, of which 702 tons were high-grade ore containing 3155 oz. of silver per ton, with 10.01 per cent. cobalt, 5.48 nickel and 37.69 arsenic. The remaining 2803 tons contained 210 oz. of silver per ton. The total net value of the ore shipped was $1,363,783. The cost of producing silver, per ton of ore, in 1908 was as follows: Operations, $105.46; depreciation at the rate of 24 per cent. on the plants and buildings, $13.03; marketing ore, $51.02; corporation, legal and other expenses, $6.50; less income from rents, etc., $8.10, or a total cost of production, $167.91, which, based on the amount of silver produced, is $0.20715 per ounce.

The exploration work for the year exposed much new ore, and on Jan. 1, 1909, the ore reserves were estimated at $1,078,000. During the year 10,013 ft. of underground work was done through 12 shafts and two tunnels. The company owns 846 acres of land, 383 acres of which have not been prospected. Since Jan. 1 a rich vein has been found in the Fourth of July and No. 64 shafts. The total dividends paid by the company since it began operation four years ago is 44 per cent. on the capital, or $2,640,000.

The report of the United States Steel Corporation for 1908 gives the following figures for the export sales made, in long tons:

	1907.	1908.	Changes.
Pig iron and scrap....	.....	21,898	I. 21,898
Finished steel....	1,014,014	777,276	D. 236,738
Miscellaneous....	68	232	I. 164
Total.....	1,014,082	799,406	D. 214,676

Comparing these with the total exports, we find that the Steel Corporation in 1908 furnished 87 per cent. of the total exports of finished steel, and 47 per cent. of the pig-iron exports.

Three Thousand Horse Power Winding Engine

Details of a Coupled High Pressure Type to Operate at 150 Lb. Steam Pressure and 50 Deg. Superheat; Safety Gear of the Whitmore Type

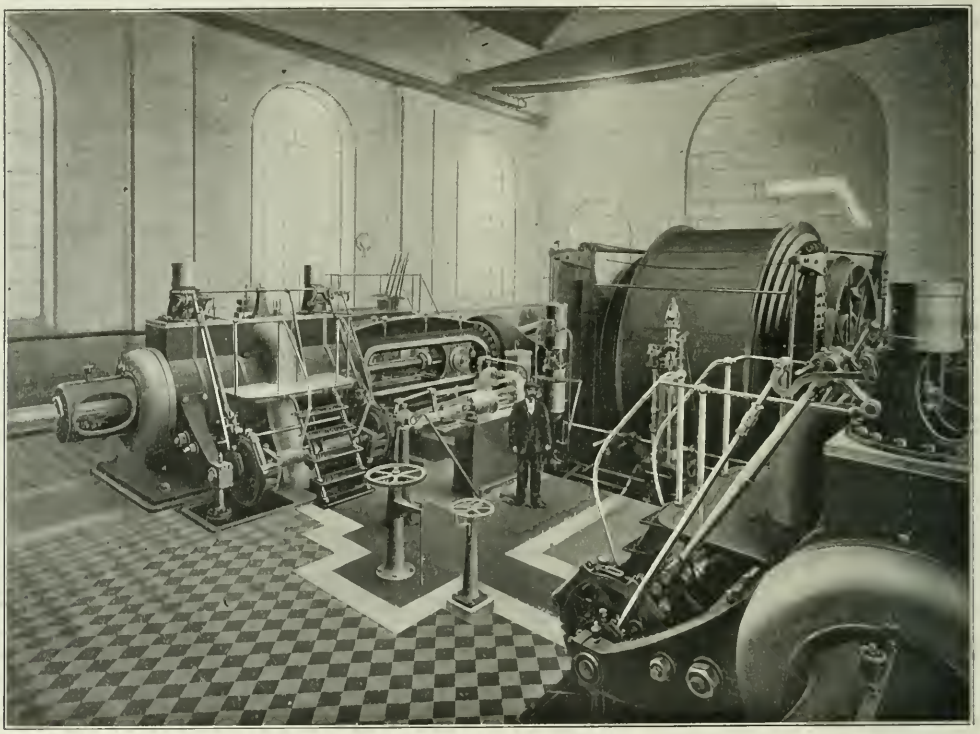
BY J. B. VAN BRUSSEL*

The winding-engine plant illustrated herewith has recently been installed in an English colliery. The engine is of the coupled high-pressure type, each cylinder being 36 in. diameter and 72 in. stroke. The cylinders are joined directly to the engine-bored guides and under the piston rods are supporting brackets. The back covers are easily removable for the purpose of examining the pistons. Provision is also made on the supporting feet of the cylinders to allow for expansion to take place in a straight line. To make this possible the holding-down bolts of the cylinders are separate from the foundation bolts. The cylinders are constructed for a working pressure of 150 lb. and superheat of 50 deg. Fahrenheit. The cylinder body and steam chest are well protected with nonconducting material and covered with blue-steel plates secured by polished bands.

The valves are lifted and released by levers actuated by eccentrics driven from the lay shaft running the same speed as the engine and parallel to the engine frame. An auxiliary eccentric is placed by the side of each trip lever eccentric to vary the cut-off by means of a cam lever which is also under the control of the governor. The grades of cut-off vary from 0 to 80 per cent., and steam may also be admitted up to 90 per cent. of the stroke when not under control of the governor. The exhaust valves are similar in design to the steam-inlet valves, and are actuated by means of rocking levers worked from the steam eccentric, thus giving a full exhaust under all grades of cut off. The valves are so placed as to effectively drain the interior of the cylinders and allow the pistons to work with the minimum amount of clearance.

The governor, which is of the static type, is driven by a roller chain from the engine shaft, the governor being coupled to the trip motion by cross-shafts and bevel gearing and so arranged that the reversing hand lever can be left at full gear, the governor automatically varying the steam admission. The governor is so set that the engine speed cannot exceed 50 r.p.m. The reversing is effected from the driver's platform by a hand lever capable of easy movement. This hand lever is connected to the steam-reversing engine with floating lever attachment, in order that the reversing gear may promptly take a position corresponding to the driver's reversing lever.

On the reversing shaft is placed a lever and rod connecting with the governor



A 3000-HORSEPOWER WINDING ENGINE AT AN ENGLISH COLLIERY

*Brussels, Belgium.

transmission shaft, and thus disconnecting the governor from the cut-off gear when reversing. Provision is made to throw the trip gear to full-steam position to enable the steam reversing to be effective even when the engine is running full speed in the opposite direction. A safety gear of the Whitmore type is fitted to this engine, which shuts off steam from the engine and applies the brakes, thus preventing the possibility of overwinding if the attendant fails to shut off steam, or starts the engine in the wrong direction.

A steam separator 3 ft. in diameter by 9 ft. long is placed between the cylinders and is followed by a 12-in. parallel slide valve. The main throttle is placed next this valve and is of the equilibrium type with cast-steel body. The engines are fitted with a most efficient system of drain gear and all the valves and handles are in a convenient position for ease in working.

The winding drum is of the built-up type, with channel-steel arms firmly secured to cast-iron bosses. The form of the groove is such that slipping of ropes is reduced to a minimum. The brake paths are faced with steel plates and arrangements made for adequately ventilating same and keeping cool when running on the brake. The drum is arranged for two ropes, each rope commencing on a flat 13-ft. diameter, then continuing up a slow core to 14 ft. diameter, then running up a spiral to the cylindrical portion of the drum, which is 17 ft. in diameter. The distance between the flanges of the cylindrical portion is 7 ft. 6 in. in the clear.

The brakes are operated by a vertical engine and weights. The brakes are put on by the weights and released by the engine, the engine being fitted with a system of floating levers whereby the position of the piston and consequently the degree of intensity with which the brakes are applied can be varied at will. The position of the piston corresponds to the position of the lever on the driver's platform. The brake engine is also coupled to the overwinding device and, as in the case of the former, the steam is cut off and the weights apply the brakes.

The depth indicator is arranged so that 1 ft. movement of the cages is represented by at least 1 in. of the pointer of the barrel. It is also provided with gong to ring at approved periods before the end of each of such wind. The driver's platform is on the left-hand side of the engine. All the operating levers are here handily arranged for controlling the throttle, reversing, brake engine, drain valves, etc.

The leading dimensions of the engine are: Diameter of cylinder, 36 in.; stroke, 72; diameter of piston rods, 7; diameter of crank bearings, 18; length of crank bearings, 32; diameter of crank pin, 10; length of crank pin, 12; diameter of crank shaft in drum, 22; diameter of gudgeon, 8; length of gudgeon, 12; length of connecting rod, 15 ft.; diameter of connecting rod at ends, 7 and 8 in.; diameter of connecting rod in middle, 9 inches.

The West African Goldfield

The West African goldfield of Gold Coast Colony has been attracting considerable attention in London of late, and the shares of the producing mines, as well as those of companies owning undeveloped properties, have been bought. The Consolidated Goldfields of South Africa Company, Ltd., has given a lead in drawing capital toward this goldfield, which up to the present has given disappointing financial results, by guaranteeing a large amount of money, about £250,000, for opening up new properties. This mark of confidence in the future success of the field has been prompted, it is said, by favorable reports from Walter Broadbridge and J. H. Curle. The results obtained by the producing mines do not call for any great enthusiasm. Although a good deal of gold is produced the dividends have been insignificant. For the last three years 1906, 1907 and 1908, the value of the gold produced has been £877,568, £1,154,885 and £1,186,342 respectively. Last year the Abosso Company alone distributed a dividend. Up to the present the cost of working has been high compared with the Rand; owing partly to the bad climate which causes difficulty in securing efficient management; and partly to the small scale of operations, the largest mill on the field being one of 50 stamps. If the mines can be worked on a larger scale, costs will no doubt be reduced, but to do this a large amount of development work and a considerable outlay are required. The thickness of banket on the West Coast compares unfavorably with the Rand and a far greater footage of development will be required for a given tonnage. Then again the continuity of the West Coast banket as a payable ore deposit is still uncertain. It may be found that the beds are workable only in certain portions, and that in between the reef may be too narrow or too poor to work at a profit.

A map of the West Coast banket area is marked off into blocks much the same as on the Rand and an enthusiastic speculator, who figures out tonnages as on the Rand should bear this point in mind. With increased outputs a reduction in grade may be expected. In examining the statistics of the producing mines, it will be seen that there has been a great falling off in the yield lately compared with the yield obtained at the commencement of operations, a sign that the mines were started on a grade above the average.

Although the field has undoubted possibilities, it would be unwise to look upon it as a second Rand, and those who are finding the money for its further development would do well to concentrate their efforts on the best known portions of the banket.

The Peat Fuel Industry of Canada

A memorandum prepared by the Dominion Superintendent of Mines and presented to the Canadian House of Commons, gives some information relative to the peat-fuel industry of Canada and its possibilities substantially as follows:

The high prices of imported coal in the middle provinces of Canada, the depletion of our forests, together with the increasing value of the forests for other purposes, and the suffering induced on account of scarcity of fuel in recent years consequent upon labor conditions are causes which have again prominently brought forward the question of utilizing peat bogs and lignite deposits for the production of marketable fuel and other purposes.

The estimated area so far reported distributed over the different provinces of the Dominion is 37,000 sq.m. The areas covered by peat bogs in the different provinces are, in square miles: Nova Scotia, 250; Prince Edward Island, 10; New Brunswick, 250; Quebec, 500; Ontario, 10,450; Alberta and Saskatchewan, 25,000. The beds vary from 5 to 10 ft. in depth. Further investigation will undoubtedly prove that this estimate represents but a fraction of the total area available.

Although several attempts have been made to manufacture peat fuel, especially in Ontario, they have, as a rule, resulted in failures, due principally to lack of knowledge. The successful working of peat bogs and manufacture of the raw peat into marketable fuel depend on:

1. The proper classification of the different peat bogs, since the peat occurring in one bog might be suitable for peat-fuel manufacture, while that from another might not.

2. The treatment of the raw material and the apparatus used for its combustion either for domestic or industrial purposes.

These facts, upon which the whole success of the industry depends, can be determined only by experiments carried out on a commercial scale and in an intelligent manner.

In several European countries peat is used largely for domestic and industrial purposes with satisfactory and economical results, and as conditions in Canada are quite as favorable for the manufacture of peat fuel and the use of lignite, there is no reason why, with the employment of proper methods and latest ideas, peat-fuel manufacture and use cannot be successfully introduced into Canada.

The memorandum recommends the establishments of a government testing and experimental plant, where the values of these fuels could be demonstrated and investigated.

Colliery Notes

An explosive mixture of firedamp ignites at a minimum temperature of about 650 deg. C. It must be exposed to this temperature for about 10 sec., however, before ignition takes place.

In one German district where safety lamps are used exclusively, the cylinders of the lamps are now made of a specially patented hard glass. This increases the cost of lamp 40 per cent., but prolongs its life 83 per cent.

In putting down boilers, it is advisable to see that the under strata is dry, and to put in a concrete foundation, covering the length and breadth of the space occupied, not only by the boilers, but also the outside walls forming the house and flues. The best kind of a sludge drift leading away from a boiler house, is built of large earthenware pipes, laid in good concrete.

There is no longer any question that coal dust will explode and damage a mine that is free from gas. One writer has aptly said: "Gas will always bear the relationship to coal dust that the detonator does to the high explosive, even though the latter in each case does most of the damage, and can usually be exploded in the absence of the former."

Coal miners generally believe that blackdamp is any mixture of gases which is heavier than air, non-explosive, extinguishes a lamp, and does not cause any noticeable effect on the miner when mixed with sufficient air to allow a lamp to burn. In investigating this subject it has been found that an atmosphere, which is extinctive to lamps, may be lighter than air. Such a condition may occur when the atmosphere is a mixture of nitrogen and carbon dioxide, in which the quantity of CO_2 is so small, that the mixture is lighter than air. A similar condition will exist if the mixture contains less oxygen than is necessary to support combustion, and a percentage of firedamp above the explosive limit.

One question that often arises is, whether the ventilation of a mine should be maintained even when the pit is not working. In this connection it is always best to see that ventilation is constantly produced, even when the pit is idle. In many countries (England, for instance) the mine laws specifically state that ventilation shall be maintained at all times, unless the mine is abandoned. Any mining man of experience must realize that the policy of constant ventilation is the only sensible plan to adopt. It is always easier, in dealing with a large quantity of gas to remove it little by little, than to try to remove it all in a body. What the blood is to a man as it courses through his body, so is the ventilation to a mine

When a central rescue station is established to serve a group of collieries, the station should be in direct telephonic communication with every colliery within its radius by means of a private wire to each; the telephonic line between each colliery and the station should be tested daily and the tests recorded in a book at the station where at least one assistant should be continuously on duty. Those who oppose the establishing of rescue stations do so on the ground that prevention is better than cure. Although explosions can be prevented, they continue to occur, and it is certainly wise to spare no reasonable expense in properly equipping such central stations, so that when the unexpected does happen, perhaps hundreds of lives may be saved.

Much care should be observed when electric motors are installed underground American operators could learn much from observing the practice in continental mines, where the chambers for motors are constructed with water-proof arched roofs and tiled pavement; everything being as clean underground as is usual in surface plants. If the arched roof in such a chamber does not prevent the dripping of water, it is then best to have recourse to inclosing covers, which should be of the weather-proof ventilating pattern, and easily opened for examination of the windings. Totally-inclosing covers, admitting of no ventilation, prevent the accumulation of dust, but interfere with the cooling, and necessitate the use of large types of machines in which the material is insufficiently utilized, with a consequent lower efficiency and higher price.

Concerning the question of forced draft, a considerable diversity of opinion exists. In a new system of forced draft recently put forward, the steam is taken direct from the boiler and led by pipes into the side flues, where it becomes superheated, and is then carried to the air injectors, where it draws in and mixes with air, giving up to it a portion of its heat, and drives it into the fire, on each side of the door at a point a few inches above the dead plate. On one side of the injector apparatus a pipe is led from the flue direct, and in addition to the air, heated gas is also drawn in, so that a mixture of superheated steam, air, and heated gases is delivered into the fire at a high temperature. Tests with the apparatus have shown an increase of 30 per cent. evaporative efficiency with a marked decrease in the quantity of smoke emitted

When electric power is used underground, due precaution should be taken that the insulation of the winding and current-carrying parts is of a character to resist the continued action of a moist atmosphere. The insulating material used for high-tension work is generally better suited to stand this action than that commonly used on low or medium pressures, and it is therefore especially important in cases where medium pressure is employed to pay particular attention to the class and method of insulation, and to avoid the use in it of any material of a hygroscopic nature. The accumulation of coal dust on the windings should be avoided as much as possible, as it might form a conducting film, or layer, over the insulation to the frames. Periodical inspection and cleaning should be enforced as a preventative. Motors should be placed in well-built chambers, properly lighted and ventilated with intake air.

Recent tests show that an ordinary miner's lamp (of the type generally worn on the miner's cap) when burning tallow, consumes 2.49 cu.ft. of oxygen and produces 1.74 cu.ft. of carbonic acid per hour. The same lamp when burning oil consumes 1.13 cu.ft. of oxygen and produces 0.78 cu.ft. of carbonic acid per hour. The same investigators determined the candlepower of various lamps by photometry as follows: Wolf safety lamp (having a wider flame than most safety lamps and a white enameled reflector), burning with a flame 9 in. high gave 8 candlepower. Scottish miners' oil lamp (consuming 13.8 grams of oil per hour) average during 15 min. with uniform flame, 1 candlepower. The kind of oil used affects the candlepower considerably. Scottish miners' tallow lamp (consuming 17.4 grams tallow per hour) average during 15 min. with uniform flame, 2.3 candlepower. Scottish miners' lamp (consuming 13 grams paraffin wax per hour) gave 1.6 candlepower. Scottish miners' lamp (consuming 19.3 grams paraffin wax per hour) gave 2.6 candlepower.

The English coal mine laws forbid the use of electric motors, that are liable to sparking, in gaseous workings. In an attempt to solve this problem, competent engineers have recently made a series of experiments to determine the proper method of encasing such motors. It was found that practically all of the protective devices proposed were a positive danger in an explosive atmosphere. Inclosings made of wire gauze or solid covers were found to be inefficient. The covering of the openings with wire gauze (even with two layers) was not found altogether satisfactory. It was discovered that if gaps were provided of a certain size, that is, not too small to prevent the egress of the heated gases and cause a dangerous rise of pressure, and not so large as to allow free passage of the burning gases, the communication of the explosion was avoided. In some cases the failure of the gauze may have been due to the too coarse mesh, but generally it was found that the gauze did not offer sufficient cooling surface to prevent the inclosed gases from being raised to a dangerous temperature, and finally allowing the explosion to be communicated to the external atmosphere

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Production of Copper in 1908

We have received official reports for the full calendar year 1908 from all of the producers in North America. These show that the production of copper in the United States in 1908 was 948,196,490 lb., against 879,241,766 lb. in 1907. In each year the statistics are computed on the uniform basis of production of the Michigan mines, plus the fine copper content of the blister copper produced by the other smelteries, plus the copper content of ore and matte exported, the last being a comparatively insignificant item. As we have previously pointed out, this method of computation differs from that based on the output reported by the refineries, and is adopted as representative of the production of the country because it comes nearest to the output of the mines. Details of the statistics are given in the accompanying tables.

PRODUCTION OF COPPER IN THE UNITED STATES

Groups.	1907.	1908.
Michigan mines	220,317,041	222,267,444
Smelters in Arizona and Texas	262,597,624	292,048,641
Smelters in Montana and Wyoming	229,362,164	258,060,399
Smelters in Utah and Nevada	90,100,052	77,351,088
Smelters on Pacific Coast	(a) 21,936,026	39,880,529
Smelters in Mississippi Valley	(a) 24,062,550	24,391,646
Smelters on Atlantic Coast	(a) 13,640,930	15,675,379
Smelters in Tennessee	(a) 14,784,379	14,464,585
Miscellaneous	(b) 2,441,000	4,056,779
Totals	879,241,766	948,196,490

(a) These statistics do not measure the relative importance of these groups of smelters which produce much copper from foreign ore. (b) Includes exports of ore and matte and copper produced by lead desilverizers.

PRODUCTION OF COPPER BY STATES.

State.	1907.	1908.
Alaska	6,610,680	4,394,887
Arizona	256,866,761	290,167,795
California	34,398,823	36,890,353
Colorado	13,344,118	13,896,689
Idaho	11,471,101	8,749,559
Michigan	220,317,041	222,267,444
Montana	226,290,873	252,558,330
Nevada	1,462,450	12,174,269
New Mexico	8,652,873	8,523,652
Utah	68,333,115	70,978,952
Wyoming	2,919,137	2,384,356
South and East	(a) 22,408,696	20,822,368
Other States	(b) 6,166,098	4,387,836
Totals	879,241,766	948,196,490

(a) Includes Vermont, New Hampshire, Pennsylvania, Virginia, North Carolina, Alabama and Tennessee. (b) Includes Washington, Oregon South Dakota, Texas and the production of the lead desilverizers and others which it is impossible to distribute according to place of origin

PRODUCTION OF COPPER IN NORTH AMERICA.

Country.	1907.	1908.
United States	879,241,766	948,196,490
Mexico	126,710,000	89,576,464
Canada	46,356,382	55,781,992
Cuba	3,059,152	6,537,064
Totals	1,055,367,300	1,100,092,010

The production of copper in Canada and Mexico is computed on the same basis as in the case of the United States. Our statistics differ somewhat from those of the Canadian government, because the latter reckons the copper content of ore, matte and blister copper, while we do not enumerate it until it has all been converted into blister copper, which to a large extent is done after the crude material has been exported from Canada. The basis of blister copper is the only one that precludes danger of duplication. In the cases of Mexico and Cuba there are no official statistics.

Many of the producers of blister copper resmelt a good deal of scrap copper. This has been carefully excluded in our statistics. It is to be remarked that all of the copper that we report as the production of the smelters, and consequently of the mines, does not finally appear as refined metal, several million pounds per annum being recovered by the refiners in the form of bluestone. The production of the latter as a by-product in the United States was 37,654,961 lb. in 1908, compared to 34,867,650 lb. in 1907. A small portion was obtained each year as a direct product in the treatment of matte, but the bulk of this production is made as a by-product by the electrolytic refiners. The copper content of bluestone is roughly 25 per cent.

THE WORLD'S COPPER PRODUCTION.

(IN METRIC TONS).

Country.	1907.	1908.
Argentina	224	226
Australasia	41,910	40,123
Austria-Hungary	1,062	1,700
Bolivia	2,540	2,540
Canada	21,035	25,305
Cape of Good Hope { Cape Co.	4,298	4,550
Cape of Good Hope { Namaqua	2,540	2,440
Chile	28,863	38,927
Cuba	1,388	2,966
Germany	20,818	20,523
Italy	3,353	3,022
Japan	38,001	44,700
Mexico	57,491	38,190
Newfoundland	1,758	1,453
Norway	7,122	9,337
Peru	20,681	(e) 22,240
Russia	15,240	20,405
Spain-Portugal	50,470	53,425
Sweden	1,577	2,032
Turkey	1,270	1,068
United Kingdom	711	...
United States	398,930	430,099
Totals	721,282	765,271

(e) Estimated.

The statistics of the world's production of copper ore are based on our own figures for North America, together with those of Henry R. Merton & Co., and the respective governments for other countries, the official figures being used when they are available and of undoubted accuracy.

The Virginian Railway

The opening of a new railroad into a district of established traffic has always a disturbing effect, even though the new line may develop some traffic especially its own. This has been the case with the Virginian railway, to which reference has already been made in these columns. The expected effect has been increased by reports regarding the intentions of the owners of the new line. It is stated, without contradiction and apparently from well informed sources, that the company intends to enter largely into the seaboard trade, especially in New England territory. To this end it will establish at central points on the coast large storage plants from which coal can be furnished directly to consumers; and in connection with these it will maintain steamship lines which will deliver coal to the different distributing ports. At the present time the seaboard trade is carried on mainly by sailing vessels and barges; steam colliers will be able to make quick and regular trips and to maintain stocks at the distributing yards, no matter what the conditions of wind and weather may be. How far this plan is to be carried out is uncertain, but there seems to be little doubt that something of the kind is in contemplation.

One effect will be to change to an important degree conditions in the seaboard trade. At present sales are made at prices —whatever they may be—delivered at shipping points, the purchaser paying the coastwise freight rate. Under the new plan prices will be fixed at the port of delivery, throwing the freight rate upon the selling company and making the price to the consumer of rather a speculative character to those companies which do not own their own vessels. The reports have already caused a commotion in the seaboard bituminous-coal trade and there is a degree of uncertainty which has prevented many large consumers from closing their contracts for the season.

Possibly all the current rumors are not correct. It is evident, nevertheless, that the Virginian railway intends to have a hand, and an important one, in the large trade for which it was built to serve. A fuller exposition of its plans is anxiously awaited by some of its rivals.

Current report also has it that negotiations are in progress for a combination with the Chesapeake & Ohio railroad for a Western connection, the object being to secure a share of the Western trade, which is already much disturbed at the competition of West Virginia coal.

The Anthracite Situation

Although the anthracite operators and miners have been gradually approaching an agreement, it cannot be said that the situation is yet definitely settled. As we anticipated, the very strong position of the companies has gradually forced the miners into a practical acceptance of the companies' proposition for the renewal of the present agreement for a three-years' term. A few concessions of minor importance were made by the operators' committee, apparently more for the sake of appearances than for anything else. The final proposition is being considered by a miners' convention which is now in session. It is within the possibilities, however, that some trouble may arise to prevent the settlement and it is not safe to say that a strike is finally averted; nor will it be safe to say so until the agreement is finally made and signed by both parties. Those who can recall the situation 16 or 17 years ago will remember that the worst strike on record in the anthracite country followed the actual closing and signing of a preliminary agreement.

State Regulation of Mining in Norway

As is well known, the Norwegian government has been taking an advanced position with respect to the conservation of the resources of that country, and particularly the protection of domestic interests. This has to a large extent prevented the preëmption of the great water powers by corporations. Indeed, it is considered to have retarded development to some extent.

A concession recently granted for the working of the Glomrudkollen zinc mines is illustrative of the present policy of this government. The concession is for 82 years, at the end of which period the mines revert to the state. Their operation must be carried on according to the laws governing the proper working of mines. The company must submit a working plan to the Department of Mines, which has the right of altering it, but the company may appeal for a final decision to a commission of arbitration. The company, under a penalty of 10,000 kroner, binds itself not to join any combination calculated to raise prices in Norway. Only Norwegian workmen and officials may be employed, and Norwegian material must be used if as good and not exceeding in cost by 10 per cent. that supplied from abroad. If a company store be opened the net profits accruing therefrom must be devoted to the benefit of the workmen.

It is interesting to note that the litigation between the American and British stockholders of the Harney Peak Tin Mining, Milling and Manufacturing Company, which has been before the courts for 14 years, has been ended and a reorganization is in process of being effected. During all these years Dr. A. R. Ledoux has been receiver for the company, but has been prohibited by the courts from spending any money in development of the mines. We understand that under the terms of the reorganization the first thing to be done is to make a careful test of the most promising properties to determine what is the grade of any ore found in quantity, and to inaugurate this work Doctor Ledoux has already gone to the Black Hills. It is gratifying to know that through this settlement there is at last a possibility of establishing a tin industry in South Dakota.

An important incident in its bearing upon coal traffic is the purchase by the Pennsylvania Railroad Company of the stock in the Norfolk & Western Railway Company which it sold three years ago. This large block of stock will give the Pennsylvania a controlling voice in Norfolk & Western affairs. Two considerations have doubtless prompted this purchase, one being the opening of the Virginian railway; the other is the manifest intention of the independent operators in the Pocahontas district to compete actively for coal business on the seaboard with the Clearfield, Cambria and Pittsburg regions. This can be done only by securing extremely low rates from the railroad, to meet which would involve a considerable sacrifice of revenue by all the other lines concerned.

This transaction and some other recent movements have given rise to rumors of a contemplated "soft-coal trust." To these revivals of an old story little credence is to be given. The bituminous trade is too large for one combination to handle.

Mineral Riches of the German Colonies

By Robert Grimshaw*

As the Germans are beginning to understand that they cannot compel the negroes in Africa to become farmers, also that their own people who have no capital cannot settle there and get rich, they are turning their attention to discovering minerals which they can export to Germany and other countries. In this they are succeeding admirably. The following is a résumé of a report recently published by the Imperial Colonial Department.

Hard coal, which has already been tested, and concerning which the reports as to its value are favorable, has been discovered in southwest Africa near Keetmanshoop; also in East Africa on Lake Nyassa, and in the German possessions in the Indian ocean. Iron ore is found in Togo, southwest Africa, and Kaiser Wilhelm Land. Signs of gold have been noted in both Southwest and East Africa; in the latter, recently on Kironda creek, where it is to be worked by a company already formed. Blue dirt, the soil in which diamonds are found, has been met with in several places in Southwest Africa; and in the same places a variety of other precious and semiprecious stones. Mica of excellent quality is found in Kamerun, in the district of Ostdinge.

Phosphate beds are among the discoveries in the Bismarck archipelago, and this material has been shipped therefrom. The first shipments have been received in Germany, the amount being stated as 3911 metric tons between Jan. 1 and June 30, 1908. There is marble in Southwest Africa in the neighborhood of the railway station Kubas.

As there are in the German colonies and protectorates immense areas awaiting prospectors, as for instance, in German East Africa, and on Lake Tanganyika, as well as in the Kilimandjaro district; and as farther in the back country (Hinterland) of Komerun, there are large districts which have not been geologically surveyed, the Colonial Committee charged with such work intends to have these regions properly surveyed by geologists and prospectors, in order to afford the population new sources of income.

The most important copper deposits are in the Oktavi district. There are in this region several mines, of which the Tsumeb is the most important. The ore of this mine has been shown to be very rich in copper, so that the company exploiting it has changed its original idea of working it in Africa, and intends sending the best grades to Europe for smelting. According to the opinion of experts, officially published by the government the yield of this mine should be about 35,000 tons of ore per year.

*Engineer, Dresden A, Germany.

River-bed Mining in California

Special Correspondence

More attention is being paid these days than for some time past to river mining in California. Steam shovels and engines take the place of the old wing-dam and Chinese pump in these operations, though those old appliances are still in use along the Klamath river at certain localities. Up on the Stanislaus river, which divides Calaveras from Tuolumne county and San Joaquin from Stanislaus county, several companies recently formed have taken up much of the river bottom, especially between Parrot's Ferry and Camp 9 of the Standard Electric Power Company. Hereabout the primitive style of river-bed mining will be modernized. Steam shovels are to be used to lift the auriferous gravel from the river bed. At Otter Bar similar enterprises are under way; and at the confluence of the Middle and North forks of the river, operations of the same nature are projected. Up to this time only intermittent operations have been carried on when there was a low stage of water in the stream.

A New Grondal Plant in Sweden

By N. V. Hansell*

One of the most recently erected Gröndal plants in Sweden is the one connected with the Lulea Iron Works in northern Sweden. The ore used there is taken from the well known Gellivara mines and contains 58 per cent. iron, 0.10 per cent. sulphur and 1.3 per cent. phosphorus. Although this ore is high in iron, on account of its high phosphorus content, it was found to advantage to fine grind it, separate it wet, and afterward briquet the concentrates. The latter generally contain 72 per cent. iron, with 0.017 per cent. sulphur and 0.008 per cent. phosphorus. The tailings have a total iron content of 8.4 per cent., composed of about 1.5 per cent. magnetite and the balance in silicates and hematite. They contain 5.7 per cent. phosphorus. The quantities of concentrates and tailings stand in the ratio of 78 to 22, making the total recovery of iron 97 per cent. The briquets usually average about 70 per cent. iron.

In the Swedish iron industry briquets have been extensively used in the blast furnaces. From an ore containing as much phosphorus as the Gellivara briquets are produced with only 0.008 per cent. phosphorus and 0.006 per cent. sulphur. The iron obtained is high grade, with guaranteed 0.01 per cent. sulphur and 0.02 per cent phosphorus. In the blast-furnace charge briquets alone are used, making the iron percentage of the charge between 65 and 70. The charcoal consumption per ton of pig iron is said to be lower than in the usual Swedish practice, on account of the physical character of the briquets.

*29 Broadway, New York City.

Steel and Iron in France

The production of pig iron in France is reported by the Comité des Forges as below, in metric tons:

	1907.	1908.	Changes.
Foundry iron.	651,700	705,527	I. 53,827
Forge iron....	673,885	543,967	D. 129,918
Bessemer pig..	122,046	118,121	D. 3,925
Basic pig.....	1,988,343	1,949,107	D. 39,236
Special irons.	152,975	74,428	D. 78,547
Total...	3,588,949	3,391,150	D. 197,799

Foundry iron includes 111,101 tons direct castings in 1908. Special irons included ferromanganese and similar alloys. The raw material used in 1908 included 7,357,686 tons domestic iron ore, 1,508,114 tons imported iron ore, 144,339 tons manganese ore and 649,652 tons of scrap, cinder, slag and pyrites residue.

The steel production is reported as follows, in metric tons:

	1907.	1908.	Changes.
Acid converter..	78,771	77,581	D. 1,090
Basic converter..	1,669,757	1,632,296	D. 37,461
Open-hearth....	1,001,463	1,002,789	I. 1,326
Crucible.....	16,782	12,662	D. 4,120
Electric.....	.....	2,289	I. 2,289
Total.....	2,766,773	2,727,617	D. 39,156

Electric steel was reported separately in 1908 for the first time. The figures above are for ingots. Finished steel reported was 1,860,308 tons in 1907, and 1,894,022 in 1909: an increase of 33,714 tons. The larger items of finished steel in 1908 were 390,037 tons merchant steel, 344,772 tons plates and sheets, 333,756 tons angles, shapes, etc., and 322,241 tons rails.

The National Bureau of Standards in the Department of Commerce and Labor has contracted with Constructor Emery, who built the large testing machine at the Watertown arsenal, to furnish a new testing machine, to cost $150,000, for the use of the Bureau of Standards. This machine will be installed for the purpose of making tests for the public and for the other departments of the Government, the work of the Bureau of Ordnance in the War Department being now limited to the testing of materials for guns and gun carriages.

The first electrometallurgical plant for making tool steel in Russia has just been installed at the Oboukhoff works, near St. Petersburg. Professor Lipine, after visiting most of the plants of this nature in other countries, decided that the Heroult system was the best adapted for the purpose, and the present equipment is of that type.

The Hand Jig in Practice

By C. N. Nelson*

Under my direction at Santa Barbara, Chihuahua, we had occasion to use over 30 hand jigs and the following data and sketch are from notes taken over a period of 10 months. The ores of the district are mainly oxidized lead and silver minerals with occasionally gold and copper; and it is on these soft, easily sliming ores that the hand jigs prove their usefulness. With sulphides, of course, good results are easily obtained.

As may be seen from the sketch, the screen moves in the water and the hutch product, called *lamas* or slimes, is retained with the water in the hutch. When the latter fills up with slimes nearly to the top the screen is removed and the hutch emptied by shoveling. The concentrates are obtained from the screen by the use of a tin scraper, first cleaning off the layer of tailings and then the concentrates. Five-gallon oil cans are used to remove the products. This sounds like a tedious and costly operation but as one man can produce about one-half a ton of concentrates and slimes per day of nine hours, it is not very costly with Mexican labor.

The jigs are made in batteries of two and three for economy of lumber and space. A good arrangement is to have two rows of jigs with a track for the tailings car down the center, and room for ready access of wheelbarrows to all the jigs.

The heads should be carefully screened, and two or three sizes maintained as closely as possible. The mesh of the jig screens is, of course, varied according to the size of the heads and proportion of slimes desired. A ¼-in. aperture iron wire screen was used for the coarser material, and ⅛-in. aperture for the finer. For more careful work still finer screens may be used.

The jig patio is generally let out on contract to one man who contracts to deliver the concentrates and slimes on the patio above a given minimum assay value. The contractor furnishes all labor necessary but has the ore delivered to the screen at the head of the patio. The prices were about $2 per ton for the coarse and $1.50 for slimes, with labor at 75c. per day of nine hours. These prices varied with the grade of the heads and the convenience of operation.

The water was furnished from a tank about 8x5x6 feet, which supplied 20 jigs and took its small supply from the mine. The water is needed chiefly in refilling the hutches after a clean-up, though a little is used all the time to make up for the splash.

The heads are wheeled up to the jig and piled in front and the screen filled by shovel when required. The concentrates are not removed every time the tailings are cleaned off, but allowed to accumulate a little. The motion of the screen is given by a quick down stroke on the long arm with a slower recovery. The spring of the arm and looseness of the suspension give an even motion with the required variation in the up-and-down movements. This action has to be learned by the operator; the men also get very skilful in judging the amount of work needed to clean a screen full of ore, and the depth to scrape to keep the tailings clean.

The assays given in the accompanying table were averaged from about three months' operation on 3000 tons of ore. The value is given in United States currency on the basis of silver at 60c. per oz., copper at 18c. per lb., lead at 4c. per lb., the metric ton being used.

HAND JIG PATIO AT SANTA BARBARA, CHIHUAHUA

HAND JIG OPERATIONS.

	Oz. per Ton		Per Cent.		Value Per Ton.
	Au.	Ag.	Pb.	Cu.	
Ore	.12	8.0	11.6	...	$18.41
Concentrates	.17	24.5	34.0	2.0	55.94
Slimes	.42	12.0	29.0	0.6	43.52
Tailings	.06	3.0	2.5	...	5.20

The use of hand jigs is peculiarly appropriate to small mines in a region where water is scarce and ores soft and easily slimed, and where a shipping product must be made with moderate initial outlay. In theory the jig is rather interesting, as it may be said to combine the action of the jig with that of the old Cornish dolly-tub.

*Mining engineer, 120 North Norwood avenue, Buffalo, N. Y.

The domestic production of metallic sodium in 1908, according to statistics collected by the Engineering and Mining Journal, was 2000 short tons valued at $1,000,000.

The Kent Coalfield in England

Special Correspondence

Kent Collieries, Ltd., is a company formed in 1905 to work the coal which had been proved to exist under the well known Shakespeare's cliff at Dover, England. For one reason or another the company has so far succeeded in doing little more than proving the existence of the coal as a workable deposit, and is now seeking for fresh capital. Two shafts have been sunk, known as No. 2 and No. 3. No. 2, which has an inside diameter of rather more than 14 ft., has been sunk to a depth of 1632 ft. and has penetrated several seams of coal. This shaft is lined with iron casing and concrete backing to a depth of 1200 ft. below which it is lined with brick and cement. No. 3 shaft, which will be the main hoisting shaft, has an inside diameter of 18 ft. and is down 674 ft., the bottom being some distance yet above the coal. In No. 2 shaft several seams of coal have been cut, while others have been proved to exist by boreholes. Coal was raised from a seam at 1274 ft. and 200 tons were sold to the railway company, which traverses the coalfield, for testing purposes, the results of the trials being reported satisfactory. The thickness of the seam at 1274 ft. was 20 in. A larger seam, 4 ft. in thickness, was met with in a borehole at a depth of 2221 ft. and it is intended to sink the shafts to this depth, when further funds are subscribed.

The coalfield has been reported on by a large number of experts, including Professor Hull, a member of the Royal Coal Commission 1901 and a director of the company. Professor Hull states that no fewer than 13 seams of coal of various thicknesses were proved by boring, of which seven might be considered workable. The lowest was the 4-ft. seam mentioned above. The bottom of the coal formation

has not yet been met with, so that further coal seams may still be found to exist. Another expert who has reported favorably on the undertaking is Carl Hold, a German mining engineer from Westphalia.

The possibilities of the coalfield have recently attracted the attention of prominent coal owners of the South Wales coalfield and their coöperation has been promised, provided the shareholders will find the money required for the further sinking of the shafts and for equipping the colliery with a suitable plant for mining the coal and making it marketable. These practical gentlemen from South Wales are not prepared to take up the scheme unless they first have all the money which their long experience in coal mining tells them will be required, the amount being about £125,000. If the colliery is properly equipped these gentlemen, one of whom is chairman and the other the managing director of the well known Powell-Duffryn Steam Coal Company, of South Wales, say that they believe that Kent coal can be won profitably.

The geographical position of the colliery is favorable. Situated on the seacoast close to Dover, the coal would find a ready market for railway, industrial and shipping purposes. According to the South Wales experts, however, too much weight ought not to be placed on the geographical situation, because Newcastle coal could be delivered at the wharves in the Thames for 11s. 6d. per ton and if suitable arrangements existed at Dover harbor, coal could no doubt be delivered there at a price to compete with Kent coal. The businesslike way in which the undertaking was discussed by the South Wales coal experts at a recent meeting of the shareholders inspired confidence and it seems probable that the requisite amount of capital will be found. If so, it will probably not be long before coal mining in Kent, the garden of England, will become an accomplished fact.

The Consumption of Scrap*

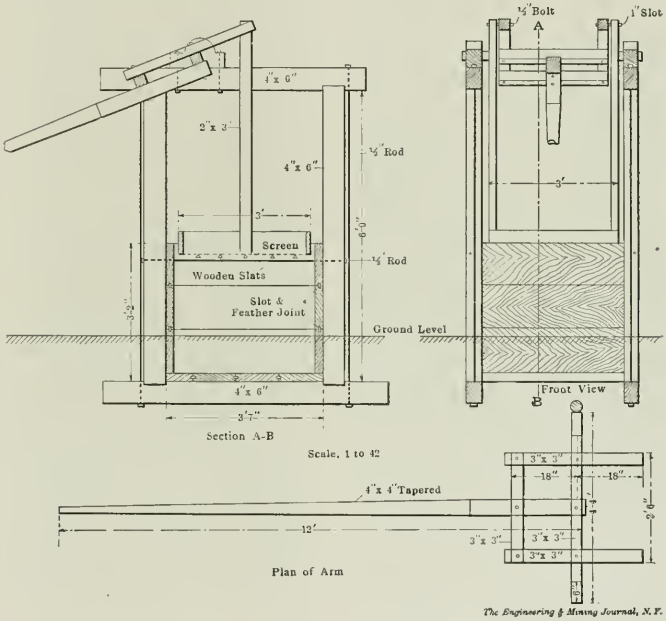
In addition to the millions of tons of iron ore which are annually consumed in this country in the manufacture of pig iron there is an ever-increasing consumption by our blast furnaces of mill cinder, scale, scrap, etc. While the consumption of materials of this character is not annually ascertained by the American Iron and Steel Association, it has been ascertained by the Bureau of the Census for the census years 1880, 1890, and 1900; also for the calendar year 1904. The Bureau has also ascertained for the same years the consumption of old rails and all kinds of iron and steel scrap by our rolling mills and steel works. By combining these two statements the interesting results which are shown in the following table are obtained. Gross tons are used throughout:

Scrap, etc.	1880.	1890.	1900.	1904.
Blast furnaces	316,114	1,145,699	1,600,313	1,865,385
Rolling mills and steel w'ks.	1,198,842	1,726,162	4,113,287	5,124,277
Total....	1,614,966	2,871,761	6,713,600	6,989,662

The great increase shown in the table in the use of scrap by rolling mills and steel works from 1890 to 1900 and from 1900 to 1904 is explained by the development of the basic open-hearth steel process, which actively began late in the 90's and which has since made wonderful progress. The acid open-hearth process is also a large scrap consumer. While no accurate figures are available it is probable that in 1904 the open-hearth process alone consumed approximately 3,000,000 tons of iron and steel scrap, and that in 1907, when the production of basic open-hearth steel was more than double that of 1904, the consumption of scrap in the open-hearth process approximated 6,000,000 tons.

In the above table the iron and steel scrap consumed by iron foundries, cast-iron pipe works, car-wheel plants, forges which manufacture scrap bars, etc., is not considered. If the scrap consumed by establishments of this character were included, and due allowance were made for the great increase in consumption by our basic open-hearth steel furnaces, it would probably be found that the total consumption of iron and steel scrap, cinder, scale, etc., in this country in the calendar year 1907 would amount to at least 12,000,000 tons, and might reach 12,500,000 tons, or almost one-half of our total production of pig iron in that year. The scrap and cinder consumption of 1908 was naturally much less than that of 1907. There was doubtless a large accumulation of scrap in 1908. . . . We are informed that there is an increasing tendency to substitute scrap for pig iron in the open-hearth furnace.

*From the *Bulletin* of the American Iron and Steel Association.



DETAILS OF HAND JIG AT SANTA BARBARA

The Minister of Labor in Belgium has proposed a plan for the pensioning of old miners. Funds are to be raised by taxing employers 15 fr. per year for each miner engaged, and a similar amount is to be deducted from the wages of each mine worker. These receipts, enlarged by grants from the government, are expected to permit the payment of at least 360 fr. per year to every miner who reaches the age of 60 years.

According to the *Queens. Gov. Min. Journ.*, both stream and lode tin are reported as being discovered in the Northern Territory of South Australia, the locality on this occasion being a few miles east of Eureka mines of Pine creek.

Zinc Mining in Butte

By A. H. Wethey*

Butte has been known for so long a time as one of the greatest sources of supply of copper in the world, that it has not received much recognition heretofore as a probable center from which large quantities of zinc may be furnished. It is true that considerable quantities of zinc ore have been found from time to time in various of the producing copper mines of Butte, but such ores have been more valuable for copper and silver than for the zinc they contained, and no effort has been made to recover the zinc.

Extensive development work during the last two years in the eastern end of the Rainbow lode has resulted in the discovery of immense deposits of zinc ore, containing from 10 to 50 per cent. zinc. In order to render the ores of sufficiently high grade for the zinc smelters, the Butte Reduction Works has recently installed a concentration plant for that purpose. The concentration of zinc ores differs from that of the copper ores in the Butte camp. With the copper ores every effort is made to save as much of the copper as possible with a minimum amount of crushing. It is only after all the coarse mineral has been saved that fine crushing is resorted to in order to save the copper in the slimes. With the zinc ores it is found necessary to crush the ore much finer than is the practice with the copper ores. The concentrates from the ores developed in the Elm Orlu mine owned by the Elm Orlu Mining Company, and the Black Rock mine owned by the Butte & Superior Copper Company, readily concentrate up to above 40 per cent. zinc, and will carry in addition from 3 to 4 per cent. copper, from 20 to 30 oz. silver and from $1 to $2 in gold. The zinc smelters after distilling off the zinc sell the residue to lead and copper smelters, for whom it is an excellent material, it being practically free from sulphur, while most of the zinc is eliminated in the distillation process.

The concentration plant at the Butte Reduction Works will have a capacity of about 300 tons per day. It requires about 2 to 2½ tons of the zinc ore to make 1 ton of zinc concentrates. It is estimated that in the two properties already referred to, there are approximately 400,000 tons of zinc ore already developed. It seems singularly appropriate that Ex-Senator W. A. Clark, who has been interested in the Butte district for over 30 years and was one of the pioneers in the development of its mines, and also in the erection of plants for the treatment of the Butte ores, first for the treatment of silver ores and then for the treatment of copper ores, should now be among the pioneers in the erection of a plant for the wet concentration of zinc ores. The Elm Orlu property is owned by Ex-Senator Clark and his son, W. A. Clark, Jr., while the Butte Reduction Works is owned by Ex-Senator Clark, and is the oldest smelting and concentrating plant in this district, having been in continuous operation since 1885.

*General manager for W. A. Clark's mining interests, Butte, Mont.

A New Direct Method for Determining Nickel in Steel

By H. Grossmann and Walther Heilborn*

When separating nickel from tri-valent iron by the method already described in the Journal, p. 1044, 1908, the precipitation of ferric hydroxide by caustic alkali or ammonia must be prevented. This is most easily effected by the addition of some soluble tartrate. The amount of tartrate to be added varies, according to the relative amounts of nickel and iron, and in the analysis of nickel a great deal more of the tartrate has to be added than in the analysis of alloys containing, approximately, equal amounts of the two metals. If to a solution of nickel steel only a little more tartrate is added than necessary to prevent the precipitation of the two hydroxides and then the precipitation of the nickel by the new method effected, the color of the solution above the precipitate remains red and the liquor contains most of the ferric iron in the colloidal state, for the complex ferric alkali-tartrate primarily formed is largely hydrolized. This is corroborated by polarimetric methods, not to be described here. The colloidal solution produced by the hydrolysis not only retains considerable amounts of the nickel-dicyandiamidine, but may also coagulate spontaneously and completely spoil the analysis. If, however, a large excess of tartrate is added the hydrolysis is largely diminished and the alkaline solutions of a yellowish or greenish color will keep unchanged many days and will always yield good results.

Scheme of Analysis

In consideration of the above the practical execution for the determination of nickel in steel is as follows: Dissolve 0.5 to 2 grams steel, according to the percentage in nickel, in aqua regia, evaporate on the water bath to a volume of about 10 c.c., filter off any impurities and the silica precipitated and add to the solution about 15 grams of sodium-potassium tartrate for each gram of steel. In the presence of much manganese oxidation must be prevented by the addition of some hydrazine sulphate. In case, after addition of the tartarte, a crystalline precipitate of yellow color is formed (it consists of potassium hitartrate colored by inclosed mother liquor), a little ammonia is added and the precipitate redissolved. To the solution giving off a strong odor of ammonia an excess of caustic soda is added. In most cases about 40 c.c. of a 20-per cent. solution seems to be sufficient. In case, however, no precipitate is formed after a little while, some more caustic soda is added. The nickel dicyandiamidine naturally is formed more quickly with a high percentage of nickel in the steel and with a small amount of solution. In the analysis of alloys rich in nickel the filtration may be effected as soon as the liquor above the precipitate has cleared up completely, while solutions containing but little nickel are left to stand for quite a while before filtering.

The suitability of the described method is shown by the accompanying analyses applied to six different grades of nickel steel from Krupp. The percentages given in the last column are those found at the Krupp works by the potassium cyanide method.

ANALYSES OF DIFFERENT GRADES OF NICKEL STEEL.

Amount Used, Grams.	Ni—$(C_2H_8N_4O)_2$ Found, Grams.	Ni Found, Per Cent.	Ni Found by the KCN Method, Per Cent.
2.0235	0.1690	1.88	1.88
2.0878	0.1726	1.86	
1.2784	0.1710	3.01	2.96
1.3002	0.1699	2.94	
0.9936	0.2155	4.88	4.91
1.0190	0.2212	4.89	
0.5434	0.1312	5.43	5.45
0.6012	0.1443	5.40	
0.6612	0.2596	9.56	9.58
0.6302	0.2680	9.57	
0.5096	0.5938	26.22	26.25
0.6100	0.7103	26.20	

*Pfalzburgerstr. 8, Berlin W. 15, Germany.

Batopilas Mining Company

The report of the Batopilas Mining Company, April 12, 1909, for the year ending Dec. 31, 1908, states that the work for the year was confined to the Porfirio Diaz Tunnel, Todos Santos, San Miguel, Camuchin, Animas and Exploration mines. The development work consisted of 21,343 ft. of drifts, shafts and raises. The ore handled during the year was, first-class, 944 tons, second-class, 99 tons, and third-class, 31,731 tons, or a total of 32,776 tons. The 100-stamp mill operated 258 days, crushing 31,732 tons of ore. The average net recovery from the third-class ore was 6.5 ounces silver per ton, producing 19.15 tons of first-class concentrate, containing 96,821 ounces. There were also 613 tons of second class concentrates containing 103,263 ounces or a total of 200,085 ounces. The company's surplus, which has accumulated during the years 1905 to 1908 is $715,085.

According to E. F. Pittmann, undersecretary for mines, the mineral production of New South Wales for 1908 was £8,600,607, a decrease of £1,067,771, as compared with that of 1907.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Cortlandt E. Palmer has returned to New York from Mexico.

B. B. Thayer has gone to Butte, Mont., on a periodical tour of inspection.

C. Colcock Jones is examining mining property in the vicinity of Goldfield, Nevada.

R. Meeks is at Webster, N. C., superintending the erection of machinery at the nickel mine there.

Huntingdon Adams is now manager of the Compañia Minera de Natividad y Anexas, S. A., of Oaxaca, Mexico.

Camille Clere passed through New York last week on his return to Paris after a year spent in Colombia and Ecuador.

H. F. E. Gamm has returned to Rutherford, N. J., from a professional trip to Blacksburg, S. C., to visit some manganese and tin properties.

H. W. Hardinge is returning to New York, having made an extensive trip through Colorado and Arizona in the interest of the conical mill.

Norval J. Welsh has completed a two months' examination trip in Coahuila and Chihuahua, Mexico, and is at the Engineers' Club, New York, for an indefinite stay.

Percy E. Barbour has accepted the management of the Promontorio mines at Minas Nuevas, Sonora, Mexico, recently acquired by the Clark Copper Company, of Los Angeles, California.

James MacNaughton, general manager of the Calumet & Hecla, has returned to the mine after an extended visit South, where he went to recover his health, having been ill with appendicitis.

R. M. Raymond has been appointed managing director of El Oro Mining and Railway Company, and will have his headquarters in the city of Mexico. Alfred F. Main succeeds Mr. Raymond as general manager at El Oro.

George Gordon Crawford, of Birmingham, Ala., president of the Tennessee Coal, Iron and Railroad Company, who has been abroad for the past three months for his health, after an attack of typhoid fever, is expected in New York, April 28, and in Birmingham a few days later.

Edward Flynn, former president, of Alabama district No. 20, United Mine Workers of America, has been appointed chief State mine inspector of Alabama for a three-year term, commencing May 1. Mr. Flynn served out the unexpired term of J. M. Gray, who took a position with a Walker county coal company.

F. G. Coggin, superintendent of the Champion and Baltic stamp mills of the Copper Range Consolidated Company, and also the Atlantic stamp mill, has resigned from the Copper Range mills, to take effect May 1. He will be succeeded by Edward Keopel, superintendent of the Trimountain mill, who will then become head of all three of the Range mills. Mr. Coggin will for the present remain as head of the Atlantic mill.

Obituary

Job Froggett died in Youngstown, O., April 18, aged 80 years. For over 40 years he had been prominent as a blast furnace manager in the Mahoning Valley district. He retired from active work 10 years ago.

William M. Stewart died in Washington, April 23, aged 82 years. He was born in Lyons, N. Y., in 1827, but passed most of his boyhood in Ohio. He entered Yale College, but left there to join the rush to California in 1849. After mining for some years he studied law and was admitted to the bar. About 1860 he went to Nevada and soon became prominent in the then new territory as an owner on the Comstock, and in politics. In 1863 he was chosen one of the United States Senators from the new State, and was in the Senate until 1875, when he returned to Nevada and engaged in mining. In 1887 he was again elected to the Senate and served three continuous terms, until 1905. During that period he became prominent as a leader of the advocates of silver coinage, and was the most widely known of the group of "silver senators." After his retirement from Congress he lived chiefly in Washington, though he frequently visited Nevada, where he had extensive interests in the newer mining developments of the State. Senator Stewart made and lost several fortunes in the course of his career, but is believed to have been possessed of valuable property at the time of his death.

Societies and Technical Schools

Morenci Mining Society—A society has been organized at Morenci, Arizona, for the purpose of visiting the mines of the district and studying their geological features and methods of working.

Canadian Mining Institute—A meeting of the Cobalt Branch was held in Cobalt, Ont., April 21, at which R. W. Brigstock was elected chairman, A. A. Cole secretary-treasurer for the ensuing year, and E. L. Fraleck, Robt. Bryce, S. L. Logan, M. T. Culbert and H. P. Davis as executive committee. E. L. Fraleck read a paper on mining conditions in Ontario; Neil McDonald spoke on Larder Lake, and A. A. Cole on sampling at La Rose vein. President W. G. Miller, of the Institute, made an address, congratulating members on the success of the branch.

Missouri School of Mines—The Senior class accompanied by Professor Durward Copeland and Instructors Boyd Dudley, Jr., and H. T. Mann, has been visiting metallurgical plants in St. Louis and vicinity. At the Laclede-Christy plant the manufacture of refractory materials used in furnaces was studied. At the plant of the St. Louis Blast Furnace Company the class saw the production of pig iron and at the Scullin & Gallagher plant the open-hearth method of steel manufacture. The metallurgy of zinc was investigated at the Edgar zinc works and the metallurgy of lead at the Federal Lead plant at Federal, Ill., at the St. Joe Lead plant, at Herculaneum, and the National Lead Company's plant at St. Louis.

University of Wisconsin—This institution at Madison has arranged a new course in mining engineering, to cover four years. Ore dressing and assay laboratories are to be equipped in a special building. A course in practical assaying will follow those in general chemistry and quantitative analysis. The course in excavation and quarrying will include excavation, explosives, blasting and allied subjects. Tunneling, boring and shaft sinking will form the subject of another course in which the ventilation, drainage, and timbering of mine shafts will be considered, with the methods of sinking shafts. In the course on prospecting and mine development the relation of mining geology to exploration will precede a consideration of the various forms of prospecting on the surface and by shafts and drifts, and the development of veins discovered. A separate course in exploitation of mines will be given. Mine accidents, their causes, control and prevention will be treated in the general course.

American Society of Engineering Contractors—On April 14 and 15, meetings were held at the United Engineering Society building, in New York, at which a constitution was adopted and officers and directors were elected. The object of the society is the advancement of engineering knowledge and contracting practice; the maintenance of a high professional standard among its members and the elimination of those practices and abuses that now exist in the engineering and contracting business, and to strengthen the bond that should exist between engineers and contractors. Officers for the first year were elected as follows: George W. Jackson, Chicago, president; Halbert P. Gillette, New York, first vice-president; F. Baxter, New York, second vice-president; Daniel J. Bauer, New York, temporary secretary. The society will begin monthly meetings in the fall. It is already assured of a large membership. The temporary secretary has his office at 721 Park Row building, New York.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Goldfield, Salt Lake City, Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 23—The dredge miners are having more troubles of their own because State Engineer Ellery comes out in the public press and says that the main contributing cause of the overflow of the Feather river at Biggs is the dredges. The great piles of rock which they have left behind them in their operations have changed conditions so that the river is obstructed and the flow of water is naturally retarded in its movement toward the Sacramento river. He wants the dredges to carry on their operations according "to one system." He is compelled to confess that erosion is another cause of the floods but says that "this would not happen if the dredges were compelled to level out the heaps of cobbles and stones which they have piled up." He gives it as his opinion that dredge mining is a matter that must be controlled or otherwise the rivers will be ruined. Mr. Ellery intends sending an engineer from his office to make a complete detailed survey and prepare for overcoming the present bad conditions. A levee along the west side of the river is suggested and it is also thought that the river must be "straightened."

The "good roads" question in the mining districts of California is one attracting much more attention than ever before. In fact it has become recognized, that the more prosperous and active camps, or districts, are those which have good transportation facilities. At the present time a number of mining communities are trying to get better roads to places near railroad lines. Washington, 18 miles from Nevada City, is one of these. During the winter the mining companies at Washington had to keep the road open with their own teams. To develop the mineral resources of that portion of Nevada county there should be good transportation facilities and the Nevada County Promotion Committee has taken the matter in hand for the mining companies with the idea of getting the county itself to pay out more money for good roads.

Sierra county, an isolated mountain region without railroads, and at an elevation where there is much snow in winter, has a number of mines, but they still remain largely in an undeveloped condition owing to lack of good communications. It is believed that the prevailing conditions would be greatly bettered by the construction of a road from the vicinity of Goodyear Bar, Sierra county, to Marysville, Yuba county, following generally the shortest practicable route along the North Yuba river. The mining people of the county are engaged in an effort to make the county supervisors build it. A number of mining companies have offered $1000 each toward the proposed road and other citizens of Forest, Alleghany, Downieville, Sierra City and other towns will contribute.

Many oil producers who have been vigorously denying that there was an overproduction of petroleum in California have met with a surprise when officials of the independent producers announce that an excess of 10,000 bbl. per day above consumption is now being made, and that by the end of the year this excess will be about 20,000 bbl. daily. A curtailment of production is advised until business conditions improve and the market can absorb a greater amount of oil. The Associated Oil Company has about 750,000 bbl. in storage in the Kern river field and the Standard Oil Company has 12,000,000 bbl. It is impossible to dispose of this oil at present prices. Meetings of those principally concerned will shortly be held and it has virtually been agreed that a suspension of development throughout the State will be recommended.

Meantime the oil companies listed on the Oil Exchange paid in dividends $402,000 last month and this does not include some of the very big ones. But the Japanese have quit taking oil from Gaviota—the Santa Maria field—and none has been sent them this year. It was thought that the demand from that quarter would greatly increase but the contrary is proving to be the fact.

Butte

April 21—On February 19 a further hearing of testimony in the case of Fred Bliss vs. Anaconda Copper Mining Company, *et al.*, was had in the Federal district court before Judge Hunt. The mining company had some time previous offered testimony to the effect that everything possible was being done toward the elimination of the poisonous fumes from the smoke of the Washoe smelter. At the hearing held on the nineteenth, the complainant was to have an opportunity to give testimony showing by what means the company could further abate the smoke nuisance. The complainant failed to introduce any testimony on this point, but instead filed his written offer to arbitrate the question at issue. In his offer to arbitrate, the complainant states that he is willing either to submit the matter to a board of arbitration or to have condemnation proceedings instituted in the ordinary manner for the purpose of allowing the smelting company to purchase his land. The complainant further insists that should the defendant mining company agree to arbitration, such arbitration should include the claims of all of the members of the Deer Lodge Valley Farmers Association, who are equally interested with complainant in the matters involved in the trial of the case. The decision of the court may not be made for some time to come.

In the action of E. W. Beattie, Jr., vs. Bald-Butte Mining Company, instituted in the Federal district court a short time ago, Judge Hunt recently appointed N. P. Walter and Cornelius Hedges, Jr, as receivers for the company. This allows one representative for each of the two contending factions in the company. The State Board of Railroad Commissioners has decided to reopen the hearing on coal rates recently terminated. The hearing will probably be some time before May 1.

In the case of the United States against the Northern Pacific Railway Company *et. al.*, Judge Hunt, of the Federal district court, has entered a decree in favor of the Government in conformity with his decision rendered a week ago. By the decree the patent of the Northern Pacific to certain coal lands in Carbon county is declared to be null and void and the company is enjoined permanently from asserting any claim to the land. The case will doubtless be appealed to the circuit court of appeals.

Denver

April 23—In the Cripple Creek district, the apex and trespass controversy between the Jo Dandy Company and the New Haven Gold Mining Company, has been amicably adjusted, and the $100,000 plant of the Jo Dandy (which was burned some months ago) will probably be rebuilt at once. The production of this mine prior to 1904 was large; the ore is found in a mineralized phonolite dike which traverses the property, and also in a fissure zone in the breccia. In the Eclipse No. 1 claim of the New Haven Company, the gold is in a system of parallel narrow seams which form the vein; it is also found in the breccia.

The deep drainage tunnel appears to be in difficulties, inasmuch as only $388,500 of the $500,000 required has been subscribed, and 70 per cent of the former

sum has already been spent. The tunnel company has asked the Colorado Springs Mining Stock Association for $5000 to assist in the work, and will ask donations from all those mining companies in the district which have not already contributed. The original water level of the district was at about 9600 feet elevation, and was lowered first by the Standard tunnel, the portal of which was at 9027 feet, and next by the El Paso tunnel, at 8783 feet, the present one being at 8020 feet. It is generally considered as a great basin or collection of basins of underground water connected with one another, in the breccia area. Practically all the mines in this area will be unwatered by the completion of this deep drainage tunnel, and it is therefore felt that all mines in the district should contribute toward its construction.

It was shown at the annual stockholders' meeting that the Eagle Ore Company in 1908 sampled 193,000 tons of ore. A theft of concentrates is reported from the Golden Cycle mill, and it is stated that the manager has secured the return of $5000 in cash and other valuables forming part of the proceeds of the robbery.

In the Red Mountain district, on the divide between Ouray and Silverton, the San Antonio company, owning the Carbon Lake mine, is the only one doing any extensive work at this writing. This bids fair to prove one of the largest copper producers in the State, and the manager is only awaiting the opening of the Silverton railroad to send down 50 cars of ore which he has stacked up at the mine. From July 1, 1908, to Feb. 1, 1909, 178 cars of about 23.5 tons each were shipped to the Durango smelter, the average yield of the ore being 11 per cent. copper, 8 per cent. lead, 0.12 oz. gold and 7.25 oz. silver. Several carloads ran from 20 to 22 per cent. copper, this high-grade being mainly enargite. This ore has been produced from drifts and stopes from a shaft only 200 ft. deep, but the orebody is from 40 to 60 ft. wide. A tunnel, the total length of which will be 2300 ft., and which will deliver the ore into the railway cars, is now in 1600 ft., and should cut the orebody 300 ft. below the present workings.

In the same district, the Red Mountain Railway, Mining and Smelting Company, owning a large area, including the Yankee Girl, Robinson and others of the early heavy producers, is doing but little owing to financial difficulties. The long Joker tunnel of this concern was stopped owing to lack of funds, within 200 ft. of the Genessee-Vanderbilt vein, from which so much was expected. A few leasers are at work, however, and the Treasury tunnel is working a small force.

Salt Lake City

April 23—Ore shipments from the Tintic district for the past week to the Tintic and Salt Lake valley smelters were as follows: Centennial Eureka, 40 cars; Colorado, 28; Iron Blossom, 33; Sioux Consolidated, 16; Brooklyn, 6; Dragon Iron, 29; Ajax, 2; Beck Tunnel, 7; May Day, 2; Yankee, 2; Black Jack, 2; Eureka Hill, 1; Bullion Beck, 2; Swansea, 4; Mammoth, 21; Laclede, 1; total, 196 cars.

The annual meeting of the Emma Copper Mining Company resulted in the election of the following officers and directors: John A. Kirby, president; Joseph Lipmann, vice-president; H. S. Joseph, treasurer; W. M. Wantland, secretary; these officers, with H. E. Peery, of Ogden, constitute the directorate. The company owns a number of patented claims in the Alta district.

It is announced that interests affiliated with the Nevada-Douglas Copper Company have formed a corporation for the purpose of providing a custom smelter in the Yerington district in Nevada. It is understood that the construction company, to whom the contract for the railroad has been awarded, has agreed to have the railroad from Wabuska to the Nevada-Douglas mine, completed and running by August 1. The Orem interests have recently acquired the townsite of Morningstar, near the mines, and it is understood that they have rejected the overtures of well known smelting interests to erect a plant in the Yerington district, and take a controlling interest in the Nevada-Douglas properties.

At the annual meeting of the Utah Consolidated Mining Company, Sidney Chase, of Chase & Barstow, bankers, of Boston, was elected a director to succeed James Phillips, Jr. Other retiring directors were reëlected. At the annual stockholders meeting of the Utah Copper Company, on April 23, the following directors were reëlected: J. Dawson Hawkins, C. M. MacNeill and Spencer Penrose, all of Colorado Springs; D. C. Jackling, of Salt Lake; Charles Hayden, of Boston; W. B. Thompson and John Hays Hammond, of New York, and K. K. MacLaren, of Jersey City. Mr. Hammond was reëlected managing director. The following officers were reëlected: President, C. M. MacNeill; vice-president and general manager, D. C. Jackling; secretary and treasurer, Spencer Penrose.

Goldfield, Nevada

April 23—Four hundred and twenty men are employed by the Goldfield Consolidated Mining Company. The amount of ground broken in the various properties for January and February was: Combination, 1656 ft.; Mohawk, 986 ft.; Red Top, 1818 ft.; leasers, for January, 1489 ft. The Clermont shaft is 1050 ft. deep and is connected with the Mohawk workings at the 600 ft. level by a 1000-ft. crosscut. A station has been cut on the 1000-ft. level, from which point laterals will be run to thoroughly explore the property at this depth. This ore shoot, as developed, shows a width varying from 40 to 50 ft., and from 80 to 100 ft. long. It is opened up on the 230-, 280- and the 380-ft. levels. The tonnage of ore extracted and treated for the first three months of the year was: Mined, 45,967 tons; milled, 45,606 tons; shipped, 341 tons. From this the net profits are estimated at $1,584,436. The costs for mining, milling and transportation are: January, $7.136; February, $6.315, and estimated for March at $5.85 per ton. The results obtained in the new mill are highly gratifying to the management, and a comparison of cost sheets shows that it is treating the same grade of ore at less than one-half the amount per ton as charged against the Combination mill.

J. F. Brim, of the Ely Amalgamated Copper Company, has been advised that the Steptoe Valley Smelting Company has deeded back to the Government a strip of land 1½ miles long by ½ mile wide near the smelter. Some of this territory has been claimed by mining companies and individuals and this action on the part of the Steptoe company is a victory for the other owners. Among those who will be benefited is the Ely Amalgamated Copper Company. This ground is within 100 ft. of the smelter. They will at once take steps to obtain patents for their claims and will begin the shipment of ore to Utah smelters at an early date.

The report of the State bullion tax agent, James F. Haley, submitted to Governor Dickerson April 16, shows a gold production of $14,373,545 for the year of 1908, the tax collected on this being $101,000. The production by counties is as follows: Nye, $6,517,174; Esmeralda, $4,917,507; Lincoln, $809,606; Storey, $700,645; Eureka, $454,426; White Pine, $207,101; Humboldt, $103,850; Churchill, $100,074; Elko, $92,854, and Lyon, $47,360.

Toronto

April 24—The Department of Public Works has begun the survey for a wagon road from Charlton to Gowganda, for which $50,000 has been appropriated. It is expected that the work of construction will begin in June.

The Ontario government has issued an order in council throwing open to prospectors 1,439,300 acres of land in Algoma district, lying north of Sault Ste. Marie. The land was set aside as a grant to the Algoma Central & Hudson Bay railway, about five years ago, and closed to all prospectors except those of the company. It is now declared open to all until Dec. 30, 1910, unless the company completes the road to the main line of the Canadian Pacific before that time. It is provided, however, that all discoveries of coal, iron ore, iron pyrites, or nickel ore belong to the railway.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

FAIRBANKS

A half million dollars is expected in the clean-up on 17 below on Goldstream. The property is worked on lays. Many other claims in this vicinity are making good, while the lode claims are coming to the front.

NOME

More than 20 good placer properties are showing renewed activity in this vicinity, with expectations of large gold outputs.

VALDEZ

Ellamar Copper—Operations were suspended some time ago because of the dangerous proximity of their main workings underneath the sea to the ocean floor. Regular work will be resumed after the completion of a cofferdam to keep the water of the ocean away from the working zone. The dam will be built under the direction of C. A. Middlekamp, superintendent.

Sunrise District—Julius Singer has purchased the Harry Ellsworth claims and will install a dredge with a capacity of 2000 yd. of gravel per day.

Moose Pass—Twelve miles from Mile 29 on the Alaska Central railroad is a new district containing placer and quartz. Free-milling gold quartz is also reported from Indian creek. Quite a stampede has occurred to Moose creek.

Matheson Brothers—The property near Hope is to be worked this summer with a steam shovel, a new experiment in placer mining in the Cook's Inlet country.

Alaska Central Railway—Bonds have been issued to the extent of $250,000 as a first lien on the property. The money will be expended in extending the railroad from Mile 52 to Mile 74.

Copper River Railway—The immediate construction of a branch to the coalfields is being considered to bring about their rapid development for commercial use. Two broad-gage locomotives were loaded in Seattle for shipment North, and upon their arrival train service will be inaugurated over 55 miles of road.

Arizona

Copper Production for March—The production of copper in Arizona for March amounted approximately to 27,070,000 lb., distributed by mines as follows:

	Pounds.
Copper Queen	8,500,000
Calumet & Arizona, Superior & Boston	4,300,000
United Verde	2,900,000
Old Dominion	2,970,000
Detroit	2,100,000
Arizona Copper	2,950,000
Shannon Copper	1,650,000
Imperial Copper	1,300,000
Miscellaneous	500,000
Total	27,070,000

COCHISE COUNTY

Calumet & Arizona—Four of the six furnaces are in operation.

Superior & Pittsburg—One of the largest orebodies in the Bisbee district has been opened on the 1200 level of the Hoatson shaft.

Copper Queen—Seven furnaces are in operation, and the April output is estimated at 8,500,000 lb. of copper.

Centurion-Arizona—Recent shipments to the smelter at Douglas are reported to yield 14 per cent. copper.

Leadville—While grading for the Mexico & Colorado railroad between Gleeson and Courtland, a body of carbonate ore carrying 7 per cent. copper was opened, at a depth of 12 ft. The deposit is said to be 50 ft. wide.

Shattuck & Arizona—A high-grade copper carbonate ore, 5 ft. thick, was opened recently on the 600 level.

GRAHAM COUNTY

Stevens Copper—A large amount of prospecting work has been done recently. Development work will begin soon.

MARICOPA COUNTY

Vulture—The first cleanup yielded 115 oz. gold bullion, valued at $1800. The large orebodies have been reëncountered on the 450-ft. level.

YAVAPAI COUNTY

Copper Chief—The large orebodies blocked out are crushing the old timbers, which necessitates retimbering many of the drifts and stopes.

Grand Island—The double-compartment shaft is now 100 ft. deep. Superintendent Wilson announces the early delivery of the new steam plant, with which sinking will be continued to a depth of 300 ft. A talc formation has recently been encountered accompanied by a heavy flow of water.

Arizona Power—The early delivery of electrical power will greatly stimulate mining in this district. The substation at Jerome is nearly completed.

Cleopatra Copper—Electrical machinery is being installed. A 12-drill, electric, Ingersoll-Rand compressor is now on the ground, and a 30-h.p. electric hoist has also been delivered. This hoist will be operated in the winze located 1200 ft. inside the Dillon tunnel. The ore consists chiefly of chalcopyrite and black oxide, occuring in a porphyrytic formation.

Butte & Verde—Messrs. Mulcaire, Bradley, Shea and others, of Jerome, have recently incorporated a group of 10 claims near Allen Springs, as the Butte & Verde Gold and Copper Company. Capital stock is $1,500,000, divided into 1,500,000 shares of the par value of $1 each. The property is partially developed by 200 ft. of tunnel.

YUMA COUNTY

Golden Star—The initial dividend of 1 per cent. was declared payable May 15. The milling facilities will be increased early in May.

California

AMADOR COUNTY

Plymouth Rock—Pritchard Brothers, lessees, near Plymouth, are extracting gold from the pocket recently discovered.

BUTTE COUNTY

Butte Creek—The power line from Centerville has been connected with this new dredge and active work on the gravel bed has commenced.

CALAVERAS COUNTY

Voinich—Ore has been found running $8 per ton and a 40-stamp mill is planned.

EL DORADO COUNTY

Prevolcanic Channel—After a partial suspension of operations for some weeks on account of stormy weather, work has been resumed with a large force. The gravel is cemented and must be milled.

FRESNO COUNTY

Arkansaw—At this property near Trimmer Springs, J. F. Ellwood vice-president, the miners are taking pay ore from the tunnel. There has been considerable snow in that section of late.

INYO COUNTY

Bishop Creek—Development on the oreshoot continues favorable. The sinking of another 100 ft. of shaft has commenced and three shifts of men have been set at work again.

MARIPOSA COUNTY

E. J. Mahoney, of San Francisco, has

purchased for Eastern men, the Rattler, Cold Springs, Hidden Treasure and half of the Lucky Strike, at Mountain King, on the Merced river in Hall's gulch. These claims will now be suitably equipped and developed.

MONO COUNTY

Bodie—The Syndicate mine and mill, under lease to the New Bodie Mining Company, is being worked on the leasing system. Goldfield men are about to begin operations on the Snowdrift claim. The Reading-Meagher properties are to be developed this summer.

NEVADA COUNTY

California Exploration Company—This company has bonded the old Nichols mine near Grass Valley and has commenced pumping out the old shaft. Oscar Coflin is manager.

Pittsburg—Manager Kerr has finally cleaned out the long drain tunnel and the water is flowing out that way. The main shaft has been partly cleaned out and retimbered.

Spenceville—There is a renewal of activity at this copper camp. C. C. Bittner and Otto Woehler are taking out excellent ore from their copper properties.

Native Son—The strike of rich ore at Blue Tent, a few miles from Nevada City, was in the main tunnel 800 ft. from the entrance. The mine was worked years ago, but was abandoned, and now Wisconsin men have taken charge of it.

Central Consolidated—At Banner Mountain, seven miles east of Grass Valley, in Nevada county, has showed up a valuable body of ore.

PLACER COUNTY

Orpheum—A new electric pumping and hoisting plant has been installed and a mill will shortly be put up. Chas. Peach is superintendent.

PLUMAS COUNTY

The drift mine on Spanish Peak, C. W. Fagg superintendent, has resumed operations after being closed down all winter.

SHASTA COUNTY

Esperanza—A new hoisting plant, air drills, etc., have been provided. The work of developing the property has commenced. A. J. Oswald is manager.

SIERRA COUNTY

Chipps—At Sierra City a new vein has been found carrying exceptionally high-grade ore.

SISKIYOU COUNTY

Scott River Dredging Company—This company is now handling a large amount of gravel with the new dredge.

TUOLUMNE COUNTY

Little Bonanza—This mine, near Sonora, has been leased to C. P. Curnow, Jr., and D. G. Peters has been appointed superintendent. A 20-stamp mill is to be erected on the property and the mine worked on a large scale.

Tarantula—After testing their ores the company owning this mine near Chinese has decided to install machinery.

United Mines Company—All differences have been settled, the claims paid for, and work has recommenced.

YUBA COUNTY

Northern Gold Mining Company—Organized at Marysville to work certain claims at Brownsville. The principal owner is J. E. Coulsen, of Goldfield, Nevada.

California Mother Lode Mining Company—W. C. Wilkins, president, is about to start work on the mines at Indiana Ranch. A compressor is to be purchased and a cyanide plant built. The mill will be enlarged to 20 stamps.

Colorado

BOULDER COUNTY

John Jay—It is announced that J. A. Reynolds, of Chicago, and associates have purchased this mine at Jamestown and will erect a cyanide mill.

CLEAR CREEK COUNTY

Gambetta—A carload of high-grade zinc ore, also carrying about 40 oz. silver per ton, was recently shipped from this property on Republican mountain.

Mendota Mines—The Mendota mill in the upper Clear Creek district is being operated three shifts and the company is marketing monthly from 50 to 60 tons of lead concentrate and 30 to 40 tons of zinc concentrate, as well as about 200 tons of an intermediate iron product.

Seven-Thirty—Arrangements are being made by George Tarkington, manager, to unwater the shaft and undertake exploratory work.

Terrible—Wood & Co., leasing on the 14th level of this mine on Brown mountain, are obtaining a good tonnage of lead-zinc ore for concentration. Recently a vein of high-grade silver-lead ore from 10 to 20 in. wide was encountered and ore from same is being shipped. Work is also being done in the mine on company account.

TELLER COUNTY

Delmonico—Shipments are being made from the high-grade ore recently encountered on the 300-ft. level of the property on Bull cliff.

Tornado — Humphreys & Thompson, leasing on this mine on Raven hill have been sending out smelting ore for several weeks. The mine is owned by the Elkton Consolidated Mining and Milling Company.

EL PASO COUNTY

United States Reduction and Refining Company—At the annual stockholders' meeting the following directors were reelected: J. Dawson Hawkins, C. M. Mac Neill and Spencer Penrose, of Colorado Springs; H. M. Blackmer, H. A. Dubbs and K. K. MacLaren, of New York, and J. Q. MacDonald, of Florence, Colo.

Idaho

LEMHI COUNTY

Weimer—W. B. Andrew and associates, of Salt Lake City, have taken a two-year lease on the mines on Birch creek. This property formerly shipped 14 to 18 per cent. copper ore, shipment being made via DuBois, after a wagon haul of about 50 miles.

Indiana

CLAY COUNTY

The joint board of miners and operators of the Block coalfield held a meeting April 16 and took up the grievances that occasioned the calling out of 50 men at the Mary mine. The trouble arose over the introduction of machines and the selection of 12 picked men to operate them, leaving 36 men idle. The mine owners proposed to give all of the men an equal share of the work in the mine; the proposition was accepted and the work was resumed April 26.

The board settled another matter which has been causing friction in this district for some time. The chief complaint grew out of the discharge of a cager in a mine of the Progress Coal Company, where, because of work being slack, the man was displaced by the mine superintendent, who looked after other duties. The displaced man was offered another position in the mine, but refused to accept it. The joint board sustained the position of the company, and the men were ordered back to work.

Michael C. White, superintendent, and Thomas Maxwell, mine boss of the Vivian Bogle mine were brought into court charged with failure to keep stretchers and blankets at the mine for use in case of accident, and with driving entries beyond a distance of 45 ft. without cutting a breakthrough. Both men entered pleas of guilty to violating the law in these charges and were fined.

GREENE COUNTY

Keystone Coal and Mining Company—A new shaft is being sunk near Howesville, two miles east of Jasonville. The company has had an option on several hundred acres of coal land in Greene county for two years. The coal from the new mine will be hauled out by the Monon road by a switch to be completed soon.

The work is supervised by Johnson Carmichael.

VIGO COUNTY

Glen Ayr Coal Company—This company, controlled by John Freeman and David Ingle, is opening a mine six miles east of Terre Haute on the main line of the Vandalia railroad which will be put in operation June 1. The mine will have a capacity, when fully developed of 1000 tons daily, and will employ nearly 200 men. The mine will be known as Glen Ayr No. 2; No. 1 being a short distance from the new mine. The tipple for the new mine has been completed.

Michigan

COPPER

Lake—A crosscut has entered the formation and drifting north and south on this lode is under way, with the face of either drift showing the same characteristic richness that has been in evidence in other openings.

North Lake—The Lake lode was tapped with a diamond drill in the No. 3 hole.

Challenge—This property, under the management of the St. Mary's Mineral Lands Company, continues to carry on exploratory work without any material change in conditions. The shaft is about 800 ft. deep. A diamond drill is also operating at this point to ascertain the copper contents of the formation at depth.

Columet & Hecla—An electrically operated hoisting plant has been installed at the slope shaft, 3000 ft. from the 57th level of Red Jacket shaft, and will work the ground adjoining the Tamarack, Jr., property. The shaft is down 2200 ft., at an angle of about 23 degrees, cutting across the face of the lode. The rock coming from this shaft will be hauled to Red Jacket shaft through which it will be hoisted to surface.

Franklin—Drifting is under way on the Pewabic lode at three different points from No. 1 shaft on the 23d, 24th and 25th levels. In all these drifts first-class ore is being exposed. A crosscut to cut the lode at the 26th level is also under way.

Keweenaw—Work will be discontinued soon on the Medora shaft and all activities centered in opening on the Kearsarge lode.

Copper Range—Extensive trenching operations will be carried on in conjunction with the three drilling outfits on the lands held under option from the St. Mary's Mineral Land Company.

Tamarack—No. 1 shaft is being equipped with two large steam pumps, one at the 500-ft. level and the second at the 900-ft. level. These pumps will handle the water coming into the shafts, No. 2 and No. 5, and will eliminate the water hoisting at No. 5 shaft.

Adventure—Preliminary work prior to beginning the sinking of a new shaft to open the copper-bearing formations that were exposed in the drill cores is under way. This shaft will be south of No. 3 shaft and in a position to command the ground tributary to the three new formations.

Isle Royal—The new high-duty hoisting plant at No. 6 shaft is in commission, using a 7-ton skip. The new shaft on the Baltic lode is down about 350 feet.

Mass—Drifting on the newly opened amygdaloid formation continues with no change in the grade of the ore. The formation at the point of intersection with the crosscut is about 12 ft. wide and assays taken show about 92 lb. of copper to the ton. The copper is evenly distributed throughout the entire face of the lode. This lode was first exposed by a drill core which cut it about 100 ft. below the point it is opened by the crosscut from the 17th level.

Michigan—The copper-bearing lode that was recently opened in the old adit on the Bee tract of this company is holding out great encouragement for its ultimate success. The formation carries a good grade of stamp rock.

Minnesota

IRON—MESABI RANGE

Great Northern Iron Ore Properties—The trustees of these properties, which include the greater part of the northern section of the Mesabi, report that the tonnage mined by operating companies was 3,281,061 tons in 1907, and 1,468,925 in 1908; a decrease of 1,812,136 tons. On the properties leased to the Great Western Mining Company—the subsidiary of the United States Steel Corporation—exploration was prosecuted with vigor with continued satisfactory results. A monthly average of 77 drills has been maintained, as against the 40 required by the terms of the lease. Exploration work has been completed on about 3600 acres of the leased lands. None of the properties covered by the lease to the Great Western Mining Company was put on a shipping basis during the year. Development work, consisting of surface stripping to the extent of approximately 3,500,000 cu.yd. and the construction of yards, tracks, etc., has been conducted on several properties at large expense and in a manner to prepare these properties for mining and shipping large amounts of ore. The expenditures amounted to about $3,000,000. The total receipts of the trustees were $1,749,214; expenses, $75,390, and dividends, $1,500,000, leaving a surplus of $173,824 for the year.

The tonnage tax bill, providing for a tax on iron mines based on the tonnage produced, was passed by the Legislature, but vetoed by Governor Johnson. He took the ground that the present system of taxing iron-ore lands had proved satisfactory, and that the further imposition of a tonnage tax would be unjust, putting an inequitable burden upon the owners of iron lands. The bill failed to pass over the veto.

Montana

BUTTE DISTRICT

Butte-Montana—A spur from the Great Northern Railway is being run to the company's Alex Scott mine. About 100 tons of first-class ore, and the same amount of second-class is in the bins ready for shipment.

Amalgamated—A new shaft is being sunk on the Modoc Extension claim, of the Anaconda company. The claim is directly north of the Boston & Montana company's West Colusa mine.

JEFFERSON COUNTY

Corbin-Wickes—It is reported that a company is in course of organization in Boston for the purpose of acquiring the outstanding stock of this company. A total of 115 acres is owned or under control. The new company will have a capital of 150,000 shares of a par value of $5 each. It is expected that active mining will begin as soon as additional machinery is installed.

PARK COUNTY

Bear Gulch Placer Mining Company—An action has been instituted against the Kimberly-Montana Gold Mining Company, for the purpose of restraining the latter company from interfering with the water used in a certain ditch near Jardine, Park county. The plaintiff also requests that the court quiet its title to the water right and ditch in question.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Atlanta Cherokee—Two strong quartz ledges have been encountered on the 530-ft. level showing a small amount of gold. Plans have been made to sink to greater depth.

Grizzly Bear Lease—A new 75-h.p. hoist is to be installed. It is expected that the shaft, now 400 ft. deep, will reach the Clermont vein at a depth of about 475 ft. The lease has recently changed hands and is now controlled by W. E. Dowlen, of the Nevada Reduction Company.

Gold Bar—Shipments are maintained at the rate of one carload a week. The ore is said to run $65 to $100 per ton.

Goldfield Belmont—This property adjoining the Daisy in the Diamondfield section is preparing to resume shipments. A good grade of ore has been encountered on the 400-ft. level.

Blue Bull—A shipment of five tons was made from the Knickerbocker lease last week. The vertical shaft has been sunk

to a point 100 ft. below the tunnel level and a crosscut started toward the orebody 32 ft. distant.

Florence Goldfield—A strike was made April 10 on the 200-ft. level of the main Florence vein. The stope just started shows a width of 12 ft., 3 ft. of which is high-grade ore, the remaining 9 ft. being milling ore.

ESMERALDA COUNTY—HORNSILVER

Great Western—The winze from the 300-ft. level, now 35 ft. deep, has developed 15 in. of good ore. In the west drift on the 300-ft. level, 3½ ft. of ore is exposed. The first shipments contained 300 oz. silver to 1 oz. gold. The ratio at present is about 30 oz. silver to 1 of gold. Three carloads a week are being shipped.

ESMERALDA COUNTY—HAWTHORNE

Goldfield Alamo—The Hubbard lease has declared a second dividend of $50,000. The shaft is now 410 ft. deep. The silver content is increasing while lead is diminishing.

ESMERALDA COUNTY—LUNING

Taft—Well defined veins running northeast and southwest, which carry gold, silver and copper, have been discovered. Much work has been done on this property.

Rawhide Western Railroad—The proposed road will give outlet to the east of Rawhide, as well as aid the Fairview and Lodi districts, which have a large tonnage of ores.

ESMERALDA COUNTY—RAWHIDE

Sunbeam—This property has been shut down for a long time owing to legal matters, but has lately been acquired by San Francisco people and is now running regularly. Sulphide ores, carrying gold, have been encountered on the 190-ft. level.

Prosky Reef No. 1—A rich vein has been encountered and is now being farther opened up to determine the extent of the orebody.

Townsite Leasing Company—W. B. Wedell, of Ogden, Utah, is sinking a new shaft near the vein of the Nugent lease; this firm also operates the Kerns No. 1 lease and the Townsite lease No. 1. On the Nugent property last week a new vein was opened up on the lower level.

Victor—The Goldfield leasers have enough ore in sight to build a 10-stamp mill. It will be erected near the shaft and material has been ordered.

King-Heisner—The machinery and lumber for the 75-ton cyanide mill have been coming in regularly by teams. All of the grading and a great deal of the pipe lines have been completed, including the water tank which is to assist in the water supply of the town. This mill is to be the most complete in the district and is expected to be in operation by June 1, 1909.

LANDER COUNTY—AUSTIN

Austin-Manhattan—The old tunnel which penetrated Lander mountain a distance of 6000 ft. has been cleared and retimbered to the breast. A station is now being cut at its intersection with the Frost shaft, and on arrival and installation of the hoist, the shaft will be sunk to the 1100-ft. level. The compressors are now in place and are capable of supplying 25 power drills. Work will start immediately on the clearing and retimbering a crosscut from the tunnel 2800 ft. long.

LINCOLN COUNTY—PIOCHE

Jack Rabbitt—The crosscut on the 700-ft. level of the Day mine has penetrated ore nearly 400 ft. About half of the ore contains 15 oz. of silver per ton. The same body of ore was encountered on the 600 and 800 levels. The company is now shipping about 60 tons per day.

Mendah-Nevada—About 200 tons were shipped during March. This is principally the ore taken out in development. The shaft has reached the 900 level and the station is being cut.

Pioche King—A new 50-h.p. Alamo hoist with Franklin compressors has just been installed. The property is about two miles southwest of Pioche near the Prince Consolidated Mining Company. The shaft is 50 ft. deep.

NYE COUNTY—BULLFROG

National Bank—The Logland lease has another shipment ready for treatment. The ore is being extracted from the incline between the tunnel and the surface.

NYE COUNTY—PIONEER

Bullfrog Pioneer—This property is now shipping between 75 and 100 tons daily. The compressor and five drills were started April 14, and three additional drills are *en route* to the property.

Mayflower—The report, covering operations for March shows a net profit of $7000 from the five-stamp mill, 365 tons of $30 ore being treated during the month. The best ore yet encountered is exposed in the raise from the 300-ft. level. Development work has also been started on the 400-ft. level.

NYE COUNTY—ROUND MOUNTAIN

Lehigh Antelope—A mill run of 156 tons of ore was made last week from which over 1000 oz. of bullion were recovered, worth slightly in excess of $12,000.

NYE COUNTY—TONOPAH

Tonopah Mining—The diamond drill has struck ore at a depth of 1600 ft. The Mizpah shaft is now being sunk to catch the ore on that level.

West End and Tonopah Extension—A mill is to be erected to treat the ore from these two mines.

MacNamara—The regular monthly dividend of 1c. per share was declared payable May 5. Last week 300 tons of ore were shipped. The shaft is now 710 ft. deep.

Oklahoma

OTTAWA COUNTY

Miami—That this camp is in a prosperous condition is shown by the fact that of its nine mills all are in operation. These are the Emma Gordon, Golden Hen, Queen City-Joplin, Miami-Yankee, New State, King Jack, Index, Dan Isley and Swastika. The Tom Lawson ground was forfeited and the mill has been removed. The Old Chief mill burned down and the Indianola Mining Company, which was operating the mine, refused to rebuild the mill on a 30-per cent. royalty and has given up the lease.

The Wanhilla is building a mill and will soon be operating. The Turkey Fat, whose ground was developed from the Tom Lawson, is sinking a shaft and will build a mill at once.

On the Sullivan lease one shaft is in ore and another is being sunk to the ore developed by the Old Chief. A mill will be built as soon as this shaft is completed. The Emma Gordon has completed a shaft 1000 ft. north of the mill and has contracted the building of a tram to the mill. This will make four shafts connected with the mill. This company has just made a rich strike of ore in a deeper run northwest of the mill. In spite of the fact that nearly all the companies are operating under third and fourth leases at the outrageous royalties of 25 to 35 per cent. the camp is progressing.

Oregon

LANE COUNTY

Bohemia District—An exhibit of representative ores for the Alaska-Yukon-Seattle fair is being gathered and will be exhibited in Cottage Grove for a time before it is shipped to Seattle. The specimens collected to date from Bohemia mines embrace gold, silver, copper and galena. Many of the gold specimens show free gold in abundance.

Oregon Mineral Paint Company—This company, with mines situated four miles north of Cottage Grove, Ore., has purchased three acres of ground at St. Johns, near Portland, and will erect a paint plant. This will give employment to a large number of men at the mine. The raw mineral will be hauled over the Southern Pacific railroad, a distance of 148 miles from mine to the plant.

Kelso—W. P. Ely, secretary, will have men put to work on the new plant which was started last fall, and was shut down on account of deep snow.

Combination Mines—R. H. Clark and Sherman Clark have purchased a large amount of supplies for their milling plant, part of which is on the ground.

Golden Rule—R. L. Ormsby states that his company intends to install its milling plant this spring. Work has been in progress at the mine all winter.

South Carolina

York County

A tract of 1500 acres of land containing deposits of manganese has been purchased by H. F. E. Gamm, of Rutherford, N. J. The ore is reported to contain 51 to 60 per cent. manganese, and ½ per cent. phosphorus.

South Dakota

Lawrence County

Speculation is rife regarding the revival of tin mining. There seems little doubt that tin exists in the Tinton district of the Black Hills, though no extensive development has been done. Milling on a small scale has been carried on, but in order to make the operation a paying one a large tonnage and modern concentrating machinery are essential.

Hercules—Grading is about completed for the 40-stamp cyanide mill under construction, and the foundations are being put in. The mill is expected to be in operation this fall.

Altia—The work of unwatering the mine, until recently known as the Puritan, is now under way.

Golden Crest—The mine has been unwatered below the 125-ft. level, where the workings were found in good condition. The new mill is expected to be in operation by June 1.

Utah

Salt Lake County

Bingham Mines Company—The Dalton and Lark mines have recently been operated by leasers who have been shipping lead-silver ores. In view of the completion of negotiations for acquiring title to the mines formerly belonging to the Bingham Consolidated Mining and Smelting Company, preparations are now being made to operate these mines more extensively.

Columbus Consolidated—Ore is now being shipped to the Pioneer sampler at Sandy. As soon as possible the shipments will be increased to 100 tons per day. The upraise from the 400-ft. level is about 100 ft. in ore. The width of the orebody is about 40 feet.

Kennebeck—A compressor has been purchased and will be installed as soon as the snow is off the ground.

South Columbus—Ore has been encountered in a winze 70 ft. below the tunnel level in the eastern part of the property. Sinking is to be continued 30 ft. farther.

Summit County

Ontario Mine—Arrangements are being made for the driving of a tunnel from the 600-ft. level which will tap the Wabash at a depth of 800 ft., the New York at a depth of 1000 ft. and the Nail Driver at a depth of 1100 feet.

Juab County

Yonkee Consolidated—The power plant which was disabled, owing to the presence of acid in the water, has been repaired and the company is continuing its development work.

Tintic Volcano—The new shaft is now about 60 ft. deep. The property flanks that of the Tintic Standard on the east.

Iron Blossom—A 15-drill Ingersoll-Rand compressor has been purchased to provide the mine with independent power. Compressed air is now being obtained from the Colorado mine, but the development of the Iron Blossom and the possibility of the sale of the Colorado mine and Tintic smelter have apparently made it desirable to be independently equipped. The stock of the company has recently suffered a severe decline on the Salt Lake Exchange.

Uncle Sam Consolidated—A winze recently opened a large body of ore that is said to carry 50 per cent. lead with a fair silver and gold content. It is expected that regular shipments will be resumed as soon as suitable smelting arrangements can be made.

Washington

Asotin County

West Coast Portland Cement Company—This company recently installed a complete experimental plant at Asotin, to thoroughly test the merits of the cement-making raw materials with a view of installing a plant of large capacity.

Snohomish County

Wayside Mine—The vein encountered by the tunnel is equal to expectations. The Atlas Corporation, which owns this property, was so badly in debt that it passed into the hands of a receiver. The staunch men of the corporation advanced a substantial sum for development work, and this was carried out under the management of Receiver Edward Hawkins. All of the obligations of the Atlas Corporation are paid.

Wisconsin

Zinc-lead District

Benton—The Calvert property has been taken over by Wm. N. Smith and associates; a 75-ton mill will be provided. The mine is opened up by 100 ft. of drift, showing heavy sheet jack; the pitch is crosscut 40 ft., carrying a 30-ft. stope. A 12-ft. vein of sheet and disseminated jack has been penetrated by shaft on the Fields land, five miles southeast of Benton, by Robert W. Hunt & Co. The shaft is completed at 184 ft.; the range is proved a quarter mile by drilling. The Lucky Twelve Mining Company will place machinery equipment on its prospect just north of the Fields; a rich deposit of jack is proved by shaft and drill at 130 ft. The Fox Lead and Zinc Company has obtained siding facilities from the Northwestern railway, and is building an aërial tram to load its ores direct on cars; the mine is turning out from four to six cars of zinc concentrates weekly.

Canada

British Columbia—Cariboo

Preparations are being made for the opening of the placer gold-mining season. Gravel washing is usually commenced during May of each year, and the indications are that it will be practicable to get the water running in flumes and ditches by the middle of that month.

British Columbia—Peace River

The provincial government is sending F. C. Campbell, for many years mining recorder at Trout lake, Lardeau district, to the Peace river country. This big district is being made reasonably accessible by the construction of the Grand Trunk Pacific railway. As the occurrence of gold and coal in it have both been repeatedly reported, Mr. Campbell will be gold commissioner for the district, as well as official representative of the government in other departments.

Nova Scotia

Dominion Iron and Steel Company—Owing to the favorable settlement of the litigation with the Dominion Coal Company, the directors decided to adopt a liberal policy as to dividends. A cash dividend of 10½ per cent. was declared on preferred stock payable May 10, toward clearing off arrears, which will leave dividends for 4½ years amounting in all to 31½ per cent. still due. It is proposed to clear off the balance of accumulated dividends as rapidly as the income will permit, devoting to that object all further moneys received on the claim against the Coal Company. The total claim for damages is placed at $3,951,092, which, deducting the $2,750,000 received on account, leaves a balance of $1,201,092 to be paid.

Ontario

Lake Superior Corporation—Subscriptions were received by the Bank of Montreal in Montreal and London from April 14 to 19, for $5,000,000 first mortgage collateral trust 40-year 5-per cent. bonds, part of the issue of $10,000,000 dated 1904, of which about $9,000,000 have long been outstanding, but largely held by the Canadian Improvement Company. These bonds are a first charge upon certain landed property of the corporation and, directly or indirectly, on all of the stock and bonds of the subsidiary companies. The proceeds of the bonds are to be used chiefly for improvements and additions to the works at the Sault Ste. Marie.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ended April 17 were

as follows: Buffalo, 60,930 lb.; Chambers-Ferland, 60,000; Coniagas, 63,615; Crown Reserve, 119,480; La Rose, 485,468; McKinley-Darragh, 66,900; Nipissing, 130,240; Right-of-way, 150,680; Temiskaming 60,200; total 1,197,513 pounds.

Chambers-Ferland—The raise which was run to the surface of this property by the Right-of-way mine is now in operation. An air line has been laid to the mouth of the shaft and a drill put to work on La Rose vein. Stoping is being undertaken on the main vein on the 150-ft. level of No. 1 shaft.

Foster—The company has entered into an arrangement with the Argentum Mines, Ltd., by which the latter company is to operate the Foster mine for five years in connection with its own mine.

Green-Meehan—In accordance with the decision of the shareholders, a transfer of the assets of this company has been made to the Consolidated Silver Cobalt Mines, Ltd.

Kerr Lake—S. R. Heakes, manager, states that the company is limiting its output to two tons of ore per day, and that for each ton mined three to four tons are being put in sight. The total cost of production, including everything, is 7c. per oz. of silver. The average of this year's shipments has been 3300 oz. silver to the ton.

La Rose—This company has acquired the Lawson property, which has been for a long time in litigation, taking over the outstanding shares of the Lawson mine, Ltd., in exchange for its own stock. Surface prospecting and development work on the Lawson will be begun immediately.

Silver Leaf—Another small vein about 2 in. in width, carrying native silver, was recently struck in drifting toward the Foster and is being followed up. The present force consists of 16 men and two drills.

Crown Reserve—A financial statement covering the first three months of the present year has been issued, showing a surplus at the end of March of $437,302. Ore was shipped to a total net value of $452,405. The company paid $45,779 for operating expenses, spent $10,949 on plant, and paid $40,168 royalty to the provincial government. Out of the balance $256,322 was paid in dividends, leaving a surplus of $90,185. General Manager Cohen states that at the depth of 75 ft. in the west winze below the 100-ft. level the vein is strong and yielding rich ore. A winze is being sunk at the east end of the same vein which will block out ore on three sides. In prospecting crosscuts during the last three months eight veins have been cut, three of which are from 3 to 4 in. in width with rich ore, the other five running from 1 to 1½ in. wide, with good silver contents.

Ontario—South Lorraine District

Haileybury—This company has sold 20 acres, being the southern part of its property, to C. M. Ehrlich, New York, and H. G. Wood, Buffalo, for $100,000.

Quebec

McDonald Copper Mine—The Eastern Canada Smelting Company has bought this mine, which is in Weedon township, Wolfe county, near the Quebec Central railway.

Mexico

Chihuahua

Dolores—The February production amounted to $79,000, of which $29,000 is reported as profits. According to estimates the March output was slightly in excess of this.

Rio Plata—The new cyanide plant will be in commission soon. The manager, D. W. Shanks, accompanied by President Miller and others from New York, recently inspected the property.

Dos de Abril—The Huizopa Mines Company has succeeded the Dos de Abril Mining Company. The officers of the new corporation are arranging for the resumption of work on a larger scale. The home office of the company is at Cleveland.

Candelaria—This company, operating in the San Pedro camp, is shipping about six cars of lead ore daily. Other active properties in this camp are the Cinco de Mayo and Durack.

Parral Output—The production of the Parral camp for the week ending April 9 was 10,120 tons, as compared with 9410 tons for the week preceding. The district, particularly in the Santa Barbara section, is showing constant improvement.

Republica—It is officially reported that the first dividend will be paid during the month of May. The property is maintaining a steady production from its cyanide plant. Lately explored orebodies insure a large tonnage of 100-oz. silver ore. J. Gordon Hardy is consulting engineer and manager.

Santa Mathilde—J. W. Cowan and associates of Tennessee have taken a bond and lease on this and adjoining claims situated in the Dolores district, near the Sinaloa line. A three-stamp mill, concentrator and small cyanide plant have been ordered from San Francisco. The ores are gold and silver with the gold predominating.

Guanajuato

Guanajuato Consolidated—Report for March: The mill ran 29 days. Estimated value of concentrates, $41,000; total gross value in products, $93,000; less working expenses, including marketing of bullion and freight and treatment charges on concentrates shipped to smelter, $69,050; estimated profit, 23,950 pesos. Of this 11,700 pesos were expended on development account; amount of development work done, 345 feet.

Jalisco

Cinco Minas—H. E. Crawford has an option on these mines for $520,000. The first payment of $50,000 has been made.

Amparo—The second quarterly dividend of 2½ per cent. will be paid May 10. The mine entered the dividend list last February.

Oaxaca

Mimiaga—The discovery of a new and rich orebody is reported.

Sinaloa

San José—Francis Breuil has installed a two-stamp mill on the San José gold mine near Palmarito, and is now developing the mine.

Las Tajos—Engineers representing D. M. Barringer and associates, of Philadelphia, recently examined this and the Mina Grande mine in the Santiago de los Caballeros district.

Palmarito—A small force of men is working in the mine, pending the successful solution of trouble with the mechanical roasters in the lixiviation plant. C. Dupree Smith is now in charge of the work.

West Coast—The concentrating plant, situated in the Los Tajos district, is producing high-grade copper concentrates, which carry some gold and silver. Additional machinery and equipment has been ordered from Denver, which will double the present capacity of the mill. A vertical shaft is being sunk on the Rio mine to cut the vein 235 ft. below the present working tunnel. The shaft is being sunk with hammer drills. A hoist and equipment has been shipped for use on this shaft.

San Antonio—The bond and lease which was held by Southern Pacific interests, on the San Antonio and Estrella del Norte mines, situated in the Las Chivas district, expired March 20. The mines are owned by Castro Brothers and Jesus Imesquita. The option will not be renewed.

Jesus Maria—The February output was 120 kg. of gold bars, assaying about 700 fine.

Rosario—Situated near the Jesus Maria mine in the San José de Gracia district is working about 100 men and is producing a good milling grade of ore. Notwithstanding the death of Antonio Echavarria, the discoverer and one of the principal owners, the usual shipments of bullion are being made.

Toro Bueno—Edward Cook has taken an option for 18 months on this mine from Serapio Lopez and associates. The purchase price of $50,000 is payable in four payments, due in 3, 6, 12 and 18 months. Work was started at once on the mine and the force is being increased.

Zacatecas

San Roberto—Since the South African company began operations, the output is $20,000 to $30,000 per month.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 28—Coal-trade conditions in the West show little change. The demand for steam coal continues to improve slowly, but domestic trade is off. The Lake trade has hardly begun, and is held back by the current dispute over rates from the mines to Lake Erie ports; and also by the delay in starting ore shipments, which makes the offerings of tonnage light. A late opening is looked for; meantime stocks of coal on Northwestern docks are gradually disappearing, although no scarcity has yet been felt.

The anthracite situation is still an open one. Conferences have been held between the operators' committee and the representatives of the miners. The current report is that the miners have agreed practically to renew the old agreement for three years with a few unimportant modifications, which are nominal rather than actual concessions. The whole mater is before a district convention at Scranton, which is now in session, and it is not altogether safe to predict the result. All that can be said is that present chances seem to be against a strike, but a positive statement will not be safe until the agreement has been signed.

The Seaboard bituminous trade is in a disturbed condition, owing to the action of the West Virginia railroads and operators in making rates on coal delivered at the seaboard at prices which imply an exceedingly low freight rate. How long this condition will last is uncertain. An important point is that the Pennsylvania Railroad Company has purchased the large block of stock of the Norfolk & Western which it sold over two years ago. This purchase will give the Pennsylvania once more a controlling voice in Norfolk & Western affairs and will doubtless lead to some adjustment of coal rates. Reports, however, which were started from Philadelphia, have it that the new Virginian railway and the Chesapeake & Ohio will continue to make low rates. The Virginian road, it is said, intends to secure as large a share as possible of the bituminous coal trade with a view to concentrating that trade. These reports recall the rumors of a bituminous coal trust on a large scale which were current five or six years ago and must be accepted with caution—except insofar as that the Virginian people are doubtless out for all the business they can get.

The Hocking Valley Combine—The Circuit Court at Columbus, O., has decided that the holding of coal-company stocks by the Hocking Valley Railroad Company is in contravention of the State law; also that the proposed combination with the Kanawha & Michigan and other roads is contrary to law, as they are parallel and competing lines. The case is to be carried up to the Supreme Court on appeal.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 17, short tons:

	1908.	1909.	Changes.
Anthracite	1,565,811	1,511,243	D. 54, 68
Bituminous	9,848,588	10,411,529	I. 562,941
Coke	2,089,664	2,936,925	I. 847,261
Total	13,504,063	14,859,697	I. 1,355,634

Increase for the week, 202,233 tons. Total increase year to date, 10 per cent.

Shipments reported by Southwestern Interstate Coal Operators' Association, month of January, short tons:

	1908.	1909.	Changes.
Missouri	247,103	252,264	I. 5,161
Kansas	570,351	534,219	D. 36,132
Arkansas	228,052	135,399	D. 92,653
Oklahoma	313,952	213,807	D. 100,145
Total	1,359,458	1,135,689	D. 223,769

The total decrease this year was 16.5 per cent.

Coal receipts at Boston, three months ended March 31, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	389,904	362,541	D. 27,363
Bituminous	824,000	788,633	D. 35,367
Total domestic	1,213,904	1,151,174	D. 62,730
Foreign	142,350	76,835	D. 65,515
Total	1,356,254	1,228,009	D. 128,245

The foreign coal is chiefly from Nova Scotia mines.

New York

Anthracite

April 28—Business is going on quietly in hard coal, although the dispute between miners and operators is not yet settled. Buying on the April discount has been rather large. No announcement has yet been made as to the May discount and it is not quite certain whether it will be made. It probably depends on the result of this week's conference between miners and operators.

Prices on domestic sizes are $4.25 for lump and $4.50 for egg, stove and chestnut, f.o.b. New York harbor. Prices on steam sizes are a little unsettled, as demand is rather in excess of present supply. Current quotations are $3.10@3.25 for pea; $2.35@2.50 for buckwheat; $1.70@2 for rice; $1.25@1.50 for barley, f.o.b. New York harbor.

Bituminous

The Seaboard coal trade is disturbed by the action of the West Virginia operators, who are evidently trying to secure business even at low prices. Thus Pocahontas has been offered as low as $2.15, f.o.b. Lambert's Point, and prices to correspond have been made on New River, f.o.b. Newport News. In their search for trade some West Virginia operators have even offered to make delivered prices at Eastern ports, a practice which was abandoned three or four years ago by general consent; its revival will be witnessed with regret by most dealers.

In current trade buying does not seem to have been revived by this competition. The far East is taking occasional cargoes, but is still dull and sleepy. Along the Sound a small but regular business is noted. New York harbor is doing a little business, but cannot be called active. Prices remain about the same as last week and buyers seem to be waiting the result of the West Virginia action. All-rail trade is fairly active. Car supply is abundant but transportation is a little slow.

In the Coastwise vessel trade boats are still rather scarce, owing to the weather. Rates on large vessels from Philadelphia are nominally unchanged, but smaller vessels are getting an advance of 5 to 10c., making the freight from Philadelphia to Boston about 65c. In New York the smaller vessels are asking from 10 to 15c more than a week ago.

Birmingham

April 27—The Southern coal market shows a little improvement but it is slight. Little labor has left the district, so confident are the miners that there will be a resumption ere long. The improvement in the coke demand has caused a steady output at a larger number of ovens. It is believed there will be a good demand for coke all through the summer. Some of the larger companies are still stocking coke for future use.

The Star Cahaba Coal Company, with small mines in Shelby county, is in litigation, a petition in bankruptcy having been filed, and a receiver being named.

Chicago

April 26—The coal market continues quiet, with fine coals more and more in demand and lump correspondingly difficult

to sell. There is little demurrage trouble; shipments, speaking generally, are fairly well adjusted to the demand. Hocking Valley coal has been somewhat in overabundance, and occasionally Illinois or Indiana lump has to be sacrificed to be unloaded. Domestic coals are very weak, except anthracite, Contract making is increasing and is in general at low prices. Competition in this as in the open market is keen, and to get hesitating users of coal prices are cut.

Lump and egg from Illinois or Indiana mines sells for $1.75@2.25; run-of-mine for $1.65@1.75, and screenings for $1.40@1.60.

Eastern coals are stronger as general business conditions improve. Smokeless, well held down as to shipments, brings $3.20@3.45 for lump and $2.95@3.15 for run-of-mine. Hocking Valley sells for $2.90@3.15 and is somewhat sluggish. Youghiogheny at $3.15 for ¾-in. gas and Pittsburg No. 8 at $2.75 for ¾-in. lump are quiet. In the anthracite market something of the briskness apparent is attributed to the lack yet of warm weather, but there are evidences that the average retailer and consumer are laying in supplies early to get the benefit of the spring discounts.

Cleveland

April 27—The coal market is still stirred up over the question of rates on Lake coal. Until that is settled, and until ore begins to move, there will be little coal started up the Lakes.

The local market is quiet and unchanged with possibly a little better demand for steam coal, but no change in prices. Some slack has been sold at a slight advance, as that grade is in light supply.

Indianapolis

April 26—The showing of the leading mining companies of the State for the past week indicates a gradual increase in the output. The orders taken during the past week have caused firmness in the market, although prices remain at a low level. Shops, railroads and power houses are increasing their weekly orders. There is also a manifest confidence in the Indiana coal industry by the several new companies that are sinking new mines, while a number of old companies are making extensive improvements.

Pittsburg

April 27—Production at the railroad mines has increased materially during the past week, the additional tonnage going to Lake ports for shipment to the Northwestern markets. There is also an increase in the local demand, but prices are low. Sales under contract have been made within the past few days at around $1 per ton for mine-run coal at mine. Large producers are still endeavoring to hold the price at $1.15, but the bulk of the business is going at $1.10. Slack remains at 55@65c. The river mines continue to operate at capacity and a large tonnage is accumulating. The rivers until today were at a good barge stage, and several million bushels went out on the rise. It is estimated that about 60 per cent. of the capacity of the railroad mines is being brought out.

Connellsville Coke—Conditions in the coke trade continue bad and some sales of furnace coke for spot shipment are made at as low as $1.40@1.50. On contract to July 1 the asking price is $1.60. One or two large contracts for shipment through the second half were made lately, but the price is not given. Producers are quoting $1.75 for the last half. Foundry coke also is down, $1.85 and less being done for spot shipment. On contract the asking price is $1.90@2.10, but some producers are holding for $2.25 for late delivery. A number of ovens have been closed during the week and production generally is being curtailed.

The *Courier* gives the production in both fields at 233,151 tons. The shipments were 9127 cars, as follows: To Pittsburg district, 3511 cars; to points west of Pittsburg, 4726 cars; to points east of Connellsville, 890 cars.

Foreign Coal Trade

Coal in Peru—The production of coal and lignite in Peru in 1908 was 185,565 metric tons, an increase of 105,000 tons. The greater part of this coal was mined by the Cerro de Pasco Company and was converted into coke for the use of that company.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on April 17: Best Welsh steam, $3.54@3.60; seconds, $3.42; thirds, $3.30; dry coals, $3.48; best Monmouthshire, $3.12; seconds, $3.06; best small steam, $2.46; seconds, $2.16. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, April 28—The iron and steel markets generally show a considerable improvement, as far as the volume of new business is concerned. Activity is gradually developing on several lines and there appears to be a greater confidence in the future.

The large business in structural steel continues. Orders for bridges and buildings come in steadily. Some of these are of large dimensions, but the small orders which naturally predominate make up a very considerable aggregate. A conservative estimate of structural orders for the month of April foots up a total at something over 200,000 tons, this quantity including only orders actually placed. Orders for bars have also been liberal at the low prices recently fixed, while in sheets and plates there has been a fair business. In wire products business has not been active, for the reason that further reductions are expected. An exception is found in nails, on which lower prices have been named at Pittsburg, and for which the demand appears to be very large.

Rail orders from domestic roads have not been much in evidence though several small contracts have been placed. There has been quite a business in rails for export, recent contracts including 6000 tons for Panama, 5000 tons for Brazil and 13,000 tons for Mexico.

In pig iron there has been more business than for a number of weeks past, both in the West and in seaboard territory. New England manufacturers seem to be waking up and are taking both foundry and basic iron for second and third quarters, and the same is the case in New York and New Jersey. Buyers seem to have more confidence in the future and also to have made up their minds that prices are near the bottom and are taking iron accordingly.

United States Steel Corporation—This preliminary statement for the first quarter, issued today, gives net earnings and income as below:

	1908.	1909.
January	$ 6,052,743	$ 7,262,605
February	6,709,428	7,669,336
March	7,469,834	7,989,327
Total for quarter	$18,229,005	$22,921,268
Depreciation and subsidiary co. acco'ts		$ 3,736,199
Interest and sinking fund		7,311,963
Total charges		$11,048,162
Balance		$11,873,106
Dividends declared		8,846,432
Surplus for the quarter		$ 3,026,674

As compared with the December quarter of 1908, the net earnings show a decrease of $3,304,217; the increase over the March quarter of 1908 being $4,692,263. The dividends declared for the quarter were the usual ones, of 1¾ on preferred, and ½ per cent. on common stock. The unfilled orders on the books on March 31 were 3,542,595 tons; which compares with 3,603,527 tons on Dec. 31 and 3,765,343 tons on March 31, 1908. During April, however, there was a large increase in orders.

Birmingham

April 27—The tonnage sold for the month of April in the South has been satisfactory. The Tennessee company, which has been selling iron on a basis of $11 per ton, No. 2 foundry, now quotes $11.50, while others have been getting $11.50 per ton right along. There is a little iron on the furnace yards in this district, but not enough to cause any apprehension.

Officials of the American Radiator Com-

pany, of Chicago, are in Birmingham, completing the deal whereby that concern takes hold of the plant of the Birmingham Pipe and Casting Company.

The sale of the properties of the Southern Steel Company, bankrupt, having been confirmed by the special referee, the reorganization of the company is but a matter of form, and the steps looking to a rehabilitation of the work will soon be in hand.

Foundries and machine shops look for a brighter future also. It is announced that the Payne & Joubert foundry and machine shops in this district will be more than doubled in the next few months, plans now being in hand.

Baltimore

April 26—Exports for the past week included 3,958,200 lb. steel billets to Liverpool. Imports included 10 ingots electric steel from Antwerp; 20 tons spiegeleisen and 746 tons ferromanganese from Liverpool; 4950 tons iron ore from Cuba.

Chicago

April 26—The iron market seems to be strengthening both for pig iron and finished products. Contracts for third- and fourth-quarter deliveries of pig iron are more numerous and Southern interests are trying to hold the price of No. 2 firmly up to $11.50 Birmingham, or $15.85 Chicago. Some sales, however, are undoubtedly made at less. Melters are inclined to increase their purchases for needs of the next three months also, buying with more confidence. Some Southern iron is selling at $12, Birmingham, in small lots. There is no decided turn of the market, but conditions are more encouraging for the seller than in many weeks past. Northern iron remains quiet and steady, with No. 2 selling for $16.50 @17, and local furnaces supplying the demand closely. Lake Superior charcoal remains at $19.50@20.

Iron and steel products are in increasing demand generally, though sales are not notably large in the two very heavy lines, railroad supplies and structural material. Coke is improving in demand, though the best Connellsville remains at $4.70, Chicago.

Cleveland

April 27—Ice still holds at the Sault but it is believed that boats will be able to get through in a few days. Several vessels have started, having no difficulty in getting crews, notwithstanding the orders of the unions. Nothing definite has been settled about iron-ore prices, and the only sales have been a few small ones from dock stocks.

Pig Iron—Buyers seem to have made up their minds that prices are as low as they will go, and there has been a good local business in foundry and basic for second and third quarters. Prices are on a basis of about $15, Cleveland, for No. 2 Northern foundry.

Finished Material—Good sales are reported of structural material, with a fair business in bars and plates.

Philadelphia

April 28—Inquiries for basic iron made a week or so ago have developed into orders, and two or three large sales have been effected on which deliveries will be made in May. In other kinds of iron makers have been obliged to submit to shading in order to effect sales on account of the persistent shading of Southern irons. Quite a number of small buyers in this territory have been in the market within a few days and have bought more liberally than for months. Some consumers are beginning to purchase more material than the work in hand called for. Very little iron is being bought for third-quarter delivery, though business of this character is known. Forge iron continues to drag.

Steel Billets—More steel billets have sold within the week, but delivery is uncertain, the buyers feeling that now is a good time to secure themselves. These sales show a slight reduction from recent quotations.

Bars—Bar iron is quoted at 1.30 for refined and 1.25c. for common, with an unsatisfactory demand. Large consumers are withholding orders or buying small lots.

Pipes and Tubes—Locomotive work is improving steadily. The Pennsylvania Railroad Company has ordered the construction of 44 engines of large capacity. The small-shop demand for tubes is better.

Scrap—The scrap market is dull, although there are more buyers looking around for supplies, but only for present wants. There is more inquiry for cast scrap than for any other kind this week. Railroad scrap is dull and is held for higher figures. The stock is quite large and the dealers feel that there will be no difficulty in unloading it a little later.

Pittsburg

April 27—The improvement in the iron and steel trades which set in about the first of the month has gained additional force, and the whole position of the market is distinctly better. The current bookings are at a greater rate than at any previous time this year and are well ahead of the average of last year. Production is also larger. The Carnegie Steel Company is producing 21,000 tons of steel ingots daily, its full capacity being 28,000 tons. The sharp competition in steel bars, structural shapes and plates has resulted in good bookings.

As a result of this position the Carnegie Steel Company this morning advanced its prices on bars, plates and shapes $1 a ton, and decided not to take business as far ahead as formerly. Its new prices are not absolutely fixed, being flexible as were the old prices. The new prices, for attractive business, are 1.15c. for bars and 1.25c. for plates and shapes, at Pittsburg, prices for Chicago delivery being 15c. per 100 lb. higher. When the break occurred in February bars at once dropped to 1.20c. and plates and shapes to 1.30c. These prices held for a short time, but of late have been shaded very generally, bars being sold regularly by two or three interests at 1.10c., occasionally at slightly less, while shapes and plates sold at 1.20c. and in the case of specially attractive tonnages as low as 1.10c. was done.

There has been sharper competition in wire nails, and 10c. a keg under the official price of $1.95 is being done regularly on attractive orders. Some producers are now comfortably filled up for two months. There has also been sharper competition in small spikes, which have been sold in some cases as low as $1.60 per 100 lb., the old price being $1.80. Standard railroad spikes have been shaded 5c. to $1.65.

Pig Iron—There has been much more active inquiry in the past week, and sales have been larger than at any previous time this year. The Massillon Iron & Steel Company, the independent cast-iron pipe interest at Massillon, O., has bought 20,500 tons of northern foundry iron, for delivery in the second half, paying on the basis of $14, Valley, for No. 2. The International Harvester Company, Allis-Chalmers Company and General Electric Company have bought, following the purchase of 10,000 tons by the Westinghouse Electric & Manufacturing Company. Some good inquiries have appeared from Pittsburg consumers. For prompt delivery foundry and basic iron can be had at $14, Valley, or $14.90, Pittsburg, but for third quarter at least 25c. advance is demanded. Bessemer has been quiet, at $14.75, Valley, for prompt. $15 and upward for second half.

Steel—The market is somewhat firmer. Some mills at a distance from Pittsburg would shade nominal prices, but for Pittsburg delivery billets are firm at $23. Shipments have improved on old contracts.

Sheets—Demand has slightly increased. Prices remain at 2.25c. for black and 3.25c. for galvanized, 28 gage, ordinary carload lots, while on attractive orders a concession of $1 a ton is given.

Ferromanganese—Prices quoted show quite a range, as a few low sellers are making the market, others quoting much higher prices. On ordinary carloads the market is about $42, seaboard, or $43.95, delivered Pittsburg, but on large lots $41, seaboard, could be done.

Metal Markets

New York, April 28—More activity in business is noted in several lines, and there is a measurable degree of improvement.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1909..	$21,252,462	$ 5,161,648	Exp. $16,090,814
" 1908..	1,447,205	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,024	Imp. 13,437,021
Silver:			
Mar. 1909..	5,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,369	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,656	" 1,755,631

Exports from the port of New York, week ended April 24: Gold, $2,600,250, chiefly to Argentina and Brazil; silver, $729,870, chiefly to London. Imports: Gold, $111,286, from Central and South America; silver, $82,316, from Japan, Australia and Mexico.

Gold—Prices on the open market in London are at the normal point, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American eagles. The Bank of France is again buying gold, but there is no sharp competition. In New York exports continue to Argentina and Brazil; some gold has also been taken for shipment to Paris.

Platinum—Business continues on a fair scale with prices unchanged at $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our St. Petersburg correspondent reports under date of April 15 that a fall in prices is to be noted. The larger dealers will not sell at current quotations, as they expect a rise; but there is some metal in the hands of weak holders and this has affected quotations. At Ekaterinburg the nominal price is still 5 rubles per zolotnik, but small holders have sold at 4.60@4.80 rubles—equal to an average of $17.67 per oz. for crude. In St. Petersburg crude metal, 83 per cent., is offered at 18,000@19,000 rubles per pood—average $18.13 per oz. It is expected that these weak holders will soon be sold out.

Silver—Silver has shown some strength this past week, owing to purchases on China account and recovering by speculators of silver sold short at somewhat lower prices. The market closes steady today.

SILVER AND STERLING EXCHANGE

Apr.	22	23	24	26	27	28
New York....	51¾	52¼	52½	52	52⅜	52⅜
London.....	23 11/16	24 1/16	24	23 15/16	24 1/16	24⅛
Sterling Ex..	4.8760	4.8750	4.8745	4.8745	4.8735	4.8730

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 15:

	1908.	1909.	Changes.
India.... ...	£ 2,150,638	£1,175,400	D. £ 975,138
China..	505,400	983,200	I. 476,800
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 2,747,138	£2,241,400	D. £ 505,738

Imports for the week, £5000 from Mexico and £295,000 from New York; total, £300,000. Exports, £47,000 to China and £25,000 to India; £72,000 in all.

Copper, Tin, Lead and Zinc

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
22	12⅞ @13	12½ @12⅝	57	29½	4.20 @4.25	4.10 @4.15	4.92½ @4.95
23	12⅞ @13	12½ @12⅝	57⅛	29⅝	4.20 @4.25	4 10 @4.15	4.92½ @4.95
24	12⅞ @13	12½ @12⅝	....	29⅝	4.20 @4.25	4 10 @4.15	4.92½ @4.95
26	12⅞ @13	12½ @12⅝	57⅝	29½	4.20 @4.25	4 10 @4.15	4 90 @4.95
27	12⅞ @13	12½ @12⅝	57⅞	29¼	4.20 @4.25	4.10 @4.15	4.90 @4.92½
28	12⅞ @13	12½ @12⅝	57⅝	29¼	4.20 @4 25	4 10 @4 15	4.87½ @4.92½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—During the week April 22-28 the market has remained very quiet. Some transactions of moderate volume have been made with European and domestic consumers. Lake copper was sold at 12⅞c. for good ordinary brands, while some special brands fetched 13c., and Calumet & Hecla is said to have realized a trifle more. Electrolytic copper has been freely offered at 12¾c., delivered, 30 days, equivalent to somewhat less than 12⅝c., cash, New York, even for delivery as late as August, and concessions were made to develop business. At the close the market is unchanged at 12⅞@13c. for Lake copper, and 12½@12⅝c. for electrolytic, in ingots, cakes and wirebars. The average of the week for casting copper has been 12⅜@12½ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14¼c. base, carload lots at mill. Business has been rather light.

The transactions in the London standard market at the beginning of the week were of considerable volume at somewhat higher quotations. The full advance, however, was not maintained, and the market closes steady at £57 7s. 6d. for spot, £58 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@75.

Exports of copper from New York and Philadelphia for the week, 5823 long tons. Our special correspondence gives the exports from Baltimore at 1988 tons copper.

Tin—The transactions on the London Metal Exchange have been of moderate volume, and the market remains exceedingly dull. This is somewhat surprising in view of the good consumption which is reported from this side. The close is cabled at £132 7s. 6d. for spot, £133 12s. 6d. for three months. In this market tin is offered at the close at 29¼ cents.

Lead—While the demand for this metal has somewhat relaxed, quotations nevertheless remain firm, and close at 4.10@4.15c. St. Louis, 4.20@4.25c. New York.

The London market has shown a hardening tendency and fair transactions are reported. The close is firm at £13 7s. 6d. for Spanish lead, £13 10s. for English lead.

The John Wahl Commission Company reports to us from St. Louis under date of April 28 as follows: Lead dull and trading of only a retail character. Common brands of Missouri lead obtainable at 4.12½c. and lightly salable at that price. Corroding brands of southwest Missouri lead worth 4.17½ cents.

Spelter—The demand for this metal seems to have been taken care of for the present, and the few orders which presented themselves were eagerly competed for. Prices show a declining tendency and close at 4.87½@4.92½c., St. Louis, 5.02½@5.07½c., New York.

No change is to be reported from the other side, and London quotations close steady at £21 12s. 6d. for good ordinaries, £21 17s. 6d. for specials.

New York quotations for spelter, April 22-24, inclusive, 5.07½@5.10c.; 26, 5.05@5.10c.; 27, 5.05@5.07½c.; 28, 5.02½@5.07½ cents.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The John Wahl Commission Company reports to us from St. Louis under date of April 28 as follows: Spelter is a little lower, spot selling at 4.90c., and metal for May delivery at 4.92½c., East St. Louis.

Other Metals

Antimony—Business has fallen off again, and the market is quiet. Prices are unchanged at 8½c. for Cookson's; 8¼c. for Hallett's; 7⅞@8c. for U. S. and other brands.

Aluminum—No change is to be noted in business or prices. No. 1 ingots, 22@24c. base; wire 31@32c. and sheets 33@34c. base.

Quicksilver—Business is not particularly active. New York quotations are $44.50 per flask of 75 lb. San Francisco, nominal at $44 for domestic orders and $42 for export. London, £8 7s. 6d. per flask, with £8 2s. 6d. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, three months ended March 31, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	30,191	18,910	Imp.	11,291
Copper, 1908	34,205	16,568	Imp.	17,637
Tin	10,390	10,099	Imp.	391
Tin, 1908	11,374	10,159	Imp.	1,215
Lead	52,906	11,241	Imp.	41,664
Lead, 1908	59,285	14,379	Imp.	44,906
Spelter	27,417	1,564	Imp.	25,853
Spelter, 1908	24,697	1,723	Imp.	22,974
Quicksilver, lb.	893,993	270,196	Imp.	623,797
Quicksilver, '08	878,066	572,880	Imp.	805,176
Ores:				
Tin ore and con.	5,137	.....	Imp.	5,137
Tin ore, 1908	6,684	.....	Imp.	6,684
Pyrites	206,547	.....	Imp.	206,547
Pyrites, 1908	245,182	.....	Imp.	245,182

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 128 tons copper matte, 4859 tons fine copper and 8393 tons lead.

British Iron Trade—Exports and imports of iron and steel and their products in Great Britain for the three months ended March 31 are valued as below, in long tons:

	Exports.	Imports.	Excess.
Iron and steel	£ 8,914,419	£ 1,854,828	Ex. £ 7,059,591
Machinery	6,761,462	1,151,456	Ex. 5,610,007
New ships	1,499,864	.....	Ex. 1,499,864
Total	£17,175,745	£ 3,006,283	Ex. £14,169,462
Total, 1908	19,953,214	3,128,834	Ex. 16,824,380

Decrease in exports this year, £2,777,469, or 13.9 per cent.; decrease in imports, £122,551, or 3.9 per cent. The quantities of iron and steel were, in long tons:

	1908.	1909.	Changes.
Exports	989,259	931,403	D. 57,856
Imports	246,945	277,877	I. 30,932

The imports this year were largely of blooms, billets and other half-finished material.

British Iron Ore Imports—Imports of iron ore into Great Britain, three months ended March 31, were 1,402,510 long tons in 1908, and 1,363,012 in 1909; a decrease of 39,498 tons. Of the imports this year 1,052,175 tons were from Spain.

Zinc and Lead Ore Markets

Joplin, Mo., April 24—The highest price reported paid was $43, the base price ranging from $38 to $41 per ton of 60 per cent. zinc for sulphide ore, and $17 to $19 per ton of 40 per cent. zinc for silicate ore. The average price, all grades, was $37.36, with a minimum of silicate sales. Lead ore is reported sold as high at $58, 80 per cent. grades bringing $57. The average price, all grades, is $57.08 per ton.

With this week is ended four months of 1909, with an increase of 18,967 tons of zinc and 9769 tons of lead. The zinc value is a gain of $772,433, the lead value a gain of $272,621, and the total value is $1,045,054 greater than the same period of last year. The shipment is an average of 5628 tons per week for each week of this year, against an average of 4514 each week last year.

SHIPMENTS, WEEK ENDED APR. 24

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,041,870	829,380	$102,461
Joplin	1,969,860	250,570	46,474
Miami	609,480	255,910	15,954
Galena	687,650	163,850	15,847
Granby	917,790	10,000	12,747
Duenweg	586,740	53,440	11,701
Prosperity	406,800	121,640	11,397
Alba-Neck	540,000	.....	10,800
Oronogo	589,270	1,780	9,876
Aurora	435,760	3,730	8,255
Carthage	375,840	.....	7,516
Spurgeon	233,030	69,380	5,266
Sarcoxie	299,750	.....	5,028
Badger	74,050	9,890	3,256
Cave Springs	141,640	.....	2,832
Saginaw-Shoalsburg	74,320	51,810	2,830
Zincite-Sherwood	115,780	.....	2,256
Totals	11,999,630	1,761,380	$274,496
Four months	191,417,490	41,388,570	$4,252,764
Four mos. last year	153,483,380	21,849,190	3,207,700
Increase	37,934,110	19,539,380	1,045,054

Zinc value, the week, $224,212; 4 mos, $3,435,548
Lead value, the week, 50,284; 4 mos, 817,206

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.66	.....	32.97	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.63	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	64.59	.....
October	35.95	.....	33.28	.....	62.63	.....
November	39.13	.....	36.02	.....	64.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.81	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., April 24—The highest price paid for zinc ore was $41; the base price was $39@39.50 per ton of 60 per cent. zinc. For 80 per cent. lead ore, $53 per ton was paid.

SHIPMENTS, WEEK ENDED APR. 24

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green	405,400	71,800	.....
Strawbridge	396,000	.....	.....
Platteville	360,000	.....	146,450
Galena	324,000	.....	.....
Days Siding	176,000	.....	.....
Livingston	60,000	.....	.....
Cuba City	50,500	88,700	.....
Total	1,771,400	160,500	146,450
Year to Apr. 24	31,614,924	1,067,960	2,883,100

Highland and Linden are not reported. In addition to the above there was shipped to the American Zinc Ore Separating Company, 135,500 lb. and to the Joplin Separator Works, 225,000 lb. zinc concentrates.

Chemicals

New York, April 28—The market is quiet; most of the current deliveries are on yearly contracts.

Copper Sulphate—Prices remain unchanged at $4.60 per 100 lb. for carload lots and $4.85 per 100 lb. for smaller parcels. Sales have been moderate.

Arsenic—Current quotations for white arsenic are 2⅞@3c. per lb. Sales are improving slightly.

Nitrate of Soda—Current sales continue rather small. Prices remain unchanged at 2.15c. for spot nitrate and 2.12½c. for futures.

Mining Stocks

New York, April 28—The general stock market this week has been a good of a traders' market with many fluctuations, but perhaps no very definite tendency. It continues to show considerable strength, and though fluctuations have been in both directions, there is no apparent tendency to a decline. It must be said that the market seems to ready to absorb all the stocks that were offered. Speculation has been helped by cheap money and also by the apparent disposition of the foreign markets to retain the stocks recently purchased here. The Turkish trouble has affected the London and Paris exchanges very much less than was expected.

On the Curb the copper stocks were a good deal in evidence and prices were fairly well held. Nevada Consolidated continued to be in demand. The one exception was North Butte, which was severely handled both here and on the Boston exchange and showed a sharp decline.

Cobalt stocks were in good demand and at fair prices. The Nevada gold stocks are rather reviving, more interest being taken in them, with consequent better buying.

Boston, April 27—A $14.50 drop per share in the price of North Butte mining stock the past week has proved somewhat disastrous to the market and has undermined public sentiment. The reason for this sharp decline remains a mystery up to the present time. Undoubtedly there has been liquidation of large inside holdings of stock but the last 10 or 20 points on the down side were mainly the result of bear manipulation. From a high at $85.25 made on Jan. 2 of the present year, the price reached $52.50 today, representing a decline of $32.75 or a depreciation of over $13,000,000 in the value of the property. On Monday alone the stock broke

$9.25 per share which is enough to affect loans on the stock. The stock reached $120 per share in 1907 and went as low as $30 during the panic period of that year. A covering movement carried the stock up to $56.50 at the close tonight. The one great criticism is that North Butte has paid out practically all that it has earned.

A bear attack on Copper Range broke the stock to $73.50, which represents a decline of $4.50 for the week. East Butte has suffered to the extent of almost $3, touching $13.25. A selling movement in Butte Coalition carried the price off $1.62½ to $22.50. Mass mining touched $10, but closed off at $8.75 tonight. Activity has been confined to a few stocks but declines have been general.

Amalgamated has been little affected by price movements in this market as its fluctuations have been dominatel by the strength of the New York list.

Boston Stock Exchange members are somewhat upset over the likelihood of the removal of the exchange from State Street to a spot southerly in direction. State Street to Boston is the same as Wall Street is to New York and sentiment may insist upon remaining in the present location. The lease in the present quarters does not expire for two years yet.

Southwestern Development has been the Curb exchange feature. After selling up to $1.06¼ it broke to 17c., rallying subsequently to 35 cents. A bull campaign was spoiled by the slipping of either treasury or pooled stock.

STOCK QUOTATIONS

NEW YORK Apr. 28	
Name of Comp.	Clg.
Alaska Mine	.44
Amalgamated	75⅝
Anaconda	44¾
Balaklala	‡2 1/16
British Col. Cop.	6
Buffalo Mines	3⅝
Butte Coalition	22¾
Colonial Silver	¼
Cum. Ely Mining	7⅝
Davis-Daly	5⅞
Dominion Cop.	⅝
Douglas Copper	2⅞
El Rayo	3
Florence	3 7/16
Foster Cobalt	.34
Furnace Creek	.10
Giroux	7⅞
Gold Hill	⅛
Goldfield Con.	8 7/16
Granby	96
Greene Gold	¼
Greene G. & S.	7
Guanajuato	1⅝
Guggen. Exp.	179½
Hanapah	15
Kerr Lake	7 7/16
McKinley Dar.	.94
Miami Copper	15
Micmac	¾
Mines Co. of Am.	⅜
Mitchell Mining	⅛
Mont. Sho. C.	1½
Nev. Utah M. & S.	2¼
Newhouse M. & S.	2⅜
Nipissing Minea.	10½
Old Hundred	¾
Silver Queen	.46
Stewart	¾
Tennessee Cop'r.	40⅝
Tri-Bullion	1/16
Union Copper	1
Utah Apex	6½
Utah Copper	‡7¼
Yukon Gold	4 7/16

BOSTON Apr. 28	
Name of Comp.	Clg.
Adventure	8
Allouez	38
Am. Zinc	‡25¼
Arcadian	3⅞
Arizona Com.	41
Atlantic	10⅝
Boston Con.	12½
Calumet & Ariz.	97½
Calumet & Hecla	600
Centennial	‡30¼
Copper Range	74½
Daly-West	10
East Butte	13¾
Franklin	14¾
Greene—Can	10
Hancock	‡10¾
Isle Royal	22⅛
Keweenaw	3
La Salle	13⅛
Mass	9¾
Michigan	12½
Mohawk	59
Nevada	20¾
North Butte	56⅛
Ojibway	11¼
Old Colony	‡48
Old Dominion	50¾
Osceola	124
Parrot	31
Quincy	88
Rhode Island	14¾
Shannon	13½
Superior	39½
Superior & Bost.	15
Superior & Pitts.	13
Tamarack	66
Trinity	13½
U. S. Smg. & Ref.	44
U.S. Sm. & Re., pd.	46⅛
Utah Con.	39¼
Victoria	4¾
Winona	4¾
Wolverine	142
Wyandotte	2¼

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡38¼
Am. Smelt. & Ref.	88¾
Am. Sm. & Ref., pf	106½
Colo. Fuel & Iron	37⅝
Federal M. & S., pf.	‡82
National Lead	87¾
National Lead, pf.	104
Pittsburg Coal	11
Republic I. & S.	23⅞
Republic I. & S., pf.	77½
Sloss-Sheffield	‡76
Standard Oil	668
U. S. Steel	53¾
U. S. Steel, pf.	115
Va. Car. Chem.	46⅝

BOSTON CURB	Low.
Ahmeek	160
Black Mt.	1 1/16
Chemung	17
Globe Con	4
Helvetia	2⅞
North Lake	17¾
Ray Central	2 13/16
Ray Con	14
San Antonio	10½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Apr. 24		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	1.80	1.50
Cont. C. & C.	81.00	80.00
C. C. & C. pd.	80.00	79.00
Cont. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.26	.18
St. Joe	12.00	11.00

LONDON Apr. 28			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton's Ind.	0	3	1½
Camp Bird	1	3	3
Esperanza	2	16	3
Tomboy	1	2	6
El Oro	1	4	9
Oroville	0	11	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Apr. 28.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.44
Best & Belcher	.39
Caledonia	.11
Chollar	.07
Comstock	.23
Con. Cal. & Va.	.61
Crown Point	.50
Exchequer	.19
Gould & Curry	.09
Hale & Norcross	.18
Mexican	.76
Ophir	1.17
Overman	.12
Potosi	12
Savage	.19
Sierra Nevada	.17
Union	.32
Utah	.02
Yellow Jacket	.62
TONOPAH STOCKS	
Belmont	1.03
Extension	.50
Golden Anchor	...
Jim Butler	.17
MacNamara	.30
Midway	.28
Montana	.82
North Star	.03
Tono'h Mine of N.	7.00
West End Con.	.35
GOLDFI'D STOCKS	
Adams	.02
Atlanta	.15
Blue Bell	.04
Booth	.20
Columbia Mt.	.14
Comb. Frac.	1.06
Con. Red Top	.07
Cracker Jack	.04
Dia'dfield B. B. C.	.06
Goldfield Belmont	.04
Goldfield Daisy	.40
Great Bend	.15
Jumbo Extension	.16
Kendall	.06
Lone Star	.06
May Queen	.04
Oro	.10½
Red Hill	.11
Roanoke	...
Sandstorm	.13
Silver Pick	.18
St. Ives	.13
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.04
Homestake King	.02
Mont. Shoshone C.	1.75
Tramp Cons	.07
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1.18¾
Nevada Smelting	.87½
Nevada Wonder	.70
Nevada-Utah	2.68¾
Penn-Wyoming	.02
Pittsburgh S. Pk.	.81
Rawhide Caol't'n.	...
Round Mt. Sphinx	.16

COLO. SPRINGS Apr. 23	
Name of Comp.	Clg.
Acacia	‡.06½
Black Bell	....
C. C. Con	.03
Dante	.06½
Doctor	.09
Elkton	.64
El Paso	.45¾
Findlay	.14¾
Gold Dollar	.10
Gold Sovereign	‡.03
Isabella	.20⅝
Jack Pot	.06¾
Jennie Sample	.07⅞
Jerry Johnson	.05¾
Mary McKinney	.37
Pharmacist	.03
Portland	.87
Un. Gold Mines	.05¾
Vindicator	.62
Work	‡.07

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Apr. 15	May 7	$0.01
Blue Wing, Ida.	May 8	June 5	0.005
Carney Copper, Ida.	Mar. 25	May 1	0.003
Crown Point, Nev.	Apr. 18	Apr. 28	0.10
Echo, Ida.	May 1	June 1	0.002
Elk M. & M., Ida.	Apr. 20	May 20	0.001
Exchequer, Nev.	May 5	May 26	0.05
Helvetia	May 15	.....	0.50
Imlay, Nev.	Apr. 6	Apr. 28	0.03
Laclede, Ida.	Apr. 7	May 1	0.003
Mexican, Nev.	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida.	Apr. 28	May 28	0.005
Rexall S. & C., Utah	Mar. 26	Apr. 25	0.01½
Savage, Nev.	Apr. 8	May 6	0.10
Sierra Nevada, Nev.	May 4	May 25	0.10
Union Con., Nev.	Apr. 8	Apr. 30	0.10
Utah, Nev.	May 6	May 27	0.03
Yerington Gold, Nev.	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.760	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.854	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.645	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	.....	14.469	18.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.933	.....	.....	13.469	.....
May	4.263	.....	.....	12.998	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.468	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.819	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.825	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for $1.00, thirty-three for $5.00 and one hundred for $15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

ALUMINUM.

9117—ALUMINUM FROM CLAY, ETC.—Ueber Verwendbarkeit von Tonerdesilikaten zur Aluminiumfabrikation. Max Moldenhauer. (Metallurgie, Jan. 8, 1909; 7½ pp.)
Results of experiments, including description of apparatus and methods, on the extraction of aluminum from silicates of the metal. 40c.

9118—WELDING—Autogenous Welding of Aluminum. M. U. Schoop. (Electrochem. and Met. Ind., April, 1909; 2 pp.)
Describes the requirements necessary for a thoroughly practical application of this method. Illustrated. 40c.

ASPHALTUM.

9119—FRANCE—Geological Occurrence and Mining of Asphalt in France. S. A. Ionides. (Min. Sci., April 1, 1909; 2 pp.)
A description of the methods used in mining, together with the uses of asphalt. Illustrated. 20c.

CALCIUM CARBIDE.

9120—MANUFACTURE of Calcium Carbide. (Engineering, March 26, 1909; 3½ pp.)
The author describes the calcium carbide factory at Odda, Norway, and gives a detailed account of the electric power plant which develops 23,000 electrical horse-power. To be continued. 40c.

CARBORUNDUM.

9121—MANUFACTURE of Modern Grinding Wheels. (Am. Machinist, Apr. 1, 1909; 4 pp.)
An outline of the process by which carborundum is made, and how it passes from crystals into complete grinding wheels. Also some notes on testing. Illustrated. 20c.

CEMENT.

9122—PORTLAND CEMENT for Use in the Tropics. R. K. Meade. (Eng. News, April 8, 1909; 3 pp.)
The author gives analyses and descriptions of a number of representative American cements. Also some notes on the use of American cement in Central and South America and the Philippines. 20c.

9123—PORTLAND CEMENT—The Manufacture of Portland Cement. W. M. Kinney. (Proc. Eng. Soc. Western Penn., March, 1909; 32 pp.)
The author gives an historical review of the cement industry with descriptions of the principal processes and machinery that are employed today in the cement industry. Illustrated. 40c.

COAL AND COKE.

9124—CANADA—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can. Min. Journ., Mar. 15, 1909; 5½ pp.)
This instalment describes the Emery seam and the lower seams of the Glace Bay basin. Map and illustrations. 20c.

9125—COAL SAMPLING and Analysis. N. W. Lord. (Eng. News, April 8, 1909; 1 p.)
Some notes on the benefits derived from the analysis of fuel coal. Also a description of some of the laboratory methods. 20c.

9126—COKE—Etude sur la Fabrication du Coke la récolte et le traitement des sous produits de la distillation de la houille. A. Say. (Bull. Soc. de l'Ind. Minérale, Mar., 1909; 39 pp.) Continuation of article previously indexed.

9127—COKE—Washed Coal for Coke Making. Walter J. May. (Pract. Engr., Mar. 12, 1909; 1 p.)
Discusses the utility for washed coal in the coke industry describing briefly a method of operation. 20c.

9128—COKE-OVEN CONSTRUCTION—Progress in By-Product Coke-Oven Construction at Indianapolis. C. G. Atwater. (Prog. Age, Mar. 15, 1909; 2½ pp.)
An illustrated article describing the work on the plant of Citizens' Gas Company at Indianapolis, Ind. 40c.

9129—COKE-OVENS—The Base Contained in the Tar from Otto-Hilgenstock Coke-Ovens. F. G. Trobridge. (Journ. Soc. Chem. Ind., Mar. 15, 1909; 2 pp.)
A chemical discussion of the conditions of distillation in retort coke-ovens as compared to those in gas retorts.

9130—COKING PLANT at the Midland Coal, Coke and Iron Company, Ltd., Apedale, Staffs. (Iron and Coal Tr. Rev., Mar. 19, 1909; 1¾ pp.)
A general description of the Midland Coal, Coke & Iron Co.'s Plant, at Apedale, which is equipped with ovens manufactured by Messrs. Simons-Carves of Manchester. Illustrated. 40c.

9131—COLLIERY EQUIPMENT—Bentley Colliery. (Iron and Coal Tr. Rev., Mar. 12, 1909; 1½ pp.)
A description dealing in particular with the mechanical equipment of the plant, with illustrations and plans. 40c.

9132—COLLIERY EQUIPMENT—Gas and Electric Plants at Collieries. (Iron and Coal Tr. Rev., Mar. 5, 1909; 1½ pp.)
This paper read before Nat. Assn. Coll. Mgrs. deals largely with the electric power generation and coking plants at the Powell Duffryn colliery, and a number of other important plants. 40c.

9133—CONVEYING—A New Departure in the Hauling of Coal at the Working Face. (Iron and Coal Tr. Rev., Mar. 12, 1909; 1½ pp.)
Describes conveying appliances to be placed in front of the working face and shows how they favor the rapid and economic handling of the coal. Plans. 40c.

9134—DIAMOND DRILLING—The Cost of Diamond Drilling for Coal in Pennsylvania. E. E. White. (Eng. and Min. Journ., Mar. 27, 1909; 1 p.)
Tables are given showing the cost per foot, the kind of rock and the actual rate at which the boring was accomplished. 20c.

9135—EXPLOSIONS—Remarks on Some Recent Explosions in Coal Mines. C. J. Coll. (Journ. Min. Soc. of Nova Scotia, Vol. XIII, 1908; 17 pp.)
The author gives notes on some of the recent coal mine explosions, together with remarks on explosives, open lights, electric mining machinery, coal dust, fire damp, and suggestions for the prevention of coal mine explosions.

9136—EXPLOSIONS—Report of the Glencoe Colliery Inquiry Commission. (Natal Govt. Gazette, Dec. 22, 1908; 20 pp.)
Gives the results of the investigation made by the Government commissioners of Natal with particular reference to the causes of and responsibilities for the explosions, and an outline of the precautions to be taken in similar cases. 60c.

9137—EXPLOSIONS—The Work of the Foreign Mining Explosion Stations. Geo. S. Rice. (Black Diamond, April 3, 1909; 3 pp.)
The author discusses certain experiments which have been performed to determine the action of explosives and to ascertain under what conditions coal dust is most dangerous in a mine. Illustrated. 20c.

9138—MACHINE MINING—Mining Coal with Machines in England. George R. Dixon. (Eng. and Min. Journ., Apr. 17, 1909; 3⅔ pp.)
The author discusses the use of coal mining machinery, the quantity of coal produced, and a comparison of costs with hand labor. Illustrated. 20c.

9139—MINING METHODS — Pocahontas Region Mining Methods. H. H. Stoek. (Mines and Minerals, Apr., 1909; 6½ pp.)
A short geological description of the district, together with methods recommended for developing the mines. Also gives the names of the land holding companies which are operating mines in this section of the State. Illustrated. 20c.

9140—MINING METHODS — The Best Methods of Working Seams of Coal in Steep Measures. H. A. Staples. (Coll. Guardian, Mar. 19, 1909; 1½ pp.)
A close study of the economic phase of the question. Describes and illustrates by line drawings the various methods. To be continued. 40c.

9141—MONTANA—Geology of the Great Falls Coal Field, Montana. Cassius A. Fisher. (U. S. Geol. Surv., Bull. No. 356, 1909; 85 pp.)
A report, fully illustrated with maps, geological sections and photographs describing the rock formations; indicating their character, distribution, structure and stratigraphic relations and also embodying a brief statement of mineral resources other than coal.

9142—NEW MEXICO—Report of the Mine Inspector for the Territory of New Mexico to the Secretary of the Interior for the Fiscal Year Ended June 30, 1908. J. E. Sheridan. (Washington, 1908: Government Printing Office; 48 pp.)
A detailed report with statistics on the coal mining industry of New Mexico.

9143—NEW ZEALAND—Methods of Mining Coal in New Zealand. Sidney Fry. (Eng. and Min. Journ., Apr. 10, 1909; 3 pp.)
Gives some notes on the location, and geology of the district, together with detailed description of the Westport-Stockton colliery in which the equipment is similar to that used in the United States. Illustrated. 20c.

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A historical résumé of conditions in British coal mines emphasizing the recent advance in knowledge of the causes of explosions in mines and the way miners meet death. Describes life saving apparatus.

9147—SHAFT SINKING—Collar at No. 1 Allan Shaft, Stellarton, N. S. H. E. Coll. (Journ. Min. Soc. of Nova Scotia, Vol. XIII, 1908; 6 pp.)
A description of the method of sinking a shaft through a considerable thickness of

water-bearing sand and clay before reaching bed-rock.

9148—SHAFT SINKING Operations at Wellesley New Fitting, Wemyss Collieries, G. D. Budge and P. Dunsire. (Trans. Min. Inst. of Scotland, Dec. 10, 1908; 7 pp.)

The author describes the method adopted to pierce the new shaft upward from four different levels and gives notes on the method of excavating the ground, blasting, walling, hoisting and ventilation.

9149—SHAFT—Concrete Lined Mine Shafts at Filbert, Penn. (Eng. News, Apr. 8, 1909; 1½ pp.)

A very complete description of the method of sinking and lining a shaft at the property of the Frick Coal Company. Detailed drawings are given showing the methods used.

9150—SURVEYING—Modern Practice in Surveying. T. A. O'Donahue. (Min. Engineering, April, 1909; 2 pp.)

The author gives a description of Harrison's clinograph, together with methods used for accurate measurements. To be continued. Illustrated. 20c.

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9173—FRANCE — The Three Producing Gold Mines of France. E. Walch. (Eng. and Min. Journ., Apr. 17, 1909; 2 pp.)

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9182—NOVA SCOTIA—Notes on Geological Structure at the Richardson Mine as Shown by Plans and Models of the Same. E. P. Brown. (Journ. Min. Soc. of Nova Scotia, Vol. XIII, 1908; 16 pp.)

The author gives these notes on the geology of the district so that they may be recorded and helpful to others interested in the mineral development of the province. Illustrated.

9183—ORE HANDLING—Methods of Ore Handling at the Richardson Mine, Guysborough County, Nova Scotia. H. S. Badger. (Journ. Min. Soc. of Nova Scotia, Vol. XIII, 1908; 20 pp.)

Discusses the method of ore handling from the standpoint of a mine superintendent or mine operator. Photographs are given of a plaster of paris model showing the Richardson mine and the methods of handling ore underground.

9184—ORE TREATMENT at the Giant Mine, Hartley District, Rhodesia. R. C. H. Cooke. (Min. Journ., Mar. 20, 1909; 1½ pp.)

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This publication contains geological notes on the Bonnievale and Kunanalling Districts, Coolgardie, and the Black Range district of East Murchison Goldfield, together with maps and illustrations.

9188—WESTERN AUSTRALIA — East Murchison Goldfield. Western Australia. Charles G. Gibson and A. Montgomery. (Aust. Min. Stand., Feb. 10, 1909; 2 pp.)

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A complete discussion of the conditions prevailing in these districts, with illustrations and maps.

IRON AND STEEL.

9190—AIR-FURNACE PROCESS of Pre-

paring White Cast-Iron for the Malleablizing Process. Henry M. Howe and Enrique Touceda. (Paper before A. I. M. E., Oct., 1908; 10 pp.)

A paper giving the composition of the iron and slag at different stages in the "air-furnace" process of preparing hard metal for conversion into malleable cast iron by annealing. Tables.

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The author describes the methods used for standardizing solutions and also gives notes on the comparison of standards. He discusses Marguerite's and Penny's methods for determining iron in ore; also the Lake Superior method. Illustrated. 20c.

9192—BASIC BESSEMER PROCESS, The. (Iron Age, Mar. 18, 1909; 3 pp.)

An exhaustive chemical investigation by German engineers. Notes on the metallographic examination of pig iron, and the composition of converter gases. Also some notes on the heat economy of the bessemer process. Illustrated. 20c.

9193—BASIC STEEL PLANT — La Nouvelle Aciérie Thomas des Usines métallurgiques de Burbach (Prusse rhénane.) (Génie Civil, Jan. 2, 1909; 6 pp.)

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9198—CALIFORNIA—An Iron Deposit in the California Desert Region. Charles C. Jones. (Eng. and Min. Journ., Apr. 17, 1909; 3½ pp.)

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Describes the nature and occurrence of iron ores in Lapland, with notes on the methods of mining, transporting and treating them, and statistical data. To be continued.

9210—MALLEABLE CASTINGS—Production of Malleable Castings—XIII. Richard Moldenke. (Foundry, April, 1909; 2 pp.)

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This paper describes a long series of determinations of permeabilities of standard compressed steel, bessemer steel, and Norway iron over a wide range of excitation, in order to determine the magnetic behavior. Illustrated. 60c.

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Describes in particular the advantageous use of vanadium in die steels, hand saws and cast pinions. Illustrated. 20c.

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9221—CONNECTICUT—The Sources of Agricultural Lime for Connecticut. E. H. Jenkins and E. M. East. (Conn. Agr. Exper. Sta., Bull. 163, Feb., 1909; 18 pp.)

Treats of its sources, composition and prices, with notes on its action in the soil.

NICKEL AND COBALT.

9222 — ANALYTICAL METHOD — Nuevo Procedimiento para el Dosaje del Niquel en Presencia del Cobalto. Juan A. Sánchez. (Anales de la Sociedad Cientifica Argentina, Oct., 1908; 9 pp.)

Describes a method for separating and determining cobalt and nickel in common solution by means of potassium cyanide.

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A few notes on the cost of mining, smelt-

ing, and the names of a few of the principal mines operating in Bolivia. 40c.

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Discusses some of the attempts to extract zinc from its ores electrolytically instead of by furnace treatment. 40c.

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A discussion dealing with the mechanical and metallurgical phases of the electric smelting of zinc ores. Goes carefully into details and gives complete data of experiments performed. Illustrated. 60c.

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9236—ARKANSAS—Mineral Resources of Arkansas. A. W. Estes. (Proc. Am. Min. Congress, Dec., 1908; 5 pp.)

The author discusses in a general way zinc, lead, coal, bauxite, marble and diamond deposits of the State with reference to their commercial value.

9237—CALIFORNIA — Stratigraphy and Palaeontology of the San Pablo Formation in Middle California. Charles E. Weaver. (Univ. Cal. Pub., Vol. V, No. 16, Jan., 1909; 26 pp.)

A discussion setting forth the relation of the San Pablo formation to the other California tertiary horizons.

9238—DEFINITION OF ORE—What is an Ore? James F. Kemp. (Min. and Sci. Press, Mar. 20, 1909; 4½ pp.)

The recapitulation of the definitions found in various authorities with Prof. Kemp's own idea upon the subject. 20c.

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The author describes in a few words the faulting as observed in a number of principal mining districts of the world. Illustrated. 20c.

9240—MEXICO—Geology of the Guanajuato District, Mexico. C. W. Botsford. (Eng. and Min. Journ., Apr. 3, 1909; 3 pp.)

A discussion of the various geological formations, the ore deposits and the various faulting systems. Illustrated. 20c.

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The authors give descriptions of anglesite, barite, calcite, epsomite, linarite, olivenite and a number of other minerals from various districts. Illustrated.

9242—ORE DEPOSITS—Modern Ancient Volcanoes and Ore Deposits. Arthur Lakes. (Min. Wld., Mar. 27, 1909; 2 pp.)

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" " chem. pure " .40

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" No. 2 " 15.00
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" ordinary " 2.50
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Domestic f.o.b. shipping port:
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Foreign crude ex. dock " 8.00@10.00

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Powdered " .80@.85

GRAPHITE—Ceylon.
Flying dust, finest to best lb. .02½@.04
Dust " .02½@.05
Chip " .04@.08
Lump " .05½@.12
Largel ump " .08½@.10½

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German lb. .02½@.02¾

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Nitrate, com'l " .07½@.08½

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Sulphate (Epsom salt) 100 lb. foreign " .90@1.00

MANGANESE—
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70@75% binoxide lb. .01@.01½
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85@90% binoxide " .01½@.05
90@95% binoxide " .06½
Ore, 80%-85% sh. ton. 16.00@32.50

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Selected " 25.00
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Guar. 97%, with 5% Thorium oxide, nominal lb. .08 and up

NICKEL—
Oxide, crude, lb. (77%) for fine metal contained .47
Sulphate, single lb. .09@.11
Sulphate, double " .06½@.08

NITRATE OF SODA—100 lb. 95% for '08 2.15
95% for 1909 2.15
95% for 1910 2.15
96% is 2½@7½c. higher per 100 lb.

OZOKERITE—best lb. .14@.17

PAINTS AND COLORS—
Litharge, Am. powdered lb. .05¾@.06½
English glassmakers' " .08½@.08¾
Lithopone " .03¾@.07
Metallic, brown sh. ton. 16.50@22.00
Red " 14.00@18.00
Ocher, Am. common " 8.50@9.00
Best " 16 00
Dutch, washed lb. .02¾@.03
French, washed " .01½@.02
Paris green, pure, bulk " .21½
Red lead, American " .06@.06½
Foreign " .08½@.08¾
Turpentine, spirits bbl., per gal. .40½@.41
White lead, Am., dry lb. .05½@.05¾
American, in oil " .06½@.07
Foreign, in oil " .10½@.10¾
Zinc white, Am. extra dry " .05½@.05¾
French, red seal, dry " .06¾@.07
French, Green seal, dry " .07½@.07½

PHOSPHATES—Acid .57@60c. per unit
*Fla., hard rock 8.50@9.00
land pebble 68% 3.75@4.00
†Tenn., 78@80% 5.00@5.50
75% 4.75@5.00
68@72% 4.25@4.50
‡So. Car. dried rock 7.00@7.25
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*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

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Bicarbonate crystal lb. $.08½@.09
Powdered or granulated " .08½@.08¾
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Scotch " .10¾
Bromide " .20
Carbonate (80@85%) " .03¾@.04
Caustic, ordinary " .05¾@.06½
Elect. (90%) " .05½@.06
Chloride (muriate), 100 lb. 1.90
Chlorate, powdered " .09½@.09¾
Crystals " .09@.09½
Cyanide (98@99%)
Carloads (30,000 lb.) " 18c.
5-ton lots 18½c.
Less than 5 tons 20@ 22½
Kainite, long ton, bulk, 8.50; bags, 9.50.
Permanganate lb. .09½@.10½
Prussiate, yellow " .13@.13½
Red " .30@ 33
Sulphate (basis 90%) 100 lb. 2.18@2.21

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Domestic, non-arsenical, furnace size, f.o.b. mines per unit. 11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines 10@10½c.
Imported, non-arsenical, furnace size, per unit .12@.12½
Imported, arsenical, furnace size, per unit .11½@.12
Imported fines, arsenical, per unit. .09
Imported fines, non-arsenical, per unit 10½@11c.
Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl. .72@1.13
N. Y. agricultural sh. ton. 3.80@4.50

SALTPETER—Crude 100 lb. 4.00@4.50
Refined, crystals " 5.50@6.00

SILICA—
Ground quartz, ord'ry lg. ton. 10.00@15.00
Silex, ground " 13.00@15.00
Silex, floated " 35.00@40.00
Lump quartz " 5.00@5.50
Glass sand " 2.75

SILVER—Nitrate, crystals oz. .33½@.36¾

SODIUM—
Acetate lb. .04½@.05
"Alkali," per 100 lb., 58/48 .80@.87½
Bicarb. soda, per 100 lb 1.00@1.30c.
Soda, caustic, per 100 lb., 78/60 1.90@2.00
Soda, caustic, powdered .02¾@.03½
Salt cake, per 100 lb., bulk .45 up
Salt cake, bbl .65@.85
Soda, monohydrate, per lb. 1.40@1.75
Bicromate lb. .06½@.06¾
Bromide " .20
Chlorate, com'l " .08½@.09½
Cyanide ("100% KCN")
Carloads (30,000 lb.) " 18c.
5-ton lots " 18½c.
Less than 5 tons " 19c.
Hyposulphite, Am. " 1.30@1.50
German " 1.60@1.70
Phosphate 100 lb. 2.20@2.50
Prussiate " .08½@.09
Sal soda, f.o.b. N. Y. " .65@.75
Foreign, f.o.b. N. Y. " .80@1.00
Silicate, com'l " .65@1.50
Sulphate, com'l (Glauber's salt) 100 lb. .65@.80
Sulphate, com'l, calcined .65@.85

STRONTIUM—Nitrate lb. .07½@.08

SULPHUR—
Louisiana (prime) to New York, lg. ton. 22.00 up
To Boston, Philadelphia or Baltimore " 22.50 up
Roll 100 lb. 1.85@2.15
Flour " 2.00@2.40
Flowers, sublimed " 2.20@2.60

TERRA ALBA—French & Eng. 100 lb. .80@1.00

TALC—Domestic sh. ton. 15.00@20.00
French " 15.00@25.00
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TIN—Bi-chloride, 50% lb. .09½
Crystals " .21@.24½
Oxide, lb. " .32½@.35

URANIUM—Oxide " 3.50

ZINC—
Chloride solution, com'l 20° " .02¾
Chloride, granular " .05@.06
Dust " .05@.05½
Sulphate " .02¾@.03

NOTE—These questions are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

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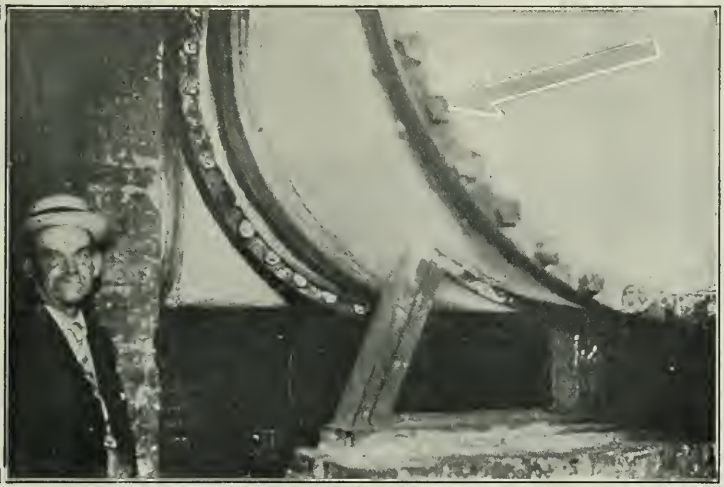

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					ca.	
German Empire	89	239	580	426	400	1734
Austria	9	13	81	91	80	274
France	8	6	57	10	10	91
Russia	5	19	80	22	20	146
Holland, Belgium	1	3	16	9	5	34
England	...	...	9	24	50	83
Spain, Switzerland, Scandinavia	...	1	2	11	5	19
Mexico	...	...	1	19	15	35
Japan	...	...	...	5	5	10
Canada	...	...	...	20	?	20
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Since July, 1908. Anaconda and St. Lawrence Mine Fires.
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The Engineering and Mining Journal

VOL. LXXXVII. NEW YORK, MAY 8, 1909. NO. 19.

New Type of Washer for Low-grade Gold Ores

A Machine Which Has Been Found to Be Superior to Other Types for Treating the Saprolitic Ores of the South Atlantic States

BY JOSEPH HYDE PRATT*

One of the more important changes to be noted in gold-mining practice in North Carolina is the introduction of a pulverizing and concentrating machine of the log-washer type, known as the Modern pulverizer and concentrator, for treating certain of the saprolitic ores that are found quite abundantly throughout many portions of this State. The old log washer consisted of a trough that was slightly inclined when in use and fitted with a couple of revolving steel or wood logs, to which were fixed spiral arms. These advanced the material to be washed from the lower end against the water which came in at the upper end. The logs were 20 to 30 ft. long and were more generally used to wash ores containing considerable clay.

The old principle of the log washer is unpatentable, but this new machine possesses many mechanical improvements that adapt it to the work that it is called upon to do. The saprolitic ores of these South Atlantic States contain a great deal of clay and it has been found impossible to save the gold by ordinary sluicing and amalgamation.

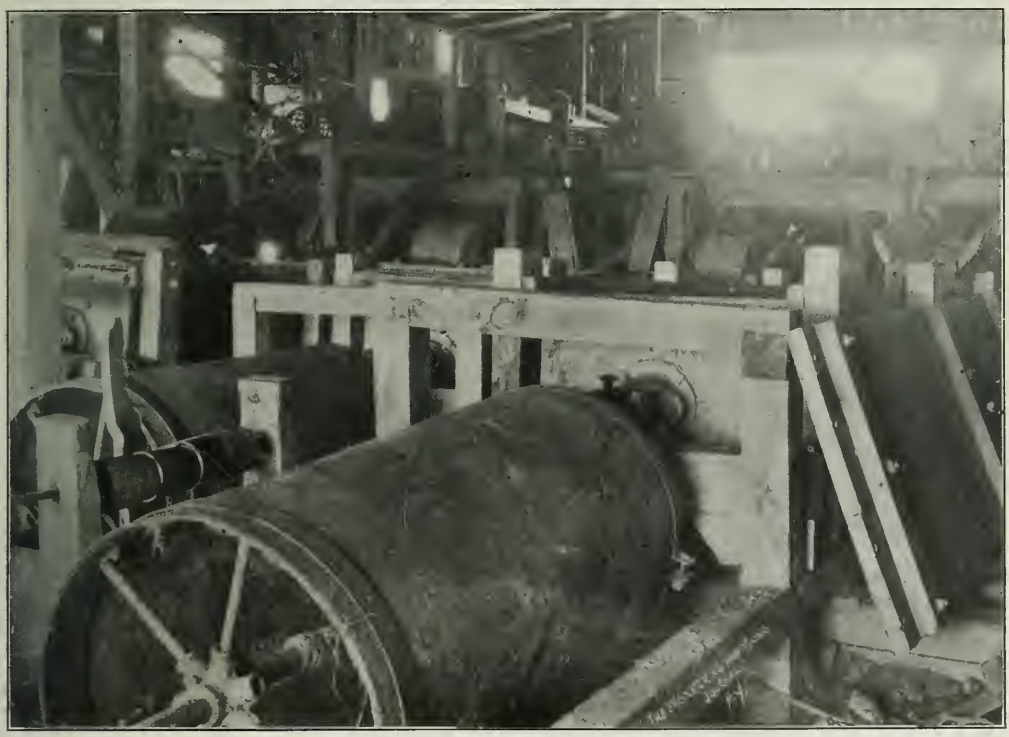

FIG. 1. GENERAL VIEW OF THREE SETS OF UNITS IN POSITION

The New Machine

Each separate unit of this new machine, Fig. 2, consists of two improved log washers running at high enough speed to readily disintegrate the soft material and so mix the clay into a fine pulp with water that the gold can readily settle to the bottom. Each machine is essentially a long trough of boiler plate (two thicknesses ¼ and ⅛ in. each) containing a revolving cylinder fitted with heavy cast-iron arms set spirally so that the ore, while being hammered fine, is gradually worked to the discharge end, which is raised 6 in. higher than the feed end, Fig. 4. At the end of the washer, the larger, hard and nearly barren quartz stones are removed by a revolving screen and belt conveyer, this being done to save wear and power in the second washer, where the

*State Geologist of North Carolina, Chapel Hill, N. C.

gravel is still farther reduced in size and more gold settles out.

From the trommel of the first machine, the coarse material is carried by either a traveling belt or an open-sluice box to the riffled-sluice box outside the building. The boxes are about 12 in. wide and nearly 200 ft. in length. The material, after passing through the second washer, is again screened, and the screenings run into the same line of sluice boxes as the first screenings, Figs. 3 and 5. The riffles of these sluices are made by boring inclined holes in a board that just fits the sluice box. Mercury is then placed in these holes. The pulp from this second screen, free from stones, passes through special riffled sluices about 4 ft. wide and 8 to 16 ft. in length, which contain mercury to amalgamate and save any free gold that does not settle in the machine. From these broad riffle sluices it passes to the narrow ones, 200 ft. long, through which the coarser material has passed.

The steel troughs are about 2 ft. wide by 2½ ft. deep, the first being 18 ft. long and the second 12 ft., with a semi-circular bottom and a flat wood top. The revolving cylinder is made of an 8-in. steel pipe over a wood core carried upon a heavy steel shaft, passing through stuffing boxes at the ends of the trough.

Wrought-iron bars reach through this cylinder crosswise and project on one side about 1 to 1½ in. to receive a nut that fits the thread turned on this end of the bar. The other end of the bar projects 3 in. beyond the cylinder as a rectangular-shaped plate and to this 5½x2½x2-in. cast-iron arms or paddles are bolted. The greatest wear and tear of these machines is on the paddles, the life of which is four to six weeks. There are 48 of these paddles to the longer trough. There is about 4 in. clearance between these arms or paddles and the bottom of the troughs, which allows the formation of a bed of stones or pebbles; this reduces the wear on the bottom of the trough and also assists in saving the gold. This bed of stones is, of course, more or less shaken up by blows from the large fragments of quartz and by the revolving paddles, thus permitting the gold to settle through these to the bottom of the trough similarly as in panning. The constant striking of the paddles against the surface of the water will also weight and sink some of the fine and flake gold that has a strong tendency to float off. As the discharge end of the machine is 6 in. higher than the feed end, the gold after it is once down among the pebbles of the bed, is not apt to be pushed out of the machine. Fig. 1 is a general view of three sets of units in position.

Riffles of the sluices are made by boring inclined auger holes in the planks laid lengthwise in the sluice boxes. Since all the coarse gravel has been screened out, there is little wear upon the riffles and the fall and quantity of water used are less than in the sluices of regular hydraulic mining. In cleaning up, the planks are lifted up and turned over and the gravel and mercury washed to the end of the sluice where quicksilver and amalgam are washed out in hand pans. When through cleaning up, the planks are simply replaced and the riffles filled with mercury and the machine started again.

In cleaning the washers, which is usually done twice a week, the machines are stopped and all the gravel within washed out with a hose through an opening in the bottom. This gravel is then panned by hand and the gold amalgamated. Any nuggets that occur in the rock are pounded free from quartz and are then also amalgamated. The amalgam from all sources is strained out of the quicksilver and then retorted and the bullion sold.

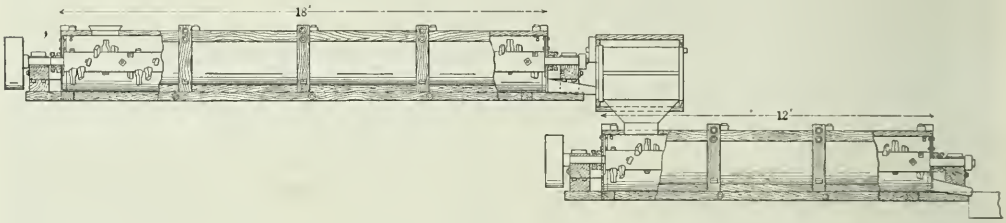

FIG. 2. MODERN PULVERIZER AND CONCENTRATOR

Adjustment of the Washer

It is recommended by the makers that the first washer be driven at 150 to 250 r.p.m., and the second one at 250 to 350, and that for a capacity of 10 tons per hour, each machine be given 72 gal. of water per minute. This will then at times require 25 h.p. for a complete unit of two washers and trommels. These factors will vary greatly with the character of the ore. Since the power, and therefore, the wear, will increase even more rapidly than the square of the speed, this should be kept low. In the absence of any coarse stones, there is also danger that the pulp may be too greatly agitated to allow the settling of the gold. On the other hand, the speed and work must be sufficient to grind up the ore. If there is too much, there is a danger of the gold being washed out. While a large capacity is of advantage and desirable, still it will mean danger of insufficient grinding, too thick pulping, or too strong a flow of water. A great deal of skill and patience is, therefore, required in adjusting these machines, but when once adjusted, they will work satisfactorily. It is to be recommended that a first unit be installed and run for several months at various speeds, capacities and amounts of water, giving the machine sufficient time after each change of conditions to adjust itself. Also careful tests of the ore and tailings should be made between times. The capacity and speed should first be adjusted until the best result is given in reducing the amount of gold left in the tailings so combined that it will not pan. The pulp should, of course, be kept at a reasonable consistency throughout the changes and the amounts of water finally adjusted so that the tailings will show a minimum of free gold in the pan.

Installation at the Shuford Mine

These machines are made in Knoxville, Tenn. One of the first plants, one of four double units, was installed at the Shuford mine, Catawba county, North Carolina. The fines obtained by washing the ore over a grizzly are carried by means of jets of water down a trough about 35 ft. long, thus becoming pretty uniformly mixed before being divided among the four washers. The trough is divided at a point about 35 ft. from the grizzly and then each of these is subdivided into two troughs, each about 25 ft. from the first division. At each division point the mixture of ore and water strikes against sharp edges that divide the material nearly equally, sending one-half of the material into each trough. Each of these four troughs feed to a unit machine through the wooden top of the trough. At this mine the machines are run at only 150 r.p.m. They were tried at a lower speed, but there was trouble with the gold sticking to clay balls. The machines use about 150 gal. of water per minute and the whole plant is run by a 35 h.p. engine which, when the three units are running, is probably overloaded. The tailings, when tested, usually pan nothing

at all, but assay a few cents, due to gold included in the sand. While this loss could be reduced by speeding up the second washer to grind the sand finer and trusting to the riffles to save what little additional free gold would not then settle in the machine, it is doubtful whether with the present small plant and so vast a quantity of ore controlled by the company such refinements are advisable, since they would probably reduce the capacity of the plant. It is estimated that the present cost of treatment is 22c. per cu.yd. loose measure with a recovery of between 50 and 75c. per cu.yd. A great deal of the success of the Catawba Gold Mining Company is due to its conservative policy, and the skill with which the whole mining and milling operation has been conducted.

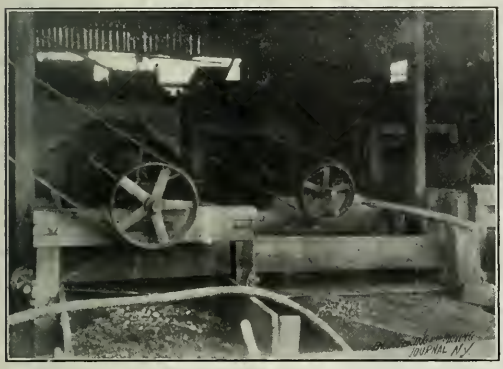

FIG. 3. SCREENS USED AFTER MATERIAL HAS PASSED THROUGH SECOND WASHER

FIG. 4. TROUGH OF BOILER PLATE CONTAINING REVOLVING CYLINDER

FIG. 5. SLUICE BOX AND TRAVELING BELT

FIG. 6. SELF-LOADING SCRAPE

Property of the Catawba Company

The property owned and operated by the Catawba Gold company will bear a short description. The mine is situated in Catawba county, N. C., 4½ miles slightly south of east of Catawba, a station on the Southern railway. The mining tract comprises about 425 acres, of which 20 acres contain the workable mineral deposits. This latter area is covered with auriferous quartz and the soil is also auriferous. The underlying schists and gneisses were found to be penetrated by seams of auriferous quartz which ran in every direction. There were, however, no veins, strictly speaking, although some of the quartz seams were several inches in thickness, and were persistent for a considerable distance in length and depth. The entire surface for a width of 300 ft. or more, and for a distance of 1000 to 2000 ft. is ore, assaying 50c. to $1 per cu.yd. When the property was first opened, an attempt was made to mine by sinking shafts, running drifts and then stoping, but was practically a failure from the start. A shaft was sunk to a depth of 115 ft., and several levels started from this and some stoping carried on. Although many of the narrow quartz seams contain gold in some quantity, it was too expensive to mine it on account of the amount of waste material that had to be removed. About 1904, after the property had been closed for many years, it was bought on account of the depth to which the saprolites extended and their area; and also because it was desired to test with them the practicability of the new type of log washer. The process proved successful and the mine is now being profitably operated. Instead of attempting to mine the ore by stoping and trying to eliminate the low-grade material, a method of open-pit work, Fig. 7, was introduced, and all the material taken out was treated in the separators. The pit is now 90 ft. deep and 200 to 300 ft. across the top.

When mining was first started, the ore was drawn out of the pit by means of a self-dumping skip running on a wooden track, and discharged on a grizzly at the top of a pit. While this method handled the ore very cheaply, more economy was desired, and finally an ingenious method was devised consisting of self-loading scrapes, Fig. 6, holding from three-fourths to nearly two tons of ore. There are two of these scrapes on an endless wire rope, the loaded scrape pulling the empty one back down into the pit, Fig. 7. The ore is broken down from the sides of the pit by blasting with powder, the holes being 20 ft. deep, and al-

lowed to fall in piles at the bottom. The scrapes, as they are pulled back into the pit, are hauled over this and then, when started toward the surface, their own weight causes the edge of the scrape to be pulled down into the ore and they are readily filled by the pull of the cable. A loaded scrape can be dumped in the hopper about every 75 seconds. The scrapes are 5 ft. wide, 5½ to 6 ft. long, and 18 in. high at rear, tapering somewhat toward the front end. The bottom of the scrape extends only for a distance of about 18 in., the ore between the remainder of the side pieces of the scrape resting on the ground. The scrapes run in a trough or trench in the dirt, the steeper portions of which are protected by scantling. As the scrape comes to the top it runs over a hopper and most of the ore immediately drops out. A special blade and handle permits of emptying in a few seconds. The hopper is in the shape of a circular trough made of boiler plate, into which flows two streams of water of sufficient volume and strength to wash the ore through a grizzly and then to the concentrating machines.

FIG. 7. OPEN-PIT WORK

According to the *Journal* Soc. Chem. Ind., March 31, 1909, it has been shown that small quantities of bismuth exert little or no influence on the chemical relation of copper and nitric acid.

According to *Engineering* a contract has been made with Messrs. Sir John Jackson, Ltd., for building 300 miles of railroad across the Andes from Arica, Chile, to La Paz, Bolivia.

German Diatomaceous Earth

Infusorial or diatomaceous earth finds many practical applications, notably in the manufacture of dynamite, polishing soaps, soluble glass, gutta-percha articles, and many other things. Germany has long been the principal producer of this earth and affords the best qualities. The principal deposits are in Hanover, where the *Kieselguhr* occurs in beds among other alluvial deposits or in proximity with lignite seams. It generally forms a granular mass of gray, brownish or pale green color; it has a dry feeling, absorbs water with avidity, is friable, and at ordinary temperatures resists chemical decomposition. It occurs in great quantities near Hützel, in the Lüneberger Helde, and at Unterlness, in the same part of Hanover. It is also found at Vogelsberg, in Hesse, at Jastrobe, in Hungary, at Franzenbad, in Bohemia, and in Tuscany.

The valuable characteristics of the earth are its light weight, its absorptive power, and its non-conductivity of heat, which makes it one of the best insulating materials. It is mined in much the same way as brick clay, in open pits. It is then spread on planks or on the bare ground, in the sunshine, to dry. Artificial methods of drying do not seem to prevail. The earth should never be allowed to come in contact with flame, as it will calcine rapidly. There is no special necessity for drying *Kieselguhr* beyond that point accomplished by the sun, and, although numerous artificial means have been tried, they have not come into general use. Dry-air ovens may be advantageous in wet seasons, but are not economical except with the very finest grades of earth, such as are used for dynamite.

As the earth comes from the ground, it contains 70 to 90 per cent. of water; after drying in the sun, it still retains 15 to 25 per cent. of moisture. During shipment, it must be carefully protected from moisture.

According to *Engineering-Contracting*, April 7, 1909, the record for daily excavation in the central division of the Isthmian Canal was broken on Feb. 27, 1909. On that day 59 shovels excavated 77,064 cu.yd., an average of 1306 cu.yd. per shovel for the eight-hour day. The material excavated was loaded in 2177 Lidgerwood flats, 352 large western dump cars, and 2754 small western and Oliver dump cars, a total of 5283 carloads.

According to the *South African Min. Journ.*, March 13, 1909, the Consolidated Goldfields group yielded the following profits during February: Simmer and Jack, £57,568; Robinson Deep, £42,746; Knights Deep, £24,101; Simmer East, £7470; Simmer Deep, £10,546; Jupiter, £5413; Luipaardsvlei, £5182 and the Nigel Deep, £738, making a total of £153,704.

Concentrating Difficult Lead Ores at Broken Hill

Auxiliary Concentrating Department Used at Block 10 Mill When Price of Lead Is High. Gangue Rocks Contain Unusual Amount of Rhodonite

BY GERARD W. WILLIAMS*

The ore at the Broken Hill Block 10 Mine, Ltd., New South Wales, is similar in nature to that treated at the adjoining mine of the Broken Hill Proprietary Company. In the matter of rhodonite the gangue is intermediate between the quartz-calcite of the South and North mines, and the markedly rhodonite-bearing ores of the Junction North and British mines. The mill, which is of recent construction, embodies certain departures from the normal type. In particular the final concentration of the sands and slimes is so arranged that any set of tables may be cut out and the sands run direct to the dump as soon as it is shown that the price of lead will not permit of profitable closer concentration. As every unit and subunit is driven from separate motors, and as strict and careful assays are kept of the work done on any set of tables it may be easily determined when it no longer pays to further concentrate any particular class of tailings.

The Mill

The mill comprises four units each independent of the other and driven by separate motors, as well as an auxiliary series of slimes retreatment vanners and a vanner extension series of concentrators. The two latter can be cut out of circuit when the concentrates obtained no longer show a profit on working costs. It follows, then, that with lead at a high price the percentage recovery of lead will be higher than when the metal stands low on the market and it no longer pays to reconcentrate the slimes and tailings.

The ore from the mine, after passing the weigh bridge, is tipped from the trucks over a 1½-in. grizzly. The oversize is distributed between two Austin gyratory crushers which break down to 1½-in. cubes. The crushed ore is conveyed by aërial tram to the mill bins. The mill is situated about half a mile away from the shaft. The serious creep on this and the adjoining mines a few years ago destroyed the old mill and rendered the ground in the vicinity of the shafts unsafe for further building purposes. As before stated, the mill consists of four sections together with two auxiliary sections common to the four units. For the present only one unit will be described.

The ore from the bins is fed on a shaking screen by means of roll feeders. This screen has 3-mm. punched holes. The oversize is fed to a pair of Cornish rolls. The rolls are 30x15 in., and run at 14 r.p.m. These rolls have a maximum capacity of 1000 tons per week. The crushed ore from the rolls is divided over two trommels, each 6 ft. long and lined with punched steel (⅛-in. diameter holes). The trommels are fitted with longitudinal strips of 1½-in. angle iron, riveted at 2-ft. intervals in the trommels. These strips of iron have added considerably to the efficiency of the trommels. It seems that the strips prevent the ore from sliding round inside and by frequently lifting up the ore and allowing it to fall back on the screen a high screening efficiency is obtained.

Tandem Rolls Abandoned

The oversize from the trommels is returned by a raff wheel to the rolls. The experiment of running two pair of rolls in tandem was tried, the second pair taking the oversize from the first pair. The management states that the power costs were increased by 60 per cent. as against the present method, while slimes were only reduced by 5 per cent. As each unit at this mill is driven from separate motors, power costs are readily and accurately determined.

The undersize from the trommels (i.e., product passing an ⅛-in. diameter hole) passes over a small conical spitzlutte. The underflow runs to a double-compartment coarse jig. From the first two compartments concentrates are obtained, from the third and fourth compartments the middlings are elevated to a No. 4 Krupp ball mill. These mills grind from 4 to 5 tons per hour to pass a 3/64-in. hole. The pulp from the ball mill goes to a spitzlutte, and the underflow is fed to a double-compartment fine jig. The slime overflow from the spitzlutte at the head of the coarse jig passes through a small spitzkasten and the underflow is run over a Wilfley table. The tailings and slimes from this table, together with the overflow from the spitzkasten and the overflow from the fine jig spitzlutte gravitates to the slimes thickener. This thickener takes slimes from all the units and for the time being may be left out of consideration.

The tails from the coarse jigs are sent to draining bins and then to the dump. To return to the fine jigs: Concentrates are obtained from the first two compartments, the middlings from the third and fourth compartments are returned by elevator to the Krupp mill already referred to, and the tails go to the boot of another elevator which delivers them to two 5-ft. Forwood-Down grinding pans. The product from the pans is concentrated on two Card tables. The concentrates go to the shipping bins, the tails to drainage bins and then to the dump, and the middlings run to a spitzkasten. This spitz, which for purposes of reference will be called spitz "A," delivers the underflow to two single-belt slimes vanners. The tails from these vanners go to the dump, the middlings to the "vanner extension" house and the concentrates to the shipment bins.

Slime Treatment

It is now necessary to return to the slimes which went to the thickeners. From now on the plant will be considered as a whole, as the four units lose their individuality at this point. The slimes and fine sands in the thickener, which takes the overflow product from all spitzkasten and spitzlutten in the four units, is pumped to a distributing box. From this box the thickened slimes are fed to four spitzkasten. The slime water which overflows runs to a sump which also receives the overflow from the main settling box. This sump receives all drainage water and after passing over "V" settlers the water is returned to the rolls.

The underflow from the four spitzkasten is distributed over 10 Card tables. The concentrates go to the bins, the tails to the drainage bins and the middlings from six tables are fed to the spitzkasten referred to previously as spitz "A." The middlings from the other four tables pass over a Card table and then pass on to the "vanner-extension" plant. The slimes from the "V" settlers, wherein the bulk of the slimes contained in the main sump return water are collected together with all drainage from the bins, trucking floors and all other places, are collected in a central sump and pumped to the "retreatment tables. The latter comprise four Wilfleys and five vanners.

The middlings from the "retreatment tables" pass to the "vanner-extension" plant. The latter comprises a series of "V" settlers, four spitzkasten, nine single-belt vanners and one Card table. As previously indicated, a strict check is kept on the assay value of all concentrates obtained from these two auxiliary plants, and they can be cut out as soon as the price of lead falls to the point when it no longer pays to retreat the middlings from the primary Card tables and slimes vanners.

Sampling and Auxiliary Concentration

The Block 10 is the only mine where the system of auxiliary concentrators is in vogue and in view of the extreme market

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fluctuations of lead and silver the system has many advantages. The manager of this mine posts the assays for each set of concentrators in the mill. The assays are made for every shift and in consequence the mill officers and men know at once which shift is doing the best work. The result is that a certain spirit of rivalry is created, which naturally tends to better work all around.

Too often, but little attention is paid to accurate sampling and, as a result, the actual work done on any particular set of tables is unknown. But where a careful record of the work of each shift in every department is kept the mill officers can at once place their hands on the weak spot. Detailed assaying of this character naturally involves extra expense, but if one may judge from this mill, the results more than justify the expenditure.

The labor-distribution sheet for the mill, per shift of eight hours, is as follows: Shift bosses, 1 man; tipping floor to bins, 1; rolls, 2 (boys); raff wheels, 2; jigmen, 4; grinding pans and ball mills, 1; 18 Card tables, 2; central slimes race, 1; 20 tables and vanners, 2; spitzkasten attendant, 1; elevator floor, 1; trucker boss, 1; trucking concentrates, 1; trucking tailings, 10; slimes pump, 1; slimes retreatment, 3; horse driver (to dump), 1; vanner extension, 1 (and 2 boys); sampler, 1; total, 35 men and four boys per shift, or 105 men and 12 boys per day.

The boys receive about $1 per shift, the bulk of the men, $1.83 per shift; and those engaged on the pans, jigs and groups of concentrators from $2 to $2.50. Shift bosses are paid $2.95

Milling and General Costs

The cost of dressing the ore, during the half-year ending March 31, 1908, was $1.495 per ton of 2240 lb. The recovery of lead was 72.1 per cent. and of silver 40.6 per cent., the crude ore averaging 15.1 per cent. lead, 13.7 oz. silver and 18.7 per cent. zinc. Other data concerning the mill products will be found in the accompanying table. During the period mentioned, 67,054 long tons of ore were mined and milled, the general costs being as follows:

PRODUCTS FROM BLOCK 10 MILL.

Product.	Percentage by Weight.	Silver, Oz. Per Ton.	Lead, Per Cent.	Zinc, Per Cent.
Concentrates*..	17 5	32 4	61.2	9 4
Jig tails....	28 9	6 7	3 7	15 4
Vanner tails....	10 7	11 0	6 2	24 2
Jig middlings..	2 0	10 5	6.6	23 6
Willfey tails..	1 6	9 1	5 1	18 8
Willfey extension tails.....	2 5	9 4	5 0	22 6
Reground tails.	22 3	8 1	3 6	23 3
Slimes....	14 5	11 6	10 2	24 2
Crude ore†..		13 7	15 1	18 7

*Recovery of lead, 72.1 per cent.; silver, 40.6 per cent.
†Tonnage treated, 67,054 tons (2240 lb.).

GENERAL COSTS AT BLOCK 10 MINE.

		Per Long Ton.
Ore raising..		$2.720
Transport of ore		0 067
Ore dressing:		
Breakers	$0 103	
Milling	1 252	
Slimes retreatment.	0 140	
		1 495
Total .		$4 282

Difficult Ore at the Junction North

Ore dressing at the mill of the Broken Hill Junction North Silver Mining Company is of more than usual interest, as the crude ore averages 40 per cent. rhodonite, which increases the difficulty of fine grinding and concentration. The specific gravity of the concentrates, which contain 10 per cent. of blende and 18 per cent. of rhodonite and garnet, varies from 5.9 to 6.2, while the specific gravity of the tailings ranges between 4.5 and 4.8. The working ratio in water, therefore, varies from 5.2 to 3.5 under the best conditions, and under the worst conditions from 4.9 to 3.8.

In order to obtain anything like satisfactory results from the concentrating tables they have to be run at high speed and with a long throw. The Wilfleys run 260 strokes per minute with a 1⅛-in. throw. Needless to say the tables suffer. T. H. Palmer, manager of the Junction North company, has designed a rubber vanner belt table for sand concentration. The rubber is claimed to exercise a sort of selective action on the metallic concentrates and in consequence it is possible to run the belts at a lower speed than the ordinary concentrating tables. These vanners, which have proved extremely economical in practice, will ultimately replace all the Wilfleys tables in the mill.

Sequence of Mill Operations

The ore milled averages 14.8 per cent. lead, 10.5 oz. silver and 8.7 per cent. zinc. Following is a brief account of the sequence of metallurgical operations. The ore is raised in trucks and after passing the weigh bridge, is dumped over 3-in. grizzlies. The oversize from the grizzlies passes through a No. 5 D Gates breaker. The undersize from the grizzlies and the product from the breaker pass over a shaking screen having 2-in. holes. The oversize is sent to another breaker, which reduces it to 1½ in. The final product is elevated on an 18-in. Robins belt conveyer to the mill bins. The belt is 400 ft. long, rises at an angle of 17.5 deg. and travels at 160 ft. per min. The conveyer has a capacity of 5000 tons per week. The mine output, however, averages only 1400 tons per week.

From the mill bins the ore is fed by means of roll feeders to four 3-deck shaking screens. The top grating is punched steel with ½-in. holes, the intermediate screen has 3 mm. holes and the third or bottom screen has 0.75-mm. holes. The screens are actuated by "out of balance" flywheels and double buffers. They are said to do excellent work at low cost, but the vibration is very heavy. On concrete foundations this type of screen might be successful, but otherwise the vibration imposes a severe strain on the woodwork of the mill.

The oversize from the upper and intermediate screens is fed to two pairs of Cornish rolls, a choke feed being maintained. The rolls are 33 in. in diameter by 18 in. on the face. The tires of the flanged rolls are Krupp armour plate, but Cammel-Laird toughened steel is used for the plain rolls. The tires have a life of 15,500 tons and each pair of rolls has a maximum capacity of 1500 tons per week. Running at 23 r.p.m., the rolls require about 40 h.p. each. The product from the rolls is again elevated to the shaking screen and the product which passes the 3-mm. screen and is retained on the 0.75-mm. screen is sent to two May jigs.

Minerals Finely Disseminated

The concentrates, which are obtained from the first two hutches of the jigs represent only 25 per cent. of the total lead recovered. The galena is in fine grains and in consequence the ore must be finely crushed before the bulk of the contained mineral is liberated. The middlings from the two jigs go to four 4½-ft. grinding pans and two No. 4 Krupp mills. The jig tails are sent to the mine for stope filling.

The product from the grinding pans and ball mills shows on sizing that 13 per cent. remains on 0.5-mm. mesh, 56 per cent. on 0.25-mm. mesh and 11 per cent. on 0.15-mm. mesh. This product is elevated and distributed, without classification, to nine Wilfleys and five sand vanners. The product that passes the 0.75-mm. mesh in the three-deck shakers is distributed to four Krupp vanners. The tailings go to the dump, together with the tailings from the other sand tables; the middlings to the grinding pans and the slimes to the settlers that receive the slimes from all the other tables. After thickening the slimes are passed over six slime vanners.

The mill is still in a transitional stage and costs and recoveries have recently been slightly improved upon. In particular the recovery of lead has been increased to 65.5 per cent., the lead recovery during the last half of 1907 having been 63.7 per cent. The silver recovery for that period was 45.1 per cent. The concentrates averaged 58 per cent. lead, 29.1 oz. silver and 6.2 per cent. zinc. On a weekly average of 1350 tons treated, the cost of dressing the ore was $1.88 per long ton, but as the mill was working under exceptional disadvantages this cost is abnormal. During the same period mining cost averaged $2.84 per ton, about 75 per cent. of this expense being for labor.

Mica Mining

A. S. Atkinson*

Until quite recently, mica was one of the unimportant mineral products which mining engineers passed by without much more than a cursory investigation. It was only 10 years ago that I could have secured the option on Canadian mica deposits for an insignificant sum while now these same deposits yield an annual output valued at $50,000. The change came when the electrical industry began to use mica in connection with electrical apparatus and, so rapidly has the demand increased that today mica mining is an industry of fair repute. In spite of the fact that we, as a nation, are the largest electrical manufacturing country on the globe, and the largest consumers of mica in the industries, less attention has been paid to the exploitation of the mineral here than in Canada, India and other countries.

It would seem as if this might be due to the fact that we have no great possessions of good mica to draw from but this is not borne out by the geological reports. We have valuable mica deposits in half a dozen States, notably in New Hampshire, North Carolina, South Dakota and Alabama. Recently very excellent deposits of phlogopite were found to exist in North Dakota and another rather extensive deposit of muscovite was unearthed in Tennessee. Biotite is found in considerable quantities in western Pennsylvania and Virginia.

Mica of Commerce

In general there are three species of mica recognized in commercial uses. Muscovite, or potash mica, has a wide demand and when found in a pure state the crystals are nearly white with a slight yellowish tinge. It is in special demand for windows of lanterns and for stove doors. Biotite is known as black mica and is of magnesia-iron composition. It is found in deposits in this country and in Canada and while not suitable for all purposes, has a commercial value. Sometimes black mica belongs to the phlogopite or magnesia-aluminum variety, as this mica ranges in color all the way from amber and light brown to black. Both of these micas are of great value when found in large deposits, with good cleavage, and especially when obtained in large and nearly transparent sheets.

Canadian and United States Mining Methods

The total output of mica in the United States averages scarcely $100,000 per year, while that of Canada reaches nearly $250,000 and India is accredited with a yearly output of nearly a million dollars worth of this mineral. The reason for the latter's supremacy in mica mining is found in the cheap labor costs of the country. The better facilities and modern methods of America should, however, more than overbalance this advantage.

In Canada and the United States, the methods of mining pursued show how far this infant industry has advanced over that of India. Mica is found in a great variety of veins or sheets, masses, dikes and lenses; the pegmatite occurs chiefly in the Laurentian formations. In open quarries the mica is taken from the surface rock in a simple way, but the work as a rule is interrupted by bad weather, so in New Hampshire where open quarries are worked, a portable tent or shed has been found useful to protect the workings. The power drill is used and also knives driven by compressed air which cut out the sheets in big masses so they can be easily split as needed. Underground mining is the more satisfactory method and is adopted where the deposits are sufficiently large to warrant extended work. A number of underground mines are worked successfully under improved conditions and the returns justify the investment. Where underground mining is to be adopted, the deposit should always be sampled with drills before extensive equipment for hoisting, etc., is put in.

The general method of opening up underground deposits is to sink a shaft and then open up the deposit at intervals of from 30 to 50 ft. Sometimes the mica is found only in small deposits and when one has been exhausted, drifts are run in several directions to find other pockets. These pockets as a rule, in a good mica, are close together, and a few tests with drills beforehand enable the miner to work with intelligence.

Hand drilling is often resorted to in order to prevent damage to the mica crystals. The holes are loaded with very small charges so that no great destructive work will be done by the explosive. The chief object is to loosen the rock and not blow up the mica. When the mica deposit is uncovered hand picks must be used. All sorts of power drills and blasting charges have been tried for mica mining, but in each case the work must be performed with care and in consideration of the conditions which prevail. In the past, in some cases, the rock was simply blasted out and then carried to sheds where the mica was picked. This, however, proved a very wasteful process as many fine sheets of mica were injured. Formerly the mica was split and trimmed by hand, but the modern method is to use machines and by them the output per man has been more than quadrupled.

Commercial Considerations

Mica sheets of unusual size and perfection always command special prices. In the Saguenay district of the lower St. Lawrence, and also at the Mattawa, north of Ottawa, very fine large sheets of mica are found in the deposits. The mica appears in thick layers of dark rose color, which when split furnish some of the best sheets found. This district has not been thoroughly explored and new discoveries of good deposits are constantly being made.

Near the surface, mica is apt to be injured by water seeping through the rocks, which either discolors the mineral or renders it very friable and brittle. For this reason after a deposit has once been proved, it pays to work it by underground methods as the better quality of output insured will overbalance the greater expenditure necessitated. The surface discoloration and weathering do not usually extend to any depth.

Surface mining is, of course, cheaper on account of the smaller plant required and the simplicity in getting at the material. In underground mining at least 1250 lb. of mica must be extracted from every 100 tons of rock mined to make the work profitable, but in surface work if 800 lb. of trimmed mica can be obtained from each 100 tons of rock, the profits are satisfactory. In the Saguenay district as much as 3000 lb. of trimmed mica are obtained from each 100 tons of rock from underground mining and at some of the surface mines 2500 lb. are secured.

Many other considerations affect the cost of mica mining. In one mine in Canada a ton of fine mica ranging from 3 to 7 in. in size is mined at a daily expense of $47 but in another mine the cost is $170 for only 600 lb. These two mines probably represent the two extremes of cost. The variance is caused by differences of the deposits and supply, but it is not likely that the latter mine could be worked long if it were not that large, exceedingly fine specimens are obtained, which usually command high prices in the markets.

The average yield of many mines will probably show only 5 per cent. of mica sheets cutting 4x6 in. and 50 per cent. cutting 1x3 in. However, in such cases the supply must be large enough so that at least 600 lb. of trimmed mica can be obtained from 60 tons of rock at a total daily cost of about $50.

The public has been slow to invest in mica mining, and in fact nearly all of the mines are operated by close companies which realize that a steady and uniform profit is more valuable than spasmodic abnormal yields. A mica mine is in no sense a wildcat, but a safe and sure investment if the conditions are thoroughly investigated before mining is undertaken. In many cases old abandoned mine dumps are now being worked over, for at present, scraps of fine mica can be marketed at a fair profit.

Consideration of the Physical Properties

The physical properties of mica greatly

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affect its commercial value. Perfect transparency is one of the most valuable qualities and where this transparency is without any flaw, the returns from a mine are 20 per cent. higher. In some cases impurities have been deposited between the cleavage planes of the mica and in others the crystallization has been disturbed. In either case the transparency is seriously affected, and in most cases this defect cannot be eradicated. In some localities feldspar or quartz has been deposited between the cleavage planes. Where these impurities are in a loose condition they can be removed by a process of washing which does not injure the product.

Flexibility is another very essential characteristic and as mentioned above, mica mined from surface workings is apt to be soft and lacking in this respect. Where the mica is partially decomposed, it has little commercial value other than for use in paint.

Considerations of the quality of the mineral should always precede a decison to invest money in the exploitation of mica deposits. Failure to do this has resulted in many disappointments. This is just as necessary as investigating the nature of the deposit, for both are essential to success. While less expensive machinery is required for mica mining than for any branch of metal mining, the proper equipment of a plant demands quite a little investment of funds. Unless the supply and quality are going to prove satisfactory for a considerable time, it is unwise to undertake the work of opening an underground mine. Surface mining on the other hand may be undertaken without much risk.

Assaying Silver Bullion

F. T. C. Hughes (*Bull.* 41, I. M. M.) describes an interesting method of assaying silver bullion in use at the Indian mint. The method consists of dissolving the assay piece in nitric acid, precipitating the silver with hydrochloric acid and weighing the silver chloride formed. The work at the mint embraces the determination of the silver contents of fine silver, Mexican dollars, Chinese "lycee" silver, and various coins. In most cases granulated samples are taken of the melts as well as punchings from the coins. The assay-piece weight chosen is 18.821 grains, which weight of pure silver gives 25 grains of silver chloride. The 25-grain weight is the unit weight, and the other weights are decimal parts of it.

The assay pieces (*musters*) are carefully adjusted to weight, check weighed, and placed in bottles. To each bottle 5 c.c. of nitric acid (sp.gr. 1.25) is added by means of a pipette, and the solution assisted by placing the bottles on a hot plate. The nitrous fumes are removed from the bottles after solution is complete by blowing into the bottles through a piece of glass tubing. The bottles are then removed from the hot plate and 150 c.c. of cold distilled water introduced into each bottle, followed by the addition of 5 c.c. of hydrochloric acid (sp. gr. 1.075). The bottles are then stoppered, allowed to stand a few minutes and then shaken by hand, a final twist of the hand serving to wash down the sides and the stoppers. The bottles are nearly filled with a rapid inflow of water, settled for an hour when the supernatent liquor is removed by siphoning until about 1 in. is left in the bottom of each bottle. The bottles are again nearly filled with water, shaken and settled overnight, with the stoppers in place.

The stoppers are removed in the morning, the bottles inclined and tipped so that the chloride may collect on one side and inverted in a trough of water over small Wedgewood cups standing in white porcelain saucers. The finger is kept over the mouth of the bottle while inverting, but is removed before any of the chloride has touched it. The bottles are held by clips in their inverted position and are tapped and turned until all of the chloride has settled out. The finger is again placed over the mouth of the bottle and the bottle removed for traces of chloride.

The cups are removed from the trough and any particles of chloride in the saucers carefully transferred to their respective cups. The water is carefully decanted from the cups, tapping them meanwhile to collect their contents. The cups are next dried in hot-air ovens at 212 deg. F. until the cake of silver chloride shrinks away from the cup and can be readily loosened by means of a gentle tap. The temperature of the ovens is next raised to 350 deg. F., and maintained at that temperature for three-quarters of an hour. The cups are then cooled, the hardened cake removed with a pair of platinum-tipped forceps to the balance pan and rapidly weighed to prevent the absorption of moisture, which is liable to take place in damp weather.

The results are accurate, but the time and labor consumed are large. Gold, platinum, tin, antimony, bismuth, mercury and lead interfere in this method, and slight modifications are necessary when they are present. The silver is recovered from the silver chloride by melting the chloride with 70 per cent. chalk and 4 per cent. powdered charcoal.

Departure in Sheet-ore Mining in the Joplin District

By Temple Chapman*

The "sheet-ore" mines of the Joplin district are now developed continuously over a stretch of country about 10 miles in length, and a greater ore area is indicated. The workings about each mill usually cover an area of from 10 to 40 acres and the ore mined has usually been of a thickness varying only between 8 and 12 ft. in hight. This stratum has rarely been worked profitably when the average saving of zinc and lead concentrates amounted to less than 3 per cent. of the crude ore mined, and yet the general yield from all the sheet-ore mines runs but slightly over 3 per cent. The cost of this mining plus the 10 per cent. royalty paid by most sheet-ore mines is as great or greater than the receipts at present ore prices. Therefore the following departure in mining methods is important.

Recently several of the "sheet-ore" mines have sunk deeper into the "sheet" and have taken up a "12-ft. stope" (the floor of the mine). From this operation the yield of concentrates has hardly averaged 2½ per cent. of the tonnage of crude ore mined, but the cost of mining has been greatly reduced and the grade of the concentrates has been high (63 per cent. zinc). Where in the heading 10 air drills and $100 worth of dynamite daily were required to "break" 500 tons of rock, in the stope one machine drill and $20 worth of dynamite are doing the same work and keeping a big mill busy day and night.

In the Red Dog mine at Webb City, Mo., we are taking up a "second stope" or third level, showing the sheet orebody to be approximately 30 ft. in thickness in all. In the accompanying illustration above the white crosses will be seen the stratum of disseminated lead and zinc ore originally worked by all the sheet-ore mines, this original level usually having a hight of 10 ft Below this will be noted the two strata indicated by the four white crosses which mark the second level or "first stope" now operated by a few of the Webb City mines. Still lower is the "second stope" or third level opened in the Red Dog mine where the entire thickness of the "sheet-ore" body was first worked. The photograph shows the wonderful regularity of the stratification. There are four main strata each about 8 ft. thick, which consist of (1) the richer, disseminated zinc and lead ore; (2) a more or less barren stratum of white flint; (3) a good grade of zinc ore contained in two regular seams; (4) a disseminated and pockety lead ore. Each main stratum is of a distinct color and different formation from each of the other three.

Above the ore, extending to the surface, is a body of limestone 200 ft. in thickness, while under the ore and going down to the sandstone is the second limestone 600 ft. thick, so our new development shows that the entire flint stratum between the two limestones is mineral-bearing and probably "pay ore." It also indicates the possibility that 30 ft is the workable thickness of the sheet-ore body throughout its area in this district. The amount of ore that might be mined from a 40-acre tract, leaving enough pillars for holding the roof, would be 3,000,000 tons, and the yield in zinc and lead concentrates, at 2½ per cent. saving, would be 75,000 tons.

*Webb City, Mo.

MINING THE ENTIRE SHEET-ORE BODY AT RED DOG MINE, WEBB CITY, MO.

Ore Handling Bridge at Duquesne Steel Works

The Duquesne Bridge Has a Span of 230 Ft. with a Cantilever Extension of 65 Ft. at Either End; Capacity Exceeds 600 Tons per Hour

At the Duquesne plant of the Carnegie Steel Company a large ore-handling bridge has recently been installed which possesses a number of interesting features. The bridge spans an ore yard of about 1800 ft. in length, serving six large blast furnaces. Adjacent to the furnaces are storage bins under which the larry cars operate to conduct the ore from the bins to the furnace skips. One supporting leg of the bridge rests on this bin structure, and the other is carried by a concrete wall 26 ft. high.

The bridge is of approximately 230 ft. span between trucks, and has a cantilever extension at either end of about 65 ft. The iron ore is brought within reach of the bridge by transfer cars, which operate between the car dumper and the ore yard and run on tracks carried by the bin structure. These transfer cars discharge their load through an open track on baffle plates, which form a temporary pile along the bin side of the storage yard. By means of the grab bucket the bridge gathers up the ore and places it in storage or removes it from the storage pile and delivers to transfer cars for distribution into various compartments of the bins, from which the supply for the blast furnaces is drawn as needed.

At the farther end of the bridge a V-shaped leg furnishes the support but at the furnace end, a single shear leg supports the bridge as is shown in the accompanying illustration. Throughout the design of this structure flexibility was sought; this provides for the inequalities in travel of the two ends of the bridge,

GENERAL VIEW OF ORE-HANDLING BRIDGE AT CARNEGIE STEEL COMPANY'S PLANT, DUQUESNE, PENN.

HANDLING ORE AT YOUNGSTOWN, OHIO, WITH A HEYL & PATTERSON BRIDGE

and absorbs endwise shocks and thrusts due to the quick acceleration of the trolley, without straining the bridge.

The bridge is propelled along its track by two 52-h.p., Westinghouse, type K, crane motors; a motor is placed on each truck and is controlled from the cab. The two controllers for these motors are set adjacent, and are so arranged that a single handle moves either controller separately or both simultaneously. This arrangement allows one end of the bridge to be moved without affecting the other, and on a long travel should one end of the bridge structure get in advance of the other end, the higher-speed motor will be retarded until the slow one overtakes it.

On this bridge is used a 10-ton Hulett patent excavating bucket, which is operated by two 225-h.p., Westinghouse, crane motors of mill-type construction. The bucket with its load of ore weighs approximately 50,000 lb. The trolley traversing mechanism is driven by a 225-h.p. motor of the same type as the hoisting motors. The two bucket-operating motors are geared together and operate by a single magnetic-type controller, providing also for dynamic braking. This relieves the trolley of a considerable item of wear in the matter of brake blocks. The bridge is of large capacity, having been constructed to handle 600 tons per hour. It has, however, within the last four months far outstripped this amount. The bridge was constructed by Heyl & Patterson, Inc., of Pittsburg.

At Youngstown, Ohio, an ore-handling bridge of much the same type, but of approximately 100 ft. greater length has been installed at the plant of the Youngstown Sheet and Tube Company. This bridge is shown in operation in one of the accompanying engravings. The propelling gear differs from that of the Duquesne bridge in having four motors instead of two, the trucks at the four corners being in this instance duplicates.

DETAILS OF V-SUPPORT OF ORE BRIDGE AT DUQUESNE, PENN.

Rapid Estimation of Arsenic

Harley E. Hooper (*Bull*, 41, *I. M. M.*) describes a rapid method for the estimation of arsenic in ore. The method is based on the reaction between arsenic, when present in its higher form of oxidation, and potassium iodide in an acid solution. The iodine set free by the reduction of the arsenic is titrated with standard thiosulphate solution. The method is suitable for sulphide or oxidized ores containing 1 per cent. or more of arsenic and is free from interference by the other ordinary constituents of ores, such as lead, copper, zinc, iron, manganese or nickel, since these are either removed during the analysis or do not react with the thiosulphate.

In the standard thiosulphate solution, 1 c. c. = 0.005 gram of arsenic and is standardized either against copper or arsenious oxide. In standardizing with copper, 0.3 gram is dissolved in 10 c.c. dilute nitric acid, the fumes boiled off, ammonium hydrate added till just alkaline, any excess boiled off and 1 c.c. of glacial acetic acid added. The solution is cooled, potassium iodide added and the free iodine titrated with the thiosulphate. The arsenic value is 75/127.2 of the amount of copper taken.

The standardization with arsenious oxide is made by taking 0.264 gram of the pure salt, adding 5 c.c. of concentrated nitric acid, evaporating to dryness and heating strongly for a few minutes, then taking up the residue with 25 c.c. of a 25-per cent. sodium-hydrate solution, warming and diluting to a bulk of 50 c.c. The solution is neutralized with concentrated hydrochloric acid, 25 c.c. more acid added in excess, then cooled, the potassium iodide added and the titration performed with the thiosulphate. Starch is not used as an indicator during the titration, but after the solution is colorless, starch is added as a test of the completeness of the titration.

The method for a 20-per cent. ore is to take 0.5 gram of the ore in a 12-oz. tumbler beaker and treat with 10 to 15 c.c. of a moderately strong solution of potassium chlorate in concentrated nitric acid. The solution is evaporated to gentle dryness and then heated for a few minutes to get rid of oxidizing matter. After cooling and adding 10 c.c. of dilute ammonium hydrate, the solution is brought to a boil, 25 c.c. of sodium hydrate (25-per cent. solution) added, boiled again, filtered hot and washed with hot water. If the volume exceeds 50 c.c. it should be evaporated to that bulk and then neutralized with concentrated hydrochloric acid and treated as in the standardization.

The proportion of hydrochloric acid present should be from one-half to three-fifths of the total volume. The titration should be done slowly, especially toward the end and if the yellow color returns a few drops of thiosulphate will discharge it, and the higher reading should be taken. The method is altered when antimony is present by fusing the ore with sodium peroxide in a nickel crucible and extracting the fused mass with water. Starch as noted before should not be used as an indicator during titration but only to confirm the end point and if any color is shown the analysis must be repeated. For careful work, blanks should be run to test the reagents.

Restoring Dredged Ground *

In the State of Victoria, Australia, much gold is obtained by hydraulicking and dredging. In 1907 there were 133 dredging plants in operation, 45 of these being bucket dredges, 84 pump-hydraulic sluices, and four jet elevators. In 1907 these plants treated 20,199,892 cu.yd. of material which yielded 97,821 oz. gold, or an average of 2.32 grains per cu.yd. of gravel treated. In this industry 2468 men are employed. Three of the bucket dredges treated more than 9000 cu.yd. a week; four, more than 8000 cu.yd.; and 17 dredges between 6000 and 7000 cu.yd. a week. In many respects dredging is in a more advanced state than in most other districts, for in Victoria an attempt to restore the dredged area to usefulness for agricultural purposes is being made and meeting with some success.

The Sand Launder Ordinarily Used

One of the features of the year has been the tendency for bucket dredges when working in suitable ground where the material is of a loose, friable, sandy nature to discard screens and elevators and to use instead riffle-bottomed sluice boxes such as are shown in Fig. 1. This latter method is more economical both in regard to initial cost and to maintenance, and by the adoption of a simple contrivance (the silt distributer) the dredged material is classified so that the fine sand is deposited on top, partially restoring the dredged area to usefulness. But the main advantage of these launders is the additional saving of gold obtained rather than the restoration of the area, for as none of the water is removed from the dredged material the silt is carried deep into the gravel, and so the best part of the soil is lost. These sand launders are laid with cocoa matting placed under protecting sheet iron having ¾- or 1-in. openings in it, held down by battens and cleats. The area of the extra gold-saving surface is about 120 sq.ft. About one-twenty-fifth of the gold is saved in the sand launders, this being the finest gold in the gravel.

In bucket dredging when the gravel contains much clay, difficulty is experienced in saving the gold, for the balls of clay which are not broken up carry considerable gold into the tailings. This difficulty has been overcome to a large extent by the use of a revolving screen, inside of which are heavy iron chains hanging in loops and bunches. This screen works longitudinally around a fixed iron bar attached to which are spikes or teeth spaced about 6 in. apart. These teeth act as a paddling rake, and the loose-fitted, dangling chains agitate and break up the coarse lumps of material as the screen revolves.

Restoring the Dredged Area to Usefulness

As has been said before, considerable attention is being given to the reclaiming of dredged ground. The sand boxes described above are not especially suitable for this work, but at two plants, the Constance dredge at Eurobin, on Owens river, and the Tullock's dredge on Livingston creek, Omeo, satisfactory restoring devices are being used, while the Crooked River company has recently started to use similar contrivances. In any restoring process advance stripping is necessary in order to keep separate the surface soil and in order to enable the dredging to be done with as little water as possible, so that the fine silt will not be carried down into the underlying coarse gravel.

The method used with the Confidence dredge consists in working the gravel and surface soil separate. The gravel is deposited near the dredge, while the soil, which is stripped before the gravel is touched, is conveyed farther and is deposited on a part already covered with gravel. On the Confidence dredge the main sluice box is 4 ft. wide by 18 in. deep, and its length from the drop-chute bars to the end of the delivery is 56½ ft. An opening, 5 ft. long, extends from the lower end of the main box to the upper end of the extension loam launder; during ordinary dredging operations while the special loam chute is not in use, the gravel discharges through this opening.

The Loam Launder for Resoiling Ground

The upper end of the extension loam launder, Fig. 2, is as wide as the main launder, but within a short distance the width is reduced to 26 in., the depth being 9 in. The movable portions of the launder *E* and *F* are made of ⅛-in. plate, bent into a semi-circular trough; a light angle iron is riveted along each of the upper edges to form flanges. When the chute is in position for use, these flanges rest on top of the upright sides of the main sluice box. Sections *E* and *F* of the loam launder, when in operation, extend along the inside of the main sluice box from near the bottom of the drop-chute bars to just across the 5-ft. opening, bridging the latter and conveying the resoiling material into the extension loam launder which deposits approximately the same thickness of soil on top of the gravel as was originally there. The upper end of section *F* is made rectangular, and of such size that it fits into the main sluice box near the drop-chute bars. The portable sections *E* and *F* are raised and lowered by a continuous wire rope extending from a winch on the dredge framework. This rope goes from the chain strap around the end of section *E* through a small pulley *H*, fastened to a rope passing from the head of the derrick to the aft gantry; then it passes through a double pulley suspended on the before-mentioned line, and is next taken through another small pulley *L* on the framework of the dredge to the drum of the winch used to raise or lower the loam launder. The operation of raising or lowering occupies only three minutes; the whole time from the stopping of gravel dredging to the delivery of loam from the buckets into the launder is about 10 minutes. When being raised the

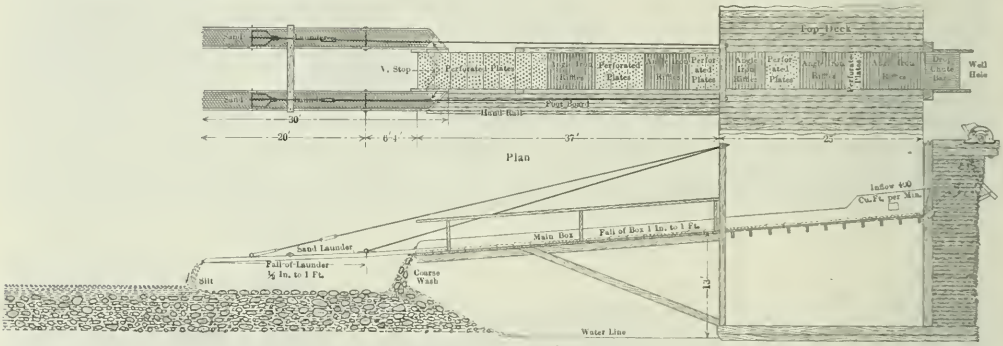


FIG 1. TYPE OF TAILINGS LAUNDERS USED IN VICTORIA, AUSTRALIA

*Abstracted from the report of D. B. Sellars, State hydraulic engineer, in the Report for 1907 of the Secretary of Mines for Victoria, Australia.

shorter and lighter section *F* rises from the main box first, and continues to ascend until blocked by the stops at *G G*. Then the upper end of *E* begins to rise and is hoisted to *H*, where it is held in position until again required. While dealing with surface soil or loam, sections *E* and *F* are lowered each morning into their place inside of the main box, and advance stripping is done for two or three hours.

Advantages of the System

During that time, with a face from two to three chains long sufficient ground is stripped to admit of gravel dredging for the remaining portion of the 24 hours. The soil is stripped at the rate of about 85 cu.yd. per hour; the gravel is dredged at the rate of 60 cu.yd. per hour. Allowing for delays, in a week's run of 130 hours about 100 cu.yd. more of ground can be dredged, and in the case mentioned more gold can be saved by separately stripping and conveying the overburden through the loam launder than by sending both gravel and overburden together through the sluice box. The cost of stripping the soil and dredging the gravel is about 2d. per cu.yd., the area resoiled being six acres.

Water is required to wash the soil along the launder, but in practice it is found that only about 10 per cent. of the quantity necessary to keep the sluice box clear of ordinary gravel is sufficient to convey the loam through the resoiling launder. By the exercise of a little care and by building small brush and stone dams, the quantity of loam that is carried back to the pit by the return water can be reduced to moderate limits. Some soil drops into the pit when scooped up by the buckets, and some soil goes away in suspension at the save-all box, so that all the soil cannot be deposited again on top of the gravel. Nevertheless, the Confidence dredge is at present replacing from 80 to 85 per cent. of the surface loam on top of the dredged gravel so that the resoiled gravel is almost as useful for grazing and agriculture as originally.

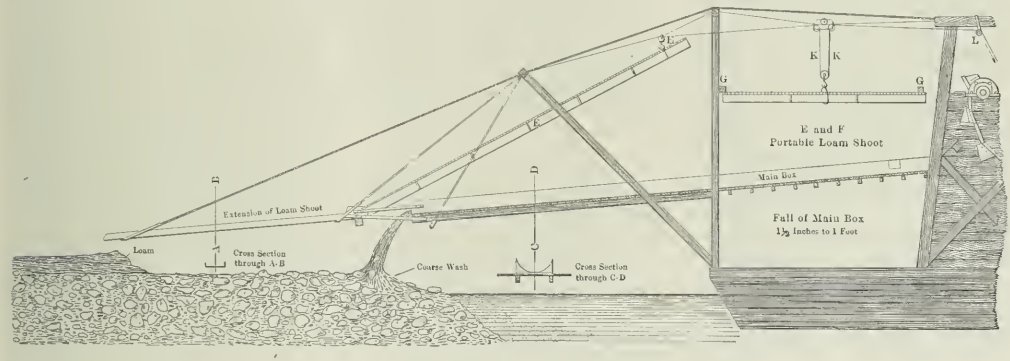


FIG. 2. CROSS-SECTION OF CONFIDENCE DREDGE, SHOWING LOAM LAUNDERS RAISED

Assaying Stamp Mill By-Products

Much has been written concerning the assaying of ores and usual metallurgical products, but there has been published comparatively little regarding such by-products as battery chips and screens, plumbago crucibles, drosses, etc. The methods described by Leslie J. Wilmoth (*Journ.* Chem., Met. and Min. Soc. of South Africa, VIII, pp. 230-232) for the assaying of by-products were indirectly the result of some experiments on the assaying of copper ores for gold. An almost pure carbonate of copper ore was mixed with a gold ore in such proportions as to contain 8 per cent. copper and 35 dwt. gold per short ton.

Object of the Experiment

The object of the experiment was to collect the gold in a lead button and pass the copper into a gold free matte by adding sufficient sulphur to the charge to unite with the copper. The charge used was: Ore, 1.0 a.t.; granulated soda, 2.0; fused borax, 2.0; litharge, 1.0; sulphur, 1.2 grams; charcoal, 1.5 grams; one 6-in. iron nail. The iron nail took up any excess sulphur and kept the lead button malleable. It was found that the lead collected all of the gold and the matte was practically gold free.

The method was so successful that it seemed applicable to the assaying of battery chips. The sampling of battery chips is at the best very unsatisfactory and when to this is added equally unsatisfactory methods of assaying, the perplexity of arriving at the true value of a lot can be imagined. It was desired, therefore, to remove one of these perplexities by devising a suitable method for this material, which consists of lumps of iron ranging from the size of a pin head to lumps 0.5 inch in diameter. The matting method was successfully applied to the battery chips using: Chips, 1.0 a.t.; granulated soda, 1.5; fused borax, 1.5; sulphur, 0.5; silica, 0.5; charcoal, 1.0 gram; iron nail.

The silica was used to protect the crucible and it seems as though an excess of flux was used. The nail served the same purpose as in the ore assay. The charge is given a hot quick fusion and then washed down with a small amount of litharge and charcoal. The heat used is a little higher than with the usual assay, and after the fusion has become quiet the crucible must stand in the furnace for a full twenty minutes. The method is excellent for gold, but when silver is to be determined, the matte should be re-run by scorification.

The sample of battery screens consisting of small clippings of the screens is carefully oxidized in roasting dishes in the muffle until all the iron is in the oxide condition. The roasting dishes are then removed from the muffle, cooled and their contents pulverized using care to avoid losses during the operation. The sample may then be assayed by the usual methods or by the matte method. The basic character of the slag tends to a loss of gold in the slag with the usual methods, and Mr. Wilmoth, therefore, prefers the matte method. The charge for the direct fusion was: Oxide, 1.0 a.t.; granulated soda, 1.5; fused borax, 1.0; litharge, 2.0; silica, 0.5; charcoal, 1.5 grams. The charge used for the matte method was: Oxide, 1.0 a.t.; granulated soda, 1.0; fused borax, 0.5; litharge, 1.0; silica, 0.5; sulphur, 0.5; charcoal, 1.0 grams; one nail.

According to Consul John E. Kehl, a local railway company has acquired a large tract of land at East bay, about 15 miles from Sydney, Nova Scotia, which is said to contain large deposits of gypsum. The deposits will be thoroughly exploited by the present owner, with the assistance of government experts. Tests already made point to an exceptionally large quantity of material of unusual purity.

According to the *Journal* Soc. Chem. Ind., March 31, 1909, a small percentage of copper in lead has little or no influence upon the reaction of lead with nitric acid.

An Investigation of the Cost of Mining Coal

Actual Operation Costs Are Analyzed, and it Is Shown That the Rate of Wages Is an Effect, Not a Cause, in the Economy of Mining

BY J. R. FINLAY*

Modern civilization is propelled by the annual combustion of upward of 1,200,000,000 tons of coal. This vast use of power other than human or animal muscle is the basic fact in the mightiest revolution in industry, in art and in habits that the human race ever experienced. Every time we press a button to turn on an electric light, every time we enter an elevator or a street car we participate not only in a human revolution, but in a great geologic fact; for the mining and destruction of coal removes some of the important strata of the earth's crust.

Coal mining is the basis and dependence of other kinds of mining just as it is of other industries. And farther, since coal mining is one of the simplest and commonest of mining operations, it serves as a standard by which the complexity and cost of other kinds of mining may be appraised.

If coal were not so abundant and widespread its use could not, of course, be so extensive and fundamental. The fact of its wide distribution is the most powerful element in the conduct of the business. If coal were not cheap it could not be so extensively used; it would not, therefore, be so valuable. But because it is cheap it is often wasted; it is cheap because it can be offered in the market by innumerable competitors, whose aim is not the wise use of coal, but ready money profit from it. Hence this most valuable of mineral resources has been in considerable measure crudely and greedily exploited.

The cost of coal to the consumer depends on two elements that vary widely: 1 Mining, and 2. Transportation; but since the effect of the latter is self-evident, I do not propose to discuss it.

Factors that Influence Cost of Mining

I. The cost of mining coal depends, in my judgment, upon the following factors:

(a) The thickness of the seam.

(b) The purity of the coal in the seam.

(c) The regularity of the seam.

(d) The geological attitude as regards angle of dip occurrence of faults, etc.

(e) The climate, cost of living, etc.

(f) The depth.

(g) The amount of water to be pumped.

(h) The solidity of the roof.

(i) The presence of gas, dust, or other elements of danger.

(j) Topography of the surface.

Some other factors may influence the cost in a minor degree. Such as the hardness of rock encountered in development work, hardness of coal, cost of supplies, etc.

It will be noted that I have mentioned only natural conditions leaving out the factor that many would be inclined to place first on the list—the rate of wages. I do not believe that this is a factor at all. The price of labor is determined by the natural factors. It is an effect, not a cause, in the economy of mining. If we have two neighboring districts with the same natural advantages, but in which the rates of wages are different, that difference is apparent, not real. The difference will be equalized by the supply and demand for labor as automatically as water runs down hill. If a mine pays lower wages than its neighbor it will have poorer men; if other conditions are the same, the cost will be the same. You cannot change this natural law; it is like the force of gravity.

Labor Costs and Wages

I hope that no one will understand this dictum to mean that where natural conditions are the same, the wages will be the same, or that the cost of labor will be the same; on the contrary, these things vary a good deal. Management, scale of operations, appliances of all kinds vary, or may vary, almost without limit among various enterprises. These factors help to establish wages and labor costs; they are quite independent both of natural conditions and of labor conditions, and have to do with the success or failure of enterprises. They introduce variations in cost that are, or may be, equal to the margin of profit that there is in the business.

How Labor Costs May Differ with Same Rate of Wages

To elaborate a little, let us suppose that Smith and Jones are two rival operators in neighboring coal mines in which the natural conditions are exactly the same and in which coal is salable at $1 per ton. There are only two mines in the district and each can produce twice its actual tonnage. Smith is a good operator, with sufficient capital, equipment, development and ventilation. He can mine coal for 60c. per ton. Jones is a poor operator, and his mine is poorly opened. It costs him $1 per ton to produce coal. It is obvious that the successful and opulent Smith has the decision as to how great a difference there shall be in labor costs in that district. He can prevent Jones from making a profit, and can close him down by selling coal under $1 per ton, which is Jones' cost. It is obvious that the difference between labor costs here will be approximately as 6 is to 10. This is not due to the rate of wages; it is just the difference between Smith and Jones.

How Wages May Differ and Costs Be the Same

Now let us suppose that Smith and Jones are 2000 miles apart and each sells his coal at a point midway between them with equal transportation costs. Smith can supply the market and so can Jones, and each wants to seel all he can, and can produce all he can sell. Smith can sell without loss as low as 60c. per ton. Jones, if he pays as much wages as Smith, cannot sell for less than $1. Neither Jones nor his employees know anything of Smith's superior methods and appliances, and they have no means of living except by selling coal. Obviously under these conditions there is only one thing to do—work for less money. So Jones fixes his wages at 60 per cent. of Smith's wages and continues business. This rate is fixed by the efficiency of Jones as against Smith. His men get just what they earn. In other words, the final result is exactly the same as if each laborer were in business for himself.

Actual Costs

Returning now to the natural factors that govern the cost of coal mining, the find that their number and importance is very considerable, and if all coal were to be mined we should have enormous differences of cost. As a matter of fact, these great differences do not at present exist because the commercial conditions of the country cause the elimination of all mines except those favorable for cheap working. This results from the fact that there is in this country, according to the U. S. Geological Survey, 2,000,000,000,000 tons of coal of all kinds easily accessible. This coal is spread over an area of 500,000 sq.m., and may be attacked at many thousand favorable points. The unfavorable seams will have to wait to be worked after the better ones are exhausted.

Price of Coal at Mines

According to the excellent review of the "Production of Coal" for 1907, published by the U. S. Geological Survey, the extreme variation in the price of coal at the mines in the various States is only from 90c. in West Virginia to $4.10 in Idaho.

*Mining engineer, 2 Rector street, New York City.

The last figure is for only 7500 tons, and doubtless represents a case where an isolated but unfavorable seam may be worked because high transportation charges prevent the introduction of coal from other places. Leaving out such abnormal cases and considering only States where the output reaches 1 per cent. of the production of the country we find that the price of bituminous coal at the mines varies only between 99c. for West Virgina to $1.68 for Arkansas. Pennsylvania anthracite is valued at $1.91, but I shall explain later that the cost of anthracite is radically different from that of bituminous coal and no comparison should be made except with very careful explanation.

It is probable that the figures of average price of coal at the mines give the best general idea to be had of the cost of mining throughout the country. The price, of course, exceeds the cost, but it can be confidently asserted that the difference is not over 10 to 15c. per ton, if we consider the whole output of States. Within given fields there must be considerable variation; some mines working cheaply and with large profits, while others have no profits at all and some, if all capital charges were correctly made against them, would be found running at a loss. But it is quite obvious that the entire industry cannot run at a loss and that the average complete cost must fall inside the average selling price. It is difficult to get specific figures that will illuminate the general subject as accurately as the broad figures published by the Survey and I doubt if we can form a better idea of average costs than by assuming them to be 90 per cent. of the selling price. This assumption gives us the following for bituminous coal:

SELLING AND COST PRICES OF BITUMINOUS COAL.

	1903.	1904.	1905.	1906.	1907.
U. S. price	$1 24	$1 10	$1.06	$1 11	$1.14
Cost	1 11	0 99	0 95	1 00	1.00

United States average price for 5 years, $1.13; estimated cost, $1.00.

	1907 Price.		Estimated Cost.
Pennsylvania	$1 03		$0 93
West Virginia	0 99		0.90
Maryland	1 20	Appalachian	1.08
Virginia	1.02	field.	0.91
Kentucky	1 06		0.95
Illinois	1.07	Illinois field.	0.96
Alabama	1.29	Southern field.	1.17
Arkansas	1 68	Ozark field.	1.50
Colorado	1 40		1.26
Wyoming	1 56	Rocky	1 40
Utah	1.52	Mountain	1.37
New Mexico	1 46	field.	1.31
Washington	2 09	Puget-Sound field.	1 88
Michigan	1 80	Michigan field	1 62

These costs are intended to be complete, that is, to cover both operating and capital charges. I shall endeavor to give some reasons for believing them to be fairly accurate, but first let me disavow any intention of applying them to any particular property or district. It would be more enlightening, possibly, to take some detailed statements of costs and compare and digest them. But such statements are hard to get and I must confess that those I have been able to secure are open to grave question as to their accuracy. For instance, I have the statements of a coal company operating three different mines. Detailed statements of operating costs for each month for each mine are given for a period of years. The aggregate tonnage and total operating cost may be figured out only with great labor. To get five years' operation averaged, I should have to combine 180 different cost statements. If this were necessary to secure the facts, one might be heroic enough to do it, but, after all, it would only give the results of an insignificant fragment of a single field and a single management. But far worse than this, after making this compilation, I should still doubt its accuracy because a single glance at the balance sheet reveals the fact that in mining 1,000,000 tons of coal, $350,000 has been added to capital charges. The writing off of such charges is a matter of judgment, based on familiarity with the property itself. I cannot possibly supply either the time or the experience required to form a judgment of my own as to this rate of depreciation, and yet, in a business of narrow margin like that of bituminous coal, it is a matter of great importance whether 1c., or 5c., or 15c. per ton must be added for depreciation.

It is interesting to note that E. V. d'Invilliers, in his article on "Estimated Costs of Mining and Coking" (*Trans.* A. I. M. E., Vol. XXXV, 1905) shares the same difficulty in arriving at true costs for coal-mining operations. He expresses himself as follows: "The cost of coal delivered to an oven, and the cost of the manufactured product, depends largely upon individual judgment or practice, and on general management. Therefore, without having access to the accounts of a number of individual mines, it is not possible to do more than approximate the average regional cost of mining coal or manufacturing coke. . . . For, though each plant in a district may be mining upon the same scale of wages, the computation of net mining costs may differ to a considerable extent in two adjoining plants, due to different methods of bookkeeping, to a difference of opinion as to what items are properly chargeable to mining account and to capital account, or to physical difference at the two mines."

Mr. d'Invilliers goes on to estimate the real cost of mining and coking at Connellsville and at Reynoldsville, Penn., the first a slope mine, largely self-draining, on a seam capable of producing 9000 gross tons (10,000 short tons) to the acre; the second a shaft mine where considerable pumping will be required and capable of producing 7200 gross tons (8000 short tons) per acre. His estimate per gross ton is as follows:

	Mining Cost.	Coal.	Royalty.	Total.
Reynoldsville	$0 66	$0.86	$0.04	$0 90
Connellsville	0.34	0 52	0 08	0 60

Reducing this to a short-ton basis we find that Mr. d'Invilliers' estimate of total cost is:

Reynoldsville	80c.
Connellsville	53c.

These figures are for January, 1904. I find that for that year the average price of bituminous coal in Pennsylvania is reported at 96c. My arbitrary estimate for cost of 90 per cent. of the price gives us 86c. for that year. Now, since it would seem that the Reynoldsville mine represents conditions not far from average in the Pennsylvania bituminous-coal regions, it appears that the difference between my estimate and Mr. d'Invillier's estimate is not so great, but that it might all be covered by a difference of judgment between two men in "what is chargeable to operating account."

Pittsburgh Coal Company

The reports of the Pittsburgh Coal Company, which operates 60 mines in the neighborhood of Pittsburg, so situated that they must represent nearly average conditions for the Pennsylvania bituminous field, show the following: The average number of short tons mined per acre is 7000. Net profits for 8 years average 13.8c. per ton. The total cost for all capital charges is 16.2c. per ton. If we assume that the U. S. Geological Survey figures for the value of coal at the mines will hold good for the Pittsburgh Coal Company, we get the following, per short ton:

Average price of coal for 5 years.	$1.03
Cost—Capital charges 16 2c.	
" Operating " 73 0 . . .	0 892
Profit	0 138
	$1 030

Similarly the Monongahela River Consolidated Coal and Coke Company, also operating near Pittsburg, with an extraction of 8000 tons per acre, shows the following for 9 years:

Assume price of coal as before	$1.03
Cost—Capital charges 0 17c.	
" Operating " 0 74c	0 91
Profit . .	0.12
	$1 03

Capital Charges

Without going into further tables of figures I find that in Pennsylvania the capital charges may be calculated as follows: A charge of 5c. per ton is made arbitrarily to cover the depletion of coal lands. If the property is bonded, this 5c. per ton is put into a sinking fund to retire the bonds.

In addition, current interest must be paid on capital or bonds. This charge will be in some proportion to the amount of unmined coal lands held for the future. Thus, if a company has a coal reserve for

100 years on its capital account, its interest charges must be greater than if its reserves are only enough for 20 years.

It appears that it requires approximately $1 per ton of annual product to equip a coal mine for operation. Thus, for an output of 1,000,000 tons per year $1,000,000 will be needed for plant and equipment. The renewal or depreciation of this plant will cost 6 per cent. per year.

In summary, then, we have:

For coal in the ground . . .	5c.
For interest on $1. capital .	5c.
For depreciation of same capital	6c.
Total	16c.

It is self-evident that the operating costs will vary more than capital costs; probably about in proportion to the total. Thus, if we find at one mine total costs of 96c., of which 16c. is for capital and 80c. for operating, we would probably find that at another mine where the total cost is only 72c., the cost would be 60c. for operating and 12c. for capital. My reason for believing this is that a mine that is cheap to work must also be cheap to open.

While I am inclined to think that under present or recent conditions, the average cost of bituminous coal in Pennsylvania is 90c. or more, there is reason to believe that some of the most favorable mines work much cheaper.

Mr. Gary, in his recent testimony before the Ways and Means Committee on tariff revision, states that the cost of coke at the ovens, presumably at Connellsville chiefly, was in 1906, $1.75 per ton, on which there was 54c. profit. This reduces the cost of coke to $1.21. If the burning of the coke costs 31c., we have left 90c. for the coal, of which 1½ tons are required per ton of coke. This figures the cost of coal at the mines of the U. S. Steel Corporation down to 60c. per ton. Presumably this includes a sufficient allowance for depreciation. If so, the cost seems remarkably low and probably represents the cost of bituminous coal under the most favorable conditions. At any rate it agrees pretty well with Mr. d'Invilliers' figures for a representative Connellsville mine.

Certain other figures given by Mr. Gary about costs are of interest. He says that wages of all classes at coal and coke plants belonging to the U. S. Steel Corporation in 1908 averaged $2.39 per day. Now at coal mines labor is usually about 75 per cent. of the total expense; we may, therefore, calculate that the whole cost per man per day is about $3.20. If coal is mined for 60c. per ton there must be an output of about 5⅓ tons for every man. In the State of Pennsylvania at large, the output is only 3.6 tons per man. If this output is obtained at a total cost of $3.20, then the cost per ton is 89c. This agrees with my other figures for Pennsylvania.

Let us apply this reasoning to other coalfields and see how close it brings us to my estimate of cost at 90 per cent. of the selling price.

In Michigan the wages are undoubtedly about the same as in Pennsylvania. I have estimated the cost of Michigan coal at $1.62 per ton. The output per man per day is $2.11. If we divide $3.20 by this amount we get $1.52.

Again, in Wyoming I am informed that wages of coal miners average about $3.60 per day. If this is 75 per cent. of the whole cost per man, that cost is $4.80 per day. The output per man averaged in 1907, 3.42 tons; the cost per ton, therefore, should be $1.40. This is exactly my estimate by the 90-per cent. rule.

I have no information as to the average wages of coal miners in Colorado, but some light can be had on costs there from another source. The average value of coal at the mines in that State in 1907 is given at $1.40. My 90-per cent. rule gives a cost of $1.26. The Colorado Fuel and Iron Company mined that year about 4,500,000 tons of coal at a profit of $900,000, or 20c. per ton. This profit was not altogether on mining since some of the coal was sold at a distance from the mines. Besides this the profits were diminished by certain fixed charges, of which the exact proportion belonging to the fuel department is not clear. At any rate it seems that the net profits on coal from mining were not over 10c. If, then, the U. S. Geological Survey is right in its average price of coal, the actual cost must have been about $1.30.

Following are some more detailed figures on the cost of operating a slope mine, self-draining, in Virginia. The figures are complete in all respects except that of depreciation. I am in doubt whether that item is fully taken care of, but having no means of forming an individual opinion, I cannot express one. The seam averages 7 ft. thick:

COST SHEET AT A VIRGINIA COLLIERY.

	1905-1906. Per Ton.	1906-1907. Per Ton.
Mining	$0 246	$0 251
Timbering	0 010	0 018
Ventilation	0 008	0 010
Removing refuse and deposit	0 005	0 017
Tracks	0 030	0 031
Haulage	0.067	0 102
Dumpage	0 009	0 012
Blacksmith shop	0 006	0.007
Repairs	0 009	0.008
Supplies	0 007	0 003
Salaries—Plant	0.017	0 019
Switching	0 005	0 006
Engineering	0 003	0 005
Extraordinary expenses	0 007	0 011
Adjustment stables account	0 005	
Sinking fund	0 100	0 100
Attorneys' fees and legal expenses	0 025	0 016
General expense	0.014	0 012
Salaries—General office	0 040	0 058
Interest and discount	0 073	0 068
Taxes	0 011	0 011
Insurance	0.005	0.005
	$0.702	$0.770
Summary:		
Labor	$0 382	$0.423
Supplies	0 052	0.077
Sinking fund	0 100	0 100
	$0 534	$0 600
General expense	0.056	0.070
Interest, insurance, taxes, attorneys fees	0 112	0 100
	$0 702	$0 770
Tons mined	240,371	221,552

It is interesting to note the increased cost in 1907 over 1906, due to the unhealthy pre-panic business conditions.

Coke Manufacture and Anthracite Mining

The production of commercial anthracite is so different a problem from that of mining bituminous coal that its cost is nearly parallel to that of coke. Run-of-mine anthracite is worthless for fuel. It will not burn unless it is carefully sized. It will not burn if there is even a moderate mixture of slate or bone in it. The sizing and rejection of impurities necessitates careful crushing, sizing and washing. It is distinctly a process of concentration as well as of sizing, for the loss in the "breakers" will average fully one-third of the run-of-mine tonnage. The cost of concentrating, or operating the breakers, is from 30 to 50c. per ton shipped—not cheap milling by any means, and no doubt mining men not acquainted with the fact will be surprised at it. The comparison may be tabulated as follows:

	Coke.	Anthracite.
Tons run-of-mine per ton	1½	1½
Cost of manufacture per ton	30c. to 60c.	30c. to 5[illegible]c.

Several instances of actual figures for coke have come to my attention. Mr d'Invilliers calculated average results at two Pennsylvania points for five years ending 1903 as follows:

CONNELLSVILLE REGION PLANT OF 500 OVENS.

Coal, 1½ tons, at 56c. net ton	$0 840
Charging, leveling, drawing and labor	0 326
Salaries, supplies and depreciation	0 050
Total	$1 216

It will be noted that I deduce from Mr. Gary's evidence that the actual cost of coke in Connellsville to the steel company in 1906 was $1.21.

REYNOLDSVILLE PLANT OF 500 OVENS.

Coal, 1.7 tons, at 70c	$1 19
Charging, leveling, drawing and labor	0 40
Salaries, supplies and depreciation	0.05
	$1 64

In neither of these cases have I used any table exactly as given by Mr. d'Invilliers. He does not give the details of his estimates for a five-year average, and I have endeavored to supply them. There seems to be same mistake in his average of Reynoldsville costs, for they do not work out in proportion as he gives them.

Another example of coke costs more in detail is from a 200-oven hand-operated plant in Virginia—in 1900:

Cost of coal, 70.2c. per ton.	
Coal used in making coke	1 027
Crushing	0 023
Charging	0 033
Leveling and seating	0 028
Drawing	0 210
Loading	0 134
Switching	0 023
Salaries at plant	0 033
Tracks	0 008
Repairs	0 021
Supplies	0 012
Extraordinary expense	0 006
Insurance	0 004
Total	1 561

In summary:

Raw material	1.027
Labor	0.459
Supplies	0.075
	1.561

The following year, 1907, the costs at the same plant were as follows:

Raw material	$1 227
Labor	0.524
Supplies	0.114
Total	$1 865

Anthracite Mining

The extraction of run-of-mine anthracite is rather more expensive than that of bituminous coal chiefly because the anthracite seams are very much more folded. It is necessary to do vastly more development work in rock, and necessary also to use more timber in supporting gangways than is the case in flat seams. However, the constantly changing dip prevents the use of uniform methods throughout the mines. On the other hand, the coal often occurs in magnificent thick seams. The actual difference in cost for run-of-mine I do not estimate at more than 10c. per ton, 92c. for bituminous and $1.02 for anthracite (per short ton, the long ton is used at the mines).

Below will be found consecutive statements of the costs of the Philadelphia & Reading Coal and Iron Company for a period of years. These tables in the main explain themselves, but it is worth while to make the following comments: The actual cost of mining and repairs will be seen to average about $1.80 per long ton, equivalent to about $1.60 per short ton. This is for current operating only, but it includes the cost of putting the coal through the breakers, and it is a cost based on the finished product which may be calculated to be only two-thirds the run-of-mine product. Details for the cost of breaking are not given, but from inquiries made in the region, it seems that 40c. per ton is an average. Deducting this sum we get $1.20 for mining alone, and this is for mining 1½ tons of run-of-mine coal. The actual cost, then, per ton of run-of-mine to this company seems to be some 80c. per short ton.

The capital and general charges that follow in the statements largely explain themselves. The only item to which I wish to draw special attention is that of improvements, which is regularly charged in as an operating cost. This is entirely as it should be, and the charge is doubtless based on the theory that the annual improvements to plant are simply sufficient to cover the renewal of equipment. The company has charged to improvements and equipments at collieries $13,092,635. This is equivalent to about $1.30 per ton on its annual output. Some companies would have charged a much larger amount to this item. The amount has not been increased in recent years in spite of the fact that since 1902 the output has increased 50 per cent. It is usual to charge off for depreciation at coal mines 6 per cent. of the capital employed in the plant and equipment. In the case of the Reading company, such a sum would have been sufficient in 1902, but would fall far short of the charges made in 1908. As costs are usually calculated, therefore, it would seem that this company is writing off somewhat more for depreciation than is strictly necessary. It would be obviously logical for the company to hold on its balance sheet a greater capital for an output of 10,000,000 tons per year than for an output of only 7,000,000 tons.

In other words, I wish to express my conviction that the costs given by the Philadelphia & Reading company for anthracite mining are adequate in all respects, and that, therefore, the accompanying statement gives an excellent idea of the real cost of anthracite mining.

PHILADELPHIA & READING COAL AND IRON COMPANY—STATEMENT OF COSTS.

	1902.	1903.	1904.	1905.	1906.	1907.	Per Ton.	1908.	Per Ton.
Anthracite mined, tons	6,968,566	6,299,449	8,707,508	9,438,665	9,132,353	10,034,713		10,218,392	
Mining and repairs, 1.733	$12,076,964	$11,635,094	$16,683,568	$17,378,181	$16,904,915	$18,741,729	1.867	$19,026,334	1.865
Royalty	392,646	370,226	561,603	621,530	620,217	677,143		667,722	0.066
Taxes	253,212	255,714	239,927	305,900	296,953	296,953		339,087	0.033
Repairs of houses	17,644	15,274	22,087	57,693	37,215	53,040		49,849	0.008
Damages account dirt, 0.34	35,990	6,366	47,104	25,352	7,260	15,768	0 300	2,054	
Improvements	863,428	867,330	1,273,035	1,730,974	1,131,038	1,345,229		1,286,010	0.128
Depletion of lands	374,101	340,445	454,241	478,326	458,541	499,059		514,350	0.051
Fixed charges	419,858	377,747	317,224	104 035	118,466	115,074		117,248	0.012
	$14,433,843	$13,858,196	$19,598,789	$20,691,691	$19,583,552	$21,744,995		$22,002,654	
Total cost per ton, 2240 pounds	$2 07	$2 20	$2 25	$2.19	$2.36	$2 167		$2.153	
Cost per short ton	1.85	1 96	2 00	1 95	2 10	1.93		1.93	

Coal Companies Establish Rescue Stations

Four stations for the training of miners in rescue work have been established recently by the big coal companies of the country and several more are in contemplation. This is a direct outcome of the demonstrations in rescue work being made by the United States Geological Survey, Technologic Branch, at its experiment station in Pittsburg, Penn., and at the sub-rescue station in Urbana, Ill.

"The fact that these stations have been established is gratifying to the Geological Survey," said Director George Otis Smith today. "It shows the interest operators and mine owners are taking in this humane movement, and it is bound to result in a decrease in the number of deaths in the mines. The sole purpose of the Government in taking up this work was to demonstrate its usefulness. It is not the intention to make the rescue-station work permanent."

"Perhaps the most complete of these private stations is that of the Frick Coke Company, which employs 30,000 men. The station has been erected at the Leisingring mine, near Connellsville, Penn., in easy reach of all the Frick company's mines. There is a corps of six men being trained in the use of the oxygen helmet, a device that admits artificial breathing for two hours in the most deadly gases known. In order that the men be given practical experience in the use of these helmets, a part of the station has been devoted to an air-tight room which is filled with gases that will not support life. The men are being given a daily drill in this gas-filled room and are gaining confidence in the use of the helmets. Within a short time, the corps will visit the Government experiment station at Pittsburg, where the members will be given further instructions by the Federal experts.

Whenever a disaster occurs in any of the Frick company's mines, the rescue corps will respond at once and will immediately enter the mine for the purpose of bringing to the surface miners who have been injured or are unconscious from the effects of gases. With these helmets, the rescuers can enter any gas-filled mine where it would be sure death for the miner to go. In many disasters, the men fortunate enough to be outside of the mine when the explosion occurred, have had to remain at the surface for hours, waiting for the ventilation to drive the gases out, knowing all the time that their comrades were dying.

A second rescue station has been established by the Fairmont Coal Company, Fairmont, West Va. A trained corps of helmeted men is ready for any emergency in this field.

A third station has been erected by the Pittsburg-Buffalo Coal company at the ill-fated Marianna mine, in Pennsylvania, which last November suffered an explosion with a loss of 140 lives. Already this

station has a complete corps of six highly trained men who know how to use the oxygen helmets.

A fourth station is at the Zeigler mines in Zeigler, Ill. This company also has a trained corps of six men, all picked for their coolness, courage and daring, for these elements are necessary in rescue work.

Mr. Paul, who has charge of the rescue work for the Government, recently left Washington for Europe where he will study rescue work at the European stations. "In the short time we have been operating, we have saved the lives of six men," said Mr. Paul "and if we did nothing more, the results would warrant everything that has been done so far by the United States in trying to reduce the accident death rate in the mines." However, I am satisfied more good will come from our efforts. The four stations just established will be the means of saving the lives of many miners, for we all know, many a poor fellow, imprisoned in a mine filled with the dread firedamp has lived in agony for hours before he died. I understand that the operators are to establish many more stations.

Automatic Switch Arrangement on Mine Inclines

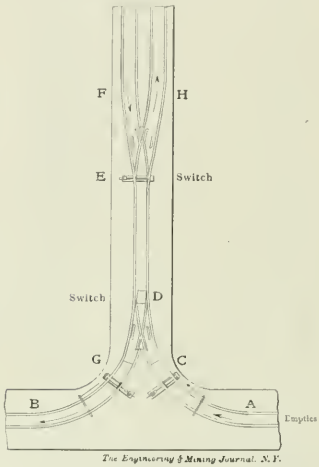
By Robert Grimshaw*

As a rule, in the German mines, and as far as I know, up to the present time in America, the inclines have at the head and foot, turn-tables on which the "empties" are directed to the various headings. These turn-tables cost money for installation and repair, and this repair item upsets the traffic; furthermore, special employees are usually necessary to turn them.

The simple and practical arrangement shown in the accompanying cut, and which I understand is being introduced into some German mines, is intended to do away with the turn-tables, and what is more important, with the men necessary to work them.

Referring to the sketch: *A* is the track for the empties, *B* that for the loaded cars on the wire-rope incline. The empties are run as far as the point *C*, and there hitched to the cables. Passing the throw switch *D* they run in the direction of the arrow past the tongue switch *E*. The full cars run in the direction of the arrow *F*, open the tongue switch *E* and pass the throw switch *D*, going as far as *G*, where they are attached to the rope, which runs them along the track *B*, in the direction of the arrow. The switch *D* is so arranged that after the empties have run over it, the loaded cars, whether they come from *F* or from *H*, are always run onto the track *B*; while the tongue switch is so arranged that it shunts the empties atuomatically and alternately to *F* and to *H*.

The hand switching arrangement at *E* is mechanically unnecessary under normal conditions, but it is there so as to provide for the chance that the switch might not work automatically. The German mining regulations call for certain arrangements of switches and barriers which must be there, whether or not any other contrivances are put in that might replace them.



GENERAL PLAN SHOWING ARRANGEMENT OF AUTOMATIC SWITCH

In order to facilitate pushing the empties, the tracks *A* and *B* are given about a 1-deg. fall in the direction of the arrow.

This arrangement renders unnecessary any coupling of the cars and turning of either empties or loaded ones. Of course, an increased output is possible; the men need not go on the incline at all, and the danger of accident is reduced.

*Engineer, Dresden A, Germany.

Colliery Notes

Recent experiments where gunpowder of given composition was exploded in the presence of one volume of firedamp to 14 of air, 5½ grains of water vapor, and 7.3 per cent. by weight of coal dust, showed: (1) That the explosion of such blasting powder left behind it gases which would burn; (2) that these gases did sometimes burn and cause a secondary flame; (3) that after these gases had burned, there was a vacuum caused as soon as they were cooled down to the natural heat of the mine strata.

In the Saar collieries, in Germany, the evolution of firedamp appears to follow a regular course and is more marked in the bituminous-coal groups than in the longflame; it also increases with the depth from the surface. The mines in this district now follow their development work by using extensive packing, which practice has greatly aided in the diminution of accidents by falls of stone or coal. Engineers at the Saar collieries claim that the use of water in settling dust is not effective, because it induces danger through causing rock to crumble. As a substitute for water, a solution of chloride of calcium is used, or, better still, its dry powder, which, in consequence of its great hygroscopic properties, is soon converted into a concentrated solution, and is capable of preventing the formation of dust for three months. The only objection advanced against the use of this salt is the expense, so that recourse is often had to a cheaper substitute, in the form of rock salt. The results obtained from the use of chloride of calcium in various German mines have been excellent.

Notwithstanding the increasing popularity of electric haulage, the endless-rope system remains in favor at many collieries where special conditions exist. The best features of this latter system of haulage are: (1) It is capable of dealing with large outputs in an easy form; (2) there is less wear and tear of rolling stock than with other systems; (3) it travels at a much lower speed than other system for a given output; and (4) it is, as a result of the foregoing advantages, less liable to breakage and accidents to persons and animals. In determining the size and weight of the rope in an endless-rope system of haulage, an ample margin should be allowed for safety, considering at the same time unusual strains which may come upon the rope by overloading. The net strain on the rope at the driving-pulley rim may be taken as the net load or resistance to be overcome by the engine. In practice, it is usual to allow from 25 to 50 per cent. for friction in engine gear and margin for undue requirements.

Some engineers believe that dust containing the highest percentage of volatile matter is the most dangerous; others assert that steam-coal dust with a high percentage of carbon is the most dangerous. Mr. Ashworth, the well known English authority states that it does not matter which kind of dust occurs providing it is equally fine and from a gaseous mine. He also says that no dust is really dangerous unless it is exposed to a certain degree of heat and for a certain length of time. In this connection, a German professor, named Bichel, has shown that 1/6 oz. of black powder would ignite, while 2 lb. of carbonite (a variety of permitted explosive used in Europe) would not do so, because the duration of the powder flame was 500 times as long as that of carbonite. This same authority states that with a temperature of 1200 deg. F., a flame must last for 10 sec to ignite firedamp, but if the heat was 1800 deg., only 1 sec. was required. Continuing the discussion, Professor Bichel says that the speed of detonation varies greatly; thus, the speed of dynamite is five miles per second, while that of carbonite is only 1½ miles per second.

Precipitation of Copper from Butte Mine Water

Waters Carry from 0.01 Per Cent. Copper to 0.03 Per Cent. and Higher; Weakly Acid Waters Require Slower Flow. Leaching Old Tailings

BY CHARLES J. STONE*

The industry of precipitating copper from the mine waters of the Butte district within the past 10 years has grown to such an extent that it is at present of material and increasing commercial importance. No less than 30 precipitating and leaching plants are in operation along the Silver Bow creek in east Butte, and the total output of precipitate, or cement copper is about 750 tons per month. The product will average 60 per cent. pure copper and approximately 900,000 lb. of copper per month are recovered.

The operators of these plants are the large mining companies themselves, down to the leasers and to the individual who takes the tail waters from the large operators and wins from it a little of the remaining copper that will precipitate. The Boston & Montana, an Amalgamated company, alone recovers 100,000 lb. of copper per month, and its operation shows a profit over and above its entire pumping expense.

While there is nothing new to engineers or metallurgists in the precipitation of copper in an acid solution by passing it over scrap iron and tin cans, yet some of the Butte operations present features of interest. Great difficulty was at first experienced by the mining companies to find something that would withstand the action of the mine waters on pumps and pipes and that would be within a reasonable cost. Phosphor-bronze castings were found to be necessary for the entire water end of all pumps where the water was found to be even slightly acid. The phosphor bronze is composed of 93 per cent. copper, 0.5 per cent. phosphorus, 4.5 per cent. tin and 2 per cent. lead. This metal, however, was too expensive for pipes.

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Water Pumped in Wood-lined Pipes

Flanged-steel pipes with lead gaskets and lead lining were found to withstand the action of the water with a degree of satisfaction, but wood-lined pipe, which is less expensive, is now in practically universal use throughout the Butte district. For high-pressure water columns in shafts and other lower pressure pipes, a flanged-steel pipe is used and the wooden lining forms a male and female connection at the joints.

The lining is composed of pine slats put in place with hot asphaltum and the key piece is fitted and driven in firmly, so that the lining is held tightly in place. The whole pipe lining is then carefully painted with asphaltum, and when the pipe is put in place, great caution is taken in packing the joint to prevent seepage. In shafts where water from the upper levels drips on the pipes, it has been found necessary to thoroughly paint and cover the pipes with canvas, and the canvas then receives a thick coat of asphaltum. Wooden, wire-bound pipes are also used underground for light service, and on the surface wooden launders or flumes are used.

The copper content as well as all other mineral salts and the amount of free acid tained in the mine waters, varies widely in different mines and different sections in the district. Cupriferous waters were not encountered to any great extent in the upper levels, nor at shallow depths, but when the shafts penetrated the great copper horizon at from 500 to 2200 ft. in depth, the waters were found to be highly charged with mineral salts and free acid.

Enriched Water from Fire Levels

Old workings, abandoned upper levels and gob or stope fillings that have long been exposed to the oxidizing influence of air and where waters leach through them, are productive of the highest grade of cupriferous water. When a deep level is opened, the flow is found to contain free acid, but only a small amount of copper sulphate is present. As the levels become opened and decomposition of the sulphides takes place, the water is enriched.

A flow coming from a section where the sulphide ore is burning or from a level where the fire has been extinguished, is enriched remarkably. The mine water of the Boston & Montana has been built up within a short period of time from this source alone from 0.02 per cent. copper content to above 0.2 per cent., and at this strength it threatened to destroy the phosphor-bronze castings of the pumps. For this reason an effort is made, where possible, to regulate the grade of water to a strength that will not attack the bronze pump parts.

The cupriferous water from the various mines carries from 0.01 per cent. to 0.031 per cent. copper as copper sulphate. The process to recover this as native copper by passing the solution over scrap iron is simple. The iron supplants the copper in its union with the sulphate radical, the copper being precipitated as a crystalline powder, while the sulphate of iron is carried off in solution. It would appear that the mine waters are extremely poor in copper as compared with the solutions in a leaching operation, but when a mining company is pumping 500 gal. per min., the precipitation amounts to approximately 1600 lb. of copper per day and the saving is effected with but little expense.

Precipitation Equipment

The copper precipitation is effected in

LEACHING TAILINGS WITH BUTTE MINE WATER

BOSTON & MONTANA SETTLING TANK AND CLEAN-UP HOUSE

open launders and in towers. The launders are set at sufficient grade so that the water flows rapidly, and scrap iron of all classes is thrown into it, but care is taken to allow the water to flow freely. The launders are from 3 to 4 ft. wide and from 1 to 2 ft. in depth, and are built single or double. The water is kept at from 6 to 12 in. in depth in the launders. If the water as it comes from the mine is strong in acid, better results are obtained where the water flows at a greater velocity, but if weak in acid, a slower flow is desirable. It is well at all times to keep the iron and launders free from accumulations of iron oxide.

The towers are built from 8 to 12 ft. wide, 10 to 14 ft. high, and from 50 to 150 ft. long, the size depending entirely upon the flow to be handled. They are built open on sides and ends and large scrap sheets of iron are placed to hold the dripping water within the water-tight bottom; or they are inclosed entirely on all sides by baffle boards to keep all water within the tower sump. The water comes into the top of the tower in an open launder and the flow is regulated by means of gates and side distributing troughs so that the shower is uniform throughout the tower. The tower is filled with scrap iron for perhaps one-quarter to one-half its hight.

Better Extraction in Towers

Experience has shown that a better extraction is effected in the towers than in the launders. This is especially noticeable where the solution is both weak in acid and copper. Doubtless exposure to air has a beneficial effect, but the arrangement is more efficient in that the falling water keeps the scrap clean and bright, and prevents an accumulation of iron-oxide slimes.

A clean-up is effected by turning the flow into other launders of the plant, scrubbing and washing the scrap free from copper scale and sluicing the launders and tower sump into settling vats, where the clear solution is decanted off. The cement copper is then dried, barreled and shipped to Great Falls where it is smelted in reverberatory furnaces. The average quality of the precipitate is between 60 and 70 per cent. copper.

A well-arranged plant is so located that the solutions can flow by gravity from the mine through the launders and down through towers, with the clean-up vats below. It is well to place the clean-up vats and dryer under the same roof. The extent or magnitude of the plant depends upon the limit of extraction it is found profitable to make from the solution. All launders and towers should be built in parallel duplicates so as to facilitate rapid and thorough cleaning. Wrought and steel scrap are better than cast iron and thin sheets are more satisfactory than heavy pieces. About 75 lb. of cement copper are recovered in practice from 100 lb. of scrap material.

Leaching Old Tailings Dumps

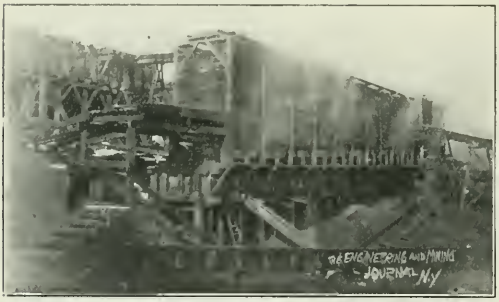
A number of the large tailings dumps from the early concentrating mills, which were neglected for years, are being worked successfully in connection with the precipitation of copper from mine waters. The dumps carry approximately 1 per cent. of copper. Years of weathering have made possible the leaching of these tailings on a profitable basis.

The dumps are from 20 to 50 ft. in depth and cover many acres of ground. The James Gillie lease, operating on the old sands of the Montana Ore Purchasing Company, is worth studying from an engineering and economic standpoint. The dump, which is located in the bed of Silver Bow creek, contains upward of 200,000 tons of sands. They average from 20 to 30 ft. in depth.

The supposedly barren tail water from the precipitating towers of the Boston & Montana Company is elevated to the highest point on the dump. Ponds of from 5000 to 15,000 sq.ft. are arranged so that the overflow from the higher will run to the next lower pond until the entire flow is absorbed. To reclaim the water after it has leached through the sands and taken up the soluble copper, two level tunnels were driven through the dump on the slime-covered soil of the valley and a cribbed trench surrounds the dump, all of which lead to a common sump to be elevated into the precipitating towers or flows by gravity into precipitating boxes.

The water which is fed to the ponds contains but a trace of copper and is very weak in free acid. After leaching, its copper content has been built up to 0.02 per cent. and precipitation is satisfactory. The product from this particular plant averages 80 per cent. copper. They are pumping 750 gal. of mine water per minute upon the sands and, approximately, 80 per cent. of this is recovered and fed to the precipitating plant. A daily analysis of the leached solution will give a close estimate of the daily recovery of copper.

This method of leaching, while attended with serious losses in solutions, is possibly the only method by which the sands can be treated commercially. However, it does not prove that it would not be advisable to convey the sands to leaching tanks and add a small amount of sulphuric acid to assist extraction. A 20 per cent. loss in solutions on the method that now obtains at this plant amounts to a loss of 324 lb. of copper per day. This, doubtless, sinks into the soil of the valley and is beyond recovery. As far as known to the writer, no regrinding and leaching test has ever been made on Butte tailings to determine if they can be worked commercially.



BOSTON & MONTANA PRECIPITATING TOWERS AND LAUNDERS AT BUTTE, MONT.

The Broken Hill Block 10 Company, New South Wales, has practically completed a contract (*New Zealand Mines Record*, Feb. 16, 1909) to sell to the De Bavay Company 300,000 tons of zinc bearing tailings. The price to be paid per ton will depend upon the average value of spelter over a term of three years

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In the February issue of the *New Zealand Mines Record* it is stated that the North London Railway Company carries 1,000,000 tons of coal and coke, and 2,000,000 tons of merchandise over its lines in the course of a year.

Manganese Deposits in Southern India

In India the production of manganese increased from 3130 tons in 1893 to 581,-036 tons in 1907. The extensive prospecting in India has opened up a new manganiferous region in the southwest embracing the native state of Mysore, the northwestern part of the Bombay Presidency, and the Portuguese territory of Goa. In Mysore alone by 1907 more than 1000 square miles of land had been taken up for manganese mining, notwithstanding the fact that this region only came into prominence in 1906. In this same year the export from Mormugao harbor increased ten-fold.

These south Indian manganese occurrences are classed by F. O. Ahlers, in a paper presented before the Institution of Mining and Metallurgy at London, November, 1908, as either being in conjunction with the South Indian laterites or, as in the hematite-quartzite bands of the Dhawar beds. The Goa deposits and others toward the western Ghats are cited as examples of the first class. Examples of the second type are found throughout the huge hematite-quartzite beds which characterize the Dhawars. Here exploitation has advanced where the manganese bodies open out into large blows of almost solid ore.

In general, although the quartzite bands carry some manganese the ore deposits worthy of note are considered to be due to secondary enrichment from meteoric waters. The replacement is easily observed on the outcrops where the iron oxides were attacked first. Angular fragments of the original iron ore are frequently observed coated with manganese.

Disintegrated quartzite fragments in the form of quartz sand are also found in much of the ore, giving to it a spotted appearance. Where the replacement has been complete the ore usually runs more than 50 per cent. metallic manganese.

The manganese deposits, information of which we gain from the work of Mr. Ahlers, are those of the native state of Sandur, Bellary district, in the north of the Madras Presidency. The Sandur state occupies an elliptical basin about 24 miles long with a width of about 13 miles. The Narihalla river cuts transversely through the two ranges of hills which form the rim of the basin.

Geology

The Sandur hills are a portion of one of the beds of the Dhawar series of rocks. These are of Archaean age and of a schistose nature. The characteristics of this locality are those of other Dhawar areas. The predominant rocks are argillites, hard crystalline schists in the lower beds, but weathered to soft shales toward the tops of the ridges. Hematite quartzite bands occur frequently running conformably with the country and massive intrusive dikes, usually of a basic nature, traverse the series. Surrounding the hills is gneiss, which is the most common rock in this part of India.

In the north end of the valley there is a true syncline, but the southern part is more complex and is connected to the east with the Copper Mountain range. Upheaval is marked as indicated by the upturned strata in the middle of the basin. The dip flattens out toward the rim, and flat hill tops forming a high plateau are characteristic. Another noticeable feature is the ferruginous deposits chiefly of laterite and lateritic conglomerates covering the plateau. Hematite is bedded with the country rocks while the laterites form a capping sometimes 25 ft. deep.

The Orebodies

The manganese deposits are situated in the softer rocks of the series usually at or near the forests of the hills. These deposits may be divided, for consideration, according to location into four divisions, namely: Those occurring at the top of the outside slope of the western range; those in a similar position in the northern part of the eastern range; those at the top of the inside slope of the eastern range, and those occurring as plateau deposits.

Deposits of the first nature are of the greatest importance, and for 24 miles along the range nearly every spur on this outside western slope shows an outcrop of ore. In places there are sheer cliffs showing 70 ft. of ore, and many are to be seen from 20 to 40 ft. high, and of lengths ranging up to 400 ft. These deposits present a remarkable view, and by their appearance of continuity and from the fact that they always conform with the country in dip and strike suggest an imbense bed of ore. Drifts and prospecting pits have, however, proved the maximum depth attained by these orebodies to be about 80 ft. The lateral extent is so great, however, that there is an immense amount of ore.

The other three occurrences of ore are of miner importance. On the inside slope of the western hills few large deposits are seen; on the eastern hills the deposits are of no great extent, and those on the plateau have a depth of only about 10 ft. The manganese ore ends abruptly in contact with a conformable layer of hematite which changes in a couple of feet to ferruginous shale and then to lithomarge. The lithomarge is relatively thick and underlaid by the country rock.

The Ore

The manganese ore of the Sandur deposits is remarkably pure, although always associated with iron. Psilomelane is the chief ore. It is hard and of a bright, steely luster where exposed to the air, but friable and schistose in the interior of the deposits. Braunite and some wad is also found in the plateau orebodies. This is more closely associated with the iron capping than with the massive deposits. Remarkable, too, for Indian manganese occurrences, nests of fine manganite crystals are found all through the ore. Crystals of pyrolusite and probably of hollandite as pseudomorphs after manganite have also been identified by A. Chose in his study of the ore of Sandur. Harmful impurities all run low, silica usually below 2 per cent., and phosphorus fairly constant at 0.01 per cent. The ore always carries some iron, seldom less than 5 per cent., and ranges through all stages from ferruginous manganese to pure hematite.

By students of these orebodies the original rock is considered to have been metasomatically replaced by the oxides of manganese and iron through the agency of meteoric waters. Mr. Ahlers found that the country rock 10 ft. below the lithomarge contained 3.75 per cent. metallic manganese. He considers that as erosion advanced the manganese was concentrated, then acted upon by solutions, charged with carbon dioxide derived from decaying vegetable matter, acting as solvents. These solutions rising as the surface rocks became heated in summer, deposited their metallic burden at the surface. This is corroborated by the fact that the greatest wealth of ore is found on the hillsides most exposed to the sun. The association of ore with lithomarge is characteristic of the region. Everything indicates that the site of these interesting orebodies was formerly occupied by a soft shale, while this same evidence all tends to disprove any such theory as that of original deposition which might be offered to explain these occurrences.

Zinc Mining in Algeria

It appears from particulars given at the general meeting of the Mines d'Ouasta et de Mesloula, Algeria, that the working of both mines was successful in 1908. The Ouasta calamine is forwarded to Antwerp and the zinc contents of the shipments have been improved by the newly installed concentrating mill. The Mesloula lead ore, sold to the Compagnie de Pontgibault, was forwarded to the works at Couéron in Loire-Inférieure. The board of directors has informed the shareholders that concentrating mill No. 2, begun in 1908, is now completed and started. Thus equipped, the Mesloula mine can yield a yearly production of 10,000 tons of marketable ore and will rank as the first lead mine in Algeria. The company is interested with Mokta-el-Hadid in the Ain Alléga concession of lead, zinc and silver ores, and is carrying out an interesting program of investigations both in Algeria and Tunisia.

Milling in the Cripple Creek District, Colorado

By S. A. Worcester*

It is my purpose in this article to afford some useful suggestions to operators interested in the Cripple Creek district, by mentioning some of the causes which have contributed to failure in its past milling operations; also by directing attention to results thus far obtained by mills in operation, to encourage conservative investment in local treatment plants of moderate size, well designed for economy in construction, operation and maintenance.

I have now in mind 24 mills, ranging from 10 to 1000 tons estimated daily capacity, which have been erected in this district and operated with varying degrees of success and failure.

Mills That Were Failures

One or more of the largest of these plants have been grafting operations and have not run for more than a few days or perhaps a few weeks at any time. Two custom stamp mills, built at large expense early in the history of the district, with the aid of little or no knowledge of a practical process for these ores, had short lives, and, after periods of idleness, burned to the ground.

Two later custom mills, one a roasting and cyanide plant, the other a large chlorination plant, were operated with fair success as long as the general grade of ore was sufficiently high to justify their minimum treatment charge of $6 or more per ton. When the grade of ore lowered, they ran intermittently for a while, then were destroyed by fire. At least eight of the mills now standing were built with capacities far too large for the available ore supply. Several of the present mills were erected by managers having no practical knowledge of milling operations, yet perfectly willing to try their own valueless ideas *ad infinitum*, at the expense of the shareholders. These mills either have been, or will have to be, remodeled completely before satisfactory results can be obtained.

Aside from flagrant financial irregularities, the principal cause of failure is probably the fact that managers did not ascertain with sufficient thoroughness the quantity, character and value of ore available for treatment, before erecting plants. It is difficult for some men to believe that mill returns from their own plants will sometimes run far below their mine samples. They are also unable to resist the temptation to overestimate the continuity of an orebody and to build accordingly.

*Mechanical engineer Victor Colorado.

Faults of Location and Design

A number of mills by being located at a distance from railroads, have incurred a minimum haulage of 65c. per ton, which is quite a serious item. Nearly all of the mills are so located as to require either haulage or tramming from mine to mill. There is at present but one mill in this district at which the mine skip dumps directly into the mill bin, and this skip dumps at a point so low that the ore interferes with further dumping as soon as the bin is about one-fourth full. The items of labor and power cost and maintenance are dependent primarily on the design of the plant. In many cases plants which were intended by their designers to be completely automatic have had their mechanical details so incomplete and so poorly designed and arranged as to render continuous operation impossible.

In local cyanide plants it is no uncommon practice to shovel or scrape ore into a crusher instead of using an automatic feeder, to load tanks with a hand-operated car instead of an automatic conveyer, to level the charge with the shovel instead of the automatic excavator, to discharge the tanks with the shovel and perhaps tram the tailings to the dump with a car. Automatic machinery for these operations, now thoroughly practical, is at the command of every well-informed designer and repays its cost in a few months, sometimes a few weeks, of continuous operation.

Items of Expense and Loss

One important item of expense in this district is the cost of water. Those plants that sluice out their tailings pay large monthly bills for this item alone. Several objections to this method may be cited, including the labor cost of sluicing tanks, the expense of maintaining dams if the tailings are to be retained on the millsite, the maintenance of metal-lined sluices if the tailings are carried any considerable distance, the frequent damage to filter canvas by the sluicing stream, the liability to damage suits when tailings are allowed to run down the gulch, and the loss of possible values in the tailings, which, although at present are negligible, may at a future time be made valuable by improved processes if the tailings are retained. These objections may be removed by use of the excavator and conveyer system, which deposits the tailings automatically near the mill, at very small cost.

Among fruitful sources of loss in past milling practice has been the revolving roasting furnace in its various forms, losing much in dust and wasting heat by its short and direct passage from the grates to the stack. The revolving furnace is now out of use in this district. The chlorination process, always expensive, has now been superseded generally by the cheap and simple cyanide process. Oxidized ores are crushed to the required fineness and treated by simple leaching or by agitation in cyanide solution. Briefly summarized, the principal causes deterrent to past and present milling in this district seem to be: (1) Graft, or large financial irregularities; (2) entire ignorance or inexperience; (3) lack of knowledge of the most economical process (4) overestimated ore supplies and excessive plant investment; (5) ill-advised location of plants; (6) poor mechanical design and construction.

Passing the first and considering the second cause named, it is highly important that the manager, if not experienced in mill work, should have sufficient business sagacity to select and employ experienced and educated men for his expert work, so as to accomplish results. The third cause reminds us that laboratory tests are seldom sufficiently comprehensive to furnish full data as a safe basis for designing a milling plant. I consider it advisable to erect and operate an experimental plant, in some cases one-tenth of the probable size of the complete installation, and to operate it until all parts of the orebody have been thoroughly tested. In some cases this experimental plant may later become a unit or part of the completed mill.

The fourth cause overestimated ore supply, reminds us that the value of thorough preliminary sampling and testing is seldom fully recognized. It is far better to expend several hundred or even several thousand dollars, if necessary, in repeated sampling and adequate testing, in order to learn positively that a plant will not be justified, than to invest ten times as much time and money in a plant, only to learn that success is unattainable. The fifth cause suggests that where conditions are favorable the mill should be so located that the mine skip may dump directly into the mill bin, thus eliminating all transportation.

Designing the Plant

The sixth cause mentioned brings to mind the propriety of employing the best obtainable talent, even at considerable expense, for the design and construction of the mechanical features of the plant. The engineer employed for this work should combine thorough technical training with considerable practical experience, and should be given time sufficient to complete designs and specifications in a thorough manner, before commencing construction. Very few mining operators appreciate fully the very great economies, both in construction and operation, which are made possible by carefully considering and comparing a number of different preliminary pencil layouts of a projected plant, the engineer being in collaboration with the manager and perhaps one or

more of his assistants, and due weight being given to any suggestion offered, in order that no point of importance may be overlooked. When the drawings and tracings are completed, and specifications and bills of material written, they should be carefully checked by some other person than the designer, in order that no mistakes in figures, calculations or dimensions may pass out, to cause misfits, delays, expense and possibly litigation. This thorough and painstaking course of procedure is, in itself, more expensive than merely making one or two hasty pencil drawings and beginning work on the plant at once, but the more conservative start will inevitably result in earlier completion, at less cost, better construction and far more satisfactory operation. By submitting complete blueprints and specifications to competitive bidders, using the engineer's estimates, a low tender can nearly always be secured.

Successful Plants

Although many past records are discouraging, there are at present in more or less regular operation in this district, five cyanide plants, three of which use comparatively coarse crushing and the simple leaching process, while a fourth separates the pulp into slimes and sands, leaching the sands and agitating the slimes. The fifth plant reduces the entire pulp to slime and treats by agitation with cyanide solution, finally washing the rejected slime with the Butters vacuum filter. The average gold content of the ores treated by these five plants, with an approximate daily capacity of 250 tons, is hardly greater than $4 per ton, or 50c. less than the lowest rate offered by the outside custom mill for freight and treatment, yet these local mills are clearing a fair profit. One local plant has been treating for some time about 100 tons per day, of ore averaging less than $2 per ton, yet it is paying regular dividends. The comparative success of these plants is a standing invitation to mining operators to enter the milling field, with its probable larger net results.

Mining and Milling Costs

A few figures will suggest how small a portion of the mineral value of the ores of this district become net returns to the small shipper. Mining is seldom less than $2 per ton. Hauling is 65c. minimum; sampling $1; freight and treatment $4.50 minimum; moisture and other penalties, resampling and incidentals will raise the minimum cost to more than $8. In mining operations of moderate size, it is seldom that any net profit can be realized from ore not exceeding $8 in gold content. An operator having 8000 tons of $8 ore might possibly net 50c. per ton, or $4000, by the time the ore is exhausted, under favorable circumstances.

The following figures, based on practice, indicate good results from a very small plant, located so that the mine skip dumps into the storage bin of the mill, from which the crusher is fed. This roasting and cyanide plant of 20 tons daily capacity will cost about $12,000, ready to run. It is so designed as to be operated by one man, on each of three eight-hour shifts. Supposing this mill to operate continuously for 400 days, treating 8000 tons of $8 ore, daily operating costs per day will be about as follows: Mining cost, $40; interest, repairs and amortization, $30; labor and superintendence, $15; cyanide, $2; power, $2; roasting, $6; water, $1.80; laboratory, incidentals, etc., $1.20; total daily cost of mining and treating 20 tons, $98. The gross daily result of 85 per cent. extraction will be $136 and the net daily result $38. The total net profit from 400 days' operation will be $15,200. The plant should, after 400 days, be worth $6000. While the initial expense of a roasting furnace is an item of considerable importance in plants for treating the unoxidized ores of this district, it is a fact not generally known that a furnace of the McDougall multiple-hearth type, with which I have had considerable experience, can be built and operated successfully on these ores in much smaller and less expensive units than those now generally used. The principal objection to its adoption thus far raised, namely its tendency to produce dust, is easily overcome by a trifling modification in the method of transferring the ore from hearth to hearth. Its economy of fuel, space and power over all rectangular furnaces is quite obvious, and the low initial cost is also much in its favor. There are in this district a number of bodies of oxidized ore of low grade, entirely suitable for moderately coarse crushing and plain cyanide treatment by the leaching process. A 20-ton mill of this character can be erected in this district for about $7000. Suppose the available ore to be 10,000 tons, of $5 per ton, dumped by the mine skip directly into the mill bin. If properly designed, this mill can be operated by one man, working eight hours per day, the crushing being done in about four hours. The mining cost can be made about $1.50 per ton under proper conditions, and treatment, including labor, power, water, cyanide, amortization, repairs and incidentals, will cost about $1.20 per ton; with this automatic plant, giving a recovery of 80 per cent., or $4 per ton, there should be obtained a net return of $1.30 per ton, or $13,000 from 10,000 tons. The plant should be worth at least $3000 after 500 days.

If a plant is so located as to involve expensive transportation, and is built without a thoroughly considered design, so that the initial and operating costs are excessive; if the extent, character and value of the ore supply are uncertain; then there is small probability of success. On the other hand, with a well determined ore supply, a treatment plant so located as to eliminate all transportation, and so carefully and thoroughly designed and constructed as to reduce initial cost as well as operating cost to a minimum, there is extreme probability of the small plant competing very successfully with the distant custom mill. The mills of the past have been largely wasters. Present mills, although not all automatic, are still a marked improvement on past practice, and I predict confidently that future mining operations will be largely augmented by the success of mills of moderate size, contiguous to the mines.

Mineral Possibilities of the New Hebrides Islands

By G. M. Colvocoresses*

Little has been written concerning the geology or mineral possibilities of the New Hebrides islands. There are two reasons for this: (1) The interior of all these islands is almost unexplored; (2) such exploration and prospecting as has been done has not yet resulted in finding any workable mineral deposits (with the exception of sulphur) in spite of the occasional wild stories of hidden wealth that filter out from various parts of the group. The New Hebrides islands are situated in latitude 12-20 deg. south and longitude 165-170 deg. east, or about 200 miles directly north of New Caledonia. The total area of the group is estimated at something over 6000 sq.m., and the population is composed of about 500 whites (French and British subjects) and an undetermined number of natives variously estimated at from 40,000 to 75,000. The climate of these islands is of the worst, being very hot and very moist, especially in the hurricane season (December to March).

During the years 1902, 1903 and 1904 the greater part of which I spent in New Caledonia, various tales of mineral finds in the New Hebrides kept coming to Noumea, and at the beginning of 1905 I determined to make a trip to the New Hebrides and ascertain, if possible, the truth of some of these stories. I had, moreover, two distinct objects in view: (1) to examine the volcanic deposits of sulphur which were known to exist on the islands of Vanua Lava and Tanna; (2) to determine whether or not the New Caledonian formation of peridotite and serpentine rocks with their attendant deposits of nickel, chrome and cobalt ores

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extended northward and cropped up again in the New Hebrides.

Accordingly I spent the greater part of January and February, 1905, in the New Hebrides, traveling about on a small copra-trading steamer, visiting eight of the principal islands, examining the beaches, river beds and rock formations and any accessible point of interest, and obtaining specimens and information from the missionaries, settlers and natives. The trip itself was an unusual and interesting one, but the results in the main were unsatisfactory.

Geology

It would be hard to imagine a region in which it is more difficult to do prospecting or geological work. Expeditions into the mountains and interior of the islands were only possible in a few cases and almost invariably the jungle vegetation was so thick and the outcrops of rock so rare and hard to trace, that any real study of the formations was impossible.

The formation of practically all the larger islands seems to be similar; there is a core or center of volcanic origin, the volcanoes themselves being generally extinct, but some are still active on the islands of Vanua Lava, Ambrym, Aoba, Lopevi and Tanna. In some cases as Lopevi, the island itself is really nothing but the volcano which rises in a perfect cone from the sea to a hight of over 4000 ft., with deep water close to the shore and practically no lowlands surrounding the slopes of the mountain. On most of the islands, however, the volcanic core is surrounded by sedimentary and coral formations, and the land has been raised by successive upheavels so that the coralline limestones are often found at a hight of several hundred feet. At various times lava flows have spread out over these benches of coral and is some cases completely covered them and run over into the sea.

The coral rocks and the lavas seem to form by far the greater part of the islands. The lavas are mostly acid in character, with feldspar predominating and generally perfectly crystallized. For the most part they appear to have cooled very quickly, being full of gas bubbles. In places tufas have formed together with pumice stone and great beds of volcanic sand. There are, however, some schist formations of sedimentary origin generally of limited extent, much thrown and tilted and metamorphosed in places. These are usually covered with heavy soil and vegetation and very little can be said concerning them. Chronologically, I believe that all of the New Hebrides islands are of comparatively recent origin and they are still very incomplete since land is continually being made by the volcanic outflows from above and also by the uplift of the coral reefs from beneath. In places subsidence may be going on, but for the most part the contrary is the case.

Rocks and Ore Deposits

As stated, the rocks forming these islands are mostly coralline, volcanic lavas, tufas and schists. Nowhere was I able to find any evidence of peridotite or serpentine formations, nor of any outcrops of intruded plutonic rocks with which ore deposits might well be associated. It is, however, possible that such exist in the more inaccessible portions of the group and especially in the central mountains of Santo and Mallicolo.

Decomposition of the more basic portions of the lavas have formed small beds of ferruginous clay and ochre at several points and the latter is used by the natives as a paint with which to smear their bodies and decorate their totems. Magnetic-iron sands also are found in some quantities near the seats of volcanic action and especially along the sea beaches where the lavas have been broken and ground up by the waves.

On the island of Mallicolo there are some deposits of graphite. The mode of occurrence is not clear, but it seems probable that the deposits are of the bedded variety. They are found in schists formed largely from calcareous (coral) sediment and partially metamorphosed, due to some volcanic activity in their vicinity. The quality of the graphite is rather poor, and no deposit of commercial importance has yet been found.

On the island of Pentecost and elsewhere, I found considerable iron pyrite in the river beds, but none of the specimens examined contained gold in any appreciable quantity. Rumor of placer gold in some of the river sands and of gold-bearing quartz veins in the interior have been persistently circulated, but I was unable to find any evidence of their truth. The natives of these islands possessed no gold, the missionaries and settlers who have inhabited portions of these islands for over 50 years have never obtained any, and I am strongly of the opinion that no gold is to be found in this group in sufficient quantities to pay for its extraction.

Sulphur

As to the sulphur, it is here, of course, purely a volcanic product, and deposits have been formed and are still forming at Vanua Lava, Tanna, and to a less extent on some of the other islands. The gases emanating from the craters and the fumaroles and crevices along their sides and the waters of the hot springs near by are highly sulphurous, and the sulphur is deposited as a sublimate in thin layers mixed with sand and silicious sinter. No deposits of cinnabar, stibnite, or other sulphides seem to be associated.

As stated in an article in the Journal Dec. 23, 1905, an attempt was made a few years ago to work the sulphur deposits on Vanua Lava, and considerable money was expended for equipment. But the fever and dysentery quickly bowled over the engineers and white laborers who went there, proving fatal in many cases, and for this and other reasons the project was then abandoned. Recently there has been some dispute as to the ownership of this property, but this will probably be settled in the near future by the joint English and French commission which is for the first time issuing regular titles for all properties held or claimed in these islands.

At Tanna, considerable sulphur was mined about 20 years ago and shipped to Australia, but a later eruption of the volcano completely closed up the entrance to Port Resolution, the shipping port, and since that time no active work has been carried on here.

Possibly the sulphur deposits may be again worked in the future; also some mineral deposits of value may be discovered and worked after the natives have been brought under better control and systematic exploration is made possible. But in general, I have not a good opinion of the mineral possibilities of the New Hebrides. The difficulty of access, especially during the hurricane season, the long distance from the principal markets of the world, the high cost of all supplies, the unhealthy climate, the lack of skilled labor and the poor quality of the unskilled labor available are some of the things that would have to be seriously considered by any mining company wishing to operate in the New Herbrides.

Making an Elecric Hot Plate

C. A. Rose (*West. Chem. and Met.*, IV, pp. 113-114) describes a home-made resistance-wire electric hot plate. A box of 1/16-in. sheet steel, 2½ to 3 in. deep and the other sizes as desired, is lined throughout except the top with 0.25 in. asbestos, using several thicknesses on the bottom. The asbestos is fastened to the vertical sides by iron strips, ⅛x½ in., bolted to the box. The top of the box is a 3/16-in. plate fitted loosely and supported by the iron strips. Resistance-wire coils, ⅝ in. diameter are strung back and forth across the box, insulating each coil from the adjoining one with a 1-in. strip of heavy asbestos paper. Adjacent turns of a coil should not be in contact. The coils are held in place at their ends by wire fastenings attached to an extra strip of ¼-in. asbestos at either end of the box.

An absorption of 1280 watts per sq ft. of surface will maintain the hot plate at a temperature of 327 deg C. The length and thickness of the wire can then be easily calculated, using as heavy wire as possible on account of its mechanical advantages. With a 230-volt circuit, Mr. Rose used 600 ft. of No. 18 wire (Brown & Sharpe gage) wound in two coils, connected in multiple, for a hot plate of about 2⅓ sq ft. area.

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The Decision on the Commodities Clause

The decision of the United States Supreme Court on the appeal taken by the Government from the Circuit Court in the suits brought to enforce the Hepburn law, while it is on the face of it a reversal of the lower tribunal, proves to be much less than that in practical effect. The Circuit Court held that the so-called commodities clause was unconstitutional in that it would deprive the companies directly concerned in the suit of their property without due compensation. The Supreme Court sets aside this part of the decision, holding that the law in itself is constitutional and that its passage was within the powers of Congress to regulate interstate traffic. On the other hand, it limits materially the contentions of the Government and brings down the provisions of the law in such a way as, to make it cover a very narrow limit.

The Hepburn act prohibited railroad companies from carrying commodities which they own, or in which they were interested, and was intended to compel railroad companies to divest themselves of all ownership in coal mines or other industrial enterprises. The suit to enforce the law was brought against a number of the anthracite coal companies of Pennsylvania as the most conspicuous offenders. It proves, however, under this decision, that it cannot be enforced even against these companies. The Court holds that the ownership of stock by a railroad company in a coal-mining company does not constitute such ownership of the coal carried as would debar the railroad from transporting it; and further that it is not forbidden to carry it, provided it is sold in good faith before the transportation is begun. Under this decision those anthracite carrying roads which mine their coal through the medium of a subsidiary corporation need not make any change in their present arrangements. In two cases —those of the Delaware & Hudson and the Delaware, Lackawanna & Western— where the companies own and operate their mines directly, it will be necessary for them either to transfer those mines to another corporation in which they may own all the stock; or to alter their methods of selling by disposing of the coal at the mines, instead of selling it at tidewater or other points. Such arrangements can be made without much difficulty, although they may require a little time to effect.

In brief the Supreme Court decides that the act is constitutional, but with such limitations as will make it practically impossible to enforce it in the sense and intention with which it was originally passed.

The most important change effected by the law will be that the anthracite-coal roads will have to discontinue the practice, which has prevailed for a number of years, of buying the coal of the independent operators at an agreed percentage of the tidewater price. Such coal, it would seem, will have to be accepted at a freight rate to be established as other freight rates are. It is probable, however, that a subsidiary company could purchase such coal under any lawful agreement, as that would be quite apart from the transportation.

The Lake Coal Trade—A Study of Freight Rates

The coal operators of the Pittsburg district, through a representative committee, have recently made an application to the Interstate Commerce Commission, charging that the railroads discriminate unfairly in the rates charged on coal from that district and Ohio, as compared with West Virginia coal. This is especially the case with the rates on coal to Lake Erie ports for shipment by water to the Northwest; and it is these rates which have been selected as the point of attack before the Interstate Commission.

The case of the operators is fairly stated in a circular issued by H. P. Taylor & Co., of Pittsburg. A table has been compiled and is presented, showing the railroad rate on Lake coal from different districts, the average haul from each district, and the rate per ton-mile, based on those average distances. This table, in condensed form, is as follows:

	Present Rate.	Haul, Miles.	Rate per Ton-mile, c.
Pittsburg	$0.88	160	0.550
Ohio No. 8	0.85	155	0.548
West Virginia:			
Fairmont	0.97	240	0.405
Kanawha	0.97	351	0.274
New River	1.12	490	0.228
Pocahontas	1.12	460	0.231
Cabin Creek	0.97	453	0.214
Thacker	0.97	380	0.255
Kentucky:			
Big Sandy	0.97	420	0.231
Marrowbone	0.97	490	0.198

The ton mile rate is, therefore, more than twice as great on Pittsburg coal as on Kanawha, and nearly three times that on some Kentucky coals. It is claimed that if a uniform ton-mile rate—say 0.4c.—were imposed, the rate from the Pittsburg district to Lake ports would be 64c., while on West Virginia coals it would run from $1.28 up to $1.96 per ton. Such a difference would, of course, be of great importance. It is also urged that the cars from West Virginia mines go back empty, as a rule, while many of those from Pittsburg have a return load of iron ore.

So far this presents the Pittsburg operators' argument. The case as to rates is not presented with entire fairness, however. The terminal expenses are nearly uniform on all coal, whatever the haul, and this reduces considerably the apparent discrimination. Deducting these on a conservative estimate of their amount the actual haulage rate—to take extreme cases—would be about 70c. on Pittsburg coal and 94c. on New River; the ton-mile rates being 0.438 and 0.192c. This is still a sufficient discrepancy.

Every railroad manager, however, knows the extreme difficulty of imposing a uniform ton-mile rate in such cases as this, where its use would probably put certain districts out of competition for a certain class of trade. In the Seaboard bituminous trade the question was fought out years ago, when West Virginia coal first began to seek that market. In that case an equal ton-mile rate would have barred out the New River and Pocahontas coals entirely, in favor of Cumberland, Clearfield and Broad Top. It was only a rate, which for years did not exceed 0.25c. per ton-mile, that brought Pocahontas, for instance, into the Eastern markets, and gave it a chance to secure the place which its quality warranted in the trade. On a uniform ton-mile rate, indeed, the Pittsburg district itself would be practically out of the Seaboard market.

It does not appear, moreover, that this discrimination in rates has really affected the Pittsburg district as much as is claimed. There have been other causes in operation, and the district has really lost comparatively little of its share in the trade. The proportion of the Lake shipments furnished by three leading districts, has not varied greatly for six years past, as shown in the following table, which gives each district's percentage:

Season.	Pittsburg.	Ohio.	West Va.
1903	56 6	23 6	19 8
1904	59 4	21 5	19 1
1905	59 8	20 3	19 9
1906	60 0	19 8	20.2
1907	55 2	24 9	19 9
1908	51 4	25 2	23.4

Up to 1907 the Pittsburg district held its own very well, the loss in its proportion coming in 1907 and 1908. In 1907 the chief gain in proportion was made by Ohio. The West Virginia percentage was about stationary until 1908, when it increased considerably. Last year, however, was rather an exceptional one, owing to the great falling off in the trade. It is probable that the West Virginia gain was not due so much to the freight rates as to the fact that the operators, with a lower mining wage rate, were able to—and did—offer lower prices, while the large Pittsburg operators maintained their quotations on the same level as in the preceding year. The lower prices counted in a poor year, and the greater proportion of the trade going to the West Virginia mines was the result of cheaper coal quite as much, or perhaps more, than of the freight rates. Pittsburg coal is claimed to be the standard of quality in the West, but much of the West Virginia coal approaches it very closely.

The Index Number for 1908

The well known index number, representing the prices of commodities, computed by A. Sauerbeck for 1908 has lately been published. This is 73, against 80 in 1907 and against 72 as the average for the 10 years ending with 1908. The most important feature in these statistics is the showing that the decline in prices from 1907 to 1908 was entirely confined to materials, the index number for them alone having been 74 in 1908 compared to 86 in 1907. In food stuffs there was no decline, the number having been 72 for each year, which was the highest figure since 1893. This accounts for the general complaint that the recent industrial depression has not been accompanied by any decrease in the cost of living. The explanation is, of course, that the harvest in the last two or three years has not kept pace with the demand for food. This is a condition that will doubtless correct itself in perfectly natural ways, but in the meanwhile the shortage and correspondingly high prices impose burdens upon the bulk of the population that are hard to bear, that diminish their capacity for accumulating savings, and consequently delay the recovery of the full measure of commercial prosperity.

From the nadir of the depression in the early part of 1908 there has been a slow but steady improvement which during the first quarter of 1909 became more pronounced and is now undoubtedly gaining force. The ultra-optimistic are of the opinion that conditions are leading to an era of "unparalleled prosperity." This may be so, but it is difficult to see how it is going to come to pass until the agricultural development of the world increases so as more nearly to fit the demand. In the meanwhile it is well to remember that in spite of the undeniable revival in business the world has not yet pulled out of the slough of depression. The number of idle railway cars and unemployed men in the United States is still large, factories are still operating at less than full time, commerce in Europe is still under a cloud, and some of the unfavorable basic conditions, such as high cost of living and increasing taxation, continue to exist.

Judge Hunt, in the United States Circuit Court, on April 27 rendered a decision dismissing the case of Fred J. Bliss against the Anaconda Copper Mining Company and Washoe Smelter Company, and ordering each party to the action to pay its own costs. The decision is final. This celebrated case was begun in May, 1905, and cost the farmers of the Deer Lodge valley $100,000; the cost to the companies is not known, although it must have been many times that incurred by the farmers. The case is one of the largest that this or any other Federal court has ever heard. The decision establishes another precedent.

The Geological Survey is about to publish the results of its investigations on the smokeless combustion of coal in boiler plants. The gist of them is that the flame and distilled gases should not be allowed to come into contact with the boiler surfaces until combustion is complete. The experts of the Survey do not seem to have added anything material to the stock of knowledge in William Kent's "Steam Boiler Economy."

The Decision on the Commodities Clause

In a decision handed down on May 3 the Supreme Court of the United States has rendered a decision on the so-called commodities clause case. This involves the constitutionality and legality of the clause in the Hepburn railroad-rate law prohibiting railroads from owning and producing the commodities they transport over their lines.

Briefly summarized the decision of the Supreme Court in the cases holds the law to be constitutional, but it does not concede the contentions of the Government as to its scope. An especial exception is made as to the ownership of stock in a different corporation, which it is held does not constitute such ownership as would permit transportation under the terms of the law. It is also held that ownership of a commodity applies only to the time of transportation. If before transporting it the railroad company has, in good faith, parted with the commodity it may carry it.

The principal point of the decision is in relation to railroads holding the stock of subordinate companies, and on that important point the finding was favorable to the roads. Justice Harlan dissented on the stock feature, but otherwise the decision was unanimous.

The chief points of the decision are as follows:

1. The claim of the Government that the provision contained in the Hepburn act, approved June 29, 1906, commonly called the commodities clause, prohibits a railroad company from moving commodities in interstate commerce because the company has manufactured, mined, or produced them, or owned them in whole, or in part, or has had an interest direct or indirect in them, wholly irrespective of the relation or connection of the carrier with the commodities at the time of transportation, is decided to be untenable. It is also decided that the provision of the commodities clause relating to interest, direct or indirect, does not embrace an interest which a carrier may have in a producing corporation as the result of the ownership by the carrier of stock in such corporation, irrespective of the amount of stock which the carrier may own in such corporation, provided the corporation has been organized in good faith.

2. Rejecting the construction placed by the Government upon the commodities clause, it is decided that that clause, when all its provisions are harmoniously construed, has solely for its object to prevent carriers engaged in interstate commerce from being associated in interest at the time of transportation with the commodities transported, and, therefore, the commodities clause only prohibits railroad companies engaged in interstate commerce from transporting in such commerce commodities under the following circumstances and conditions: (1) When the commodity has been manufactured, mined or produced by a railway company, or under its authority and at the time of transportation the railway company has not, in good faith before the act of transportation, parted with its interest in such commodity. (2) When the railroad company owns the commodity to be transported in whole, or in part. (3) When the railroad company, at the time of transportation, has an interest direct or indirect in a legal sense in the commodity, which last prohibition does not apply to commodities manufactured, mined, produced, owned, etc., by a corporation because a railroad company is a stockholders in such corporation. Such ownership of stock in a producing company by a railroad company does not cause it, as the owner of the stock, to have a legal interest in the commodity manufactured, etc., by the producing corporation.

3. As thus construed the commodities clause is a regulation of commerce within the power of Congress to enact. The contentions elaborately argued for the railroad companies that the clause, if applied to pre-existing rights, will operate to take property of railroad companies and, therefore, violate the due process clause of the fifth amendment, were all based upon the assumption that the clause prohibited and restricted in accordance with the construction which the Government gave that clause, and for the purpose of enforcing which prohibitions these suits were brought.

As the construction which the Government placed upon the act and seeks to enforce is now held to be unsound, and as none of the contentions relied upon are applicable to the act as now construed, because under such construction the act merely enforces a regulation of commerce by which carriers are compelled to dissociate themselves from the products which they carry and does not prohibit where the carrier is not associated with the commodity carried, it follows that the contentions on the subject of the fifth amendment are without merit.

4. The exemption as to timber, etc., contained in the clause is not repugnant to the Constitution.

5. The provisions for penalties are separable from the other provisions of the act. As no recovery of penalties was prayed, no issue concerning them is here presented. It will be time enough to consider whether the right to recover penalties exists when an attempt to collect penalties is made.

6. As the construction now given the act differs so widely from the construction which the Government gave to the act and which it was the purpose of these suits to enforce, it is held that it is not necessary, in reversing and remanding, to direct the character of decrees which shall be entered, but simply to reverse and remand the case with directions to enforce and apply the statute as it is now construed.

7. As the Delaware & Hudson Company is engaged as a common carrier by rail in the transportation of coal in the channels of interstate commerce, it is a railroad company within the purview of the commodities clause and is subject to the provisions of that clause as they are now construed.

April Dividends

The accompanying table shows the total amount and amount per share, of the dividends paid during April, 1909, by a number of mining and industrial companies in the United States; and by some foreign companies:

U. S. Industrials.	Location.	Amt. per Share.	Amt. Paid.
American Ag. Chemical	U. S.	$3 00	$544,590
Central Coal and Coke, com	Mo.	1.50	76,875
Central Coal and Coke, pfd	Mo.	1 25	23,437
National Lead, com.	U. S.	1.25	186,317
Pittsburgh Coal pf.	Penn.	1.75	519,767
Texas and Pacific Coal	Texas	1 50	35,910
Va. Carolina Chem., pf.	U. S.	2.00	360,000

U. S. Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Alaska Mexican	Alas.	$0.40	$72,000
Alaska Treadwell.	Alas.	0.50	100,000
Alaska United	Alas.	0.25	45,050
Boston & Montana	Mont.	3.00	450,000
Am. Smg. & Ref., pfd.	U. S.	1.75	875,000
Am. Smg. & Ref., com.	U. S.	1.00	500,000
Bunker Hill & Sullivan	Ida.	0.15	45,000
Camp Bird	Colo.	0.24	196,800
Copper Range	Mich.	1.00	384,185
Colorado	Utah	0.08	80,000
Daly West	Utah	0.30	54,000
Elkton	Colo.	0.01½	37,500
Gold Dollar	Colo.	0.005	12,500
Goldfield Con.	Nev.	0.30	1,770,428
Homestake	S. Dak.	0.50	109,200
Iron Blossom	Utah	0.08	80,000
Jamison, g	Cal.	0.02	7,800
MacNamara	Nev.	0.01	5,000
Phelps, Dodge & Co.	U. S.	2.50	1,123,365
Silver King Co't'n	Utah	0.15	187,000
Sioux Con	Utah	0.07	52,249
Utah Con	Utah	0.50	150,000
Tonopah of Nev	Nev.	0.35	350,000
United States, com.	Utah	0.50	175,466
United States, pf.	Utah	0.87½	425,118
Wolverine	Mich.	5 00	300,000

Foreign Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Buffalo	Ont.	$0.05	$45,000
El Rayo	Mex.	0 48	124,000
Guggenheim Expl.	Mex.	2 50	518,252
La Rose	Ont.	0.20	228,073
Mines Co. of Am	Mex.	0.02	40,000
Nipissing	Ont.	0 25	300,000
Right of Way	Ont.	0 15	74,927
Nova Scotia Steel and Coal, pf.	Nova Scotia	2.00	20,600
Temiskaming	Ont.	0 06	150,000

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CORRESPONDENCE AND DISCUSSION

Treatment of Magnetite in Copper Blast Furnace

Last summer in operating the smelter at Hadley in southeastern Alaska, I had some experience in the treatment of magnetite carrying copper pyrites. Before saying anything about the treatment, it will be of interest to note the composition of the ores treated. The main ores smelted came from the Mamie and Stevenstown mines, and had the composition shown in the accompanying table. Silica was required to make a smelting mixture and the silicious ore used carried: SiO_2, 62 per cent.; Fe, 15; CaO, 1.3; S, 10; Al_2O_3, 5; and some copper, gold and silver the exact amounts of which I do not feel at liberty to divulge at this time.

ANALYSES OF ORES AND SLAG.

	SiO_2.	Fe.	CaO.	S.	Al_2O_3.
Stevenstown.	19.3	24.1	9.7	7.7	11.0
Mamie.....	14.0	42.0	2.5	3.0	7.5
Silicious ore.	62.0	15.0	1.3	10.0	5.0
Slag... . .	30.0	37.0	5.0	....	1.20

With these ores mixed in suitable quantities to make a smelting mixture, we find the sulphur content is rather low for making a grade of matte suitable for clean slags, also the alumina being high will cause the furnace to run slowly and further assist in the oxidization of the sulphur, giving a higher grade matte than when conditions are right for fast running.

The condition of the ore going into the furnace affects the oxidation of the sulphur. I found by taking run-of-mine ore, we kept the grade of our matte lower. In other words, by feeding large pieces of ore we got less oxidation, thereby conserving the sulphur for the matte. In this connection I might say that pieces weighing as much as 500 lb. were fed directly into the furnace. Another marked advantage in feeding coarse ore, was the reduced amount of flue dust.

By figuring the alumina in the mixture as silica I did not have any trouble with the furnace. As soon as the combined silica and alumina exceeded 45 per cent., unmistakable signs presented themselves, such as bridging and indications of an incipient freeze up. Average analysis of the slags was about as follows: SiO_2, 30 per cent.; Fe, 37; CaO, 5; Al_2O_3, 12. The matte produced usually ran about 45 per cent. copper.

For 24 hours I ran a slag having the following analysis: SiO_2, 27 per cent.; Fe, 39.6; Al_2O_3, 10.5; CaO, 6. The slag itself was fairly clean but carried from the furnace into the settler uncombined magnetite which manifested itself above the matte as a mush. On raising the silica in the slag this mush immediately disappeared. When running this low silica slag, a curious condition showed in the connection spout, namely, an incessant sparking similar to an iron cupola, and undoubtedly due to metallic iron oxidizing in contact with the air.

B. H. Bennetts.

Tacoma, Wash., April 30, 1909.

A Method for Calculating Slags

In calculating a charge for any type of furnace, either blast furnace or reverberatory, for smelting copper or lead ores, it would seem to be desirable that a definite formula be used for the slag calculation instead of the "hit and miss" method sometimes used, or going through the operations found in some textbooks. These are undoubtedly simple enough but lengthy, and not always practical. The calculation of lead blast-furnace charges in Furman's well known work is the most direct and simple, but involves the algebraic calculation of a new formula for each slag.

The use of the following formulas has saved me much time, and they are published with the hope that they will be of value to others. Of course, it must be understood that the charge calculated to make any given slag is only the basis to work from, and will nearly always be changed to meet the special conditions in running the furnace. These conditions are variable, such as quantity and pressure of air blast, size of the furnace, temperature, physical character of the ore and many others.

No attempt will be made in this article to describe the preliminary calculations for the matte, its quantity and tenor, but it will be assumed that this has been done and we know definitely all the available slag-making constituents of the ores to be smelted. In tabulating the available amounts of slag-forming constituents in the ores, it is convenient to bring them all under three heads, viz., SiO_2, FeO and CaO. The SiO_2, FeO and CaO in the coke ash may be included under their respective heads in the "stock" ore, designated as silicious ore in the accompanying table. The iron in the matte and speiss, if any, is deducted from the total FeO in the "stock" ore.

Assume that we have the following ores to smelt, considering only for our purpose their available SiO_2, FeO and CaO and leaving out of the table the gold and silver also copper, lead, sulphur, arsenic, etc.:

	SiO_2 and Al_2O_3. Per Cent.	FeO and MnO. Per Cent.	CaO and, Earthe. Per Cent.
Silicious ore....	68.0	15.0	7.0
Iron ore.....	20.0	50.0	3.0
Limestone	12.0	4.0	45.0

What weight of the iron ore and limestone must be added to 100 lb. of the silicious ore to form a slag of any desired ratio of SiO_2, FeO and CaO?

Let S = per cent. SiO_2 wanted in the slag
M = per cent. FeO wanted in the slag } 90 %
N = per cent. CaO wanted in the slag

A = lb. SiO_2 in the silicious ore.
B = lb. FeO in the silicious ore.
C = lb. CaO in the silicious ore.

d = per cent. SiO_2 in iron ore to be added.
e = per cent. SiO_2 in limestone to be added.
f = per cent. FeO in iron ore to be added.
g = per cent. FeO in limestone to be added.
h = per cent. CaO in iron ore to be added.
l = per cent. CaO in limestone to be added.

From simple algebraic equations for two unknown quantities, deduced from the slag ratio of SiO_2, FeO and CaO, we have the following formulas:

Required iron ore =

$$\frac{NBe - MCe - SBl + MAl - NAg + SCg}{Sfl - Mdl - Nfe + Mhe - Shg + Ndg}.$$

Required limestone =

$$\frac{NB + NXf - MC - MXh}{Ml - Ng}$$

Suppose we wish to charge the above ores so as to make a slag of, say 40 per cent. SiO_2, 42 per cent. FeO, 8 per cent. CaO, totaling 90 per cent. of the slag composition. The letters in the formulas would be represented as follows:

$S = 40$	$A = 68$	$d = 0.20$	$g = 0.04$
$M = 42$	$B = 15$	$e = 0.12$	$h = 0.03$
$N = 8$	$C = 7$	$f = 0.50$	$l = 0.45$

Substituting these values for the letters in the formulas, we have for the required amount of iron ore,

$$\frac{(8 \times 15 \times 0.12) - (42 \times 7 \times 0.12) - (40 \times 15 \times 0.45) + (42 \times 68 \times 0.45) - (8 \times 68 \times 0.04) + (40 \times 7 \times 0.04)}{(40 \times 0.50 \times 0.45) - (42 \times 0.20 \times 0.45) - (8 \times 0.50 \times 0.12) + (42 \times 0.03 \times 0.12) - (40 \times 0.03 \times 0.04) - (8 \times 0.20 \times 0.04)}$$

or

$$\frac{14.4 - 35.28 - 270 + 1285.2 - 21.76 + 11.2}{9 - 3.78 - 0.48 + 0.1512 - 0.048 + 0.064} =$$

$$\frac{983.76}{4.9072} = 200.5 \text{ lb.}$$

For the required limestone we have

$$\frac{(8\times 15)+(8\times 200.5\times 0.50)-(42\times 7)-(42\times 200.5\times 0.03)}{(42\times 0.45)-(8\times 0.04)}$$

or

$$\frac{120+802-294-252.63}{18.9-0.32}=\frac{375.37}{18.58}=20.2\text{ lb.}$$

For the assumed ores we have the following charge weights:

	Weight. Pounds.	SiO_2 Pounds.	FeO Pounds.	CaO Pounds.
Silicious ore..	100.0	68.0	15.0	7.0
Iron ore.....	200.5	40.1	100.2	6.0
Limestone	20.2	2.4	0.8	9.1
Total.....	320 7	110.5	116.0	22 1

From these figures we get 248.6 lb. of these slag-forming constituents, which give a slag of 39.96 per cent. SiO_2, 41.94 per cent. FeO, 7.99 per cent. CaO. A charge of 1000 lb. would be: Silicious ore, 312; iron ore, 625; limestone, 63 pounds.

Should there be no Fe in the limestone nor CaO in the iron ore, the expressions in the formulas containing the factors g and h are omitted. In regard to Al_2O_3 if the slag which it is desired to make is high in silica (a bisilicate or over), then in making up a charge include the Al_2O_3 with the SiO_2. If the slag is to be of lower silicate degree than a bisilicate, it is safer to include a part of the Al_2O_3 with the bases.

HENRY EARLE.

Denver, Colo., April 26, 1909.

Electric Smelting in Norway

In the Journal of April 24, 1909, page 844, appeared the following announcement: "The Electric Smelting Company will install at Ludvika, Sweden, two furnaces for smelting iron by electricity and two for making steel, of the type designed by Dr. Eugene Haanel, of the Mines Department of Canada."

This plant will not be erected in Sweden, but in Norway, and will consist of two electric high furnaces, of 2500 h.p. each, for the reduction of iron ores, and two steel furnaces, of 600 h.p. each, together with a rolling mill for billets and flat iron. The plant will later be extended with four more electric high furnaces and four more steel furnaces of larger size.

The above plant is being designed and will be equipped by the Electro-metall Company of Ludvika, Sweden, which designed and patented the furnaces above mentioned, and which I investigated in Sweden.

EUGENE HAANEL.

Ottawa, Can., April 26, 1909.

The Revelation of a Metallurgical Secret

On my return from Italy I have read over the accumulated numbers of the JOURNAL and have noted the editorial in the issue of Feb. 27 on the "Revelation of a Metallurgical Secret." If reference be made to page 18 of the revised edition of my "Notes on Lead and Copper Smelting," a description will be found of the Argo process as I supposed it to be, which was published in the first edition of that book in 1897. The chain of evidence leading to the conclusion is given in detail and the deduction agrees with the "revelation" in every respect, even to the electrolytic process being better and cheaper.

Philadelphia, Penn. H. W. HIXON.

April 30, 1909.

[The fact that Mr. Hixon, so cleverly deduced the Argo process does not detract from the interest of the paper by Mr. Pearce or make that paper otherwise than a revelation. However, Mr. Hixon deserves all praise for his high metallurgical knowledge and keenness in deduction which led him to the solution of a problem that for many years had baffled many inquirers. He must, of course, be gratified to have an official pronouncement that his solution was correct.—ED.]

Diamond Mine in Pike County, Arkansas

In connection with the discussion of the diamond region of Arkansas in the JOURNAL of March 20 and Feb. 13, 1909, by John T. Fuller and Prof. John. C. Branner, formerly State geologist of Arkansas and now professor of geology at Stanford University, Cal., I can readily realize how Professor Branner feels in regard to the occurrence of diamonds in Arkansas, and I distinctly remember his stating to me that he had said nothing at the time of his survey, because of the unwarranted excitement which was then spreading through Arkansas.

In the company of Dr. J. S. Diller, of the Geological Survey, I visited Elliott county, Ky., and after spending a number of days in a region in which everything was present in the way of rock associations excepting the diamonds themselves, we failed to find them. Work has been indefatigably carried on there for a number of years, and much money has been spent without finding a single diamond. It was in view of this fact that Doctor Branner was restrained from prophesying more than he did.

On my visit to the Pike county peridotite locality in January, 1907, I remained there about a week with the owners of the property and devoted more than half of that time to a diligent, painstaking search without finding a single diamond. Dr. Henry S. Washington, who visited the locality before my arrival, had the same ill success. He was there during the period of my visit and remained after my departure. There was nothing strange, however, in the failure to discover diamonds; because if they should exist in the proportion of 1/5 to ½ a carat to a load, which is the proportion of the South African yield, there would not be more than one part of diamond in from 1,000,000 to 10,000,000 or 20,000,000 parts of material. Then again, the diamond may be more or less coated with earth or mud, which would render it hard to detect.

Doctor Washington and myself found Doctor Branner's maps most carefully made and of the greatest value in our work, as were also his geological deductions, which were admirable. Knowing both Mr. Fuller and Doctor Branner as I do, I feel confident that both have meant well, and that neither would wish to discredit the other. I hope there will be no controversy where there should be nothing but harmony and good fellowship; and that the ultimate result of the property may warrant the work being carried on there.

GEORGE F. KUNZ.

New York, April 26, 1909.

Mining in the Alamos and Arteaga Districts

As a constant reader of the JOURNAL I take the liberty of making a few comments on the article which appeared in the issue of April 3, 1909, entitled "Mining in the Alamos and Arteaga Districts," by George M. Bloomer. Touching what is called Contact No. 1, Alamos district, the article in question is misleading. The principal misstatements in the article are:

Of the various mines mentioned, the Quintera and Zambona are designated as the only ones under actual operation. As a matter of fact, the Zambona, Santo Domingo and Promontorio are the mines which are being worked, the Quintera having closed down several months ago.

The Promontorio neither was nor is being equipped by the American company which bought the Mexican concern in 1905. A second American company has lately taken hold of this property and is only just commencing operations. The first company did nothing.

The Zambona workings are only 730 ft. in depth, not 1050 ft. The Teresa has no indications nor work on it to deserve at all to be termed a promising prospect. The Alamos mountain is far from being thoroughly mineralized, the mineralization being practically limited to the contact on its extreme west. Wood and water are not abundant, and "water-power opportunities" are entirely absent. The view purporting to show the Zambona mine and reduction works is not a view of the Zambona at all.

AMOS J. YAEGER.

Minas Nuevas, Son., Mex., April 19, 1909.

Chronology of Mining, April, 1909

April 1—Explosion in the Echo mine of Bucry Brothers Coal and Coke Company, Fayette county, W. Va.; four men killed—John Mitchell day was celebrated by 300,000 miners in Pennsylvania—Utah Fuel Company fined by the United States Government for conspiracy to defraud the Government of coal lands.

April 2—Coal strike inaugurated at Alberta, Canada.

April 4—Fire broke out on the eighth level of the North Mahanoy colliery, Pennsylvania.

April 8—Second meeting of anthracite miners and operators in Philadelphia.

April 9—Explosion at du Pont Powder Works, Wayne, N. J. Damage to property, 20,000—Oil still at Point Richmond, Cal., exploded; two men killed; loss, $50,000—Dynamite explosion in Berwind-White Coal Company's mine at Windber, Penn.; seven men killed, four entombed.

April 10—Riot at Velardeña, Durango, Mexico. Six policemen killed.

April 13—John Fritz medal awarded to Charles T. Porter at a joint meeting in New York of the Mining, Civil, Electrical and Mechanical engineers—Gas explosion at Superior coal mine at Linton, Ind.; 20 killed.

April 14—Sale of Alaska Copper and Coal Company's Bonanza mine to J. P. Morgan and the Guggenheims.—Eight hundred union coal miners of the Bend Coal Corporation, Johnstown, Penn., go on strike—John Mitchell addressed the Pennsylvania legislature on the "Ideals of the Trade Union Movement."

April 15—Gas explosion at George's Creek Coal and Iron Company's mine, Farmington, Va. Three men killed—Over 600 officers of the United States Steel Corporation met at Scottdale, Penn., to receive reports from the commission which visited coal industrial plants in Europe.

April 16—W. K. Niver Coal Company sold by receiver to J. V. McDonald, of New York, for $200,000.

April 17—Bald Butte Mining Company passes into hands of receiver—Federal Mining and Smelting Company passes regular quarterly dividend on common stock—J. O. Rogers appointed receiver for Lanyon Zinc Company.

April 18—The directors of the United States Smelting, Refining and Mining Company purchased 100,000 shares of the company's stock from R. D. Evans—Consolidated Silver Cobalt Mines, Ltd., assumed control of the Greene-Meehan Mining Company, Cobalt.

April 19—Pittsburgh Coal Company cancelled contract with Pittsburgh Terminal Railroad and Coal Company, to take effect October 31—Meeting of the anthracite coal operators' representatives in New York to decide upon policy toward mine workers' wage scale—Explosion of gas at Elnora mine, Highland Coal Company, Warnock, O. Six men injured—La Rose Consolidated Mining Company acquires control of the Lawson mine, Cobalt.

April 20—Judge Goff, of the U. S. Circuit Court of Appeals issues order restraining Chesapeake & Ohio railroad from increasing freight rates on coal from West Virginia points.

April 21—Bill filed in Common Pleas Court to have directors of the Tonopah Belmont Mining Company, held criminally liable for new stock issued last June.

April 22—Isabella-Connellsville Company voted first appropriation of $2,000,000 to begin construction work of plant on the Monongahela river—Plans launched for the merger of the Isabella Coal and Coke Company and the Tower Hill Coal Company, Fayette county, Penn.

April 23—Cave-in of M. & B. mine, Duenweg, Mo. Three men killed.

April 24—Judge E. H. Sullivan appointed A. Starke Oliver as temporary receiver for the Idaho Smelting and Refining Company in place of John Mocine.

April 26—Judge Lacombe in the United States Circuit Court discharged A. R. Ledoux as receiver of the Harney Peak Tin Mining, Milling and Manufacturing Company.

April 27—Judge Hunt dismissed the "smoke" case of F. J. Bliss *vs.* Anaconda Copper Mining Company and the Washoe Smelter Company—Anthracite miners meet at Scranton to discuss tentative plans for settlement with operators.—The New York & Virginia Copper Mining Company was placed in the hands of receivers.

April 28—The Tri-district convention of the United Mine Workers at Scranton, Penn., unanimously adopted the three-year extension of the present wage agreement.

April 30—The three-year wage agreement between the anthracite miners and operators signed.

The Anthracite Settlement

An agreement was finally reached last week between the operators' and miners' committees with regard to the mining of anthracite coal. The agreement was ratified by the district convention of the miners, and has been signed by the representatives of both parties. In effect it extends for three years the settlement made by the Anthracite Strike Commission in 1903, which has been in force ever since. There are some slight changes, made as a concession to the miners, but they are not of great importance. The text of the new contract is as follows:

The Agreement

Whereas, pursuant to letters of submission signed by the parties interested in 1902, "All questions at issue between the respective companies and their own employees whether they belong to a union or not," were submitted to the Anthracite Coal Strike Commission to decide as to the same and as to "the conditions of employment between the respective companies and their own employees," and the said Strike Commission under date of March 18, 1903, duly made and filed its award upon the subject matter of the submission and provided that said award should continue in force for three years from April 1, 1903, and the said period has expired.

And whereas, By agreement dated May 7, 1906, it was stipulated the "said award and the provisions thereof and any action which has been since taken pursuant thereto, either by the Conciliation Board or otherwise, shall be extended and shall continue in force for three years from April 1, 1906, namely, until March 31, 1909, with like force and effect as if that had been originally prescribed as its duration."

Now, therefore, it is stipulated between the undersigned, in their own behalf and so far as they have power to represent any other parties in interest, that the said award and the provisions thereof and any action which has been since taken pursuant thereto, either by the Conciliation Board or by written agreement between representatives of the employers and employees, shall be extended and shall continue in force for three years from April 1, 1909, namely, until March 31, 1912, with like force and effect as if that had been originally prescribed as the duration.

It is further covenanted and agreed as follows, viz.:

First—The rates which shall be paid for new work shall not be less than the rates paid under the Strike Commission's award for old work of a similar kind or character.

Second—The arrangement and decisions of the Conciliation Board permitting the collection of dues on the company property and the posting of notices thereon shall continue during the life of this agreement.

Third—An employee discharged for being a member of a union shall have a right to appeal his case to the Conciliation Board for final adjustment.

Fourth—Any dispute arising at a colliery under the terms of this agreement must first be taken up with the mine foreman and superintendent by employee, or committee of employees directly interested, before it can be taken up with the Conciliation Board for final adjustment.

Fifth—Employeers shall issue pay statements designating the name of the company, the name of the employee, the colliery where employed, the amount of wages and the class of work performed

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The Meyer & Charlton mine yielded revenue for 1908 (*South African Min Journ.*, March 13, 1909) to the amount of £251,700; the expenditure was £147,622, leaving a gross profit of £104,107.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

"Blue Gas"

What is the address of the owners of the United States and Canadian patents of this gas, which was described in the Journal of Feb. 27?

A. B. C.

The Blaugas Company of America, 1 Platt street, New York; the Blaugas Company of Canada, 671 St. James street, Montreal, Canada.

The Deepest Shaft

What is the deepest mining shaft in the United States? What is the deepest in the world? F. B. McK.

The deepest shaft in the United States, and also in the world, is Tamarack No. 3, in Michigan, which is 5253 ft. deep. Europe has no shaft of anywhere near that depth. So far as we are aware, the deepest is at a colliery in Belgium, and is 3773 ft. deep.

Radium

Please inform me if the name "radium" was not mentioned in some chemical-textbook, 18 or 20 years ago, as a supposed element. Of course, I am aware that the element was not actually known previous to the Curie discovery. D. W.

Radium was discovered by Madame S. Curie, P. Curie and M. Bemont in 1898. The word "radium" was unknown prior to 1898. It is not mentioned in any textbook, scientific journals, nor periodicals before 1898, as far as we are aware.

Tantalum Ore

What is the market for tantalite or other minerals containing tantalum?

R. L. G.

The demand is extremely small. So far the principal use for tantalum is as a filament for incandescent electric lamps. Inasmuch as the quantity required for a single lamp of the ordinary size is only about 1/100 of a gram, it will readily be perceived that a ton of ore will go a long way in this business. However, tantalum is a metal that appears to have some highly useful properties, and without doubt an increased demand for it in the arts will develop.

Deterioration of Dynamite

Does dynamite deteriorate any faster when kept in the frozen state than when kept thawed? At this mine the dynamite used is du Pont, less than six months old, but is kept frozen until a few hours before being used. We are very much troubled by gas from the "powder"—nitrogen oxides, I suppose. Good dynamite, when well thawed, has a feeling similar to that of a well ripened pear or peach—if pressed by the finger it retains the imprint. When the dynamite gets old it becomes more like soft rubber. Some of the "powder" we are using is more like this. Can you give me advice as to the proper keeping of dynamite so it will not deteriorate?

A. O. C.

If dynamite is kept in a frozen condition or kept in a dry, well ventilated magazine, whose temperature does not reach much above 80 deg. F., there is very little chance for the dynamite to deteriorate. As regards the gas from the powder, of which A. O. C. complains, it would be helpful if he would state whether he is using the nitroglycerin dynamite or gelatin dynamite, and whether he is using it in open or closed work.

Phosphate Rock

What are the principal producing phosphate fields of the United States, and what variety of rock does each produce? What new phosphate fields have been discovered in recent years?

A. P. B.

The principal phosphate producing fields of the United States are situated in Florida, Tennessee and South Carolina, named in the order of their importance. In 1908, Idaho and Arkansas both produced a few thousand tons. Florida produces three grades of phosphate, viz.: hard rock, land pebble and river pebble. Tennessee produces brown rock and black rock. South Carolina produces land rock and river rock.

Among the new discoveries, the most important are those of the western United States and the islands of the South Pacific seas. The former embraces a large area in southeastern Idaho, southwestern Wyoming and northeastern Utah, and is reported to contain an extraordinary supply of black oolitic phosphate, much like the Tennessee rock in appearance, and carrying about 70 per cent. bone phosphate. The phosphate industry in the South Pacific islands has developed greatly in recent years, and in 1908 many important discoveries were made.

Barytes

What is the $BaSO_4$ content of the average commercial dry-ground and water-floated barytes? What is the lowest grade of crude barytes sent to the grinding mills? What is the average $BaSO_4$ content of the artificial sulphate, called blanc fixe? What is the approximate cost of reducing $BaSO_4$ to BaS, and what is the most economical method? Is barium sulphate legitimately used in the paint, paper and rubber manufactures? Would a lode or deposit of barytes, containing, say, 200,000 tons of the mineral assaying 90 to 94 per cent. $BaSO_4$, and having no lime or iron as impurities, be of much value, provided it be accessible and amenable for mining at 85c. per ton?

B. T.

The $BaSO_4$ content in commercial ground or floated barytes is in the neighborhood of 98 per cent. In general, it may be said that no material containing less than 90 per cent. $BaSO_4$ is sent to the grinding mills. Of course a great deal depends on what the impurities consist of. Iron, if present in quantities greater than enough merely to stain the mineral is objectionable. Calcium fluoride (fluorite) is objectionable even in small quantities, owing to the obnoxious nature of the gas evolved in the bleaching operation. Limestone, while it has little effect upon the color of the finished product, consumes acid, and should not be present in large amount. Small percentages of minerals that do not affect the color of the barytes, or consume acid in the bleaching process, are not objectionable.

The artificial sulphate, blanc fixe, should be practically chemically pure. The usual procedure in the preparation of this material is to mix the crude barytes with coal containing little ash, in the proportion of four parts by weight of barytes to one of coal. The mixture is heated to a bright red, in a reducing atmosphere, for from 2½ to 3 hours. The charge then contains from 60 to 70 per cent. of soluble barium sulphide, the remainder being chiefly barium carbonate, which may be dissolved in either nitric or hydrochloric acid and the corresponding salt recovered. The sulphide is then dissolved in water, and the chemically pure sulphate precipitated with either sulphuric acid or salt cake. If salt cake is used as a precipitant, the purity of the final product depends upon the purity of the salt cake. We do not know the cost of reducing barium sulphate to barium sulphide.

The value of barytes as a pigment is a recognized one, and it is also used legitimately in other manufactures. Its use becomes improper only when secretly employed to give weight to different manufactured and food products.

Regarding the deposit of barytes described by B. T., we prefer not to express an opinion, as there are so many considerations entering into the question as to whether or not it is commercially available, respecting which we have not been informed. Anyway, this is a matter for reference to a consulting engineer.

According to *Engineering News*, April 29, 1909, during 14 years up to 1906 there were in Prussia, 13 firedamp explosions with 722 deaths, or 1.49 to each 10,000 workmen in each year. In England the same period shows a total of 1248 firedamp vicitms, or 1.2 killed each year to every 10,000 workmen.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

W. DeL. Benedict has returned to New York.

J. F. Erdlets, Jr., of Salt Lake City, Utah, has been in New York on business.

Alexander Agassiz, president of the Calumet & Hecla, is at the mines on his semi-annual visits.

S. M. Greenidge, of Cananea, Mexico, is examining a group of silver-lead mines near Monterey, Mexico.

C. Colcock Jones has returned to Los Angeles, Cal., from an examination of mines in the Yerington district, Nevada.

W. E. Carpenter has succeeded F. G. Goggin as superintendent of the Atlantic stamp mill in the Lake Superior district.

R. Livingstone, late assistant mines inspector of Alberta, has been appointed chief inspector in place of Norman Fraser, resigned.

Frederick Lyon has been chosen a director of the United States Smelting, Refining and Mining Company in place of R. D. Evans, resigned.

Roscoe Powers, superintendent of the St. Joseph Lead Company's mines in Missouri, was seriously injured last week in an automobile accident.

F. A. Ross, manager of the Daly Reduction Company, left Hedley, Similkameen, B. C., a short time ago on a business visit to New York.

Dr. Milton Hersey, of Montreal, has given $100,000 to the metallurgical department of the faculty of Applied Science of McGill university.

W. H. Jeffrey has resigned his position as manager of the Chambers-Ferland mine at Cobalt, Ont. His successor is C. Watson, recently assistant superintendent of the Nipissing mine.

Prof. William Nicol, of Queens University, Kingston, Ont., has undertaken to give $40,000 for the erection of a new mineralogy building in connection with the Kingston School of Mines.

George E. Gay, of Uniontown, Penn., has been appointed a member of the Board of Bituminous Coal Mine Inspectors of Pennsylvania, in place of George Whyel, whose term has expired.

It is reported that M. K. Rodgers, of Seattle, Wash., is about to resume the management of the Nickel Plate mine, at Hedley, B. C., which property Mr. Rodgers developed in the first place.

Walter Bean, of Denver, Colo., and A. G. Merrill, of Los Angeles, Cal., are making an examination of the Yale Mining Company's (Daly estate) Nickel Plate group, in Hedley camp, Similkameen, B. C.

Rudolph Agassiz, the new president of the Osceola Consolidated and other companies that have recently come under Calumet & Hecla control, is visiting the Lake Superior district looking over these properties.

Norman Fraser, for some time one of the provincial government coal-mine inspectors, in Alberta, Canada, has been appointed superintendent of the Crow's Nest Pass Coal Company's colliery, at Michel, B C.

W. H. Wardner, formerly general superintendent of the Bamberger-De La Mar mines at De La Mar, Nev., has been appointed general manager of the Golden Star Mines Company at Kofa, Yuma county, Arizona.

G. F. Greenwood, of Montreal, president of the Mexican Northern Power Company, has gone to Mexico, in connection with starting construction work on a plant for furnishing power to a large mining district in Chihuahua.

A. H. Reed has resigned as mine superintendent with the Longdale Iron Company, Longdale, Va., and has accepted a position as mining and mechanical engineer with the Independent Phosphate Company, Columbia, Tennessee.

James Gayley has been awarded the Elliott Cresson medal of the Franklin Institute, of Philadelphia. This was presented to Mr. Gayley in recognition of his invention of the dry-air blast process in the manufacture of steel and iron.

Obituary

Charles E. McCullough died at Kewanee, Ill., April 24, aged 59 years. He was prominent in the organization and management of the Western Tube Company, Kewanee, from which he retired in 1908, when this company was absorbed by the National Tube Company.

Societies and Technical Schools

American Peat Society—The New York section will meet at Syracuse, N. Y., May 15, when a number of papers on the utilization of peat for fuel and other purposes will be presented.

American Foundrymen's Association—This society and the American Brass Founders' Association will hold a joint convention at Cincinnati, O., May 18-20. Dr. Richard Moldenke is secretary.

American Chemical Society—The summer meeting of the American Chemical Society will be held in Detroit, Mich., June 29 to July 2. The council of the society will meet on June 28 and the opening session of the general meeting will be on the morning of June 29.

Titles of papers to be read at the summer meeting should be sent to Charles L. Parsons, secretary, Durham, N. H., by June 7.

Canadian Western Mine Operators' Association—A new agreement has been made between the Western Coal Operators' Association, representing most of the coal-mine operators in southern Alberta and southeastern British Columbia, and District No. 18, United Mine Workers of America, representing practically all the men employed at the mines of those districts. The old agreement expired March 31, and all important points in the proposed new agreement were disposed of at a convention of representatives of both operators and miners held here recently. The vote of the miners afterward taken resulted in a large majority in approval of acceptance of the new agreement.

Appalachian Engineering Association—This society will meet in Roanoke, Va., May 8. The following papers will be read: "Lead and Zinc Ores in Wythe and Pulaski Counties," by M. M. Caldwell, of Roanoke; "Organization and Engineering Difficulties of the Virginian Railway," by William N. Page, of Washington; "The Virgilina Copper District," by Dr. Thomas L. Watson, State geologist of Virginia; "A Geologic Engineering Code of Ethics," by Baird Halberstadt, of Pottsville, Penn.; "Properties and Uses of Mineral Gypsum," by Dr. Frank A. Wilder, of North Holston, Va. At a banquet in the evening, tendered by the Chamber of Commerce, of Roanoke, President L. E. Johnson, of the Norfolk & Western railway, and others will speak.

California Mineowners—Mineowners in California have agreed to test in some manner the new eight-hour law which goes into effect in the mines on May 6. A judicial determination of the constitutionality of this law is desired by the mineowners. In Nevada county an eight-hour rule has for some time been enforced by the miners' unions, but in other counties this is not the case. The mineowners at first thought of contesting that portion of the law which makes eight hours compulsory in the mills. It was later determined, however, to keep on just the same as at present in the mills without paying any attention to the new law until someone started a litigation on the subject. It is in the underground work that the change will come on May 6 when the law goes into effect Lawyers will be employed to advise the mineowners, who are arranging to stand together in any possible contest with the labor unions.

Over in Nevada, where they have a new eight-hour law for miners the Nevada Consolidated Mining Company at Ely is about to test the constitutionality of this law, where it provides for eight hours in the open cuts and drifts of mines.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Goldfield, Salt Lake City, Toronto, Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 30—As spring opens and miners and prospectors have again commenced active work except in the higher mountain ranges where the snow still lies deep, numbers of accounts of new strikes and discoveries are printed in local newspapers in mining districts. Some strikes have been made this month in old quartz mines on which work has been continued during the winter. The most notable of these is that in the Sixteen-to-One mine at Alleghany, Sierra county, on the same belt as the Tightner. The strike was made in the main tunnel of the mine about 250 ft. from the entrance.

The Central Consolidated mine at Banner Mountain, seven miles east of Grass Valley, in Nevada county, has showed up a valuable body of ore. The "jewelry rock" is being stored. The shaft is only 400 ft. deep.

Another noteworthy strike is that in the old Chipps quartz mine at Sierra City, Sierra county, where they have recently found rich ore in a new vein. The length of the shoot is not yet determined. Still another find is that in the Independence mine in El Dorado district, El Dorado county.

The amount due on the foreclosure of liens on the Wildman-Mahoney mines at Sutter Creek, Amador county, has been paid by the Alabama people, thus redeeming the property from indebtedness. The mines were sold about a year since to satisfy judgment. W. Murphy and associates are now in full possession of the property, and the reopening of the mines is supposed to be assured.

The effect of the decision rendered by the courts at Redding last week is to give absolute possession of the Brunswick mine at French Gulch, Shasta county, to H. D. Lacey, he having won the suit. The mine is a productive one and is well developed.

On the petition of a stockholder in the Keane Wonder mine, of Inyo county, a court in this city has restrained the sale of the property under a deed given by the directors to W. Gregg to secure an indebtedness to the Frances-Mohawk Mining and Leasing Company.

A suit has been filed in Placer county by which the Long Beach Asbestos Mining Company, of Long Beach, Los Angeles county, seeks to quiet title to three asbestos claims in Green Valley, near Towle, Placer county. The claims comprise some 50 acres of mining ground.

Last week the large ore bins of the Balaklala Consolidated Copper Company at Coram, Shasta county, collapsed and dumped about 1000 tons of ore, covering the tracks and damaging the power line. Temporary repairs have since been made, and the smelter will not have to close.

The Siskiyou Dredging Company has been organized at Oroville, Butte county, to install a dredge on 225 acres of land which have been purchased in Siskiyou county. The officers are George W. Carr, president; J. J. Hamlyn, vice-president; J. C. Osgood, secretary, and H. G. Peaks and W. R. Bassick, directors. Mr. Hamlyn has had long experience in dredging affairs at Oroville.

Fred S. King, of this city, as trustee of Eastern men represented by John Filious, of Oakland, has taken over the holdings of gypsum deposits in Death Valley, formerly owned by the Death Valley Chemical Company. A large plant is to be put up.

Butte

April 28—Thomas F. Cole, of Duluth, one of the heavy stockholders and original promotors of the North Butte and Coalition companies, was in Butte several days last week, making an inspection of the properties of the companies in which he is interested. Bondholders of the Kimberly-Montana Gold Mining Company have instituted action asking that a receiver be appointed for the company and that the mortgage given to secure the bonds, be foreclosed. The complaint alleges that the company is deeply involved in litigation and in debt and that the assets of the company are being wasted.

The annual report of the North Butte Mining Company for the year ending Dec. 31, 1908, covers a period of 10 months during 1908, operations having been suspended for two months. The cost of production averaged about 8c. per lb. Of the ore shipped from the mine 35 per cent. was first class, which is an unusually high percentage for a Butte mine. The net profits for the year were $1,863,782, which, divided among the 400,000 shares of issued stock, would make $4.66 per share; this compares with $3 paid out in dividends.

For the past several weeks much interest has been centered in the struggle between the Great Northern and the Chicago, Milwaukee & Puget Sound railways to secure the most advantageous right of way for a line running north from Coram, along the north branch of the Flathead river, and into the coal lands in Alberta, Canada. Survey parties have been busy in the locality for some time past but it is only recently that steps have been taken by either road to secure the land necessary for the right of way. Options, deeds and condemnation suits are being filed by the contesting parties daily, and the entire locality is in a state of excitement owing to the keen rivalry of the two roads. It is stated that there is but one course which is feasible for the construction of the proposed branch and that each of the companies is bent upon securing this route.

Denver

May 1—The mining and milling industry in the State of Colorado is very dull indeed, partly due to uncertainty of tariff legislation and the low price of metals, but more largely owing to the terrific winter experienced, and which one might say is still with us, for a blizzard prevailed yesterday. The snowfall in the mountain mining districts has been a record breaker with no signs at present of its melting, so that it will be very late this summer before everything is in full swing again.

To offset this, there is a strong feeling of optimism in the mining fraternity of the State, encouraged by the advance in metal prices, and in the various camps preparations are being made for active operations, not only on working mines, but what is more remarkable, on a large number which have been closed down for years. These preparations are at present chiefly of a financial character, as climatic conditions preclude shipping or surface work and improvements at this date. The gold mines of the State are least affected, and keep on the even tenor of their way.

The Eclipse tunnel, on Battle mountain, is said to have opened a large body of ore. In like manner, the Damon, near the W. P. H. and the Jerry Johnson, has just opened a large body of pay ore. The Black Belle, on Beacon hill, also by crosscutting from the shaft at the 300 level, is reported to have struck 2½ ft. of high-grade ore. In the Victor mine, now under lease, the ore was discovered by a level caving and exposing the vein. One of the most efficiently and economically handled gold mines in the district is the Crescent, on Raven hill, which is reported to have produced about 2000 tons during April. The production of this district for April is given at 59,700 tons of a gross value of $1,351,675.

Indianapolis

May 3—The United States Steel Corporation and the Brazil Block Coal Company, the latter of Brazil, Ind., are planning to open all the old mines and sink many new shafts in the territory controlled in Indiana and Illinois, which means an increase of 100 per cent. in the output of the districts separated by the Wabash river. To this end the Steel Corporation is securing titles to between 5000 and 6000 acres of coal lands in the Illinois district. Four or five new shafts will have coal rights for about 10,000 acres of unworked coal land. It is understood the prices paid for coal rights for these lands averaged $125 an acre; and from these figures coal rights alone cost $1,250,000.

Salt Lake City

April 29—It is stated that the 1,705,322 cu.yd. of overburden so far removed from the porphyry ore deposits of the Utah Copper Company will average slightly under 1 per cent. copper. General Manager Jackling has proposed a leaching method for extracting the copper in this material and it is now reported that an experimental plant of moderate capacity will be constructed at Garfield, and the proposed metallurgy of this material demonstrated on a fairly liberal working scale.

Ore shipments from Tintic mines for the week were 183 carloads, 110 of which went to the Knight smelter and 73 to the valley smelters. The shipments from the individual mines were as follows: Centennial Eureka, 40; Sioux Consolidated, 14; Bullion Beck, 1; May Day, 2; Eureka Hill, 1; Eagle & Blue Bell, 1; Mammoth, 9; Black Jack, 3; Plutus, 1; Yankee Consolidated, 1; Iron Blossom, 40; Colorado, 24; Dragon Iron, 31; Brooklyn, 5; Black Jack, 3; Beck Tunnel, 7.

The stock of the Moscow Mining and Milling Company which owns the Burning Moscow and six other claims in the Star district, Beaver county, was listed on the Salt Lake Mining Exchange. In its statement to the Exchange the company reports that 25,000 tons of ore are now developed in the mine and that 20 men are employed.

It is announced that the Highland Boy smelter of the Utah Consolidated, near Murray, is to be dismantled, a force of men having started at this work recently. All furnace steel is to be sent to Tooele, together with such other equipment as can be utilized in the new International smelter.

Goldfield, Nevada

April 27—The Nevada California Power Company has closed a contract to furnish the Bullfrog Pioneer Company with electric power. The surveys for the line have been made and construction work will commence at once. It is thought that about 1000 h.p. will be used in the Pioneer district.

Ore shipments from Tonopah mines for the week ending April 24, were: Tonopah Mining, 3300 tons; Montana Tonopah, 1030 tons; Belmont, 700 tons; MacNamara, 350 tons; West End, 130 tons and Midway, 100 tons.

The date for the session of the American Mining Congress to be held in Goldfield has been changed to Sept. 27 in order to secure the advantages of reduced railroad rates. Tickets sold for this purpose will have a return limit of Oct. 31.

Production of the Goldfield mines for the week ending April 24, was: Consolidated, 3850 tons, valued at $173,250; Combination mine 630 tons, $28,350; Hampton stope, 210 tons, $147,000; Florence, 700 tons, $31,500, and 35 tons high grade, $4900; other sources handled by Western Ore Purchasing Company, 890 tons of ore and concentrates, $186,900, and by Nevada Goldfield Reduction Company, 755 tons, $37,750, making a total valuation of $609,650.

Toronto

May 1—Dr. R. W. Ells, of the Canadian Geological Survey, stated, on April 29, to the Senate Committee on Mines and Minerals, at Ottawa, that the oil-shale deposits of New Brunswick were far richer than those of Scotland, from which the operators annually obtain 62,000,000 gal. of oil and 50,000 tons of sulphate of ammonia. This was admitted in Scotland as the result of experiments with New Brunswick samples. The Scotch shale produced 30 to 40 gal. of oil per ton, while the New Brunswick shale would produce from 60 to 110 gal. per ton and was far richer than the Scottish in sulphate of ammonia. The New Brunswick shale district extend for 70 miles from Dorchester to Horton, and seven seams had been discovered.

The road to Elk lake and Gowganda is now absolutely impassable for vehicles of any kind, and the post office has issued a notification that only letters will be forwarded, other classes of mail being held until navigation opens.

The government sale of Gowganda town lots by tender last month realized better prices than the first sale in March, the average being $152.95, and the highest price $1010 per lot.

About a month since the Ontario Department of Mines was notified of a supposed discovery of coal on the north shore of Lake Superior. Specimens were forwarded to the department and submitted to analysis. It is declared by them to be a carboniferous substance, but of little value commercially.

Hon. Sydney Fisher, Canadian minister of agriculture, has given notice that he will introduce in Parliament a bill to create a permanent commission on the conservation of the natural resources of Canada. It will give effect to the agreement arrived at during the international conference on the subject at Washington last month. It is expected that the commission will be named as soon as the bill becomes law, and will consist of from 25 to 30 representative Canadians.

The Ontario government is offering for sale by tender 1000 acres of mining land at the northeast corner of the Gillies limit, in the Cobalt district. This does not include the 40 acres containing the Provincial mine. The land is offered in 20-acre blocks, and the sales will be on a cash basis, with a 10-per cent. royalty on the output in perpetuity. Successful bidders will be required to spend $400 in development yearly for seven years. Tenders will be received up to June 1 next.

Prospectors are flocking into the Seine River goldfields east of Fort Frances, Ont. The country round Glenorchy is staked out for miles and discoveries of rich quartz are reported.

In the course of construction work on the Grand Trunk Pacific railway, near Portage lake, northwest from Sturgeon lake, in northwestern Ontario, a copper outcrop was laid bare in a rock cutting. A claim was registered by H. J. Mackenzie.

Paris

April 20—New efforts are being made to find the coal seams lying under the Lorraine oölitic-iron deposits. A local company has undertaken borings in the Haute Marne, on the boundary between that and the Vosges. The Société des Houillères de la Moselle, subsidiary of the Société Lorraine des Charbonnages Réunis, has erected a drill at Jeuvoncourt, half way between Mont sur Moselle and Gironcourt, where work has begun.

The results obtained by Mortages & Grignon at Andavakoera (Madagascar) have caused new companies to be promoted at Lille and Marseilles with a view of prospecting for further lodes. The Marseilles group will be known as Madagascar-Nord and the Lille group as Société Civile des Mines d'Or de la Loky. Work will be started after the rainy season under the superintendence of the mining engineers sent over. Meanwhile the output of the Andavakoera deposits continues quite satisfactory. They have temporarily suspended the use of native labor owing to its inferior efficiency.

The International Syndicate, headed by the Solvay firm, has acquired new interests in France by becoming owner of most of the shares in the Salines de Tonnoy near Nancy.

The Compagnie Française du Platine is endeavoring to obtain closer control over the output of platinum in Russia. Next to them the chief producer is the estate of Prince Demidoff, owning the placers of Nijni Tagilsk. But the Russian government seems bent on opposing the company's efforts, in order to prevent the deposits becoming the property of a foreign company.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

FAIRBANKS

Fairbanks creek is holding its own after having been worked for many years. Keely & Parker are making preparations for extensive work. Wobber & McCarthy are opening up their new quartz claims on Alder creek, and Johnny Scott is assembling a large crew for sluicing which will be done night and day during the full season. Ester creek is the busiest one in the entire country, and its production will compare more than favorably with any preceding year.

Arizona

COCHISE COUNTY

Copper Queen—Daily shipments of copper ore from Bisbee to Douglas are 35 carloads. The Sacramento shaft will be sunk from the 1200- to the 1400-ft. level. Seven furnaces are in operation. April output, 8,000,000 pounds.

Denn-Arizona—The main shaft is now 1265 ft. deep, 65 ft. having been sunk since work was resumed this spring.

Calumet & Arizona—Low-grade copper ore was encountered in the Powell shaft at a depth of 375 ft. The foundation for the new electric hoist was completed recently.

GILA COUNTY

Superior & Boston—The McGraw shaft is to be completed to the 400 level by June 1.

Arkansas

JOHNSON COUNTY

W. H. Taylor has resumed operations at Spadra. He intends to enlarge the capacity of the coal mines to 1000 tons daily, and to install mining machines.

California

AMADOR COUNTY

Kennedy—This mine, at Jackson, has been closed down some days owing to an accident in the shaft.

Mitchell—A year's extension has been given on the option to Cranmer Brothers; they have found a new orebody entirely distinct from the old one. The 10-stamp mill has been put in good order.

BUTTE COUNTY

Big Blue Lead—The first clean-up of this property has been made with satisfactory results, the gravel coming about up to expectations. The force of men is to be increased.

Mercedes Mining Company—This company has been incorporated to work quartz mines in the Forbestown district. The directors are Geo. S. Smith, of Oakland, and R. A. Nayo and S. Lague, of Oroville.

EL DORADO COUNTY

Indian Diggings—J. J. Crawford & Brother, of Oakland, are about to commence work on the John Culick claim.

Loveless—This mine, at El Dorado, has been bonded to E. W. McAllister, of Kansas City. A new shaft will be sunk and hoist put up.

Montauk—This property has been sold for the benefit of the creditors, having been bid in by Wm. Schaw, acting as referee. This was formerly the Zantgraf mine.

MERCED COUNTY

Yosemite Dredging and Mining Company—This company at Snelling, is now operating the dredge day and night with three shifts of men.

MODOC COUNTY

Hoag District—In some of the claims they are now down 150 ft. and have good ore. A number of small tunnels have also been run. Two mills will be ready as soon as the snow disappears. There is considerable ore on the dumps ready for them to work.

NEVADA COUNTY

Black Bear—A mill, with concentrators, has been purchased, and is being put in place. Sinking is continued without interruption and the ledge is large and retains its values.

Golden Gate—For this mine, Grass Valley district, W. P. Martin, superintendent, a 10-stamp mill has been completed and is being put in place.

Posey Cañon—The clean-up of this gravel mine is thought to prove conclusively that the main gravel channel has been cut.

PLACER COUNTY

Big Dipper—This old drift mine on the Iowa Hill divide, which was profitably worked for years by the Waterhouse Brothers, of San Francisco, has been purchased and reopened by a new company under Superintendent J. E. Rose. The name of the company is McGeachin Gold Mining Company.

Dalhonega—At this mine, near Emigrant Gap, Superintendent C. J. Tripp is rebuilding the mill burned some time since, and has put a force of men at work.

PLUMAS COUNTY

Lone Star—L. V. Tefft is about to work the gravel by the steam-shovel system.

Sunnyside—Henry Merrill, who has a lease, is commencing a long tunnel to develop it.

SHASTA COUNTY

Brackett—A valuable discovery is reported in this mine, three miles west of Redding.

SIERRA COUNTY

Brush Creek and Ante-Up—These two mines, between Goodyear Bar and Mountain House, are being reopened by a Chicago company and machinery is being supplied.

Secret Cañon—W. H. Weldon is preparing to reopen this gravel mine, near Forest City.

SISKIYOU COUNTY

Northern California Dredge Company—The new suction dredge at Hamburg Bar has commenced operations. J. A. Brent is superintendent, and the company has taken up many miles of the bed of the Klamath river.

Scott Bar Hydraulic Mining Company—This company, near Hamburg, is constructing a 25-mile ditch, 13 miles of which have been completed. This will bring a large water supply to the gravel banks.

YUBA COUNTY

Northern Gold Mining Company—This company has been organized to operate properties at Brownsville, among them the Apple Tree mine, where rich ore has recently been found.

Colorado

GILPIN COUNTY

German Gold and Uranium—Shipments are being made of uranium ores from the German mine on Quartz hill, to New York buyers for German firms. In the 120 east level high-grade gold-copper ore has been opened as well as a body of milling ore. Robert Miller, Bald Mountain, Colo., is superintendent.

Incidental—Cincinnati and Denver men, interested in a lease and bond on this mine, in the Russell district, are installing machinery and erecting a new shaft building. W. L. Shull, Russell Gulch, Colo., is manager.

Van Deren—Gano & Co., of Denver, have taken a lease and bond on this property in the Russell district and will arrange for new buildings and machinery. W. C. Le Prowse, Russell Gulch, Colo., is in charge.

Oro—Harris & Co., of Central City, have put new machinery and a shaft building on the property in Quartz Valley district and are shipping regularly principally to the stamp mills.

Sherman & Macon—It is stated that Missouri men interested in this property intend to erect a 50-ton mill. F. L. Branham, Central City, Colo., is superintendent.

Senator Mines—Chicago men have become interested by purchase of the property near Black Hawk and are arranging for the active operation of their holdings.

Alps—Lessees on this mine in Nevada district have opened up some gold and copper ores, besides the free milling ores which are being shipped regularly.

Fifty Gold Mines—On account of increasing tonnage from company mines and heavier custom patronage in its mill, a Goodman 6-ton electric locomotive has been delivered for hauling ore to the mlil. Some experimenting is being done with cyanide on the low-grade ores. Employment is being given to 125 men and the property is the heaviest shipper in the district. It is the intention of the management to electrify the machinery in the near future. M. D. Draper, Central City, Colo., is manager.

Gold Collar—Cincinnati capitalists interested in this group in Prosser gulch have authorized development of these claims. Alfred Skeels, Central City, Colo., is manager.

Tucker Mill—This mill in the Quartz valley district has been sold by the Lyons-Kyle Mining Company to W. H. Hearne, of Wheeling, W. Va., for the treatment of the Anchor ores. H. Irving Jones, Central City, Colo., is manager.

Alger-Kansas—Development of this property in Nevada gulch will be commenced. S. Harper, of Central City, will be in charge.

Aurora—Pittsburg capitalists have purchased this mine in the Russell district. Harry W. Kane, Central City, Colo., is manager.

Argo—Local operators leasing in this mine in Russell gulch have encountered high-grade ore carrying gold, silver and copper. H. C. Willis, of Central City, Colo., is manager and regular shipments will be made.

Denver Mining and Reduction—A lease for three years has been taken on the old Fitz Porter rock building below Black Hawk and concentrating tables will be installed for the purpose of handling the slimes from North Clear creek.

Frontenac Mines Syndicate, Limited—The Penn and Iron City mills below Black Hawk are being remodeled for the purpose of treating the low-grade ores from this company's mines in the Russell district. F. C. Bowman, Central City, Colo., is superinfendent.

Lake County—Leadville

Tenderfoot—The shaft on this claim in South Evans gulch is down 150 ft., and a crosscut from that point has encountered a body of ore 14 ft. thick. Shipments are now being made from three properties in this section, the Tenderfoot, the Cleveland and the Valley.

Virginius Group—These claims in the neighborhood of the Dinero tunnel in the Sugar Loaf district are to be worked by the Sugar Loaf Consolidated Mining Company.

Sunday—Connections have been made between the main shaft and the tunnel in the Bald Mountain district, and ventilation is now sufficient to permit the development of the orebody recently opened.

New Discovery—Lessees are sinking a shaft to a depth of 150 ft., 50 ft. of which are completed.

Dauntless—Work is to be resumed shortly on this and the Chance-Hilltop claims in the Horseshoe district. Zinc ore has been encountered in both claims.

Latchaw Tunnel—The recent clearing of the road has enabled this property in the Twin Lakes district to resume shipping.

San Juan County

Silverton Mining Company—The old North Star mine on Sultan mountain has been under development for some time by this company and it is stated that sufficient ore is now blocked out to warrant operating the mill as soon as the latter can be overhauled.

Idaho

Bonner County

Idaho Smelting and Refining Company—Herbert Anderson, of Chicago and Winnipeg, president, went to Sand Point, Idaho, without waiting for a warrant to be served, and surrendered to the sheriff to face a charge of embezzling $175,000 from the company.

Indiana

Clay County

Miami Coal—This company is entering the Clinton field. Two new mines are being opened on its large coal-land holdings of that section. The company owns 1400 acres of coal land in this field.

Blackford County

Petroleum operators in the oilfields of this section show a considerable gain over previous weeks. There is more activity near Montpelier than at any time since last mid-summer. There are few non-producing wells and a dry hole does not discourage operators or condemn a large space of ground.

There were eleven wells completed in the Indiana field during the week and all producers except one.

Missouri

Joplin District

Chew & Baker—A strike of shallow lead was made near Duenweg at 12-ft. depth.

Continental—Operations were resumed in the Prosperity mine after a shutdown of nearly two months, due to a fall of rock on the pumps. Mules have been placed in the mine to cheapen the haul.

De Graff—This company has just completed the erection of a 150-ton mill on its lease on the Brooks land, west of Joplin.

Delta—This mine, at Spring City, has shut down on account of the long haul underground. A new shaft will probably be sunk.

J. P. N.—P. N. Wiggins, J. P. Newill and H. Putnam have sold this mine at Porto Rico to John Durby for $20,000. He has bought the Egyptian mill and will move it at once.

Old Dominion—The Iroquois mill has been moved to the 80-acre tract in Gordon Hollow and is to be enlarged.

Quick Seven—At this mine, and in its neighborhood, near Neck City, there is a new camp which shows some good prospects.

Sunrise—The mill at Spring City was burned to the ground. The loss was covered by insurance. The company will rebuild. C. V. Miller, of Joplin, is manager.

St. Francois County

The miners of the St. Joseph and Doe Run lead companies have struck for an advance of 15 per cent. in wages. None of the other mines are involved so far, but if the strikers succeed, the movement will undoubtedly spread through the district.

Michigan

Copper

Isle Royal—Good progress is being made in sinking the new shaft on the Baltic lode. Some copper has appeared in the formation, but nothing of a commercial value.

Centennial—A much better state of mineralization is being revealed in the northern extension of the drifts from the

shaft, and particularly so at the seventeenth level drift, which is approaching the South Kearsarge lode. A gradual increase is being made in production and also in the copper contents of the rock.

New Baltic—This company has begun drilling. The results of this drilling will be awaited with much interest, as in the trenching work a very promising formation was revealed and the drill cores will show its contents at depth.

Allouez—The south drift from the fourteenth level of No. 2 shaft has again come into good copper rock, after passing through a small strip of barren ground. An improvement in the copper contents of the rock has been in evidence for the past two months.

Mohawk—This company has begun diamond drilling to test the overburden, preparatory to sinking its No. 6 shaft. This shaft will be put down about 2500 ft. south of No. 5, and will command the southern portion of the tract. The southern drifts from No. 5 shaft are in good ground and some are extended about 1300 feet.

Montana

Butte District

Butte-Alex Scott Copper Company—Articles of incorporation of the company, a Delaware corporation, were recently filed in the county clerk's office. The capital stock is $1,250,000 with shares of the par value of $10 each. The directors are stated to be Walter P. Rainbow, Clarence A. Williams and Orville G. Flister, of Pittsburg.

East Butte—It is stated that proxies for more than 125,000 shares of stock have been received to be voted in favor of the purchase of the Pittsmont company's property.

Butte & Superior—Arrangements have been made for the shipment of 2000 tons of zinc ore which is now on the dump to the experimental zinc concentrator at the Butte Reduction Works. On the 1200- and 1400-ft. levels development work is being carried on both east and west. On the 1200-ft. level the work has progressed a distance of about 300 ft., both east and west of the shaft. On the 1400-ft. level two veins have recently been cut, one 10 ft. in width and the other 14 feet.

Elm-Orlu—A new trestle and new ore bins have recently been completed for the handling of zinc ores.

Copper Eagle—Regular shipments are now being made from the mine; both first- and second-class ore being shipped. The ore carries chiefly silver and gold.

Broadwater County

Ohio Group—An option for the sum of $100,000 has recently been given on this group to G. M. Bourquin and John N. Kirk, of Butte. The property is situated in the Radersburg district, not far from the Keating Gold Mining Company's property.

Deer Lodge County

Washoe Smelter—N. P. Pratt and W. P. Heath, Government chemists, are making an investigation of the smoke problem at the smelter with a view to ascertaining a method by which the fumes may be utilized for the manufacture of sulphuric acid and for other commercial purposes.

Fergus County

North Mocasin—A cave in a winze has seriously interfered with the working of the mine within the past few weeks. The cave has been growing and has reached such dimensions that the richest part of the orebodies have been shut off from further working.

Barnes-King—It is reported that a recent strike of high-grade ore has been made in the property on the 200-ft. level, at a point not far from the mill.

Jefferson County

Daly Group—This consists of five patented claims at Wickes. It is stated that a deal is to be closed whereby an Eastern syndicate will secure control of this property. The claims are valuable, principally for silver and copper.

Brooklyn Bridge Mining and Milling Company—It is reported that operations will soon be resumed on this property which is situated in Lump Gulch, about six miles from Clancy. The property consists of 15 claims, on one of which is a shaft 435 ft. in depth. The officers of the company are: J. Krueger, of Helena, president; W. C. Barden, of Helena, vice-president; W. E. Durfense, of Butte, secretary and treasurer.

Nevada

Esmeralda County, Goldfield

Yellow Tiger—Crosscutting of the vein on the 700-ft. level is now being carried on. The property is equipped with a steel gallows frame and one of the largest hoists in the district.

Florence—An extra tube mill and several tables will be installed shortly, which will greatly increase the capacity of the plant.

Victor-Gold Bar—A 30-ton shipment was made last week, returns from which gave $95 gold, a small amount of silver and 6 per cent. copper.

Albemarle—It is reported that work will be resumed in the course of the next few weeks. The company's holdings consist of 11 claims two miles due east of Goldfield. It is equipped with a 25-h.p. hoist and the main shaft is 300 ft. deep.

Esmeralda County—Rawhide

Mint Leasing Company—A rich vein of gold is reported on the 300-ft. level. The shaft will be sunk to the 500-ft. level. Shipments of ore are made regularly.

Marigold—A vein 1 ft. wide and running high in gold is reported as being recently discovered.

Dromiac—The shaft is down 150 ft. A gallows frame and a 15-h.p. hoist are being installed.

Rawhide Queen—Regular shipments of high-grade ore are being made to the Dayton & Hazen samplers.

Mint Extension—On the 220-ft. level a vein 4 ft. wide carrying $15 in gold was encountered.

Dayton Toledo—Pay ore has been encountered on the 300-ft. level.

Royal Tiger—High-grade ore is reported on the 450-ft. level. The vein is only 2 in. thick.

Grutt Balloon Hill—Malcolm L. Mac Donald has finished his examination of the mine and it is expected that his report will be ready in about 30 days.

Sweet & Weiss Mills—Five thousand dollars' worth of bullion is said to be missing from this mill.

Schneider—E. C. Klinker, of Rawhide, has purchased the controlling interest in this mine. Extensive work will be carried on and a mill has been purchased.

Esmeralda County—Silver Peak

Pittsburg Silver Peak—The raise from the tunnel level of the Mary to the workings on the Drinkwater claim is nearly completed. The raise will be 1400 ft. long, on the incline, and will be double tracked the entire distance. The ore will be handled by two 4-ton skips.

Humboldt County—Mazuma

London Syndicate—The mill will be in operation within the next three or four days. The first ore to go through the plant will be from Wihuja lease. Teams are hauling ore from the mines to the mill. The cost of the mill, including the cyanide plant, is, approximately, $80,000.

Seven Troughs Coalition—The Kindergarten vein has shown no sign of depreciating in value. The ground at the 300 level is improving.

Wihuja—Work is progressing on the Kindergarten and the Wihuja veins. Ore shipped to the Coalition mill averages $65 per ton.

Harris Lease—The shaft on the Fairview claim is down 270 ft. A winze from the 200 level opened some high-grade and milling ore.

Jess-Bard and Sandifer Leases—These leases on the coalition have affected a consolidation. The Sandifer has a gasolene hoist and two pumps, and will keep the water out of both mines, and enable one or the other to explore the Harnan vein.

Potter-Arnett Lease—A 50-h.p. steam engine and a No. 7 Cameron pump have been installed. The shaft will be sunk to

the 300 level before any lateral work is done.

Reagan Lease—An extension of two years has been granted on the lease and the shaft will be sunk 200 ft. more, making a total depth of 500 feet.

Rambler—A 200-ft. shaft will be sunk on a 6-ft. vein, which has been opened up for 150 feet.

Big Thing—John G. Huntington has leased and optioned this property.

NYE COUNTY—PIONEER

Bullfrog Pioneer—Four feet of high-grade ore was disclosed last week in the raise from the 210-ft. level. A new 12-drill air compressor has been ordered, also an electric hoist, the latter to be installed on the 210-ft. level. Shipments for last week were approximately 500 tons.

Mayflower—A stockholder's meeting will be held in Rhyolite on May 15. Most of the ore is now being extracted from the 200- and 300-ft. levels, while development work is being pushed on the 400-ft. level.

Indiana-Nevada—This company operating three claims adjoining the Pioneer has a 15-h.p. hoist in place and is erecting a gallows frame preparatory to active development work. The shaft, now 65 ft. deep, will be sunk to the 150-ft. level at which point it is expected the vein will be cut. Four leases have been granted on the property, one block having been taken by Messrs. Taylor, Niven & Price.

NYE COUNTY—BULLFROG

Homestake—This property was closed down last week for an indefinite period, owing to insufficient ore to supply the mill. Nearly all the work underground was devoted to the extraction of ore and no attention given to the development of new orebodies.

National Bank—The Logland lease has another shipment of 20 tons ready for the smelter, which will run about $65 per ton. In addition, a quantity of milling ore has been extracted that will be held until such time as it can be locally treated.

NYE COUNTY—TONOPAH

Montana Tonopah—The mill is again working at full capacity with a 90-per cent. extraction recorded for last week. An output of about 1200 tons per week is being maintained. The semi-monthly clean-up for April resulted in 21 bars of bullion weighing approximately 80 pounds each, and 100 tons of concentrates shipped to the smelter.

Tonopah Mining—The mill report for the week ending April 10 shows that 3040 tons of ore, valued at $22.50 per ton, were crushed. Shipments consisted of 60 bars of bullion worth $800 per bar and 20 tons of concentrates at $525 per ton, making total shipments amount to $67,500.

NYE COUNTY—ROUND MOUNTAIN

Fairview—Operations have been resumed and an average of 20 tons is being treated daily in the mill. Development work is being pushed on the several levels and a steady output is expected.

NYE COUNTY—MANHATTAN

Manhattan is now the scene of much activity on account of its placer developments. The gulch from Manhattan to its junction with Smoky valley, five miles to the west is being prospected and worked by about forty different companies and leasers. Bed rock varies from 30 ft. at the east or upper end to 80 ft. at the lower end.

WHITE PINE COUNTY

Nevada Consolidated—According to James Phillips, Jr., president, the fourth unit of the Steptoe plant will cost $162,000. The company now has over $2,000,000 in cash, accounts receivable, and copper.

New Mexico

CHAVES COUNTY

It is reported that at a depth of 1120 ft. a flow of natural gas was struck. The well is three miles east of Dexter.

Oregon

BAKER COUNTY

Cougar—Theodore L. Lammers and other Spokane men have obtained a 15-months' lease, and the mine is bonded to them for $250,000.

South Dakota

LAWRENCE COUNTY

Custer Peak District—The principal property is that of the Custer Peak Mining Company, with a shaft down over 200 ft. At that level crosscutting showed about 1 per cent. copper. Winzes sunk indicated a material increase with depth. The shaft is being sunk to 400 ft., where crosscutting will be resumed.

Imperial—This company has shut down some of its mines, and is operating the mill one shift. Notices are out of a special stockholders' meeting to increase the bonded indebtedness from $300,000 to $500,000 for the purpose of retiring outstanding bonds, paying off floating debt and erecting a modern reduction plant.

Golden Crest—A new electric pump has been installed at the 125-foot level, where work is to be prosecuted before unwatering the deeper workings.

Hercules—Mill construction is now well under way. The mill flow will be as follows: The ore will pass through a No. 5 Gates crusher at the mine, thence by cable tram 3000 ft., crossing Butcher gulch, to the mill. Here it will be fed from the bins to 40 stamps to pass 20 mesh, going to two Dorr classifiers. The slime overflow from the classifiers will go to a 10x30-ft settler, the sand discharge passing through two 5x22-ft tube mills, Allis-Chalmers make. The tube-mill discharge passes to two hydraulic classifiers, the overflow from which is returned to the Dorr clasifiers, the overflow going to two 30-ft. diameter settlers. The thick slime from the settlers will be pumped to two Brown tanks, 45 ft. high and 15 ft in diameter, from which, after agitation, it will flow to a Butters filter plant. The solution from the filters and the overflow from the settlers will be pumped through filter presses to the precipitation room. The Butters installation at the Hercules will be the first in the Black Hills.

PENNINGTON COUNTY

Rochford District—Interest has been stimulated by the arrival of Robert Bunce, of London, who was in the Hills in 1907, to inspect the Standby and other properties on which he has an option. H. S. Denny, formerly of South Africa, now of Mexico City, is expected to arrive in a few days to make examinations.

Utah

BEAVER COUNTY

Indian Queen—The tunnel is in a distance of 2550 ft., and progress at the rate of 10 ft. per day is being made by two shifts. Arrangements for a complete ventilating equipment have been made. Upon its installation the progress will be increased by putting on a third shift.

Utah Gold and Copper—In the west tunnel the vein has widened to about six ft. A 250-ton concentrating plant is to be erected. The roads from the mine to the railroad are getting in condition to permit heavy shipping and the working force will be increased.

Moscow—A drift is being run on the 300-ft. level in a vein of lead-carbonate ore. Work is also being done on the 400-ft. level. The property is shipping about 2 cars per week. Twenty men are now employed.

Newhouse—The slimes-settling system of the mill is being doubled, and the other additional equipment includes 2 jigs, 16 Wilfley and to Johnston tables. Owing to a change in the character of the ore the saving in the mill had dropped from a normal of 70 per cent. to as low as 50 per cent. Samuel Newhouse, in a letter to a leading stockholder, is quoted as saying: "Personally, I am confident that when these changes are made we will increase our savings to such an extent as to enable us to meet the market conditions of copper, even though they remain bad for some time. Under Mr. Drummond's management we have introduced the caving system, which is resulting in lower mining costs, the physical condition of the mine warrants the assertion that there are many years' tonnage to be had for the mill at a very low cost under this caving system."

Beaver Carbonate—The new orebody on the 700-ft. level has been followed for 30 ft. The ore continues to be of a good milling grade. The drift will be continued and a crosscut has been started to determine the width of the shoot.

Cupric Copper Company—The steam-hoisting plant is now in commission. The shaft is now down 205 ft., but no crosscutting will be done until a depth of 400 ft. has been reached.

SALT LAKE COUNTY

Yampa—Two converters, one blast furnace and three reverberatory furnaces are now running full blast, treating 23,000 tons of ore per month from the Yampa mine. About 350 men are now employed in the mine and smelter.

Tintic—The Tintic Company, which owns the Tintic Mining and Development Company and the Yampa Smelting Company, is to issue $500,000 in convertible bonds in order to take care of indebtedness. In the readjustment made necessary by this bond issue, the company will have 900,000 shares of $3 par value instead of 700,000 shares of $5 each, as at present. The outstanding capital of $3,500,000 will first be reduced to $2,100,000 and then increased to $2,700,000.

Boston Consolidated — Production in March was 1,253,926 lb., costing 10.5c. per lb. The output of the porphyry mines was 917,163 lb., costing 11.14c.

SEVIER COUNTY

Jumbo Plaster Company—The gypsum deposit in this region is of great extent and of a remarkably pure character. An 80-ton milling plant is in successful operation, and plans for increasing the capacity are being considered.

SUMMIT COUNTY

Wabash—This mine was flooded again despite the improved pumping facilities which were installed some months ago. A plan is being considered to make connections with the Ontario's original drain tunnel. Work will be suspended until an efficient drainage system can be devised.

Daly-West—The raise in the No. 2 Ontario drain tunnel is now up 100 ft. The total distance of the raise, when completed, will be 470 feet.

TOOELE COUNTY

Boston Sunshine—The mill is now in operation and has a capacity of 150 tons. The ore is of an oxidized character and runs from $3.50 to $10 per ton. Work is being done on the 200-, 400- and 600-ft. levels.

Washington

WHATCOM COUNTY

Washington Mining and Development Company—Plans are being made to construct a $200,000 water-power plant on Collins creek in the Mt. Baker mining district.

SNOHOMISH COUNTY

Washington, Iowa and Edison Development Company—A new 15-in. vein was encountered recently at a depth of nearly 1100 ft. in the crosscut tunnel, the ore carrying galena and gold. The number of miners engaged will be increased in order to expedite the early completion of the tunnel.

West Virginia

FAYETTE COUNTY

Fire Creek Collieries Company—This company, recently organized, has bought an old mine and 3500 acres of coal lands near Pembroke, and will increase the capacity of its mine from 600 to 1000 tons of coal per day. It is intended to install a new power plant, tipple and plane, construction work to be started immediately. Officers and directors of the company include P. M. Sharples, president; Isabel Darlington, secretary and treasurer; Thos. S. Butler and T. L. Eyre. The company's main offices are at West Chester, Penn., where the owners reside.

Wisconsin

PLATT COUNTY

Highland—Shipment of zinc carbonate to the Mineral Point Zinc Company is begun again after four months' stop. The Highland Mining Company is running carbonate through its 100-ton jack mill. The St. Anthony has resumed operation on its zinc deposit; by a recent decision of the State Supreme Court, this company also takes possession of the carbonate vein, located on its land, which has been mined by John Shiffra without written lease for the last 30 years. The Wallace is running its winter's output of mill dirt through the plant of the Milwaukee Mineral Company; a raw concentrate assaying between 55 and 60 per cent. metallic zinc is produced.

Platteville—Some interesting information has developed regarding certain mining land now in litigation between the Wisconsin Zinc Company and the Enterprise Company. In tracing back title it is found that Major Roundtree, who obtained title direct from the Government, retained the mineral rights when he sold the surface land in the year 1855. The above companies both hold lease to the tract in dispute from the surface owners. The heirs of Mr. Roundtree now claim not only the right to the minerals mined, but the privilege to make such disposition of leases as they see fit. Ten concentrators are now in operation within a radius of four miles from Platteville, and a general revival of activity is promised. The new shaft sunk at the Mitchell Hollow shows good sheet jack, and a mill will be constructed by the Wisconsin Zinc Company. This company is also developing the Kohinoor.

Canada

BRITISH COLUMBIA

During three months ended March 31, approximately 500,000 tons of ore were produced in the Boundary and Kootenay districts, in the following proportions: Boundary (copper-gold), 370,000 tons; Rossland (gold-copper), 60,000; Ainsworth and Slocan (silver-lead), 25,000; East Kootenay (lead-silver, 25,000; Nelson (chiefly gold-quartz), 20,000. By far the greater part of this ore was treated at Boundary and Trail smelting works, and of the remainder part was crushed in stamp mills and part reduced in concentrating mills, the concentrates going to Trail.

BRITISH COLUMBIA—ATLIN

Three large nuggets of placer gold found on Willow creek, have been taken to Seattle. The largest nugget weighing 32½ oz. and valued at about $540, was lent to the Bureau of Mines so that the provincial mineralogist might have made a plaster cast for permanent exhibition in the mineral museum. The largest nugget known to have come from Atlin camp was found on a Spruce creek claim in 1899; its weight was 84 oz. and its value about $1400.

BRITISH COLUMBIA—BOUNDARY

British Columbia Copper Company—The supply of coke for smelting is running short, owing to labor difficulties in the Crow's Nest section, from which fuel supplies are usually obtained. The Crow's Nest Pass Coal Company having granted the demands of the local district of the American Mine Workers, the Granby Company expects its supply of coke to be regularly maintained but other smelters have to depend upon collieries not now operating and which are resisting the coal miners' demands for closed shop and other concessions to which the operators are opposed. There is no present prospect of either side giving in.

Dominion Copper Company—The reorganization committee reports that there is deposited under the plan of reorganization over $600,000 bonds out of the total issue of $800,000. The Canadian court has ordered the sale of the properties to be held on May 28 at Vancouver rather than May 17, the day originally named.

BRITISH COLUMBIA—KAMLOOPS

Herman Beckman has 12 men developing the Kimberley. An orebody of good size and fair value has lately been encountered.

BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

On the Ikeda mine, on Moresby island, another shoot of copper ore has been encountered. Shipments of ore to the Tyee Copper Company's smelter at Ladysmith, Vancouver island, are being continued. The mine is owned and operated by Awaya, Ikeda & Co., of Vancouver, B. C.

British Columbia—Southeast Kootenay

Crow's Nest Pass Coal Company—J. D. Hurd, general manager, announced publicly at Fernie recently that the company had been obliged to withdraw from the Western Coal Operators' Association owing to efforts of that body to coerce his company into insisting upon points that did not concern either it nor its employees. His company had agreed with representatives of the miners on all important matters in the scale proposed to take the place of that in the agreement to expire on March 31, and only a few minor points remained to be adjusted. He was confident the proposed new agreement would be ratified by the men, and believed there would not be a cessation of work. Mr. Hurd stated further that the record made last July of 4000 tons daily will be exceeded. October will see a daily average of 6000 tons, and by the end of the year a further increase to 8000 tons daily will have been made. One thousand more coke ovens are to be built at Fernie.

Nova Scotia

Dominion Iron and Steel Company—This company has received an order from the Great Northern railway, of Sheffield, England, for 5000 tons of 85-lb. steel rails. This is the first English order for rails received by them, and to fill it it was necessary to make new rolls, the specification calling for bull-head rails, of a type not used in Canada.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt camp for the week ending April 26 were: Crown Reserve, 121,843 lb.; Kerr Lake, 60,000; La Rose, 261,300; Nipissing, 321,272; O'Brien, 128,598; Right-of-Way, 128,102; Temiskaming, 60,000; total, 1,081,115 pounds.

Cobalt Central—At the Big Pete mine the vein in the west drift on the 260-ft. level has widened. Five narrow veins are drawing together making 9 in. of high-grade and 18 in. of good milling ore.

Consolidated Cobalt—F. B. Chapin, president, has received confirmation of a report that a strike had been made on the Green-Meehan property. The vein was found in drifting at the 100-ft. level.

Hargrave—The main shaft is now down 215 ft. When it is 92 ft. deeper a level will be run into the Kerr Lake boundary to tap the vein in the sixth level of the Kerr Lake which is supposed to extend into the Hargrave.

La Rose—Active work has been begun on the Lawson property recently acquired. The old Silver Leaf shaft, which is down over 100 ft. and was sunk on the Lawson owing to an error in the survey, has been pumped out and drifting will be begun.

Michigan Development Company—This company is now operating the property formerly known as the Coleman Cobalt, on which it secured an option from the Amalgamated. A shaft has been put down 60 ft., and 12 men are employed with S. D. Madden as manager. The company has also leased the Silver Bird property.

Paymaster—The Amalgamated property together with a leasehold on Saseganaga lake has been acquired by the Paymaster company. A crosscut has been driven 150 ft. northward from the main shaft at a depth of 100 ft. to a vein about 5 in. wide carrying low silver contents. The work is in charge of Superintendent Gordon.

Silver Queen.—The annual meeting was held in Toronto, April 28. The financial statement showed liabilities outside the capital stock (1,500,000) amounting to $14,223. The value of ore on hand and in transit—including $25,000 estimated value of ore on dump—with cash balance amounted to $40,633. At the end of the previous financial year the cash on hand was $54,861. With this balance and what the mine produced the company paid $195,000 in dividends besides spending a considerable sum in development and installing a new plant. The 12-drill compressor is producing more air than required, the excess realizing $1000 per month. The Northern Customs concentrator began treating ore from the dump on May 5. Diamond-drill prospecting will shortly be undertaken.

Temiskaming—A steel shaft house open on the sides, of a type not hitherto seen in Cobalt, is being constructed. It rests on solid concrete masonry and is over 70 ft. high. The new shaft, which is a three-compartment one, is down 350 ft., and when complete will be connected with the present workings by crosscutting.

Ontario—Gowganda District

Bonsall—At this location north of Miller lake, an 8-in. quartz vein was recently encountered, carrying high-grade ore studded with free silver.

Yukon

The official records of the gold commissioner for the Yukon show that in the fiscal year ended March 30 last, 288 quartz claims were staked, and that 40 of these were located and recorded in March. The first quartz claim was located by Isabella M. Healy on the Fortymile river in 1894, and since that time 1000 quartz claims have been staked in the Dawson division.

Klondike Dome Mining Company—Work is being pushed on the crosscut tunnel to catch the ledge at a depth of 1800 or 900 ft., when, if the values have not deteriorated, this section will boast a real quartz mine.

Sixtymile—Madison & Bouthlier in this new camp are in good pay dirt. Their work has stimulated considerable prospecting by others. In the Madison ground bedrock is 40 ft. deep, and owing to insufficient water during the season most of the work is prosecuted during the winter.

Mexico

Chihuahua

Bullion Shipments—The Chihuahua banks report the following receipts of bullion for the week ending April 24: Batopilas, 112 bars silver, 112,000 pesos; Watterson Gold Mining Company, 10 bars gold-silver, 20,000 pesos, and miscellaneous, entirely from Sierra Madre districts in western part of State, 8 bars silver, about 5000 pesos; total value, 137,000 pesos.

Republica—At a recent meeting of the directors it was decided to pay dividends beginning in May at the rate of 1 per cent. per month. The majority of the stockholders reside in El Paso and Kansas City.

Middle Mountain—This Naica company is opening up large bodies of milling grade lead-silver ores. D. M. Evans is general manager and A. C. Saunders is superintendent in charge.

American Smelting and Refining Company—An aërial tramway will be built from the Santo Domingo mine in the Santa Eulalia camp to the town of Santa Eulalia, from which latter terminal delivery of ore will be made directly to the Mineral railroad. A similar tramway has lately been completed from the Mina Vieja to Santa Eulalia, a distance of over two miles.

Parral Output—The production of the Parral camp for the week ending April 23 was 5040 tons of milling ore and 3995 tons of smelting ore, a total of 9035 tons.

Hidalgo—This large milling plant in the Parral camp was completely destroyed by fire on April 22. The loss is placed at about $125,000, partly covered by insurance. The plant had been idle for some time.

Guanajuato

Guanajuato-Jalisco Development Company—This new company will operate a number of mines in the Guanajuato district, which have been under the control of Dwight Furness. The company is organized under the laws of New York, with a capital of $1,000,000 preferred, and $3,000,000 common stock. Dwight Furness is general manager. James C. Hinchcliffe, Paterson, N. J., is president.

Sonora

Promontorio—The Clark Copper Company, of Los Angeles, Cal., has secured this old mine, and is opening it under the management of Percy E. Barbour. The mine is full of water to the tunnel level, and preparations are being made to unwater it. Ore is being extracted from the workings above the tunnel level. A producer-gas plant, stamp and concentration mill are being installed.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 5—Coal trade in the West is improving steadily, but still rather slowly. The making of contracts is less in evidence than it has been for several years, but recently this kind of business has taken on a sudden increase. It looks as if large consumers had made up their minds that it was possible that the open market might be an advancing one in the second half of the year and that contract business might be safer. In the Indiana district and in the adjoining districts of Illinois there is much interest in the plans being made for extensive operations of mines to supply the large demand for fuel for the Gary plant of the Steel Corporation.

In the East the bituminous trade also shows a slight improvement, but it is not yet marked. The principal topic of discussion is the probable designs of the West Virginia operators to secure a larger share of the bituminous trade in Eastern territory. Developments are being watched very closely.

The anthracite trade has been quieted by the announcement of the settlement of the dispute between operators and miners. The new contract which has been signed by the representatives of both parties is practically an extension of three years for the present agreement, with some minor concessions intended to remove small grievances complained of by the miners. The new agreement is given on another page.

A general subject of discussion is the decision of the United States Supreme Court on the commodities clause of the Interstate railroad law. This decision reverses that of the Circuit Court insofar as it holds the Hepburn act to be constitutional, but it limits radically the application of the law. A summary of the decision and some comments will be found elsewhere in this issue.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 24, short tons:

	1908.	1909.	Changes.
Anthracite	1,671,842	1,638,367	D. 33,475
Bituminous	10,335,276	11,053,264	I. 717,988
Coke	2,207,905	3,121,117	I. 913,212
Total	14,215,023	15,812,748	I. 1,597,725

Total increase for the year to date was 11.2 per cent. Increase for the week was 242,091 tons.

Shipments of coal over the Huntingdon & Broad Top road for the year to April 30 were 335,448 tons in 1908, and 284,321 in 1909; a decrease of 51,127 tons.

Shipments of coal originating on the Southern railway for the two months ended Feb. 28 were: Tennessee district, 226,157; Alabama district, 383,956; total, 510,113 short tons, an increase of 119,757 tons over last year.

The Pittsburg Coal Company reports shipments for the three months ended March 31 as follows:

	1908.	1909.	Changes.
Pittsburg district	2,701,873	2,130,389	D. 574,484
Hocking district	205,599	160,084	D. 45,515
Total coal	2,910,472	2,290,473	D. 619,999
Coke	2,648	96,046	I. 93,398

The decrease in coal shipments this year was 21.3 per cent.

New York

Anthracite

May 5—The settlement of the anthracite agreement has relieved a certain degree of apprehension, though it cannot be said that the trade has shown much difference. The demand for domestic coal is still showing the effect of the summer discounts. In steam sizes supply is still a little behind demand, but it is expected that with the prospect of interruption in work removed, the companies will be inclined to ship small sizes from the mines more freely.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor. Individual and washery pea can be had for 5 or 10c. less.

Bituminous

The bituminous trade is still disturbed by West Virginia coals—or rather by the discussion of what the West Virginia operators may or may not do. Pocahontas and New River are still offered at low prices, delivered at tidewater. The question most in debate is whether the offers of coal delivered at Eastern ports will be continued.

Current trade is better, especially along the Sound, and it looks as if the far East was beginning to wake up, although its business so far is rather inquiry than actual buying. New York harbor is still dependent on cheap lots, but these are not particularly plentiful. All-rail trade continues fair and improving. Car supply is good and transportation is slightly improved.

In the Coastwise trade boats are gradually becoming more plentiful, but rates remain steady, and smaller vessels in New York are not so confident about asking advances as they were a week ago.

Birmingham

May 3—The coal situation in Alabama shows little improvement, but the operators are more hopeful as the pig-iron market improves. There is no trouble in the way of getting all the help that could be desired at the coal mines.

Coke is in steady demand though not as active as it was for a while last year. There is much coke accumulated throughout the Birmingham district.

Chicago

May 3—Quiet but steady conditions exist in the coal market, the usual spring demand being apparent—for fine coals in preference to lump sizes and a lessened buying of domestic coals. Demurrage evils hold off from the market, only a few grades of Illinois coal, Hocking Valley and an occasional consignment of Eastern coal being sold subject to discount because of delay at the railroad terminal. The steam market is undoubtedly improving—perhaps faster than some dealers will admit, but competition is keen. Prices, therefore, are low and seem destined to continue low, on both Western and Eastern coals. Contract business is quiet, the disposition of consumers being to hold off, and on such contracts as are being made prices are low.

Illinois and Indiana lump and egg sell for $1.75@2.25; run-of-mine for $1.65@1.75, and screenings for $1.40@1.70. Screenings have advanced slightly as a result of the increased demand and conditions of production. Eastern coals in general are selling well, smokeless showing slight tendencies to get back to its old condition of large supply, especially on lump which, from Pocahontas and New River mines brings $3.20, with run-of-mine smokeless at $2.95@3.15. Hocking Valley has been troubled with overshipments, selling for $2.90@3.15, the latter being circular price, but with a good demand.

The anthracite market is dull again, the April rush being over and buying being chiefly in small lots for temporary use.

Cleveland

May 4—Shipments of Lake coal have hardly begun. The late ice at the Sault has kept vessels from starting out, and few cargoes are yet loaded. The unions are trying hard to keep men off the boats, but without much success.

Steam coal is improving in demand, but there is less call for slack than there was. Prices for fair grades of steam are quoted the same as last week, about $1.35 for lump, $1.10 for run-of-mine and 60@75c. for slack, all at mines.

Indianapolis

May 4—Shipments from mines are improving. Chicago dealers claim that there is too much Indiana coal going forward, but operators say that their orders and contracts warrant better working of mines. The topic of discussion just now is the extension of operations by the Brazil Block Coal Company in connection with the Steel Corporation.

Pittsburg

May 4—The Pittsburg Terminal Railroad and Coal Company has scheduled seven of its mines to start within a few days. The Lake shipping season is now well commenced, although a large vessel capacity is not yet at command as ore shipments have not become heavy. Prices continue low and unsatisfactory, some large contracts being made at around $1 per ton for mine-run at the mine. The effort to maintain $1.15 on ordinary business has not been successful, and ordinary lots continue to go at around $1.10. Slack remains at 55 to 65c. A mild freshet in the river reached its hight May 2 and some empties are now being brought up as the stage recedes, and shipments should commence in a few days.

Connellsville Coke—Prices continue unsatisfactory and irregular, good grades of furnace coke selling down as low as $1.40 in some cases for prompt shipment, although many operators hold their coke at $1.50 or higher. Consumers are showing little interest in second-half contracts, on which $1.75 is asked. Foundry coke for spot shipment is selling as low as $1.75, contract coke being held at $2@2.25.

The *Courier* gives the production in the Connellsville and lower Connellsville fields at 230,229 tons, a decrease of 3000 tons from the previous week. The shipments were 8985 cars, a decrease of 142 cars, and were distributed as follows: to Pittsburg district, 3323 cars; to points west of Pittsburg, 4739 cars; to points east of Connellsville, 923 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, with coal supplied to steamships in foreign trade, three months ended March 31, long tons:

	1908.	1909.	Changes.
Anthracite	422,865	428,974	I. 6,109
Bituminous	1,845,022	1,516,160	D. 328,862
Total exports	2,267,887	1,945,134	D. 322,753
Bunker coal	1,461,651	1,386,902	D. 74,749
Total	3,729,538	3,332,036	D. 397,502
Coke	209,202	246,791	I. 37,589

Canada took this year 1,333,255 tons of coal, or 68.5 per cent. of the total. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, three months ended March 31, long tons:

	1908.	1909.	Changes.
Anthracite	15,023	3,115	D. 11,908
Bituminous	485,168	308,354	D. 176,814
Total coal	500,191	311,469	D. 188,722
Coke	39,545	54,573	I. 15,028

Canada furnished this year 257,436 tons of coal and nearly all the coke; Australia, 38,735 tons of coal. Imports are chiefly on the Pacific coast and on the northern border, into Montana and Washington.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on April 22: Best Welsh steam, $3.72; seconds, $3.60; thirds, $3.42; dry coals, $3.48; best Monmouthshire, $3.30; seconds, $3.18; best small steam, $2.64; seconds, $2.28.

Iron Trade Review

New York, May 5—The iron and steel markets generally show a considerable increase in activity. Moreover, the general sentiment is improving and consumers seem to be acquiring more confidence in the future. At any rate they are making contracts for longer periods ahead.

In pig iron inquiries are numerous and sales are larger, running well over into third-quarter deliveries. This is especially the case in Eastern and New England territory where the foundries are buying in larger lots than for some time past. Prices are accordingly firmer for foundry iron, and furnaces are not making concessions such as were offered to buyers a short time ago. The general level of prices has not increased, but it is much better maintained. Southern furnaces are sold up to their current production for the next two or three months and are talking of advancing prices 50c. per ton. There has also been considerable buying of basic iron.

In finished material a good business continues to be done in structural steel. Building projects seem to be increasing in number and bids are being asked for some large work. Smaller contracts have made up a good aggregate business. A good business is also reported in plates and bars.

The American Steel and Wire Company has, at last, made the promised reduction in wire and wire products, for which the trade has been waiting. This reduction varies from $7 to $10 per ton, and affects many articles of general use. Thus nails have been reduced from $1.95 to $1.60, Pittsburg basing price. It is expected that these reductions will stimulate business, which had already shown a tendency to increase, but was held back by the high prices maintained on wire.

There are reports that negotiations are quietly in progress over the price of rails. It is said that offers have been made to some of the larger railroad companies of a substantial cut, provided they will place large orders. The truth of these rumors cannot be ascertained, but they have at least an appearance of probability.

Southern Basing Points—It is stated that hereafter Birmingham, Ala., is to be made a basing point for steel prices. That is, prices for steel products will be made at Birmingham, and will not be the Pittsburg price, with the differences in freight added.

Baltimore

May 4—Exports for the week included 40,000 lb. rutile concentrates to Hamburg; 36,560 lb. scrap tin to Antwerp; 145,280 lb. zinc dross and 6,677,300 lb. steel billets to Liverpool; 1709 tons steel rails and 290 tons fishplates to Buenos Aires. Imports included 200 tons ferromanganese and 1093 tons manganese ore from Rotterdam; 5800 tons iron ore from Cuba.

Birmingham

May 3—The new month has started in with many of the furnace company officials in the Southern territory in an encouraged frame of mind. The sales during the past month aggregated considerably more than the make, with the greater number of the manufacturers, and the negotiations under consideration will require much more iron. The prices have stiffened during the past fortnight and $11.50 per ton, No. 2 foundry, is the minimum, with $12 being asked in some quarters. There is considerable talk now heard in this district in regard to an increase in the output and five furnaces are reported either ready or nearly so. Some good sales are reported made during the last two weeks, one company selling 10,000 in one lot. The shipments of pig iron from the South have been slack lately. There is a little accumulated iron here, but as soon as some of the companies now holding out of the market begin selling again this will be worked off.

Operations at the steel plant of the Tennessee company at Ensley are still on.

The sale of the properties of the Southern Steel Company in bankruptcy has been practically confirmed; an appeal has been taken and the litigation is still on, but steps are now under way looking to the reorganization.

Chicago

May 3—Quiet but firm conditions exist in the iron market, the users of pig iron having apparently determined to wait a while longer before contracting for the last quarter, in which the trading centers. For third-quarter needs, however, there is still much iron to be supplied. Purchases for current needs are increasing and there undoubtedly is a better tone to the market. Efforts to keep Southern firm at $11.50 Birmingham or $15.85 for No. 2 Chicago have apparently been successful and sales range 50c. above and below this price according to the need and special conditions, this basic quotation being for third quarter. Northern iron remains firm, buying being light and production well restricted. The standard quotation on Northern remains $16.50 for No. 2, above and below which there is a range of 25 or 50c. Brisk buying for the previous week or two seems to have had something to do with the falling off in the demand for Southern iron with some of the large consumers.

In finished iron and steel the market is certainly improving, though railroad supplies are not yet in so good relative demand as other lines, and structural steel is quiet, for the present. Here, as in the pig-iron market, confidence is gaining daily. Coke is still at $4.70 for the best Connellsville, though the demand is good.

Philadelphia

May 5—More buying, both of foundry and basic iron, is in evidence. Consumers are inclined to buy further ahead than for some time past. Sellers are stiffer as to prices; no advance has been asked, but there is less disposition to make concessions. No. 2X foundry can be had at $16@16.50; No. 2 plain, $15.50@16. For deliveries running into third quarter furnaces want 25 or 50c. more. Stocks at furnaces are being reduced in quantity.

Steel Billets—Little business at current prices. Any large orders could be placed at a reduction.

Bars—Demand is rather irregular, chiefly in small lots. Steel bars sell better on the lower price. Store trade is improving.

Plates—New sales are moderate, but specifications on contracts are increasing. Late in the week some large orders came in.

Sheets—Buying is only fair, and mills are willing to shade prices on good orders.

Structural Material—One or two large contracts have been placed and others are under negotiation. Small orders are coming in well.

Scrap—No heavy sales reported, but there are some good inquiries, especially for railroad and machinery cast. Dealers are beginning to sit up and take notice.

Pittsburg

May 4—The event of the week has been the reduction in wire prices by the American Steel and Wire Company, making a new market to which all interests will adhere. From previous official prices the reductions are: Wire nails, $1.95 to $1.60 per keg, base, or $7 per net ton; plain wire, 1.80c. to 1.60c. per pound, base, or $8 per net ton; barb wire, painted, 2.10c. to 1.60c.; galvanized, 2.40c. to 1.90c., or $10 per net ton. Per gross ton these reductions average about $9. The announcement was made in a circular dated May 1, received by the trade May 3, and the new prices are effective May 1. Orders on books will be voluntarily adjusted to the new prices, and shipments in transit on May 1 will probably also be adjusted. There had been shading of 10 to 15c. per keg in nails, the official reduction now made being two or three times as much, and there had been considerable cutting in plain wire, although not much in barb wire.

The wire reduction is merely a part of the general readjustment in steel prices determined upon Feb. 18 last. Originally it was expected the reduction in wire would be made March 1, but as the trade was in the midst of the busy spring season an effort was made to hold prices until the heavy business was put through and the material distributed, and this effort has been fairly successful. The trade is now entering upon a season which is usually dull.

All finished-steel products except standard rails have now been reduced since the open market was declared on Feb. 18, the total reductions ranging from about $5 per net ton on merchant-steel bars, sheets and tinplates up to $10 on some sizes of steel pipe and on barb wire.

Pig Iron—Inquiry for pig iron is somewhat less active than a week ago. Locally the chief activity has been in the purchases of the Standard Sanitary Manufacturing Company, which has just bought 2100 tons of gray forge for May and June delivery, the price being a shade under $13.50, Valley. This company is just closing for 500 to 1000 tons of No. 2 foundry, at $14, Valley. Local furnaces are stiffer in their ideas of price, a number having withdrawn quotations in the past few days, or advanced them 25c. per ton, and asking a minimum of $14.25, Valley, on No. 2 foundry or basic, even for early delivery. There is still some iron to be had at old prices, and we continue to quote, for May and June delivery, $14, Valley, on No. 2 foundry, basic and malleable, $13.50 on gray forge and $14.75 on bessemer. For third quarter, 25c. higher all around is asked.

Steel—The market remains firm, but quiet, consumers being covered by term contracts, on which shipments are of increased volume. Billets are $23, Pittsburg, and sheet-bars $25.50, delivered Pittsburg, Wheeling, Youngstown, etc.

Sheets—Demand fairly good; prices remain 2.25c. for black and 3.25c. for galvanized, 28 gage, for ordinary carload lots, these prices being sometimes shaded $1 per ton on attractive orders.

Ferromanganese—The market is irregular, the minimum being about $41, seaboard, on large lots for early delivery and $42 on carloads, the freight to Pittsburg being $1.75. All ferromanganese contracts are being made with a clause protecting the seller in case the duty is advanced.

Foreign Iron

British Iron Production—The British Iron Trade Association reports that the production of pig iron in Great Britain in 1908 was 9,289,840 long tons; being 634,016 tons less than in 1907, and 859,548 tons less than in 1906. The production in the first half of the year was 4,635,851 and in the second half 4,653,989 tons, an increase of 18,138 tons. The average number of furnaces in blast was 309; the average make per furnace, 29,970 tons.

Metal Markets

New York, May 5—In several directions the metal markets show some improvement, but business remains rather quiet.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1909..	$21,252,462	$ 5,161,648	Exp. $16,090,814
" 1908..	1,447,206	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,024	Imp. 13,437,021
Silver:			
Mar. 1909..	6,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,369	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,656	" 1,755,631

Exports from the port of New York, week ended May 1: Gold, $2,578,100, chiefly to Paris and Brazil; silver, $1,064,420, mostly to London. Imports: Gold, $210,370; silver, $226,692, both from the West Indies, Mexico and South America.

Gold—There has been quite a demand for gold this week and prices in the open market in London have advanced ⅜d., 77s. 9⅝d. per oz. having been paid for bars, and 76s. 4¼d. per oz. for American eagles. The Bank of France is again in the market, having taken all the Transvaal gold arriving during during the week. In New York the demand for gold for export continues, $500,000 having been taken for Brazil and $1,500,000 for Paris. There is a prospect that the outward movement will continue.

Platinum—Business does not show much change, being still quiet, though electrical

sales are showing a little improvement. Dealers continue to quote $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Silver—Under the impulse of speculative Indian and Chinese buying, silver has had a sharp rise, and closes with good orders at 24⅞d. in London.

SILVER AND STERLING EXCHANGE

Apr.-May.	29	30	1	3	4	5
New York....	52⅞	53	52¾	52⅞	53⅝	53⅞
London.....	24⅜	24 7/16	24 5/16	24⅜	24 11/16	24⅞
Sterling Ex..	4.8730	4.8745	4.8745	4.8760	4.8760	4.8750

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 22:

	1908.	1909.	Changes.
India.....	£ 2,310,438	£1,404,400	D. £ 906,038
China.....	506,400	983,200	I. 476,800
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 2,907,038	£2,470,400	D. £ 436,638

Imports for the week £2500 from Mexico, £4000 from the West Indies, £175,000 from New York; total, £181,500; exports £228,500 to India.

Copper, Tin, Lead and Zinc

Apr.-May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
29	12⅞ @13	12½ @12⅜	57½	29¼	4.20 @4.25	4.10 @4.15	4.87½ @4.92½
30	12⅞ @13	12½ @12⅜	57⅝	29⅛	4.20 @4.25	4.10 @4.15	4.87½ @4.92½
1	12⅞ @13⅛	12½ @12⅜	....	29	4.20	4.10	4.87½ @4.92½
3	12⅞ @13⅛	12½ @12⅜	57⅞	28⅞	4.20	4.10	4.87½ @4.92½
4	12⅞ @13⅛	12½ @12⅜	57⅝	28⅞	4.20	4.10	4.87½ @4.92½
5	12⅞ @13⅛	12½ @12⅜	57⅞	29	4.20	4.10	4.87½ @4.92½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—During the week April 29-May 5, business broadened materially and fairly large transactions were consummated both with domestic and foreign buyers. Overtures were made for deliveries extending into the fall, but sellers were unwilling to contract so far ahead, although sales have been made for August delivery. Electrolytic copper has continued to be freely supplied at 12¾c., delivered, 30 days, or a little less than 12⅝c., cash, New York, but some interests which heretofore have been rather aggressive and inclined to make concessions have receded from that position. However, many are still disposed to shade prices for prompt and near-by delivery and such business has continued to be done at concessions. The supply of Lake copper being less extensive than electrolytic, the price for that grade has advanced to the full basis of 13c., sales having been made at 12⅞@13⅛ cents.

There is an impressive expansion in the requirements of manufacturers the world over and consumption appears to be rapidly reaching the point where it will take care of the output at the present rate. It is well to bear in mind that what has always been considered the normal increase in the consumption of copper has to be provided to a large extent by this country, expected supplies from Africa and elsewhere being still far in the future. There is still a great deal of room for improvement in the business of the large manufacturers, but the outlook for the gradual absorption of the surplus is now more encouraging than it has been for some time.

Meanwhile the demand is freely met at 12⅞@13⅛c. for Lake copper, and 12½@12⅝c. for electrolytic, in ingots, cakes and wirebars. The average of the week for casting is 12⅜@12½ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14¼c. base, carload lots at mill. Business has been more active.

The London standard market has been firm throughout the week, showing a very strong undertone and a tendency to respond to speculative buying in spite of the large available supply. The close is steady at £57 17s. 6d. for spot, £58 12s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@75.

After some large sales at the very beginning of April the market became more quiet, the price for electrolytic settling at 12½@12⅝c., which continued without change throughout the month. All of the agencies offered the metal at 12¾c., delivered, 30 days, equivalent to a little less than 12⅝c., cash, New York, and this price was shaded to consummate transactions. Lake copper was freely sold at 12⅞c. for good ordinary brands, while some special brands fetched 13c., the quotation of 12⅞@13c. remaining unchanged throughout the month. Good business in both Lake and electrolytic was done right along, but nothing of spectacular proportions. A feature of the market in the latter part of April was the willingness of the agencies to sell electrolytic for delivery as late as August.

Tin—Toward the latter part of last week and the beginning of this week the London market showed a declining tendency, but notwithstanding the fact that transactions were of good-sized volume, quotations did not show a change to any considerable extent. At the close the market has become a good deal firmer and is cabled at £131 for spot, £132 2s. 6d. for three months.

There is no change to be reported in the domestic market where business still leaves a great deal to be desired. Tin is quoted here at 29 cents.

Lead—Transactions have dwindled down to a retail volume, and prices have eased off to the level at which the leading sellers stand ready to supply the demand, quotations at New York being 4.20, and St. Louis 4.10 cents.

The John Wahl Commission Company reports to us from St. Louis, under date of May 5, that lead is dull, but prices remain steady. Ordinary Missouri brands are lightly salable at 4.10c., while 4.12½@4.15c. is asked for corroding lead.

The London market has also given way somewhat and closes at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—The market has found its level, and there is a fair-sized business from day to day at last quotations, 4.87½@4.92½c., St. Louis, 5.02½@5.07½c., New York.

New York quotations for spelter, April 29-May 5, inclusive, were 5.02½@5.07½ cents.

The John Wahl Commission Company reports to us from St. Louis, under date of May 5, that spelter is firm, but very quiet. The latest sales are on a basis of 4.90c. for prompt and 4.92½c. for late May delivery.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Reports from London are more encouraging, and prices have advanced at the close to £21 17s. 6d. for good ordinaries, £22 2s. 6d. for specials.

Other Metals

Antimony—There has been more buying, chiefly on account of the expectation that a duty will be levied on the metal. Quotations are 8⅜@8½c. for Cookson's; 8¼c. for Hallett's; 7⅞@8c. for U. S. and other brands.

Aluminum—No. 1 ingots are 22@24c., base price; wire, 31@32c., and sheets 33@34c. base. No change in business.

Quicksilver—The New York quotation is $44.50 per flask of 75 lb. Sales are improving. San Francisco sales light and prices nominal at $44 for domestic and $42 for export orders. London, £8 7s. 6d. per flask, with £8 3s. 0d. named by jobbers.

Imports and Exports of Metals

Exports and imports of metals in the United States, three months ended March 31, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	59,982	34,151	Exp. 25,831
Copper, 1908	81,364	20,241	Exp. 61,123
Tin, long tons	114	11,526	Imp. 11,412
Tin, 1908	87	7,385	Imp. 7,298
Lead, short tons	23,219	24,563	Imp. 1,344
Lead, 1908	20,297	27,946	Imp. 7,649
Spelter, sh. tons	1,382	1,098	Exp. 284
Spelter, 1908	453	256	Exp. 197
Nickel, lb	2,618,037	4,284,113	Imp. 1,666,076
Nickel, 1908	3,545,298	3,545,591	Imp. 293
Antimony, lb.	.....	1,848,993	Imp. 1,848,993
Antimony, 1908	2,616	1,923,190	Imp. 1,920,574
Platinum, oz.	.....	29,653	Imp. 29,653
Platinum, 1908	.....	10,084	Imp. 10,084
Quicksilver, lb.	10,303	.....	Exp. 10,303
Quicksilver, '08	42,687	.....	Exp. 42,687
Aluminum, value	$22,346	.....	Exp. $22,346
Aluminum, 1908	109,890	.....	Exp. 109,890
Ores, etc.:			
Zinc oxide, lb.	7,353,417	.....	Exp. 7,353,417
Zincoxide, '08	6,520,625	.....	Exp. 6,520,625
Zinc dross, lb.	5,014,932	.....	Exp. 5,014,932
Zinc dross, '08	7,262,612	.....	Exp. 7,262,612
Zinc ores, lg. tons	2,425	18,668	Imp. 16,643
Zinc ores, 1908	8,067	8,415	Imp. 2,348
Antimony ores, lb.	504	3,194,390	Imp. 3,193,886
Ant. ores, 1908	.....	284,003	Imp. 284,003
Chrome ore	.....	7,540	Imp. 7,540
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 8355 tons calamine and 10,315 tons other ores, against 4022 and 4393 tons, respectively, in 1908. Chrome ore was not reported separately last year.

Zinc and Lead Ore Markets

Joplin, Mo., May 1—The highest price reported paid for zinc was $43.50 for sulphide ore, the base price ranging from $38 to $41 per ton of 60 per cent. zinc. The highest price of silicate was $22, on a base of $18 per ton of 40 per cent. zinc. The average price, all grades, was $38.66, small sales of silicate advancing the average. The highest settling price of the week was $58 per ton for lead ore purchased last week, the highest buying price of this week being $55. The average settling price, all grades, was $56.20 per ton.

SHIPMENTS, WEEK ENDED MAY 1.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,013,020	778,620	$100,248
Joplin	2,911,740	383,350	65,942
Alba-Neck	722,970	9,270	14,728
Duenweg	647,530	86,910	14,585
Granby	924,460	61,000	13,351
Aurora	506,940	15,860	9,210
Miami	801,470	86,110	12,678
Galena	376,370	83,400	9,486
Badger	433,840	7,360	8,883
Prosperity	305,760	66,850	7,849
Spurgeon	301,090	127,320	7,713
Oronogo	352,820	.....	5,596
Carthage	261,140	.....	5,222
Quapaw	191,490	10,820	3,739
Zincite	138,410	7,540	2,840
Carl Junction	90,870	4,060	1,935
Stott City	62,270	4,770	1,383
Sarcoxie	57,670	.....	1,319
Totals	12,309,860	1,732,360	$286,705

18 weeks..... .....203,727,350 33,130,930 $4,639,658
Zinc value, the week, $238,011; 18 weeks, $3,673,550
Lead value, the week, 48,694; 18 weeks, 966,099

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	36.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., May 1—The highest price paid this week for zinc ore was $43 per ton; the base price was $39.50@40.50 per ton of 60 per cent. zinc. No sales of lead ore are reported.

SHIPMENTS, WEEK ENDED MAY 1.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Linden	542,450	.....	.....
Platteville	332,130	.....	.....
Benton	305,200	.....	.....
Strawbridge	220,000	.....	.....
Hazel Green	155,600	.....	.....
Highland	126,000	.....	.....
Harker	98,760	.....	.....
Cuba City	83,300	88,700	.....
Livingston	89,000	.....	.....
Rewey	63,200	56,900	.....
Total	2,006,640	145,600	.....
Year to May 1	33,621,564	1,213,560	2,883,100

In addition to the above there was shipped to the American Zinc Ore Separating Company 159,800 lb. and to the Joplin Separator Works 161,400 lb. zinc concentrates.

Cement Prices

May 5—It is stated today that, because of the action of certain large interests in cutting prices, a supplementary agreement has been promulgated by the cement manufacturers of the East who are in the so-called cement trust, which calls for a reduction of 15c. per barrel, excepting in New York City, where the reduction is 20c. per barrel. In addition the market in the States of Maryland, Delaware, Virginia and the District of Columbia heretofore covered by schedule *A* in the agreement is thrown wide open. This decision was arrived at by the promoters of the proposed cement combination after a series of conferences which have just been concluded.

It is also said that all efforts to get the Western manufacturers to join the combination have been abandoned for the time being owing to opposition on the part of the United States Steel Corporation.

Petroleum

May 5—The Standard Oil Company on May 4 announced a reduction of 5c. per barrel in crude-oil prices in all the Pennsylvania districts, in the Lima field in Ohio, and in the Indiana field. This is the first change in the Pennsylvania fields since March 9, 1907; and since Feb. 26, 1908, in the Lima field.

Chemicals

New York, May 5—The market is improving slightly. Deliveries on contracts are better and there is a little more current business.

Copper Sulphate—Sales are only fair. Prices unchanged at $4.60 per 100 lb. for carloads and $4.85 per 100 lb. for smaller parcels.

Arsenic—Current quotations are 2⅞@3c. per lb. for white arsenic. There is a slight activity owing to the possibility that a duty may be placed on this material.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on May 1 as follows, in long tons:

	1908.	1909.	Changes.
Stocks, Jan. 1	5,900	9,140	I. 3,240
Imports 4 months	70,600	124,700	I. 54,100
Total Supplies	76,500	133,840	I. 57,340
Deliveries 4 months	73,030	122,440	I. 49,410
Stocks, May 1	3,470	11,400	I. 7,930
Afloat for U. S.	80,000	58,000	D. 22,000

Quantities afloat include all cargoes due to arrive at U. S. ports by Aug. 15 next.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, three months ended March 31, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	1,719,158	E. 1,719,158
Bleach, lb.	22,877,205	.....	I. 22,877,206
Potash salts, lb.	100,166,429	1,075,369	I. 99,091,060
Soda salts, lb.	3,116,504	180,826	I. 2,935,678
Acetate lime, lb.	.....	24,823,451	E. 24,823,451
Nit. of soda, tons	88,592	2,051	I. 86,641
Phosphates, tons	847	247,375	E. 246,528
Sulphur, tons	6,306	6,564	I. 258
Pyrites, tons	157,696	.....	I. 157,296

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 69,384 long tons.

Mining Stocks

New York, May 5—The general stock market has been irregular. In the first part of the week they were rather quiet, but on Monday the announcement of the Supreme Court decision on the Hepburn law started a movement, which was not altogether confined to the railroads directly interested, but extended to other stocks. The decision was variously interpreted, but on the whole was considered favorable to the railroads.

The Curb market followed the lead of the Exchange, having been quiet during the first part of the week, but rather active and excited in the second half. Buying was pretty well distributed, the copper shares attracting quite a number. Nevada gold stocks are in rather better demand and were sold quite freely. Cobalt shares were strong and inclined to advance. The general tone of the market was good and it closed strong.

Boston, May 4—There has been a gradual broadening tendency in the mining-share market, which has asserted itself,

particularly the past week. As yet the public has not taken any great interest, but if prices continue to harden it is only a question of time.

Mass mining has been the bull card in this market, and it has been active in this specialty. From below $9 a week back, it touched $15.12½ today. The new lode at a depth of 1700 ft. has opened up some of the most promising ground yet seen in the mine. This strike has called attention to the South Range group and all of them have had active periods. Lake Copper is up over $5 to $24.62½ for the week, while North Lake touched $8.25 today, or above its original subscription price of last summer.

North Butte has advanced over $10 in the week's time, touching $67. The sharp decline early in the year has had no official explanation, except that the vein at a depth seemed to split. There has been some question as to the continuance of the $1 dividend rate, but 75c. per share is bid for the next on 1000 shares.

The Boston Consolidated underwriting syndicate, it is understood, was obliged to take about 15 per cent. of the new issue of 50,000 shares of stock offered at $11. Application will be made to list Nevada Consolidated on the New York Stock Exchange. It is listed on the local exchange.

On the Curb First National sold down close to $5. Activity has centered largely in the low-priced issues, but a general improvement in the tone is noted. Corbin Copper had a sharp advance to $to today.

STOCK QUOTATIONS

NEW YORK	May 5	BOSTON	May 5
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.45	Adventure	9
Amalgamated	78⅞	Allouez	40⅝
Anaconda	46¾	Am. Zinc	26¾
Balaklala	‡2⅛	Arcadian	5¾
British Col. Cop.	6⅛	Arizona Com	43¾
Buffalo Mines	3½	Atlantic	10¼
Butte Coalition	24¼	Boston Con	12½
Colonial Silver	‡¾	Calumet & Ariz.	100½
Cum. Ely Mining	7½	Calumet & Hecla	810
Davis-Daly	8	Centennial	30½
Dominion Cop.	12½	Copper Range	77½
Douglas Copper	2⅝	Daly-West	†9¾
El Rayo	5	East Butte	14⅝
Florence	3⅝	Franklin	15½
Foster Cobalt	.34	Greene-Can	10¼
Furnace Creek	.11	Hancock	10¼
Giroux	7⅞	Isle Royal	27
Gold Hill	¾	Keweenaw	2¾
Goldfield Con	*8⅛	La Salle	14¼
Granby	97½	Mass	14⅛
Greene Gold	¼	Michigan	13
Greene G. & S.	6	Mohawk	61½
Guanajuato	1⅝	Nevada	20¾
Guggen. Exp.	170½	North Butte	66¾
Hanapah	15	Ojibway	72
Kerr Lake	8	Old Colony	.05
McKinley Dar.	.93	Old Dominion	52¾
Miami Copper	15½	Osceola	133½
Mignon	¾	Parrot	33
Mines Co. of Am.	⅜	Quincy	80
Mitchell Mining	‡⅛	Rhode Island	14¾
Mont. Sho. C.	11½	Shannon	15¼
Nev. Utah M. & S.	2½	Superior	41½
Newhouse M. & S.	2	Superior & Bost.	14¾
Nipissing Mines	10¼	Superior & Pitts.	13
Old Hundred	⅝	Tamarack	70
Silver Queen	.45	Trinity	14¼
Stewart	⅜	U. S. Sm. & Ref.	45¼
Tennessee Cop'r.	41¾	U.S. Sm. & Re., pd.	46¾
Tri-Bullion	¾	Utah Con	40
Union Copper	1⅛	Victoria	5
Utah Apex	5½	Winona	14⅞
Utah Copper	57¾	Wolverine	147
Yukon Gold	4¼	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38⅞
Am. Smelt. & Ref.	91⅝
Am.Sm. & Ref., pf	109
Colo. Fuel & Iron	39⅝
Federal M. & S., pf.	84
National Lead	88¼
National Lead, pf.	106¼
Pittsburg Coal	10⅝
Republic I. & S.	25⅝
Republic I. & S., pf.	84¾
Sloss-Sheffield	78⅞
Standard Oil	670
U. S. Steel	55⅞
U. S. Steel, pf.	118¾
Va. Car. Chem.	47¾

ST. LOUIS	May 1	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	1.80	1.50
Cont.C.& C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.25	.18
St. Joe	12.00	11.00

LONDON	May 5		
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	3	1½
Camp Bird	1	2	9
Esperanza	2	16	6
Tomboy	1	1	3
El Oro	1	6	6
Oroville	0	10	9

Cabled through Wm. P. Bonbright & Co., N. Y.

BOSTON CURB	Low.
Ahmeek	155
Black Mt.	1
Chemung	16
Globe Con	4½
Helvetia	3
North Lake	‡7¾
Ray Central	2¾
Ray Con	14¾
San Antonio	10¾

NEVADA STOCKS.

May 5.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.18
Belcher	.49	St. Ives	.13
Best & Belcher	.40	Triangle	.02
Caledonia	.16	BULLFROG STOCKS	
Chollar	.08	Gibraltar	.05
Comstock	.29	Homestake King.	.02
Con. Cal. & Va.	.69	Mont. Shoshone C.	1.75
Crown Point	.50	Tramp Cons	.06
Exchequer	.28	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	...
Hale & Norcross	.19	Lee Gold Grotto	...
Mexican	.84	Nevada Hills	1.37½
Ophir	1.35	Nevada Smelting	.87½
Overman	.12	Nevada Wonder	.65
Potosi	15	Nevada-Utah	2.68¾
Savage	.23	Penn-Wyoming	.02
Sierra Nevada	.30	Pittsburgh S. Pk.	.60
Union	.36	Rawhide Cal'l'n.	...
Utah	.05	Round Mt. Sphinx	.14
Yellow Jacket	.60		
TONOPAH STOCKS			
Belmont	.95		
Extension	.61		
Golden Anchor	...		
Jim Butler	.17		
MacNamara	.26		
Midway	.23		
Montana	.74		
North Star	.03		
Tono'h Mine of N.	7.00		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.14		
Blue Bell	.04		
Booth	.18		
Columbia Mt.	.13		
Comb. Frac	.90		
Con. Red Top	.06½		
Cracker Jack	.04		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.04		
Goldfield Daisy	.35		
Great Bend	.15		
Jumbo Extension	.14		
Kendall	.06		
Lone Star	.05		
May Queen	.04		
Oro	.10		
Red Hill	.10		
Roanoke	...		
Sandstorm	.12		

COLO. SPRINGS	Apr. 30
Name of Comp.	Clg.
Acacia	.06½
Black Bell	....
C. C. Con	‡.03
Dante	‡.06⅝
Doctor	.08⅞
Elkton	.63¾
El Paso	.45¾
Findlay	.14¾
Gold Dollar	.10
Gold Sovereign	.03
Isabella	.20⅛
Jack Pot	.06⅛
Jennie Sample	.07
Jerry Johnson	‡.05¾
Mary McKinney	‡.37
Pharmacist	‡.08
Portland	.89
Un. Gold Mines	.06⅛
Vindicator	.62
Work	.06

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Apr. 15	May 7	$0.01
Blue Wing, Ida	May 8	June 5	0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Confidence, Nev	May 18	June 8	0.20
Crown Point, Nev	Apr. 28	Apr. 28	0.10
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Exchequer, Nev.	May 6	May 26	0.05
Helvetia	May 15	....	0.50
Imlay, Nev	Apr. 6	Apr. 28	0.03
Julia Con., Nev.	May 24	June 17	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Savage, Nev	Apr. 8	May 5	0.10
Sierra Nevada, Nev	May 4	May 25	0.10
Union Con., Nev	Apr. 8	Apr. 30	0.10
Utah, Nev	May 6	May 27	0.03
Yerington Gold, Nev	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	51.428	25.133	23.706
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.886	57.668
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93½	58.331	57.363
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.411	.....	14.41	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.164	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.818
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.680	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.613	5.141	4.363	4.991	20.563	21.495
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.076	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.600	.....
July	4.485	.....	4.338	.....	19.631	.....
August	4.702	.....	4.656	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.661	.....	19.750	.....
November	5.069	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Alaska, Mexican, g.	Alas	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas	200,000	25	10,485,000	April '09	0.50
Alaska United, g.	Alas	180,200	5	513,520	April '09	0.25
Amalgamated, c.	Mont	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.	500,000	100	16,900,000	April '09	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	30,625,000	April '09	1.75
Am. Smelters, pf. A	U. S.	170,000	100	3,710,000	Mar. '09	1.50
Am. Smelters, pf. B	U. S.	300,000	100	5,625,000	Mar. '09	1.25
Am. Zinc, Lead&Sm.	Kan	80,000	25	280,000	Nov. '07	0.50
Anaconda, c.	Mont	1,200,000	25	43,650,000	Jan. '09	0.50
Atlantic, c.	Ariz	3,682,520	...	6,182,520	April '06	0.50
Bald Butte, g. s.	Mich	500,000	25	990,000	Feb. '05	0.02
Beck Tunnel, g. s. l.	Mont	250,000	1	1,354,648	Oct. '07	0.04
Bent'n M.&D., pf., l.z.	Utah	1,000,000	0.10	675,000	Oct. '07	0.02
Boston & Montana.	Wis	196,607	1	10,949	Nov. '08	0.01½
Bull Beck. & Cham.g	Mont	150,000	25	53,400,000	April '09	3.00
Bunker Hill & Sull.	Utah	100,000	10	2,728,400	July '08	0.10
Butte Coalition, c. s.	Mont	1,000,000	15	10,926,000	April '09	0.15
Calumet & Arizonac.	Ariz	200,000	10	10,500,000	Mar. '09	1.00
Calumet & Hecla, c.	Mich	100,000	25	108,350,000	Mar. '09	5.00
Camp Bird, g., s.	Colo	820,000	5	5,707,200	April '09	0.24
Carisa, c. g.	Utah	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s.	Utah	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c.	Utah	283,540	5	226,832	Oct. '07	0.20
Combi'tion Co. G'f'd.	Nev	320,000	1	688,000	Sept. '06	0.15
Con. Mercur, g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich	384,185	100	8,067,885	April '09	1.00
Creede United, g.	Colo	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l.	Utah	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l.	Utah	180,000	20	5,731,000	April '09	0.30
De Lamar, g. s.	Idaho	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.	Mo	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.	Colo	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.	Colo	2,450,000	1	1,315,545	Sept. '08	0.01
Fed. Sm., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.	Idaho	120,000	100	4,331,250	Mar. '09	1.75
Findley, g.	Colo	250,000	1	337,500	Sept. '06	0.01
Florence, g.	Nev	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g	Nev	910,000	1	546,000	Jan. '08	0.05
Gemini-Keystone.	Utah	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.	Colo	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g.	Nev	3,532,371	10	1,770,428	April '09	0.30
Grand Central, g.	Utah	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g.	Cal	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.	S. D	218,400	100	24,264,240	April '09	0.50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.	Ariz	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf.	N. Y	89,126	100	1,871,646	May '09	1.50
Iron Silver	Colo	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal	390,000	10	347,100	April '09	0.02
Jerry Johnson	Cal	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.	Mont	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s.	Colo	130,551	5	130,440	Jan. '07	0.15
Ligbtner, g.	Cal	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah	190,000	1	57,000	Sept. '07	0.07½
Mammoth, g. s. l.	Utah	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l.	Utah	800,000	1	108,000	Sept. '08	0.01½
Mohawk, W.	Mich	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Punch.	Mont	80,833	25	9,437,274	Jan. '07	15.00
Nevada Hills, s g.	Nev	746,000	5	373,000	Dec. '07	0.10
New Century, z. l.	Mo	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah	600,000	10	300,000	Sept. '07	0.50
New Idria, q.	Cal	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc	U. S	100,000	100	12,000,000	May '08	6.00
North Butte	Mont	400,000	15	6,800,000	Mar. '09	1.00
North Star, g.	Cal	250,000	10	1,911,988	Mar. '09	0.30
Old Dominion, c.	Ariz	293,245	25	849,332	Mar. '09	0.50
Old Dominion, M&Sc	Ariz	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.	Nev	201,600	3	1,816,360	May '08	0.10
Osceola, c.	Mich	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. s.	Mont	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g.	Cal	51,000	100	284,925	July '05	0.10
Phelps, Dodge & Co	U. S	44,934,600	1	1,123,365	April '09	0.02½
Pitts. L. & Z., l. z.	Mo	1,000,000	1	30,000	July '07	0.02
Portland, g.	Colo	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.	Nev	100,000	10	375,000	July '07	0.20
Quincy, c.	Mich	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q.	Utah	1,000,000	1	225,000	Nov. '06	0.01½
St. Joseph, l.	Mo	1,000,000	10	6,308,357	Mar. '09	0.15
Shannon, c.	Ariz	300,000	10	450,000	July '07	0.50
Silver Hill, g. s.	Nev	108,000	1	81,000	June '07	0.05
Silver King, g. s. l.	Utah	150,000	20	11,187,500	July '07	0.33½
Silver King Co't'n.l.	Utah	1,224,425	5	1,105,402	April '09	0.15
Sioux Con.	Utah	746,389	1	335,595	April '09	0.07
Snowstorm, s. l.	Ida	1,500,000	1	690,000	Feb. '09	0.03
Standard Con., g. s.	Cal	178,334	10	5,194,130	Dec. '08	0.10
Strattnn's Independ.	Colo	1,000,000	5	4,895,865	April '06	0.12½
Swansea, g. s. l.	Utah	100,000	5	329,500	Mar. '07	0.05
Tamarack, c.	Mich	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.	Colo	300,000	5	2,016,000	Dec. '08	.48
Tonopah of Nev.	Nev	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont.	Nev	1,000,000	1	600,000	April '07	0.10
Tonopah Ext'nsion	Nev	928,433	1	283,030	April '06	0.15
Tonopah Midway.	Nev	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l.	Utah	500,000	1	295,000	Dec. '08	0.02
United States, com.	Utah	350,933	50	2,148,099	April '09	0.50
United States, pfd.*	Utah	485,845	50	5,306,495	April '09	0.87½
United Cop. com	Mont	450,000	100	5,962,500	Aug. '07	0.75
United, c. pf.	Mont	50,394	100	1,500,000	May '07	3.00
United, z. l., pf.	Mo.-Kan.	19,556	25	312,782	Jan. '08	0.50
United Verde, c.	Ariz	300,000	10	1,385,322	Mar. '09	0.75
U. S. Red. & Ref. Pf.	Colo	39,458	100	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah	100,000	10	323,000	Feb. '09	0.02
Utah Con., c.	Utah	300,000	5	7,500,000	April '09	0.50
Utah Copper.	Utah	725,950	10	1,088,925	Mar. '09	0.50
Victoria, Utah	Utah	250,000	1	177,000	Mar. '07	0.04
Vindicator Con., g.	Colo	1,500,000	1	1,980,000	Jan. '09	0.03
Wolverine, c.	Mich	60,000	25	5,400,000	April '09	5.00
Work, g.	Colo	1,500,000	1	172,500	July '08	0.01
Yankee Con.	Utah	1,000,000	1	182,500	Jan. '07	0.03
Yellow Aster, g.	Cal	100,000	10	958,789	Aug. '07	0.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Allis-Chalmers, pf.	U. S	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S	181,530	100	1,747,620	April '09	3.00
American Cement	Pa	200,000	10	1,288,000	Jan. '09	0.30
American Coal	Md	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa	150,000	100	900,000	Nov. '06	0.75
Cambria Steel	Pa	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo	51,250	100	2,643,750	April '09	1.50
Central C. & C., pf.	Mo	18,750	100	1,476,562	April '09	1.25
Col.& Hock. C.&I., pf.	Ohio	69,244	100	383,818	April '08	1.50
Consolidated Coal	Ill	50,000	100	350,000	July '04	1.00
Consolidation Coal	Md	102,500	100	z10 431,650	Jan. '09	3.50
Crucible Steel, pf.	Pa	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf.	N. J	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem. Com	U. S	74,103	100	2,223,090	Mar. '09	1.00
General Chem., pf.	U. S	100,000	100	6,255,000	Jan. '09	1.50
International Salt	Penn	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'l C.&I., cm.	Pa	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'l C. & I., pf.	Pa	15,000	100	900,000	Feb. '09	2.50
Kern River Oil	Cal	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav.	Pa	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf.	Md	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf.	Pa	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com.	U. S	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf.	U. S	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com.	N. Y	149,054	100	3,279,189	April '09	1.25
National Lead, pf.	N. Y	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel& Wire, pf.	N. Ye	25,778	100	631,561	May '09	1.75
New Central Coal	Md	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf.	W. Va	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax	Cal	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil	Cal	92,000	10	711,000	June '08	0.06
Penna. Salt	Pa	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.	Pa	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.	Pa	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.	Pa	120,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf.	Pa	297,010	100	11,434,962	April '09	1.75
Pocadontas C.C., pf.†	W.sVa	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.†	W. Va	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala	100,000	100	2,008,000	Mar. '09	1.25
Sloss-Sheffield, pf.	Ala	67,000	100	4,221,000	Mar. '09	1.75
Standard Oil	U. S	970,000	100	644,072,905	Mar. '09	15.00
Tenn. C. & I., com.	Tenn	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal	Texas	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling.	U. S	50,000	100	5,875,000	Jan. '09	5.00
U. S. Steel Corp., cm.	U. S	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S	180,000	100	14,700,869	April '09	2.00
Warwick I. & S.	U. S	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal	Pa	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. zStock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Amistad y Conc'rdia	Mex	9,600	50	$417,070	April '08	$1.36
Batopilas	Mex	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.	Ont	900,000	1	399,000	May '09	0.01
Butters' Salvador, g.	Salv	150,000	5	600,000	April '05	0.25
Cobalt Central, s.	Ont	4,761,500	1	92,230	Feb. '08	0.10
Coniagas (Nipissing)	Ont	800,000	5	720,000	July '07	0.15
Consolidated M. & S.	B. C	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass	B. C	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. s.	Mex	400,000	5	540,000	Feb. '09	0.15
Dominion Coal, com.	N. S	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf.	N. S	30,000	100	‡630,000	Feb. '08	3.51
Dos Estrellas, g. s.	Mex	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. s.	Mex	1 080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.	Mex	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s.	Ont	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn	B. C	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper	Mex	864,000	10	6,137,800	Mar. '07	0.40
GreenGold-Silv'r, pf.	Mex	300,000	10	120,000	Mar. '07	0.40
Guanajuato Con., g.	Mex	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. s.	Mex	10,000	100	30,000	July '08	3.00
Guggenheim Expl.	Mex	105,000	100	5,272,500	April '09	2.50
Hinds Con., g. s. c. l.	Mex	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.	Ont	600,000	5	1,108,000	June '09	0.30
La Rose Con., s.	Ont	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., g.	B. C	200,000	25	425,000	Dec. '06	0.48
Le Roi No. 2, g.	B. C	120,000	25	889,200	May '09	0.48
McKinley-Darragh, s	Ont	2,000,000	1	480,000	Jan. '09	0.05
Mex. Con. M.&S. Co.	Mex	240,000	10	660,000	Mar. '08	0.25
Mex. Mill.&Trans.pf.	Mex	12,000	100	35,450	Jan. '08	3.00
Mines Co. of Am.	Mex	2,000,000	1	3,545,000	April '09	0.02
N. Y. & Hond. Ros.	C. A	150,000	10	2,467,000	Jan. '09	0.10
Nipissing, s.	Ont	1,200,000	5	2,640,000	April '09	0.25
N. S.Sta.&Coal, com.	N. S	9,876	100	1,087,856	April '08	1.50
N. S.St. & Coal, pf	N. S	10,300	100	479,130	April '09	2.00
Penoles*	Mex	2.500	100	8,630,000	Dec. '07	20.00
Peregrina, pf. s	Mex	10,000	100	538,656	Mar. '09	3.50
Pinguico, pf. s	Mex	20,000	100	240,000	Oct. '08	3.00
Platanillo	Mex	206,989	1	5,580	Sept. '06	0.00
Reco, g. s. l.	B. C	985,000	1	527,082	April '06	0.02
Securities Corp., pf.	Mex	2,000	100	42,699	July '08	3.50
Silver Queen, s.	Ont	1,500,000	1	345,000	Nov. '08	0.05
Temiskaming, s.	Ont	2,500,000	1	525,000	April '09	0.06
Tezuitlan Copper	Mex	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c.	N. F	89,000	2	495,630	May '08	0.55
Trethewy, s.	Ont	945,450	1	312,008	May '09	0.10
Tyee, c.	B. C	180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

Traylor Engineering Company, Allentown, Penn., has received an order for a 46-in. by 160-in. blast furnace complete from the Bankers Mining and Development Company, 50 Wall street, New York City. This is to be installed as the first unit of a very large equipment.

The Denver Fire Clay Company has completed arrangements to carry a complete stock of assayers' and chemists' supplies, heavy chemicals, microscopical goods, school and college apparatus, etc., in Salt Lake City, Utah, and expect to be able to make deliveries from there by May 1.

The Wood Drill Works, of Paterson, N. J., has issued a special circular printed in two colors, entitled "You can't drill rock with wood, but you can do it with a 'Wood' rock drill." Which treats on the material used in the machines and that repair parts are now carried in stock at New York City. These circulars are being distributed through their agents, Harold L. Bond Company, 42 Broadway, New York City, and 140 Pearl street, Boston, Mass.

The Sprague Electric Company, New York, is sending out a new catalog, No. 424, describing its various types of conduit, conductors, boxes, fittings, etc. Among the newer types may be mentioned the single-strip flexible-steel conduit which is designed especially for fire-proof construction. Special mention is also made of the new multilet box, which is one box with many uses. The catalog is covered with an imported stock known as cloud paper, which gives it an attractive appearance. A copy will be sent to anyone upon request.

The Crocker-Wheeler Company, of Ampere, N. J., recently received an order through its Denver office for a number of small motors which will be installed in the plant of the Cox-Clark Engraving Company, Barclay building, Denver. The motors will be used for individual drive on engraving and electrotyping machinery as follows: A 3-h.p. motor driving a planer; a 1-h.p. motor driving a router; a 1-h.p. motor driving a saw; ½-h.p. each on a trimmer, a beveler and a tub rocker, and a ½-h.p. motor driving a jig saw and drill. These are all 230-volt direct-current motors of the celebrated form L type, which is built in sizes from ⅙ to 7½ h.p.

A novel style of slide rule capable of performing a wide variety of calculations, and on this account called the Polyphase slide rule, will be of interest to all whose labors involve arithmetical or trigonometric computations. It is made in a similar form to the ordinary Mannheim slide rule, being a little wider in order to accommodate an extra scale upon the slide, and has been pronounced by all who have seen and used it to be an especially serviceable rule, and one upon which a wide variety of calculations may be readily handled. In addition to the regular a, b, c, d and trigonometrical scales of the ordinary slide rule, the polyphase has on the face of the slide an inverted c scale between the b and c scales, and on the edge of the rule in place of the millimeter scale is placed a scale of cubes. This arrangement enables squares and square roots, cubes and cube roots and a wide variety of combinations, such as the 4th, 5th, 7th and 11th powers and 6th roots to be taken with one setting of the slide, and the position of the inverted c scale on the slide enables many problems involving three factors to be performed at one setting also. The advantage of this arrangement lies not alone in the lessened time required to work an example, but also in the increased assurance of accuracy due to a fewer number of settings. In a circular which is furnished with this rule 70 different examples showing a wide variety of problems involving roots, powers and combinations illustrate the manifold uses to which the polyphase slide rule may be put. Nor are these difficult either, as the arrangement of the scales is so simple that their relations may be readily grasped and new combinations especially applicable to the particular work in hand easily worked out upon them. This slide rule has just been brought out and placed upon the market by Keuffel & Esser Co., New York City.

It is always interesting to chronicle the half century of development and continued success of any concern, for it means not alone that the business has run along for 50 years, but that the line of manufacture has stood the test of time, has secured a permanent place as an integral part of the world's working tools, and has kept pace with the mechanical advancement of the times. Fifty years ago, two brothers, Philander H. Roots and Francis M. Roots, operated a woolen mill by water power. Conceiving the idea of using the rotary pump principle as a water motor, they built one of wood—case, impellers and all, except the shafts and bearings. Naturally, the machine swelled on being introduced to its driving element and it was taken to a small stove foundry to be loosened up. On re-testing with a belt drive, the foundryman noticed the air coming from the discharge pipe and remarked that he believed the machine would melt iron. The suggestion was adopted and the "grand-daddy" of Roots blowers built and put in successful operation. The clearances were, let us say, liberal, but the type, with minor modifications, endures today. Changes in impeller forms, modifications in bearing design, convenience of adjustments, and standardization are all improvements that might be said to be due to the improvement in shop methods and machine design—making the close clearances of the present day's design not only possible, but practical. The original use, for foundry work, soon ceased to be the only field. New uses constantly sprang up and an era was reached when the blower was first used as a foul-gas exhauster. Copper blast furnace furnished the next incentive to better machines for heavier duty, then trunk-line distribution and high-pressure pumping, together with air for filtration beds, are among the later developments. Now comes the vacuum-cleaning business, with its market for small machines, at vacuums ranging from 6 in. to 18 in. mercury. Thus, during 50 years have new problems constantly come up, just as regularly solved, and each has added its quota to the development of the high grade, serviceable and efficient machine of today. The business has always been in the hands of the original Roots Brothers, or their descendants, just as the design varies little from the original conception. Many men have given many masterpieces to the world, and not the least of these is the evolution of a type of machine that has endured for 50 years and so far shows no sign of decay, but rather, gathers life and usefulness as its age increases.

But a few months ago science celebrated the tercentenary of the birth of Evangelista Torricelli, mathematician and scientist, of Florence, Italy. About the year 1641 he made known one of the greatest scientific discoveries—a method of ascertaining the weight of the air by means of a mercury column. This mercury column was for a long time called the "Torricellian Tube," after its inventor, and the vacuum it includes is still known as the "Torricellian Vacuum." As soon as observations of this instrument were made it was found that the rising and falling of the mercury column had an evident connection with the weather. Otto Von Guericke, of Magdeburg, is the first on record who used the barometer as a weather glass. In 1747 Benjamin Franklin divined that certain storms had a rotary motion, but it remained for Redfield, Espey and Abbe in about the middle of the 19th century to gather the data and completely establish the truth of that which the great Franklin had dimly yet wonderfully outlined. With time, changes have been made in the instrument, and today the mercurial barometer is the accepted standard instrument for determining atmospheric pressure, and the highest grade instrument is capable of determining it to the third point of a decimal. Since this instrument must be about three feet in length, it is very cumbersome and not at all portable, so for obtaining gradients on railroads, elevation of hills and mountains, depths of mines, etc., one has to resort to an instrument that is compact, light, portable and above all things, accurate. This is the "Aneroid" barometer. An instrument containing no fluid, as its name implies. It was originally the invention of a French instrument manufacturer, Vidi, but has been perfected by English makers, and today an aneroid of high grade can be depended on at all pressures to 15 in. In the most portable forms for engineers or tourists they are made in two sizes, 1¾ in. and 2½ in. in diameter, but preference should be given to the larger size, since in this size the vacuum and different levers on which the movement depends can be made larger, consequently the instrument is capable of finer adjustment. The altitude scales vary from 3000 ft. to 20,000 ft., and the subdivisions of these scales are governed by the altitude scale itself. The 3000-ft. dials are subdivided to 10-ft. divisions, while the 20,000-ft. dials are in 100-ft. divisions. The value of these instruments cannot be gaged by their external appearance. Accurate and consistent readings depend upon many things, the chief of which, as with all technical instruments of high class, is the skill of the workman. More depends upon his knowledge of the relation of each part to the whole and their technical adjustment to each other, than upon any other factor. High grade barometer manufacture calls for labor equally skilled with the highest class watchmaking. One of the difficulties to overcome is the tendency of the metal forming the vacuum chamber to "creep;" which means that when exposed to a sudden change from a high altitude to a low altitude the metal, owing to the strain resulting from the difference in atmospheric pressure, will not return quickly to its normal state, causing appreciable error in barometric reading. This is overcome by expert knowledge of the character of metals and being able to test and select for high grade instruments only such vacuums as show a negligible degree of "creep" under varying pressures. The metal employed in the forming of vacuum chambers for the best instruments measures but .004-in. in thickness. Compensation is an essential feature in all instruments of this character. It is accomplished by making the main lever of two different metals, steel and brass. Many instruments bear the word "compensated" on the dial, yet when examined *inside* no trace of such can be found. Since the air is subject to great changes in temperature it is necessary to compensate against these changes or the unlooked-for errors will mean useless results and waste of time. Instruments of the highest grade have the regulator (where the final adjustments are made) working in a cupped-out-brass screw, into which works a hardened-steel point, insuring greater delicacy and consequent accuracy. The writer had the opportunity some time ago of visiting the factory of Short & Mason, Ltd., London, Eng., whose reputation for high grade barometers of any description is world-wide. Some of the chains used in the fine instruments were so small that 30 links covered but an inch of space. Some of the instruments had the official certificate of the National Physical Laboratory with them, at times showing errors of only 0.002 inch. The types known as surveying or mining barometers having dials from 3 in. to 5 in. in diameter are made to read by means of vernier to single feet of elevation and are so sensitive to changes in pressure that when lifted from the floor the change in elevation is readily detected in the movement of the hand. The table of equivalent altitude compared to inches of pressure as laid out by Prof. Airey, the astronomer royal of Great Britain, has been accepted as a standard scale and all barometers having altitude scales are divided and figured according to it.

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The Diamond Bearing Highlands of Bahia—I

No Eruptives in the Lavras Series, the Immediate Source of the Diamonds; Carbonados the Most Important Product. Dredging Possibilities

BY J. C. BRANNER*

It is doubtful whether there is anywhere in South America a region of so much economic importance and scientific interest, and which is at the same time so little known, as the interior of the State of Bahia. This is especially true of the portion of the State lying south and southeast of the Rio São Francisco and northwest of the city of Bahia a large part of which is known as the Chapada Diamantina, or the diamond-bearing highlands. Though I have for many years been fairly well acquainted with other portions of Brazil, it was only in the year 1907 that I undertook to see the region here referred to. The trip was made for the purpose of determining the sequence of the rocks, and of working out the general geologic structure with special reference to the distribution of the formations in which diamonds and carbonados are found.

LEDGES OF PINK QUARTZITE NEAR LENCOES

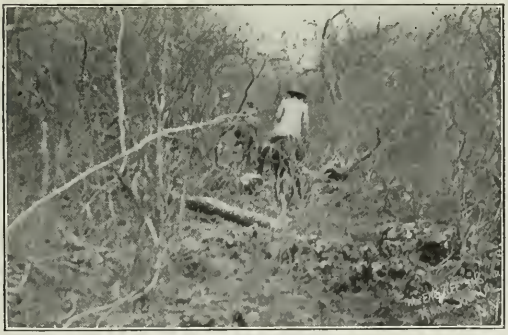
From these the earth and soil have been scraped by miners in search of diamonds and carbonados. After being washed the coarse materials are piled on the flat bare surfaces.

THE RIDGE OF DIAMOND-BEARING PINK QUARTZITE

North of Andarahy, the rocks are false bedded, jointed, and sometimes faulted. The earth has been cleared out and the loose small stones are left piled on the larger ones.

OLD DIAMOND WASHING AT MOSQUITOS, NEAR LENCOES

Showing the white shales that underlie a diamond-bearing bed. The gulleys in the foreground were formed since the washings were abandoned.



A TRAIL ACROSS THE SALITRE VALLEY THROUGH A CHARACTERISTIC CATINGA FOREST

Transportation and Climatic Conditions

This part of the interior of Brazil is best reached from the port and city of Bahia. Two railways approach it, but neither of them penetrates it. The Bahia & São Francisco railway runs from the city of Bahia to Joazeiro on the upper São Francisco by way of Alagoinhas, Queimadas and Villa Nova, a distance of 574 km. On this line there is at present a change of gage at Alagoinhas. In order to reach the region under consideration from this line, one may either take a boat up the São Francisco, and then travel southward on mule-back, or he can leave the railway at Queimadas or Villa Nova and make the rest of the trip with mules.

Another route is by rail from Cachoeira, just north of Bahia, to Bandeira de Mello,

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which is 254 km. nearly due west of Cachoeira. Beyond Bandeira de Mello, however, travel is only by mules.

The region here considered covers an area of about 200,000 sq.km. It is mostly in the semi-arid region of the interior, a region that is fairly well watered along the streams, but in other parts is subject to occasional serious drouths. There are forests in the well watered portions and some *campos* in the elevated regions, but the greater part of the region is covered by a scrubby, stunted growth of timber, called *catinga*, that can be penetrated off the trails only by laborious chopping every step of one's way through cacti, thorns and vines.

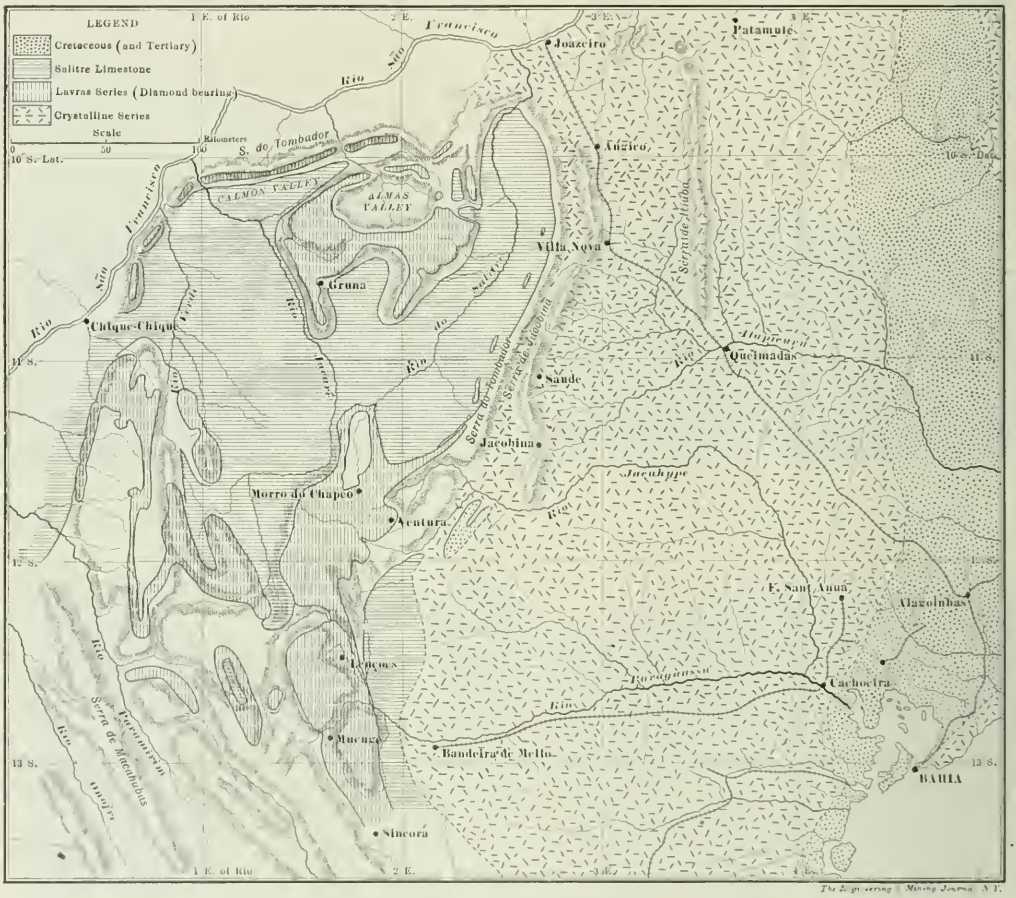
In the main the climate of this entire region, though hot, is as fine and healthful as can be found in any part of the world. This is especially true of the elevated *catinga* covered portions of the interior. Along the São Francisco and portions of Rio Salitre and Paraguassú there is some malaria at certain seasons of the year.

Outline of the Geology

The following brief sketch of the geology of the region will enable the reader the better to understand the distribution of its geologic products: Along the coast is a zone of Cretaceous and Tertiary sediments, somewhat folded and faulted, resting upon a series of old crystalline rocks that are exposed at and about the city of Bahia, and at a few other places on the coast. This sedimentary zone varies greatly in width; in some places it is wanting, while at others it extends far inland.

The most noteworthy development of these sediments in this state extends from the city of Bahia to Alagoinhas, and from that place northward to the Rio São Francisco just above the falls of Paulo Affonso. North of that stream this series is represented by isolated hills and outliers to the frontier of Ceará where they form the Serra do Araripe, the mountains to the southwest of these along the frontier between Bahia and Piauhy, and the general table lands of the State of Piauhy. A part of this Cretaceous belt is shown along the eastern margin of the accompanying map.

The rocks that appear to be the oldest in this portion of Brazil are schists, gneisses, granites and various other eruptives and metamorphics. This old series of rocks covers a broad belt between the Cretaceous and Tertiary sediments near the coast and the highlands of the interior. Over most of this region of crystalline rocks the country is a nearly level plain with an elevation of from 150 to 300 m., and broken by occasional steep-sided and fantastic peaks that rise abruptly from the *catinga* forests. There are a few mountain ranges of granite, the most noteworthy of which is the Serra de Itiuba north of Queimadas, but most of the peaks



GEOLOGICAL SKETCH MAP OF THE CHAPADA DIAMANTINA OF THE STATE OF BAHIA, BRAZIL

The Engineering and Mining Journal, N.Y.

and sharp ridges examined are of quartzite whose beds stand nearly or quite on end, while the country on both sides is of granites, gneisses, schists and old eruptives.

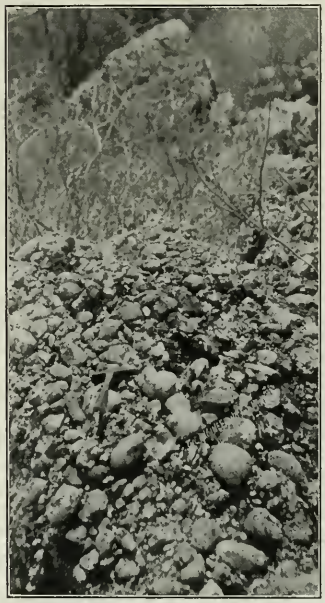
The Jacobina Range

The Serra de Jacobina is the most prominent mountain range of the region. Its southern end is about 30 km. south of the city of Jacobina, and it runs nearly north past Jacobina, Saude and Villa Nova, and at this last place it swings slightly westward and disappears on the plains south of the Rio São Francisco about 50 km. south of Joazeiro. The rocks of the Jacobina range are conglomerates, shales, talcose schists, and quartzites of the kind commonly known as itacolumites The beds are highly tilted, often on end, and throughout the entire length of the mountain range, when not on end, they have a high east dip. and the same strike as the mountain range itself. It is to be noted that this great range has the crystalline rocks on both sides of it. Lithologically this series of rocks resembles closely what was formerly known as the itacolumite series of Minas, but has lately been called by Derby the Minas series.

The Tombador Range

West of Jacobina is the great Tombador range of mountains that rises like a vast vertical wall formed by the edges of a series of nearly horizontal sandstones and quartzites that rest directly upon the old crystalline series. The Tombador beds here dip gently westward beneath the Salitre valley, and can be traced northward by their bold topography to the vicinity of the Rio São Francisco, where they cap the flat-topped mountains or form the monoclinal ridges that characterize the topography of that region.

Above the Tombador sandstones is a series of flinty beds that I have called the Jacuipe flints, and these are followed in ascending order by a great series of gray, red, yellow, black and cream-colored shales that form the surface rocks over large areas. In some places these shales closely resemble the Devonian shales of central New York, in others they are more nearly like the Mauch Chunk red shales of Pennsylvania. They have a total thickness of about 500 meters. This series is named Caboclo, from Serra do Caboclo on the Ingazeira estate on the west side of the Salitre valley.



HEAVY QUARTZITIC CONGLOMERATES

Part of the diamond-bearing series, Pedra Pintada, west side of Salitre valley.

The Diamond Bearing Lavras Series

Next above the Caboclo shales is a series of false-bedded pinkish sandstones, conglomerates and quartzites the upper part of which is called by Derby the Lavras series. These beds have an approximate thickness of about 700 meters. The diamonds and carbonados are from this series. In connection with the geology of the diamonds and carbonados it is of the utmost importance to know the upper and lower limits of the series yielding these stones. Fortunately the Caboclo shales that underlie the diamond-bearing beds are clearly defined and readily distinguished.

Above the Lavras beds is a series of red sandstones very like the Triassic red sandstones of New Jersey and Connecticut, and I have called them the Estancia red beds. These are in turn overlaid by the Salitre limestones which cover a large area in the interior of Bahia. The rocks of later age in the State of Bahia are not so well developed in the diamond region, and need not be mentioned here.

Section of the Chapada Diamantina

The accompanying section gives a resumé of the rocks of the Chapada Diamantina with the names of the series and their estimated thickness:

Names.	Thickness in Meters.	Ages?
Salitre limestones and marbles	350	Jura.
Estancia red beds	350	Trias.
Lavras series	700	Carboniferous
Cambao quartzites	100	
Caboclo shales	500	Devonian.
Jacuipe flints	100	
Tombador quartzites	400	Silurian.
Minas series	1000	Cambrian.
Crystalline		Pre-Cambrian (in part).

CHARACTERISTIC FRETWORK WEATHERING

The diamond-bearing quartzites, Pico Annibal, east of the Almas valley.

CHARACTERISTIC FALSE BEDDING

The diamond-bearing quartzite at Sitio Retiro, on Rio Ingazeira, west side of the Salitre valley.

It should be distinctly understood that the ages assigned these various series are hypothetical, and based solely upon lithologic characters and physical breaks. Diligent search has been made for fossils, but nothing has thus far been found in the entire section here given. Within the area represented on the accompanying map the Cretaceous rocks about Bahia and extending north from that place are

the oldest ones in which fossils have yet been found. The uncertainty regarding the precise ages of the various series, however, does not affect the validity of the divisions or of their sequence.

Diamonds and Carbonados

Diamonds and carbonados are here treated together because they are found together in this particular field and in this field only. The most important existing mining industry of Bahia is that of diamond washing, including both the ordinary diamonds of commerce and the carbonados or black diamonds. Ordinary diamonds have been mined in the Chapada Velha, state of Bahia, since about 1830. They were discovered in September, 1844, on the Rio Mucujé at the spot where the city of São João do Paraguassú now stands, and a little later they were found about Andarahy and Lençoes. Up to about 1856 carbonados were not supposed to have any value, and no effort was made to save them; since that time they have had a market value, and now they are the chief object of mining operations throughout the diamond district.[1]

Heretofore it has not been possible to state the area of the diamond-bearing rocks, chiefly because the geology of the region was not known. The first, and indeed the only geologic study hitherto made of the Bahia diamond district was one by Prof. O. A. Derby,[2] who spent a week or two in the region about Lençoes in the year 1905. The region supposed to yield diamonds has been variously estimated, and is usually made to include enormous areas of the overlying limestone or of underlying formations, while extensive tracts have been overlooked because no one knew the distribution of the rocks in which the diamonds are found. The studies made by me during the year 1907 have made it possible to outline for the first time the geology of the diamond region of Bahia and to determine the distribution of the diamond-bearing beds.

Referring to the geologic sequence of the rocks given above it will be seen that the Lavras series of rocks is made up of conglomerates, sandstones and quartzites that have a thickness of about 700 meters, are provisionally referred to the Carboniferous. These rocks are of a marked pinkish color, except where they have long been exposed to the weather when they commonly, though not always, become white. They are strongly and almost universally false-bedded, and are often covered with fretwork on weathered surfaces.

WASHING FOR DIAMONDS AND GOLD ON THE RIO ITAPICURU BELOW QUEIMADAS

The Pink Lavras Quartzite

A sample of the typical pink quartzite was taken in the midst of the diamond washings between Lençoes and Andarahy and an analysis, made by L. R. Lenox, gave the following results: Silica (SiO_2), 97.94 per cent.; oxides of iron and alumina (Fe_2O_3 and Al_2O_3), 1.08; lime (CaO), none; magnesia (MgO), trace; total, 99.92. The composition is about what one would expect from an examination of the rock. The pinkish color is due, no doubt, to the small percentage of iron which is very evenly distributed through the rock.

Though it is here confidently stated that both the diamonds and carbonados come from this series of rocks, the writer has never seen either a diamond or a carbonado in place in any of them. The washings, however, are always along streams that flow in or over these beds, or at the edges of them, where the detrital and residuary materials gravitate to the streams, and are there concentrated. Over a large part of the slopes of hills and mountains where the beds of this pink Lavras series form the surface rocks, the diamond washers have scraped and gathered the disintegrated rock from every crevice and cranny with the utmost care, and in this material the diamonds and carbonados are found.

In the valley north of the town of Andarahy one can hardly find a spoonful of disintegrated rock in place today, so carefully has it been removed by the diamond washers. One of the accompanying photographs shows how the small stones are pulled out and piled on top of the large ones in this search for the decomposed sandstone. Inasmuch as the pinkish Lavras quartzite is the top rock through most of the diamond region, this habit of the experienced miners is accepted as evidence that it is from these quartzites that the diamonds are derived.

Immediate Source of the Diamonds

In the elevated region in the vicinity of Morro do Chapeo the rocks of the Lavras series are the highest beds, and they are but slightly folded. There the streams rise in and flow for miles in the pinkish quartzites, and the diamonds and carbonados are taken from the beds of these streams. Many similar illustrations might be mentioned, but these are sufficient to show that there is no question about the immediate source of the diamonds in this district. Cases of diamonds in place in these quartzites have been reported to the writer, but though he has never personally seen such specimens, the geologic evidence is all in favor of the theory that the diamonds and carbonados come directly from the Lavras beds.

WAYS AND MEANS
Travel in the interior is mostly on mule back, and the roads are trails.

At the town of Ventura the diamonds are found in a deep gulch sunk in the Caboclo shales, and several hundred meters below the Lavras series. The diamond-bearing beds, however, cap the hills on one side of the gulch, while the stream that flows through that gulch is fed by many branches that rise on the high plateau of the Lavras rocks to the north and west.

One may also hear occasionally of dia-

[1] The carbonados are commonly known as carbons or black diamonds. The following articles give information regarding the carbonado business. H. W. Furness in *U. S. Consular Reports*, LXX, 96-97, Washington, 1902; same volume, pages 145-154; same author in *Popular Science Monthly*, LXIX, 272-280, New York, September, 1906.

[2] O. A. Derby, "The Geology of the Diamond and Carbonado Washings of Bahia, Brazil," *Economic Geology*, I, 134-142; the same in *Smithsonian Report* for 1906, pp. 215-221, Washington, 1907.

monds found in the region east of the area of the Lavras beds. The miners commonly speak of these stones as river diamonds, for they are usually or always along streams that flow from the diamond bearing rocks, and it is understood that they have been carried down by the streams from the diamond region proper.

In 1898-9 diamonds and gold were found on Rio Itapicurú about 40 km. below the town of Queimadas. Diamond washing was carried on in a desultory way from the Fazenda Conceição to Fazenda Boa Vista, a distance of 65 km. down the river. Not enough is now known of the details of the geology of that part of the State to be sure whether the diamonds found there come from an infolded or infaulted portion of the Lavras beds, from the removal of the Cretaceous sediments, or from some other independent source.

CARIMBE AND BATEA

When earth has to be moved, it is carried on the head in shallow wooden bowls called carimbés. Washing for diamonds is done in bateas—large, deep, wooden bowls. The one on the man's head is a carimbé; the one on the ground is a batea.

Absence of Eruptive Rocks

It should be added that no eruptive rocks occur in connection with the diamond- and carbonado-bearing rocks over the greater part of the district. That is, the diamonds cannot be attributed to the influence of eruptive rocks on the beds in which they are now found. Some basic dikes are said to traverse the Lavras beds and the overlying Estancia beds and the Salitre limestones both east and west of the Serra do André, but these reports require confirmation. But in no case can such dikes have anything to do with the occurrence of diamonds hundreds of kilometers away and over the region as a whole.

Among the crystalline rocks that underlie the sedimentary rocks of the diamond region the writer has found a considerable area of serpentine that suggests the possibility of the diamonds having originated in peridotites of the old crystalline series and having been passed down to their present position in the Lavras beds through several geologic generations.

Once the diamond-bearing formation and its stratigraphic relations are recognized, the areal distribution of the diamonds is readily determined in the field. This is due partly to the simplicity of the geologic structure, and partly to the marked contrast between the rocks of the Lavras series and those both above and below them. Over most of the region the beds are gently folded and remind the geologist of the region of folded rocks in the anthracite region of northeastern Pennsylvania. About Morro do Chapeo the folds are quite gentle but north of there, and especially in the mountains west of Gruna, the folds are closely pressed and merge into faults. In other places there are faults that have let the diamond bearing beds down until one edge is carried far below the underlying Caboclo shales. The accompanying section across the Almas valley will give an idea of the general geology of that part of the diamond region.

WASHING FOR DIAMONDS AND CARBONADOS IN THE BAHIA REGION.
From a photograph.

Rock Structure Near Alagoinhas

The structure in the vicinity of the village of Alagoinhas of Jacobina Nova is shown in the north-south section across Riacho da Boa Sorte. At this place the Lavras beds were limited on one side by a fault and on the other by the base of the series. It was thus surrounded by the underlying shales. Often the outcrop follows for many miles along the side of a mountain range, rising here and there to its crest. Again these beds form outliers, or they cap outliers made up mostly of the underlying formations.

These instances are sufficient to show the nature of the geologic problems connected with the diamond-bearing rocks. As is to be expected in such structure the area over which the diamond bearing rocks are exposed is not one single compact area, but a number of irregular areas separated by the denudation of anticlinal folds, by the burial of the synclines beneath later deposits, by faulting, or by the overlapping of later deposits. In some cases the diamond-bearing beds outcrop along narrow zones for long distances; in others they widen out over areas covering hundreds of square miles, and in still others they are mere remnants of the original beds. The accompanying map is necessarily on too small a scale to attempt to give more than a general idea of the distribution of the rocks of the Lavras series. The details, however, are readily worked out on the ground.

Productive Area Between Sincora and Morro do Chapeo

The region that has thus far produced most of the diamonds and carbonados lies between Sincora on the south and Morro do Chapeo on the north. The reason for the productiveness of this particular belt is not certainly known at present. It may be due to the greater richness of the rocks, or it may be due to the fact that it is only here that there is an abundance of water for hydraulic mining. Outside of this better worked zone water is either altogether wanting or it can be had only during the rainy season of the year, which is usually very short, and sometimes fails altogether.

WASHING FOR DIAMONDS AND CARBONADOS IN THE BAHIA REGION
From a photograph.

It is also worthy of note that, except locally, the diamonds and carbonados are not exclusively confined to any particular part of the Lavras series. About Morro do Chapeo, for example, they come from one part of the series, and about Lençoes and Andarahy from another. One of the accompanying photographs, made at Mosquitos, shows a sharp line of demarcation between beds in the Lavras series that are productive above and barren below.

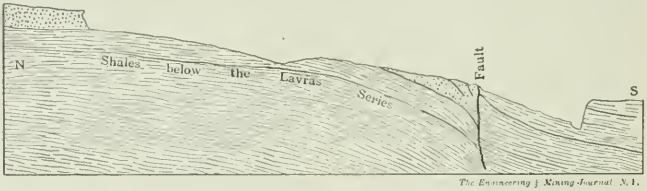
Mining Methods

The mining methods used in the search for diamonds are mostly of the rudest possible kinds. The work is all done by hand, and there is practically no machinery used in the district with the exception of a small electric plant and a little miscellaneous machinery belonging to one foreign company near Lençoes.

The Brazilian method of washing the diamond-bearing gravel was first described by John Mawe in his "Travels in the Interior of Brazil" published at London in 1812.[1] It is interesting to note that the methods described by Mawe a hundred years ago are still in use in Brazil wherever diamond mining is done on a considerable scale and are, indeed, the only ones thus far employed in the diamond regions of South America. When operations are on a small scale, the methods are modified to meet the requirements. The soils and gravels are concentrated by various crude processes, which consist of stirring the materials in the bottom of a stream, or by dashing water against a pile of gravel while it is being stirred. The final "clean-up" is made in large wooden bateas or bowls, the diamond washer standing in the water as shown in the accompanying drawings which are made from photographs.

NORTHWEST-SOUTHEAST SECTION FROM RIO SAO FRANCISCO TO THE SALITRE VALLEY

Showing the general geologic structure of the region for a distance of about 160 kilometers.



NORTH-SOUTH SECTION ACROSS RIACHO DA BOA SORTE

Sitio Cachoeirinha near the village of Alagoinhas showing the diamond bearing beds let down into the underlying shales by a fault.

SECTION THROUGH PICO NABUCO, SHOWING THE DIAMOND-BEARING BEDS AT THE SUMMIT AND THE CABOCLO SHALES BELOW

Hand vs. Mechanical Exploitation

The question naturally arises whether with modern mechanical appliances and mining methods, the mining for diamonds and carbonados could not be made much more lucrative than it is at present. This question, however, cannot be answered with a simple yes or no. Diamond washing is a peculiar business in this respect, that the values are so concentrated that the element of personal honesty of the employees is a matter of the utmost importance. A single diamond worth thousands of dollars may be found, secreted, and carried away by a diamond washer, even when closely watched.

Under the system now in vogue this risk is not important, or rather it is seldom taken, because there are no large companies employing many diamond washers. The work is chiefly in the hands of individuals working independently. A man who leases a piece of diamond-bearing ground may employ helpers to make ditches, to do digging, to remove earth, or boulders, or to help in any way that may be necessary, but when it comes to the washing of the gravels or the final "clean-up," that work is usually done by the holder of the lease alone, or by some one in whom he has perfect confidence.

Another point about machinery is that over much of the diamond-bearing ground the amount of material to be washed is too small to warrant its instalment and the frequent removals that these small deposits would entail.

Possibilities of Dredging Swamp Land

On the other hand, there are places where the local conditions suggest that machinery might be used to great advantage. For example, at certain places the topography is such that there are extensive tracts right alongside of rich diamond bearing ground permanently buried beneath swamps that cannot be drained. The native workmen have worked the ground right down to the edges of these swamps, but being unable to shut off the water, they have never been able to get at what is probably the richest of the deposits. It naturally occurs to one that some adaptation of modern gold dredges could be used to advantage in these low grounds.

Another point that is probably in favor of the dredging of these marshes is that during the first 12 years of diamond mining in the Lençoes district the carbonados were not known to have any value. According to official statistics those 12 years were among the most productive in the history of the region. And during that entire period the carbonados were thrown aside with the tailings and were of necessity washed with other waste into the swamps from which they could not be recovered by any methods with which the native diamond miners are familiar.

The objection to dredges in such a place are: (1) The difficulty of transporting the heavy pieces; (2) that one is here a long way from the factory and from repair shops. However, there are railway repair shops at Cachoeira, Bahia, and Alagoinhas, where all ordinary repairs can be made. The transportation of the large and heavy pieces of a dredge beyond the end of the railway can be obviated partly by the use of boats on the Paraguassú river above the end of the railway at Bandeira de Mello, and partly by opening wagon roads over the rest of the distance. It is also highly probable that the railway will soon be extended considerably beyond its present terminal station.

At the end of this article something will be given concerning the mining laws of the state and the conditions under which the diamond lands can be worked.

(To be continued.)

[1] An American edition of this book was published at Philadelphia in 1816. The process of washing diamonds is described at pp. 230-232 of the American edition.

Tonopah Mining Company of Nevada

During the year ending Feb. 28, 1909, 234,017 wet tons were hoisted from the Mizpah, Silver Top and Red Plume shafts, of which 155,401 dry tons of ore averaging $23.43 per ton, were shipped to the mill at Millers; 7957 tons were placed in storage at Millers for emergency use; 13,635 tons of low-grade ore were placed on the dump, and 50,206 tons of waste rock were hoisted. Mining cost per dry ton of ore shipped, including cost of sinking shaft, diamond drilling and station, was $4.80.

There were milled and treated 158,052 dry tons of ore averaging 0.354 oz. gold and 31.13 oz. silver per ton, making the total metal contents 55,884 oz. gold and 4,940,464 oz. silver. The average recovery of both gold and silver was 90.3 per cent. The total milling cost per dry ton of ore was $4.165. Upon comparison with the previous year, this indicates a reduction of $1.746 per ton in the cost of milling. The dividends amounted to $750,000.

Silver-Lead Mining in Freiberg, Germany

Mining Began in the 12th and Reached Its Zenith in the 19th Century; Academy Founded 1766. Four Types of Veins; By-products Important

BY WILTON G. BROWN*

Freiberg in Saxony has always been full of interest to the geologist on account of its famous examples of "gang structure." Just now, however, a peculiar interest attaches to the place, owing to the announcement of the King of Saxony that he will soon close the Freiberg silver mines which have worked continuously for 750 years. These Saxon mines with one exception are owned and operated by the government, and for the last few years have been worked at a heavy loss. This fact, of course, accounts for the edict which sets 1912 as the date for closing.

Geology

The Freiberg district lies on the long northwest slope of the Erzgebirge at an elevation of about 1300 ft. The surface has been cut into something of a basin by the Freiberger-Mulda river. From the Freiberg district to the north and east stretches a vast alluvial plain which in some places has a depth of more than 1000 ft. Structurally, the section is a dome of which Freiberg is about the central point. The country is biotite-gneiss. The movement which pushed up the dome is also responsible for the metamorphism of the older biotite-granite into the present Freiberg gneiss. Underneath this dome of gneiss lies a stock or batholith of later granite which was probably forced up during the same disturbance which formed the dome. Dikes of mica-syenite, mica-diorite and quartz porphyry are also found cutting the gneiss. These dikes are probably Upper Carboniferous; they are not mineralized and are older than the ore veins.

The Freiberg veins are classified as follows: (1) High-grade quartz veins; (2) Silicious lead veins; (3) High-grade lead and iron carbonate veins; (4) Barite, lead and silver veins. Of these types the first is the oldest and the last the youngest. There are two sets which follow the fault planes in the gneiss of the dome, one running about northeasterly and the other northwesterly. The veins in the granite stock do not carry ores, and this of course suggests a deeper source—an idea which is further supported by the wide extent of the ores. Probably the most extensive vein in the whole district is the "Hohe Birke" (high birch), which has been mined for a distance of four miles and to a depth of 1500 ft. The ores remaining are, for the most part, silicious and must be concentrated. Bunches of high-grade ore are broken down on canvas, packed in sacks and sent directly to the smelting furnace.

Early History

Mining was undertaken in Freiberg about the time of the third crusade, 200 years before the fall of the Eastern Roman Empire, and 300 years before Columbus set out on his voyage of discovery. In 1162 a salt miner from Gosslar brought a load of salt cross-country to Bohemia. One day he picked up in the road a chunk of lead ore seamed with silver. This was a little later the site of one of the best producing mines of Freiberg. News of his discovery spread through the Harz mountains on his return, and, when a little later, there was trouble in the Harz mines, many miners went to the new Saxon fields.

"Otto the Rich," then Margrave of Saxony, went into the mining business when silver was found. Leases were made on the basis of "ten per cent. of smelter returns," with the additional proviso that the Margrave could buy all the silver output of the smelters. Having thrown all the burden of operating on others, Otto wanted all possible revenue and so threw open the district to prospectors. This gave to the town its name Frei Berg. By the middle of the 13th century mining in the district had assumed such importance that the government mint was located at Freiberg.

Crude Methods

In the early days mining methods were primitive and consisted chiefly in "gophering" for streaks of native silver. A large mine employed perhaps 8 or 10 men, and nearly every mine had its own little smelter. The mines were operated for 400 years before the introduction of pumps, and for 500 years they worked without powder. Many miles of workings were driven with only hammer and wedge. When the ground became too solid a fire was built at the face to fissure the rock a little and to permit the wedge to enter.

Era of Greatest Production

The zenith of mining came in the third quarter of the 19th century. During that period as many as 9000 men were employed. Production of both mines and plants was crowded to its utmost. At the present time mining has dwindled until only about 2000 men are employed, and out of more than a score of properties which were working here a few years ago only two government mines and one independent mine are operating. This independent mine is being operated on a more economical basis than the government properties, and as a result shows profit. It will not be closed with the government mines. The term mine as used here means a group of mines which have more or less connected workings. Thus, for example, "Himmelfahrt" mine has five separate shafts and plants, each of which would be termed a mine in America. The separate groups are so far connected that one may travel in underground galleries almost from one end of the district to the other. Masonry or brick arches take the place of timber in the upper workings and old railroad rails serve for stulls in the recent portions. Very little timber is used.

The names given to the mines echo the strong religious tendencies of Saxony. Translating typical names, they read as follows: "God with us," "Help of God," "Christ's Gift," "Heaven's Ruler," "Road to Heaven." Further evidence of the religious tendencies is the fact that miners are compelled to attend chapel exercises each morning before going to work. So the miner attends morning prayer at 4:40 in the morning, goes on shift at 5 and is off shift at 3 o'clock in the afternoon.

Practically the only advance made during the 15th century was the adaptation of water wheels to hoisting. Once introduced, these rapidly came into general use. The 16th century saw the beginning of systematic work. Pumps were installed. A drop in the price of silver gave mining a bad setback in the first part of the 17th century. For the first time blasting was attempted. The 18th century was marked by scientific progress. The nine operating smelters were combined to form only three. All mining equipment was increased, bettered, and great improvement made in blasting practice. As an expression of increasing scientific interest, the Freiberg Mining Academy was founded in the year 1766. The practical benefits of this school were twofold: (1) Its professors made, in laboratory and field, the most careful and detailed study of veins, ores and

*Mining geologist, Helena, Mont.

minerals. (2) Its graduates were technical men fitted to direct mining operations.

In the 19th century there was considerable hardship over the matter of power. In 1844 the government began work on the "Rothschönberger" drain, finishing it some 30 years later. This tunnel drains all mines in the district to a depth of 1800 ft. and with all its branches has a length of almost 30 miles. The completion of the railroad at about the same time cheapened fuel and transportation, also making it possible to smelt foreign ores.

The total production of silver in the district is 6,500,000 kg., valued at $230,000,000. I have been unable to find any tabulation of lead production in the Freiberg district or of the value of its by-products handled in more recent years. Of course these items count up rapidly as savings, but do not begin to offset the drop in the price of silver. The lead ores here are not massive enough to have any great importance for their lead contents, especially when lead is as cheap as it is today.

Operations in 1908

In 1908 the King of Saxony lost something over $200,000 on the Freiberg mines. This was due in large measure to the low price of silver, but it was even more due to the condition of the mines. They are now over 2000 ft. deep, and even under favorable conditions it is expensive to operate at this depth. It is worse, however, when operating with old machinery, old miners, and by hand work. Add to this the fact that the Freiberg veins are narrow, and it is not surprising that there is a loss. Miners here receive only 50 to 75c. per day, but judging from what I saw, it is about all they are worth. The men themselves are mostly old, without energy, and do little work; at any rate, cheap labor is not economical when the mechanical operating expense is large.

A private company in Frankfort recently offered to buy the Freiberg smelters and mines from the government, including both those operating and those already shut down. The king agreed to make the sale if the purchasing company would agree to keep all the old employees. This was promptly refused, however. It is possible that some agreement may yet be reached with this company.

In the Freiberg district we have opportunity to compare private and state ownership of mines. Each seems to have its advantages. Of all the private mines only one is still operating, and yet it is making a margin of profit, while the government has been working its mines at a heavy loss for some years. No official is going to scrutinize his expense or labor bills quite as carefully as the man who must foot them. There is no doubt that the government has put through large projects and has made its different mines work together better than private companies could have done. Yet, so far as actual operating expense is concerned, the balance seems to lie with the private properties.

Concentration, Smelting and Refining

Concentration here is similar to American practice in most points, although the machinery is of different pattern. From the crusher the ore passes through Cornish rolls and all coarse material goes to jigs. The fine stuff is handled on tables which are between a Wilfley table and a vanner in that they have a traveling rubber belt, an end motion, and a side discharge like a table. The coarse concentrates are reduced by dry stamping to about 20 mesh before going to the smelter. Two smelters are in operation in Freiberg, and while these will not be closed with the mines it is likely that they may be combined into one plant. The bulk of their ore supply comes from Freiberg, but they receive much from other Saxon districts, and in fact from all over the world. One sees in the bins ores from South Africa, Australia, South America and even from Japan.

After sampling the ore takes one of four channels according to its nature: (1) That with 25 per cent. or more sulphur goes to the sulphur plant. (2) That with 28 per cent. zinc to the zinc plant. (3) That with 10 per cent. arsenic to the arsenic plant. (4) All other ores to the roaster or furnace of the lead smelter. All tails from the first three processes also go to the lead furnace. In the sulphur plant there are three types of roaster: (a) "Kiesofen," for egg-size ore, (b) three-stage "muffle ofen" for nut size, (c) "schüttröstofen" for dried concentrates. This last type is really a stack containing many little platforms to tumble the material over and check its fall. The gas from these various roasters comes together into a central canal and goes to the lead chambers, where it is thrown down with steam and oxidized with nitric acid in the old-fashioned way. The waste gases from this plant go to the bag-houses and pass out with the fumes from the smelter. The six lead chambers have each over 3000 cu.yd. contents and when working full the capacity of the plant is 20 tons of sulphuric acid daily. Some of the acid is shipped crude for use in different factories, some is concentrated and refined on the ground, and still another part is placed in large vats with scrap iron to make iron sulphate for tanning and fertilizer. Permission to visit the acid-refining room is given only grudgingly since one of the big $16,000 platinum dishes was stolen last year.

At the zinc plant, zinc is distilled with coal and recovered as in Joplin. At present there are not enough zinc ores coming in to keep this plant in operation. The arsenic is recovered and refined by a secret process which is not open to inspection. The roaster and "hochofen" of the lead plant are similar to the American reverberatory roaster and lead furnace, but are operated somewhat differently. Both oxide and sulphide ores go through the reverberatory, and the charge is brought to such a heat that it fuses into a mass of matte, which is broken up for the furnace. The furnaces have no "lead well" and the bullion being drawn off direct is consequently dirty and mixed with matte. It must then go through a cleaning furnace before being cast into bars.

Refining is first done by crystallizing the lead through a series of kettles. Bullion from the lead end is then reheated and further cleaned with zinc before going out as pig lead. The silver bullion from the kettles carries about 2½ per cent. in silver and is further put through two oxidizing furnaces. The first of these turns out 70 per cent. fine silver, and the second removes the last of the lead as well as bismuth. The bismuth is recovered and refined. The refined silver is then granulated and electrolized to recover the gold and platinum.

The royal mint is connected with the smelter and only a mile or so distant are the royal lead factory and shot tower. The ores are mined, concentrated, smelted, refined and the metals used in Freiberg. The precious metals are stamped into coin and the lead manufactured into wares; the sulphur is made into acid ready for use in the arts or further converted into fertilizer; the arsenic is turned into commercial oxide; the platinum, bismuth, antimony and zinc are turned out in metallic form.

Experiments show that wire from Monell metal, rolled, annealed and cold drawn, has a tensile strength of 110,000 lb. per sq.in., the elastic limit being 80,000 lb. The metal is an alloy containing approximately 70 per cent. nickel, 30 copper, with a little iron and manganese. The Orford Copper Company has granted the sole right to make wire from this metal to the Driver-Harris Wire Company, of Newark, N. J. The metal is made from Canadian nickel-copper matte.

In 1908 the production of garnet in the United States, as shown by figures collected for The Mineral Industry, amounted to 2530 short tons only, valued at $78,000. In 1907 the production was 6723 short tons with a value of $209,895. The increasing use of artificial abrasives apparently restricted the production of garnet which is used as an abrasive in the manufacture of boots and shoes.

The New Oilfield in Utah

By A. P. Rogers*

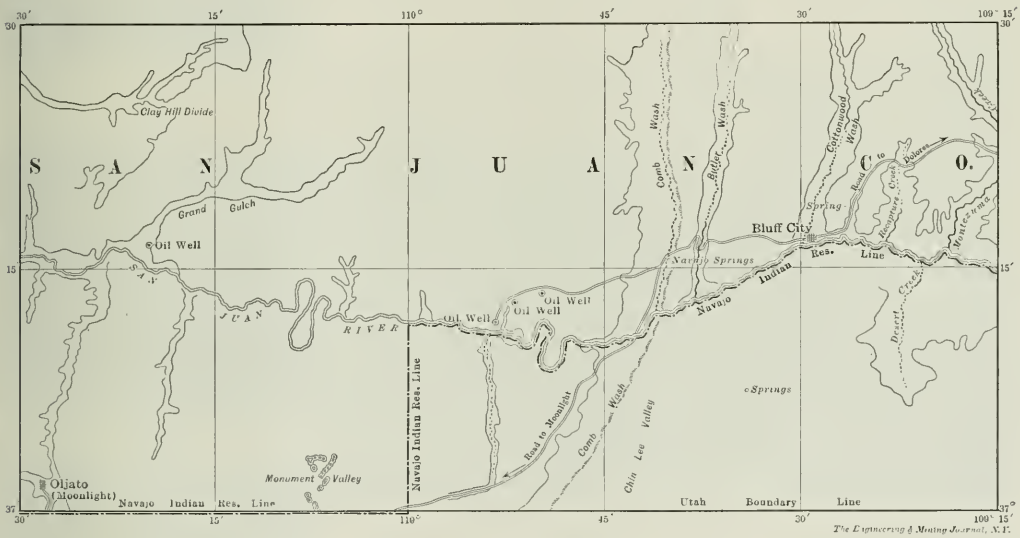
The southeastern part of Utah is one of the last portions of our country remaining to be thoroughly explored and settled. It has been practically inaccessible heretofore, for several obvious reasons, and was regarded of so little value that prospectors have left it severely alone. With the recent discovery of high-grade oil, conditions have changed. The district lies to the east of the Colorado river, where it cuts across the State, and along the course of the San Juan, before the deeper portions of the cañon have been reached. That is to say, between the settlements of Bluff City on the east and Oljato, or Moonlight, on the west, and south of the Blue and Henry mountains. The oilfields proper are about 65 miles across from east to west, and perhaps 75 miles north and south. The existence of oil has been known to the few Mormon settlers for many years, but it remained for a man from the Texas fields to make the first important discovery and set up a driller. That was five years ago; but not until last spring did the public take much interest, and only recently have other rigs been taken in to push the work. Now there are six or eight drilling outfits on the ground, with others on the way.

The country is sandstone, of the Jura-Triassic and Cretaceous ages, with occasional igneous ranges breaking through it, north or south of the known oilfield. A series of anticlines and synclines, formed by the folding of the earth's crust, have produced ideal conditions for oil deposits, and it is here all present prospecting is taking place. Bluff City is the nearest town, and there is only one railroad station anywhere near it—that at Dolores, Colo., on the Denver & Rio Grande Railroad, 80 miles away. Ten miles west of Bluff City lies the great Comb Wash, extending both north and south of the San Juan river for many miles, and from its western side an anticlinal fold rises over 1000 ft. above the river at its highest point. This is the eastern boundary of the field today. It can be followed west from this point more than 60 miles across two synclines and succeeding anticlines until the formation finally disappears below the surface near the Colorado river. Through these anticlines the San Juan river has cut deep cañons, and at various places oil seepages occur, especially from the lower sands close to the water. These cañons have exposed seven different oil-bearing sands in a depth of 1200 ft., varying in thickness from 3 to 60 ft., each one of which is sealed from the other by a strata of hard blue limestone.

In all, four wells were sunk up to December, 1908, the deepest of which is 320 ft., and the shallowest only 120 ft. Two of these struck oil and were gushers for a short time. The other two struck water in the upper sands, but as these were primarily sunk for assessment work, they are not classed as completed wells. The first and deepest well was sunk at the mouth of Grand gulch, encountering a fine grade of oil upon penetrating the fifth sand; this oil carries a higher percentage of volatile matter than any so far found in the West, and if it is obtained in quantity in other wells it will prove most valuable. No continued pumping has been attempted up to date, however.

As a result of these discoveries the surrounding country has been located for miles around, and large drilling machines, some with a capacity of 3000 ft., are being taken in to prospect the field in a systematic manner.

Anyone going into the district must make thorough preparations before starting; the summer weather is very warm and good water is scarce away from the muddy river. Supplies and equipment must be taken in, as practically nothing can be bought on the ground.



NEW OILFIELD IN SOUTHEASTERN UTAH

*Mining engineer, 52 Broadway, New York.

According to *Engineering*, April 2, 1909, a bill was recently introduced in the French Chamber of Deputies proposing modifications in the present French patent laws. One modification provides for the loss of patent rights if the inventor has not worked the patent in France or her colonies within three years of the deposit of his demand, or shall have ceased to work it for three consecutive years, except for valid reasons. Working a patent almost exclusively or principally outside French territory, after a time fixed by the courts, will also be ground for revocation.

According to statistics collected for The Mineral Industry, the production of mineral wool in the United States in 1908 was 9197 short tons, valued at $77,228, as against 9008 short tons, valued at $81,769, in 1907.

The Distribution of Transvaal Gold

SPECIAL CORRESPONDENCE

In the February *Journal* of the Chemical, Metallurgical and Mining Society of South Africa there is an interesting paper on the above subject by T. Kirke Rose, of the Royal Mint, London. The years selected for analysis are 1905 to 1907, during which years South African gold amounted to 72, 71 and 75 per cent., respectively, of the total weight of gold imported into the United Kingdom.

For 1907 the figures were for gold imported into the United Kingdom:

	Oz. troy, gross.
British South Africa	8,012,437
British India	547,452
Australasia	805,961
Rest of the world	1,334,608
Total quantities	10,698,458
Total value	£39,956,304
Fineness of bullion, average,	879.2

The bullion on arrival in London is in part refined there, and in part reëxported in an unrefined state. In the period 1903-7 Doctor Rose estimates the amount of imported bullion that was reëxported without being refined at 15 per cent. of the total. Of the bullion imported into the United Kingdom a portion is retained in the country and a portion reëxported without delay.

The imports and exports for 1907 and for four years were:

	1903-07.	1907.
Imports	£151,973,235	£39,956,304
Exports	98,059,568	26,589,442
Excess imports	£53,913,667	£13,366,862

The greater portion of the gold retained in the United Kingdom is coined at the Royal Mint, the balance, which for the period 1903-7 is estimated at £6,361,300, being used in the arts, for the manufacture of jewelry, for gold plating, for the manufacture of gold leaf, in dentistry, photography, etc. The stock of bullion in the United Kingdom apart from the floating stocks held by refiners and bullion dealers, is in the vaults of the Bank of England. The Bank does not publish separate figures of the bullion and coin, but the two classes together amounted on Jan. 1, 1908, to £31,602,515. The bullion exported from the United Kingdom goes to the countries named in the following table:

Countries.	1903-07. oz. troy (gross)	1907 oz. troy (gross)
Continent of Europe (chiefly France and Germany)	13,005,963	2,021,561
United States	6,063,671	3,143,700
British India	4,630,381	1,374,879
Rest of world	227,822	1,272
Total quantities	23,927 837	6,541,402
Value	£98,059,568	£26,589,442
Average fineness of bullion	964 8	956.9

The gold ingots sent to America have varied in amount more than those exported elsewhere. From 1903-7 (the year of the panic) they increased steadily from 158,945 oz. to 3,143,700 oz. The mean for the five years 1903-7 amounted to over 10 per cent. of the gold deposited at the United States mints. Of this total quantity in the years 1903-6, about 55 per cent. was coined, about one-seventh was used in the industrial arts, and the remainder was added to stock or exported. According to the United States Mint reports, however, the ingots exported are almost invariably United States fine bars, practically never foreign ingots. Also rather more than 40 per cent. of the imported gold bars were issued for use in the industrial arts in the years 1903 5. This would leave nearly 60 per cent. of the imported bars to be divided between coinage and additions to stock of bullion in the United States mints and assay offices. This stock is subject to great fluctuations; it was $124,083,823 on June 30, 1902, $51,910,029 on June 30, 1905, and $104,383,158 on June 30, 1906.

The paper concludes with a chart showing the disposal of the Transvaal gold in the period 1903-7: Used in coinage, 58.6 per cent.; used in industrial arts, 30.5; deposited as ingots in the Bank of France, 3.5; total, 92.6 per cent.; leaving 7.4 per cent. undetermined.

A Crude but Efficient Sample Grinder

BY A. LIVINGSTONE OKE*

Junk heaps often contain much material that is useful, especially in remote mining camps, where supplies are not readily available. Some months ago, in view of the large amount of mine sampling and assaying to be done at La Gloria mine, Batopilas, Mex., it occurred to me to rig up a crushing roll and fine grinder to assist in the work. Fig. 1 shows the rolls which were made from two old vanner flywheels, and the bearings and adjustments from the side rods and brasses. The framing is of wood, as is also the hopper. The two driving pulleys are from disused vanners. This machine has put through over 2000 samples and is as good as ever. It cost 12 pesos to build. It is driven by two 3-in. belts at about 200 r.p.m. and is very powerful. Figs. 2 and 3 show the fine grinder with its pulp box attached and also removed for taking out the crushed sample. This consists of a heavy 3-in. shaft placed on end, with a flange above rotating at high speed below the upper swinging, but non rotating, flange.

The sample is poured into the center opening of the upper flange and is discharged around the edges as in other disk machines. The upper flange is sufficiently heavy to prevent the pulp getting away until it is ground sufficiently fine. The pulp is received into a tin box, made in halves, hinged together, and entirely inclosing the two flanges. The upper flange is prevented from rotating by means of the wrought-iron yoke, fixed to the main upright at the back by a bolt passed through to form the fulcrum.

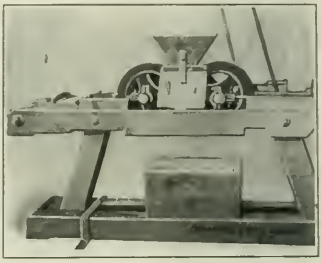


FIG. 1. IMPROVISED CRUSHING ROLLS

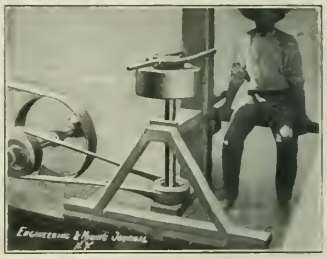


FIG. 2. FINE GRINDER WITH PULP BOX IN PLACE

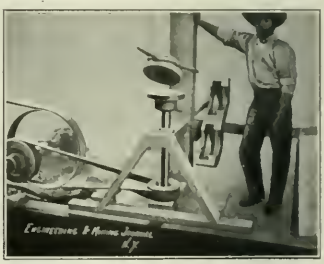


FIG. 3. FINE GRINDER WITH PULP BOX REMOVED

This yoke is also for lifting off the upper flange for cleaning between samples, and is also of use for putting extra pressure on the plates when necessary. The bottom foot-step bearing and also the upper one, were babbitted in the wood and have given no trouble. This machine puts through about 50 samples a day, with a Mexican boy working it.

*Clarke's Alameda hotel, Mexico, D. F.

Dredging at Butte

By A. Floyd Bushnell*

An interesting operation, the results of which will be watched with interest, is now in progress in the Butte district. It is the operation of the British Butte Mining Company's dredge which was built for the purpose of recovering gold from ground adjacent to the town of Rocker, four miles southwest of Butte. The dredge shown in the accompanying illustration, was started during January of this year, but the commercial results of the operations have not yet been announced.

The dredge was built by the Risdon Iron Works, of San Francisco, at a cost of about $80,000, after the plans of Col. M. H. de Hora, president and manager of the company. The hull of the dredge is 110 ft. long by 50 ft. wide, and 7 ft. 6 in. deep, with rounded bows. The lumber used in the construction of the hull and dredge was Oregon fir and the sizes of the principal timbers are as follows: keelsons, 12 x 12 in.; side stringers, 4 x 16 in.; center stringers, 4 x 12 in.; center uprights, 6 x 6 in.; frames, 6 x 8 in.; diagonal bearing, 6 x 8 in.; bottom and side planking, 4 x 10 in.; deck planking, 4 x 10 in. The hull is caulked and tarred below the water line, and thoroughly water-tight.

The gantries are built of timber uprights 14x14 in. x 40 ft. long, capped by steel box girders made of channels and plates, the tumbler gantry being further supported by two 12x16 in. diagonal braces and four 12x20-in. posts; all the posts and braces extend to the foundation timbers on the bottom of the hull and are fastened to the same with steel plates and angles.

The main ladder which supports the digging buckets is a steel girder 68 ft. long between centers, 74 ft. overall, 3 ft. 8 in. wide, 54 in. deep in the center and tapering to 30 in. at the ends. The ladder is hung at the top to the main gantry by means of a 10-in shaft, of 0.35 carbon steel and at the lower end is supported by rope blocks fitted with 36-in. cast steel sheaves with bronze bushings. The ladder rollers on which the bucket chain revolves are of manganese steel, 12 in. in diameter.

The upper tumbler which drives the buckets is a square of manganese steel with a shaft 11 in. in diameter running through it and fitted with renewable manganese-steel wearing plates. The lower tumbler has a 10-in. shaft. The buckets are of 6-cu. ft. capacity, built of heavy steel with manganese lips. Every alternating bucket is fitted with four manganese steel teeth. The buckets weigh 1,500 lb. each, and the connecting links 500 lb. There are 37 links in the complete chain and the pins connecting the buckets and the links are of forged manganese steel 2¾-in. in diameter.

The stacker at the stern of the boat is made of 15-in. steel beams, and is capable of stacking the tailings to a hight of 30 ft. above water at an angle of 30 degrees. It carries a string of close-connected steel buckets having steel links, bushed at both ends with manganese steel. The bucket belt is carried on cast-steel rollers, running in inclosed cast-iron bushings.

The main power winch comprises six drums, the head line drum being of double width, running on a 7-in. shaft; the four side line drums run on 5¼-in. shafts; the other drum is for spare line. The ladder winch, which is used for hoisting and lowering the buckets, is separate and is direct connected with a variable speed induction motor, both being mounted on the same bed plate.

The revolving screen or trommel is 32 ft. long over all and is 78 in. in diameter at the upper end, tapering to 54 in. at the lower end. All the perforated plates are ⅝ in. thick and perforated with ⅜-in. tapered holes, 1¼-in. pitch. Both the screen and the gold-saving tables are Col. de Hora's design. There are 20 tables, 10 on each side of the revolving screen; each is 2 ft. 6 in. wide and the shortest 8 ft. 6 in. long. They are divided in the middle by a cast-iron mercury trough.

BRITISH-BUTTE MINING COMPANY'S DREDGE NEAR ROCKER, MONT.

The tables are covered with cocoa mats and expanded metal, the ends of the matting being bound with brass cleats. All the fine material discharged from the screen is delivered on the tables by means of an inclined plate, fitted with an adjustable 18-in. feed roller having a length equal to the full width of the plate. The roller is driven in an opposite direction to the flow of the water at about one-half its velocity. Each table has an adjustable feed gate, and is also provided with a 1½-in. low-pressure water pipe. The tables are covered with heavy screen guards secured by Yale padlocks. The gravel from the tables discharges into side flumes, 2 ft. 6 in. wide, lined with angle iron riffles and fitted with a mercury trap at the lower end. The side flumes are so constructed that the fines can be discharged by means

*Butte, Mont.

of a centrifugal sand pump to the top of the tailings pile.

The water used on the dredge is obtained from the shaft on the property and is supplied by centrifugal pumps. An 8-in. pump driven by a separate motor discharges its water at a head of 50 ft. into the revolving screen; a 12-in. motor-driven pump supplies water at a head of 12 ft. to the feed rollers and gold saving tables.

The electric motors, of which there are nine on the dredge, are all of the induction type, 3-phase, 7200 alternations per minute, 60 cycles, 440 volts, and aggregate 300 horsepower. The dredge is electrically lighted and in cold weather is warmed throughout by radiators, the steam for which is supplied by a 40-h.p. Economic boiler. The wire ropes used are all flat-stranded crucible cast steel.

GOLD-SAVING TABLES ON THE BRITISH-BUTTE DREDGE

Instituto Mexicano de Minas y Metalurgia

This recently organized institution starts out with the prospect of a large membership, not only in Mexico, but also in the United States and Europe. Upward of 100 applications have already been received. The first meeting will be held probably in July of this year. The organization committee was composed of the following engineers:

MacDonald, Bernard	Grothe, A.
DuBois, E.	Blackburn, W. D.
Merrill, E. P.	Garrey, G. H.
Reynoso, J. J.	Farish, Geo. E.
Denny, H. S.	Denny, G. A.
Hetu, J. D.	Thomas, Kirby
Mennell, J. L.	Bellwald, J. N.
Doveton, G. D.	Ordoñez, E.
Anderson, R. H.	Newcomb, C. S.
McNeely, W. M.	Brennon, J. H.
Braschi, V. M.	Simpson, H. H.
Babb, P. A.	Saunders, McConnell
Barker, H. A.	Narváez, F.
Girault, E.	Empson, J. B.
Enos, H. C.	Johnson, J. M.
Read, H. L.	Chism, R. M.

The constitution was framed by drafting what was deemed best from those of the technical societies in the United States, England and South Africa. There are to be three classes of members, namely, members, associates and honorary members. In order to be eligible for full membership, a candidate must be at least 25 years old, and must produce evidence of a good general and scientific education, regular training as a mining engineer or metallurgist, and engagement for a sufficient period in an important position of responsiblity; or he must have had at least five years of practical mining and metallurgical experience. The annual dues are to be 20 pesos for members and 12 pesos for associates, besides which there is an initiation fee of 20 pesos for both members and associates. Meetings will be held monthly in the City of Mexico, besides which there will be district meetings in various parts of the Republic whenever there is a sufficient membership in the district to insure a successful meeting. The proceedings of the meetings are to be recorded in Spanish, but any member may make a motion or enter into discussion, or submit a paper either in Spanish or English, such motion or discussion or paper to be published in the proceedings in the language in which submitted, with an accompanying record or synopsis of the same in the other language.

The Organization Committee elected under date of April 13 a provisional council, composed of the following:

Thomas, Kirby	Reynoso, J. J.
Babb, P. A.	Denny, H. S.
Braschi, V. M.	Anderson, R. H.
Grothe, A.	Girault, E.
Ordoñez, E.	

Much good will toward the new organization has been expressed by the officials of the Government who are thrown into relations with the mining activities of the Republic, and also by such institutions as the Mexican Chamber of Mines.

Screening at the Utah Copper Mill

By H. B. Lowden*

As originally designed and equipped the mill of the Utah Copper Company at Garfield, Utah, contained trommels as the main screening equipment in the roll crushing department, the undersize passing over stationary inclined screens. Each of the twelve units comprised four trommels, 48x144 in., and two of the inclined flat screens, the trommels being clothed with rolled-slot wire cloth equivalent to about 6 mesh and the stationary screens with similar material passing a product equal to about 20 mesh.

Shortly after the first units were placed in commission, difficulties in the operation of trommels made themselves felt and more efficient and economical screening equipment was sought, to which end a number of devices were systematically tried on a large working scale. The results of these tests were so conclusively favorable to the impact screen that it was determined to equip the twelfth unit, at that time nearing completion, with these screens and to demonstrate conclusively the adaptability of the machine for the work. The twelfth unit was operated with decidedly improved results and with a capacity of 600 tons as against the 500-ton capacity of the other units, owing to the tables being able to handle a greater tonnage of the more closely sized feed. The screens in this unit were running wet.

The work of replacing all the screens throughout the other units of the mill was then determined on, and has proceeded as rapidly as possible without undue interference with operations. Sufficient time having now elapsed to permit of comparison between the two, the net result of the change can be summarized as follows: The capacity of each unit has been increased from 500 tons to 600 tons per day, the tables handling the increased feed by reason of its closer sizing; the saving of about one-fourth of the water used by the trommels is effected by running the four coarse impact screens, the crushing rolls and the elevator dry, this also increasing the life of the elevator by several months; the expense for screen cloth is also reduced, the cost of renewals being in the ratio of $128 for the trommels to $14 for the impact screens.

*Denver, Colo.

A New Coal Washery in Michigan

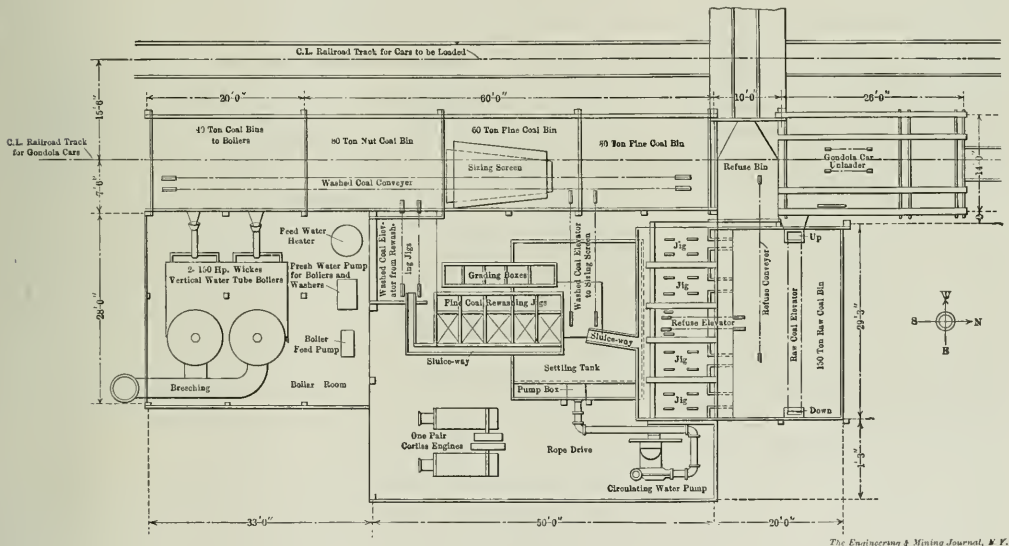
The Coal Averages about 15 Per Cent. in Ash, and Contains a Quantity of Crystallized Pyrites, so that Specially Designed Methods Are Used

BY LEE FRASER*

The Link-Belt Company, of Chicago, has recently completed a bituminous-coal washer, with a capacity of 100 tons per hour, for the Consolidated Coal Company, at Saginaw, Michigan.

The Consolidated Coal Company operates 9 mines, situated in both Saginaw and Bay counties. and produces 900,000 tons of coal per annum, 275,000 of which is slack coal. Conditions prevailing at the mines of the company make it impossible to deliver a uniform grade of slack coal, the ash percentage fluctuating between 3 and 40 per cent., and averaging about 15 per cent. But under the present operating conditions, 18 per cent. by weight of the raw coal is removed in washing, and the coal is separated into a nut size, passing over a 1-in. perforation, and a fine coal, both passing over and through a ¼-in. perforation. The undersize from the ¼-in. perforation is not blended directly with the oversize, but rewashed in Luhrig jigs, and then mixed with the oversize from the ¼-in. screen. The resulting fine coal contains 5 per cent. ash, while the nut coal contains 2 per cent. ash.

Considerable difficulty, however, was first experienced in adjusting the Stewart jigs to make the best possible primary separation. There is a great difference in the character of the various coals to be washed, the coal not coming from one mine, but from nine. Coal from Saginaw county is uniformly heavier and more free of ash, while coal from Bay county is lighter and much heavier in ash, and contains, as a usual thing, a quantity of pyrites, which has often been found to have crystallized out into pieces as large as an egg. The adjustments, however, have been perfected to an extent where the loss of coal in the refuse is a minimum, the principal loss of coal being in pieces which have a specific gravity greater than 1.35 due to some attached slate or pyrites.



GENERAL PLAN OF NEW COAL WASHER IN MICHIGAN

Method of Treatment

The raw coal is unloaded with a gondola-car unloader, having a maximum capacity of 100 tons per hour, and is discharged into the raw-coal elevator conveyer, having a capacity of 240 tons per hour at a speed of 100 ft. per min., by which it is carried to the raw-coal bins, which are built to accommodate 150 tons of raw coal. The bins are provided with the Link-Belt "Spellman" bin gates and tank, into which it is discharged by the primary jigs, by an elevator with a maximum capacity of 100 tons per hour at a speed of 33 buckets per min., and is then discharged into a double trommel for sizing. The inner shell of the trommel is of 5/16-in. steel plate, with 1-in. round perforations, 5 ft. at the small end and 7 ft. at the large end, and 14 ft. in length. The outer shell is of 3/16-in. steel plate, ¼-in. round perforations, 7 ft. at the small end, 9 ft. at the large end and 13 ft. long. Here the coal is rinsed and sized.

The oversize from the inner shell is conducted directly to the washed nut bin. The oversize from the outer shell is taken

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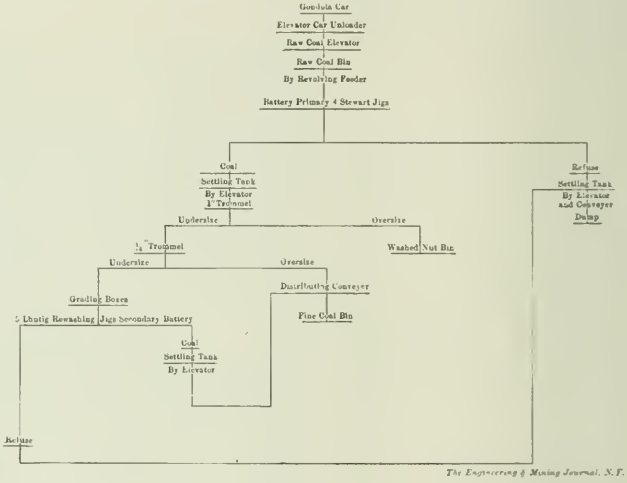
directly by the distributing conveyer to the fine-coal bins, while the undersize runs directly to the grading boxes for the Luhrig jigs, and then to a battery of 5 Luhrig fine-coal jigs. The refuse from the Luhrig jigs runs into the refuse tank for the primary jigs and is elevated with the other refuse and conveyed to the dump. The fine coal recovered by the Luhrigs is elevated from the secondary settling tank to the distributing conveyer, which has a maximum capacity of 90 tons per hour at a speed of 85 ft. per min. This conveyer handling both the oversize from the outer shell of the trommel and the fine coal recovered by the Luhrig jigs insures a uniformly mixed fine coal in the bins.

The plant is also arranged so that the distributing conveyer for the washed coal will deliver to bins in front of the boiler. And further, raw coal may be received from the raw-coal elevator conveyer by the washed-coal distributing conveyer and delivered to the bins in front of the boilers.

The overflow from the main settling tank is kept circulating through the jigs and sluices by a 12-in. L. H. Morris double-suction centrifugal pump with a lift of 27 ft. at 320 r.p.m. Power is supplied by a pair of Corliss engines and all drives are of manila rope. Steam is generated in two 150-h.p. Wickes vertical steam boilers.



FLOW SHEET SHOWING GENERAL ARRANGEMENT OF THE COAL WASHERY

Notes on the Norton Hill Colliery Explosion

By H. M. Morgans*

A recent report of Joseph Martin, inspector of mines for the southern district of Great Britain, deals with an explosion that took place at the Norton Hill colliery, Radstock, Somerset, England, in April, 1908. A perusal of the report shows that the inspector was from the outset inclined to exclude firedamp from having played a part in the explosion.

As the action of firedamp and coal dust in explosions is of such universal interest and importance, the evidence supporting the possibility of firedamp having been present may usefully be set out more fully than is done in the report.

The explosion was undoubtedly initiated by the firing of a shot part ways up an incline driven in a coal seam. The return air traveled down this incline. That the explosion did not start at the shot but at the bottom of the incline, where a boy with a naked light stood, is supported by the two following circumstances:

1. The explosion progressed in all directions from the boy as center.

2. The coal dust on the down side of the timbers (and not on the up side) in the incline was charred and small stones had been shot up the incline and were to be found embedded in the timbers as if projected uphill and against the air current. Obviously the explosion traveled up this incline toward the spot where the shot had been fired. The inspector does not express an opinion on this point.

Both near the shot and near the boy, old roads, stowed with rubbish, communicated with old workings in the seam, recently full of water but unintentionally drained. Undoubtedly firedamp had accumulated in these old workings possibly generated through decomposition of timber, etc., and had been noticed.

The formation of firedamp in this way is well known, and two other similar cases have come to my knowledge. One was in a Somersetshire colliery where gas was fired near old workings without serious results—these workings having been drained only a short time previous, after having been filled with water for more than 80 years. The other was in a gold mine in India, where old workings which had long been filled with water were struck and gas was fired. Of course, it is well known that firedamp is often generated at the bottom of ponds.

The inspector reports that explosions could easily be obtained with the dust found in various places in the track of the explosion, but does not say if such explosions could be set up by a naked light, which was evidently what initiated the Norton Hill explosion.

The incandescent explosion gases rushing from the incline bottom to the downcast shaft (up which they found vent after shattering the separation doors) passed the entrances of two roads—one on either side and nearly opposite each other. In one of these, in which the horses were stabled nearby, an explosion occurred (fatal to all the horses) though it was virtually free from coal dust. In the other road which had an abundance of coal dust on floor, sides and roof, no inflammation occurred, but the force of the explosion was felt by men working in this road at a place a long distance inbye.

Some of the roads along which the explosion did progress were not dry and dusty. On the contrary, they were distinctly wet.

That coal dust plays a most important part in explosions is now universally recognized, but in view of the facts set out above it cannot be said to have been proved that the Norton Hill explosion was a dust—and nothing but a dust—explosion.

[In connection with the foregoing notes, the following abstract of the official report on the Norton Hill explosion will be of interest: The accident occurred about 0.45 p.m., on Thursday, April 9, and caused the death of 10 persons who at that time were employed underground in the affected district. Some of the bodies showed the effect of severe burning, others of having been badly bruised by a considerable force, and others as if death was due simply to poisoning by carbon monoxide contained in the afterdamp or fumes. There were also five horses killed in this explosion. The report states that the inquiry was a protracted one because the explosion had been attributed to gas instead of dust. The jury, however, did not accept this explanation of the owners, and in their verdict, stated that the explosion was due to the ignition of coal dust, caused by a shot fired by one of the miners. About 380 men and boys were employed at the colliery, but at the time of the explosion 30

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only were underground working on the night shift. The inspector states in his report that the roadways were dry and dusty. It is also mentioned that a number of the managers of the Somersetshire collieries have considered the dust of these mines inexplosive, basing their belief on the report of the Royal Commission, which states that no explosion resulted from tests made on samples of dust received from the Somerset collieries. These collieries considered the necessity for watering, outside the considerations of practical mining in the Somersetshire coalfield. At the inquest an eminent analytical chemist was called in to prove whether the dust could be exploded. In the evidence submitted by this expert, he says that he tried to explode the dust by means of a naked light, a detonation, and firing a small cannon into it under varying conditions, and that although he obtained an ignition, he did not succeed in getting an explosion, so that he considered the dust nonexplosive. This same authority stated that he had several samples of air and a sample of water submitted to him for analysis, and that he found no trace of firedamp (CH_4) in any of the former, but that the latter—water which was given off from old workings—contained in solution 4.23 per cent. of gas by volume. The presence of this firedamp in the water indicated, as he explained, that changes and decomposition of organic matter were going on in this old goaf.

Disturbance of this so-charged water, he stated, might result in some of the gas being evolved. Referring to this evidence, the inspector states: "It appears to me, as it also did to most others versed in mining, who attended the inquest and followed the case, that since no trace of firedamp was found, or even thought at any time to have existed, during the present or former working of the mine, it is idle to suggest that firedamp could possibly have had any connection with the explosion."

Evidence of Experts

The inspector also referred to the evidence of Thomas Morgans and George Batey, both experts, who voiced the opinion that the explosion was due to an accumulation of gas. Mr. Morgans attributed the explosion to an ignition of firedamp at the bottom of the Slyving Vein incline, and accounted for the presence of the gas in the mine by its having been given off from the water (from 8000 cu.yd. which had been contained in the 20-acre part of the old workings, and which had been unintentionally and unwittingly drained, between Feb. 6 and March 8, through the leader of a fault which was recently cut. Mr. Batey gave it as his opinion that the explosion was due to gas accumulated in a cavity in the roof of the incline on the higher side of the fault, being expelled by the concussion resulting from the shot, and that it was ignited by a boy with a candle at the bottom of the incline. The inspector states that he does not consider either Mr. Morgans' or Mr. Batey's theory a true and practical explanation of the causes which brought about the accident, and further states that dust and not firedamp was the explosive agent operated upon by a shot which was fired about 40 yd. from the bottom of the Slyving Vein incline. Mr. Martin, the inspector, tells of his investigation as to the explosibility of the dust at the Norton Hill mine and gives his results as follows:

"1. The dust from the Slyving Vein's clean coal exploded violently. 2. The dust from the vicinity of the shot in the Slyving Vein incline exploded with violence, although not as violently as the clean coal. 3. Those samples taken from the upper part of the same incline and the intake road in the Middle vein exploded, respectively, with lower degrees of force."

Mr. Martin continues. "In making these tests or experiments, the point which struck me particularly was the small quantity of dust which was necessary, and indeed most effective in obtaining explosions. When a considerable quantity was present, it seemed as if it choked itself through want of oxygen, and that, although we obtained combustion in the tubes, it failed to explode. The results fully confirm the opinion I had formed, and having shown that at the point where the shot was fired, flame and dust were accounted for in a manner which can result in an explosion, it appears to me quite unnecessary to enter upon improbable theories to account for this explosion and its resultant effects. The shot, at the point indicated, was unanimously accepted as the starting pont, whether, as suggested by Mr. Morgans, by creating a partial vacuum and sucking gas from the goaf, or by shaking the roof so as to cause it to sink or come down a small amount, or both, and thus expel gas, or by dislodging gas from the cavity in the roof of the incline, as suggested by Mr. Batey. The indications of the direction of force are also unanimously accepted, except in the length between the shot and the bottom of the incline."

Action of the Suspected Shot

In explaining the action of the suspected shot, Mr. Martin states further: "This shot hole, if the evidence is to be relied on, was only about 13 in. deep, but was in hard ground, and would consequently have had a fairly heavy charge apportioned to it in proportion to its depth, with a view of ripping the roof over as large an area of the road as possible. Owing, however, to a joint or slide at the right-hand side, which was, no doubt, previously unseen, the resistance was largely reduced, with the result that the hole was overcharged, the ground simply smashed down from a limited area, and a considerable amount of flame at a high temperature was evolved, which ignited fine dust, lodged on the side and floor. This, when once started, would raise sufficient dust in the air from the floor, roof and sides to feed itself and carry the explosion forward as in other cases."

In closing his report, Mr. Martin states, "The effect of this experience will, I believe, be, not only to satisfy managers and others connected with Somersetshire collieries that they are not immune from the dangers of coal dust, but also still farther to impress the necessity of watering upon those who, having previously realized the danger, have shirked the trouble and expense of carrying it out. I have no doubt that, had there been even a small percentage of gas in the air, the damage and force of the explosion would have been greater and probably extended farther into the new vein."

It is evident from the foregoing notes, that English engineers differ as widely in their conclusions as to the initial cause and active agents in some of their explosions, as we in America. It is so probable that both dust and gas are active in all coal-mine explosions that it is often difficult to say definitely which agent is most to blame.—Editor.]

The Oxidation of Coal*

By O. Boudouard

The study of the atmospheric alteration of coal has an important practical bearing in at least two directions. The spontaneous ignition of coal, with its occasional disastrous consequences, and the coking qualities of a coal. The work of Fayol and Mahler has shown that spontaneous combustion of coal is a direct result of oxidation of carbonic matter, while it is a matter of common knowledge that the percentage of volatile matter in a coal is not the only factor governing its coking qualities, and that of two samples of the same coal, the one that has been longer exposed to the atmosphere yields the poorer coke. Mahler thinks that a careful study of the behavior of coal when subjected to oxidation might shed light on the disputed question as to the relation between coal composition and coking qualities, and believes that the fundamental requirement of a good coking coal is that it shall contain certain carbohydrates, such as will be transformed into humic acids upon contact with air. Dennstedt and Bünz think that humic acids are the ultimate products of the decomposition of coal, and that those coals that yield the larger proportion of humic acids are the more susceptible to spontaneous ignition.

*Abstract of a paper presented to the Académie des Sciences.

As a contribution to our knowledge of this subject, I have made a series of comparative experiments on the following coals: I, English anthracite; II, one-fourth *gras* from Courrières; III, Belgian forge coal; IV, forge coal of unknown origin; V, three-fourths *gras* from Bruay; VI, coal of unknown origin; VII, lignite. The coals were analyzed by ordinary methods for fixed and volatile carbon and ash and the amount and quality of the coke yielded by heating in a closed crucible were noted. One set of samples was exposed to the air at ordinary temperature, and another at 100 deg. C. At ordinary temperatures the variations of weight, due to oxidation, were very slight, and might have been caused by changes in the hygroscopic state. At a temperature of 100 deg., on the contrary, after a diminution in weight due to loss of moisture, a distinct increase in weight took place, amounting in some cases to 10 per cent. Other tests at the same temperature on larger quantities of coal gave similar results.

SEVERAL ANALYSES OF COAL, BOTH NATURAL AND OXIDIZED.

Sample No	I	II	III	IV	V	VI	VII
ORIGINAL COALS.							
Volatile matter	8 80	8.80	24 85	18.14	37.57	46 21	58.44
Fixed carbon	86.66	89.54	70.51	79.18	59.36	51.44	37.34
Ash	2.54	1.66	4.64	2 68	3.07	2.35	4.22
Coke was	loose	loose	porous	porous	porous	sl. por.	loose
EXPOSED TO AIR AT 15 DEG. C.							
Volatile matter	7.60	10 07	23 60	18.50	35 31	46.31	57.77
Fixed carbon	90.10	87.86	71 67	75.59	62.04	51 74	35.50
Ash	2 30	2.07	4 87	5.91	2.65	2.95	6.73
Humic acid	none	none	none	none	none	trace	yes
Coke was	loose	loose	porous	porous	compact	loose	loose
EXPOSED TO AIR AT 100 DEG. C.							
Volatile matter	9.83	12.51	23 83	20.85	32.92	47.25	66 55
Fixed carbon	87.84	85.32	71.98	72.83	64 69	43.75	25.60
Ash	2.33	2.17	4.19	6.32	2.39	9.00	7.85
Humic acid	none	none	trace	trace	yes	yes	yes
Coke was	loose	loose	loose	loose	loose	loose	loose
TREATED WITH NITRIC ACID.							
Volatile matter	30.10	44 81	41.95	42.27	48.76	56 04	59.91
Fixed carbon	68.10	54 78	56.50	51.59	49.64	43.24	39.48
Ash	1.80	0.41	1 55	6.14	1.60	0.72	0.61
Humic acid	none	none	yes	yes	yes	yes	yes
Coke was	loose	loose	loose	loose	sl. por.	sl. por.	loose
Change in weight, per cent	+15 6	+26 0	+6.4	+20 4	+17.2	−14.0	−36.8

ACTION OF THE HUMIC ACID

Humic acid, the presence of which was determined by leaching the coal with potash and precipitating with hydrochloric acid, was present in the original coal only in sample VI (less than 1 per cent.) and sample VII (5 per cent.); after exposure to the air at 100 deg., humic acid was distinctly present in samples III and IV (trace), V (5 per cent.), VI (14 per cent.) and VII (1 per cent.). At the same time, the coking qualities of samples III, IV and V, which in their natural state yielded a firm, compact coke, had entirely disappeared. It would seem, therefore, that there is some relation between the absence of humic acid and the coking qualities of a coal.

The increases of weight due to oxidation can be much more forcibly demonstrated by treating a coal with some energetic oxidizing agent, like nitric acid. As soon as nitric acid is put in contact with a coal, a liberation of nitrous fumes takes place, which are the more abundant as the coal is richer in volatile matters; the reaction generates heat also in proportion to the percentage of volatile matters. Oxalic acid can be distinguished as one of the the products of the reaction, and by leaching the oxidized coal with potash the presence of a relatively large percentage of humic acid can be demonstrated. After a treatment with nitric acid, samples III, IV and V had lost completely their ability to coke.

The treatment of coal by nitric acid must produce a number of unstable nitrous compounds, because the most careful heating, far below red heat, causes bubbling and a liberation of incombustible vapors. The variation in the weight of coals thus treated would indicate that the loss of volatile hydrocarbons is sometimes greater and sometimes less than the accompanying increase in weight due to the fixation of oxygen and the formation of humic acids. Samples VI and VII in particular, at the moment of reaction yielded an increase in temperature sufficient to liberate hydrocarbons and decompose the newly formed nitrous compounds, resulting in a loss of weight.

The total production of all kinds of cement in the United States during 1908, according to U. S. Geological Survey figures, was 52,775,025 bbl., valued at $44,376,656. This output was divided as follows: Portland cement, 51,002,612 bbl., $43,472,679; natural cement, 621,862 bbl., $808,500; slag cement, 151,451 bbl., $95,468. There was a heavy decrease of production in most of the Eastern and Southern States. The average price of the entire portland-cement output in 1908 was only 85c per bbl., 30c below the average price in 1907.

Round Mountain Mining Company

The annual meeting of stockholders was held at Goldfield, Nev., April 19, and the following directors were elected: L. D. Gordon, Thomas Keane, W. H. Bryant, James R. Davis, president and general manager, and J. P. Loftus, vice-president. W. E. Johnson was elected treasurer and H. G Mayer, secretary and assistant treasurer.

The manager's report states that the development work done for the year ending March 31, 1909, was 6775 ft. The main incline shaft was sunk during the year a distance of 196 ft. making a total depth of 783 ft. and four new levels opened, the 500, 550, 600 and 700. These levels were driven a total distance of 281 ft., 567 ft., 497 ft. and 254 ft. respectively.

From the main shaft 29,582 tons of ore were extracted during the year and 31,962 tons blocked out ready for stoping.

During the year the company milled 29,582 tons of ore, producing a total of $349,505 and a net profit of $169,889. The cost per ton of ore mined and milled has been reduced from $7.06 to $6.07 per ton. The company has let contracts for additional mill machinery, air compressor, air-drill equipment, 50-h.p. hoist and motors, and has entered into contract with the Nevada-California Power Company by which the power costs will be reduced approximately 20 per cent., and by the use of the new equipment mining and milling costs should be reduced from 15 to 25 per cent. During the year the company paid $127,901 in dividends.

Vanadium in Peru

By S. Jochamowitz

Particular interest attaches to the rare minerals of Peru, of which vanadium is becoming of importance. This mineral was found in the vicinity of Sierra de Pasco by A. R. Patron, engineer of the Huaraucaca smelter. The mineral is a sulphide of vanadium, and was given the name patronite from its discoverer. It occurs in veins, some of which reached a width of 15 ft.; the outcrops have been traced for several hundred feet. Shortly after the discovery (November, 1905) a company was organized for the purpose of mining the deposits. Regular shipments are now being made to the United States. The quantity exported during 1908 was over 600,000 lb. The ore is handled mostly by the American Vanadium Company, by whom it is converted into ferro-vanadium at Pittsburg. The mineral is of a relatively low specific gravity and has a dark color and green streak. In addition to vanadium, the ore contains some molybdic oxide, silica, alumina, iron and sulphur, and is believed to be a mixture rather than a chemical combination.

*Mining engineer, New York

Topographic Engineering

By W. D. Blackburn*

It is the purpose of this article to place before the readers of the Journal, with especial reference to engineers and those in charge of geologic and mining work, a few of the many facts in relation to the field of topographic engineering insofar as I am able.

Geologic

The mining geologist does not depend alone upon the underground work of a mining property; in fact, it forms a small part of the data from which he draws conclusions and makes recommendations. It is in connection with the geological features of the surface that the nicer questions of formation and mineral possibilities arise, and here it is that the topographic map is of such advantage and importance that it is an absolute necessity for any other than the most general and indefinite work.

With a topographic map in hand showing the relief of the country with accuracy, and points of especial geologic, topographic and cultural interest plotted upon it, the geologist is enabled to place upon the map with absolute correctness the boundaries of the different formations and other geologic features, so that he has before him a complete geologic picture of the country, together with the topography, the whole forming a graphic expression of information from which conclusions can be drawn easily, quickly and correctly. Not only does the map show the area in plan, but it has within it the information and data necessary to the construction of innumerable sections. Sections can be constructed at any point, or for any distance, and for this reason any part of the area can be shown with its reference to the surface profile. By combining a survey of the mine workings with the topo-geologic sheet it is possible to obtain more and clearer information concerning the relation of the workings and surface than can be secured and expressed by any other method of survey and mapping.

Mining

But it is not for the mining geologist alone that the topographic map has interest, or is of value. To the men engaged in mining and particularly in development work a map of this nature should prove of inestimable service. For the purpose of illustrating this, two cases will be discussed.

Case 1. A mine in process of development has a tunnel driven a certain distance, and it is desired to make a connection with the surface for the purpose of ventilation and to better facilitate the extraction of the ore, the work to be prosecuted simultaneously as a raise from the tunnel and as a shaft from the surface. The usual method would be to run: (*a*) A transit line from the point in the tunnel at which the connection is desired to the surface point immediately overlying; (*b*) a line of levels between the two points; and (*c*) to compute the lines thus run and, finally, to plot the results. The work may even then have only a negative value so far as the present demand is concerned, for the surface point may be, to say the least, disadvantageous as a location for shaft purposes. It is unnecessary to dwell upon the time, patience and labor required to obtain this information. Those who have had experience therein know the fact too well to require that special attention be called to it. Let us see if a topographic map combined with an underground survey would help in the solution of the problem. The map has definitely located surface points plotted upon it and also the underground workings drawn to the same scale. It is obvious that any point in the workings has its relative surface point in plain view upon the map. We may choose the most suitable point for the shaft at any time while development is in progress, and we already know, from the map, its approximate location. To determine its exact location we have recourse to the nearest or most accessible definite point, and by measurement therefrom and the determination of the course from the coordinates of the map we are able to go into the field and fix the point upon the ground with certainty. We can note from the contours the respective elevations of the tunnel mouth and the surface point just determined and, by subtraction, arrive at the depth of shaft required and make the necessary calculations as to time required for sinking and cost. By the expenditure of an hour's time we can construct a profile along the line of the tunnel and the overlying surface and we have all the information necessary to this particular connection. Further, we have all information necessary to any other connection which may be desired along this line within the limits of the topographic sheet.

Case 2. Development has been in progress at two different points within the boundaries of a group of claims. These points are widely separated both vertically and in plan. It is desired to make a connection between them by means of a third opening which will, at the same time, develop new ground. The surveys and maps necessary to the correct solution of this problem would entail a great deal of time and labor and still be subject to the same criticism as the work done in case 1; that is, it would be of negative value only. I do not wish to be understood by the use of the term "negative value" as meaning that whole work is useless. The point I desire to make is, that if the work determines that the place fixed by the survey is disadvantageous, another point will have to be determined before the work of making the connection can be begun. The chief objection to the usual method of obtaining the necessary data for connections of this sort is the time and labor it entails in the matter of field work, computation and mapping. It is not an unusual thing to make several surveys before the final result is that striven for.

With a topographic map of the same description as used in case 1 spread before us, we can see at a glance the relations of the workings between themselves and the surface overlying them as well as that adjoining; we can determine the best point for the location of the new working with the view of accomplishing the most in every possible way; and we can decide upon the future progress of the underground headings both as to distance and direction. This can all be done without an hour's field work with no reference to notes, and with absolute knowledge that the best method has been chosen from every possible one open. The projection of the workings first, with reference to points within themselves; second, in reference to each other; and finally, with reference to the surface, will place before us, in connection with the plan map, all the information necessary to a correct estimate of the time and cost of the connection, since from the two we obtain, not only distance and direction and relative elevations, but also information concerning the form of opening best suited to the work and the formation of the ground topographically and geographically.

Other Cases

These are only two of the many cases which are continually presenting themselves for adjustment to those who are engaged in mining, cases where it is difficult to determine the best method of procedure under all circumstances and where a map of the kind we are discussing would be invaluable in placing all the data in a clear and accurate form before the man who has to decide such questions. Among the many other examples which might be brought forward in this connection are those relating to railroad and tramway construction and the collection of data necessary to the computation of cut and fill, bridge and trestle work, location of towers, etc. Oftentimes it becomes necessary to know the topography of the country surrounding a mine in order to obtain data with reference to the construction of pipe lines, canals, or conduits. It is necessary to emphasize the value a good topographic map would have in the solution of problems of this class where the thing most desired is a means of arriving at a decision after all possibilities have been considered. There is nothing that will take the place of a graphic method of expressing information, and it is this that the topographic map possesses in the fullest sense and largest degree.

*Topographic engineer with Spurr & Cox, Inc., Apart. 2707, Mexico.

Surface Trials in Rand Stope Drill Competition

Twenty Machines in the Contest, Fourteen Qualifying for Preliminary Underground Test; Piston Drills Leading, Hammer Drills Close Second

BY EUSTACE M. WESTON

The stope-drill competition, held under the auspices of the Transvaal government and the Transvaal Chamber of Mines, has been completed as far as the elimination surface trials are concerned. Three-day underground trials are now being held and the machines which survive these will be given 300 shifts of continuous underground work, two machines of each class being kept at work. Generally speaking, the final award is to go to the machine that succeeds in drilling the greatest footage at the least cost for labor, repairs, motive power, supplies, etc. The first prize is $20,000 and the second, $5000. The air pressures supplied will vary from 60 to 80 lb. at the end of the pipe line.

The entries for this widely advertised contest numbered 20, including machines from the Transvaal, England, Germany and Scotland. From America only two entries were received, the Murphy and the Waugh. Neither the Ingersoll-Rand nor the Sullivan companies were represented. Locally-designed drills were much in evidence. In the results given, which are taken from the official reports, air consumption is calculated per linear foot drilled and in cubic inches per minute. The consumption per foot drilled cannot be taken as an accurate standard of comparison, as some machines, particularly the Anderson, used larger sized steel and bored a larger hole than others. The only regulation in this respect was that holes should be from 42 to 48 inches deep and to be of 15/16-in. diameter at the bottom. However, most of the drills used bits of, approximately, the same diameter, so the comparison is valuable, if not exact.

The Weight Limit

Perhaps the most important regulation in connection with the competition was that the drills should not weigh more than 100 pounds and should, if possible, weigh less. A modern American drill manufacturer or miner would at once conclude that hammer drills were the only drills which would have any chance in such a contest. I have, however, in a former article, pointed out that conditions in this field are very different from those in most American mining districts. Stopes are inclined about 30 deg. to the horizon on the average, and where small machines are used, are from 30 to 50 in. high. The ground is very hard in most cases. A bar and clamp must always be used and 95 per cent. of the holes are down holes drilled with water.

I, therefore, expressed the opinion that despite the theoretical advantages possessed by hammer drills, a suitably modified piston drill stood a good chance of holding its own for such work. Hammer drills had to work with hollow steel injecting air and water, or air or water alone into the hole. They had to be provided with some sort of cradle with automatic air or screw feed, and thus abandon much of their great advantage of portability, as when used for boring uppers with air feed alone. Similar conditions occur in the North Star mine, Grass Valley, Cal., and there the 2¼-in. piston drill thus far holds its own. The Gordon drill had shown that it was possible to make a very light hammer-drill machine giving a large output of boring power per unit of weight, but its failure under the rough working conditions of the Transvaal with its unskilled black laborer and much inferior white labor, showed that improvements were needed in both the design and the material used in the construction of such a type of machine.

Changes in Design of Piston Drills

Makers of piston drills on the other hand had to combine large output of power (in order to compete in boring speed with hammer drills) with the light weight required by the conditions of the trial. Obviously some features of the standard designs had to be sacrificed. Weight was generally economized by shortening the stroke, by shortening the piston and cylinder and by cutting down the weight of valve box, valve and cradle to the minimum. All these changes make, of course, for increased maintenance costs owing to greater wear and tear and a smaller margin of strength to provide against breakage. We have, therefore, two tendencies, one to produce a simplified and stronger hammer drill, the other to reduce the weight and increase the boring speed of piston drills. The results from the surface trials are, therefore, interesting, and in some cases, surprising.

The Competing Drills

The machines entering the competition were as follows:

(1) Holman drill. Made by Holman Bros., Cornwall; a piston drill, cylinder diameter, 2⅛ in.; stroke, about 5 in.; weight, 99 lb.; spool valve with auxiliary ball valves; rotation, automatic.

(2) Bantam drill. A locally-designed piston drill; cylinder, 2 in. in diameter; stroke, 5 in.; tappet-moved valve; weight, 82½ lb.; automatic rotation.

(3) New Century drill.

(4) De Fries drill. Both these drills were of the light hand-hammer class, weighing about 40 lb., and having no clamp or cradle. The De Fries lacked sufficient boring power; neither were suitable for the conditions of work in this field, having no arm, bar or clamp, or forward feed.

(5) Ross Patent drill. This is also a hammer drill, the design of which appeared quite unsuitable for the work.

(6) Anderson drill. Locally designed, but made in Scotland; a piston drill having a 3-in. cylinder, 5-in. stroke, with air-thrown valve having a regulating device to make up for wear. The machine was also designed for use with water passing down the piston rod, through the hollow steel; automatic rotation.

(7) Vlottmann drill. A well-known German make that has been largely used in coal and metal mining in Europe. Hammer drill; weight, 78¼ lb.; cylinder diameter, 2½ in.; stroke, 2¾ in.; weight of hammer, about 4 lb.; blows per minute, about 1000; valve motion is of the oscillating ball type and rotation is automatic, the hammer carrying a rifle bar; hollow shell with water injection is used; feed was by hand screw and the cradle could be moved forward or back on the clamp.

(8) Westfalia. Another German hammer drill; diameter of cylinder, 2¾ in.; weight, 65 lb. The feed is automatic by an arrangement of two pawls on a ratchet bar. This device is not novel, as supposed, being adapted from an early design of tunnel drill described in Guttman's work on blasting. This machine used a spray and exhausted air down hollow steel. It bored very rapidly, but it seemed doubtful to me if the pawl arrangement would wear well, and if the machine is not too light for its energy output.

(9) Keymer drill. This hammer drill was withdrawn.

(10) New Century OO piston drill. This, with the New Century hammer drill previously mentioned, is a locally invented drill. The spool valve is of novel design; cylinder, 2⅛ in. in diameter; stroke, 6 in.; weight, 92¾ pounds.

(11) Climax Imperial. Hammer drill, made by Stephens & Sons, Cornwall. This drill I have already described in a special article. It is a powerful long-

stroke hammer drill with automatic feed specially designed for work in this field.

(12) Holman 2¾-in. piston drill. Similar in design to the 2⅛-in. drill, and to the Chersen drill.

(13) Murphy drill. Hammer drill of the type well known in America; a valveless machine using hollow steel with a water feed from a detachable clamp attached to drills. Its performance against machines of the valve-moved type with anvil block, such as the Waugh, Vlottman and Climax Imperial, is interesting.

(14) The Konomax stope drill. A piston drill of local design; 2-in. cylinder; 4-in. stroke; weight, 91¾ lb.; feed, entirely automatic. This machine is valveless and gives diagrams of air consumption resembling those of a first-class engine showing the air to be used expansively.

(15) Holgate piston drill. Cylinder diameter, 3⅛ in.; stroke, 4 in. This was a locally designed and manufactured machine and, though it bored up to a rate of 5½ in. per min., it broke down several times, owing to being constructed of unsuitable material.

(16) Siskol. A piston drill using hollow steel and a water jet; water lead in through back of machine and through the piston rod to the drill bit. This machine was a rapid driller, but there was evidence that troubles would manifest themselves underground.

(17) Waugh drill. A hammer drill, manufactured in Denver, Colo. It has, like the Murphy, a rear-cylinder piston air feed and the steel is rotated or oscillated by hand. Air and water are injected down hollow steel. The machine has a hollow cylindrical short-stroke piston valve set at the rear of the cylinder. Vanadium steel is used for the anvil block, and it is claimed that reliability and freedom from breakdown is a prominent feature. The machine is mounted on a swivel cradle so that it "follows the steel" when boring and does not hold it rigid.

(18) Meyer-Fullerton. A hammer drill using hollow steel with air injection; appeared deficient in boring power.

(19) All Steel drill. Piston drill of insufficient power.

(20) Chersen. A piston drill of 2¾-in. diameter; 6-in. stroke; oscillating valves. This drill performed well in the trials organized by the "South African Mines," and has already proved itself a reliable machine, there being upward of 200 at work in this field; ordinary solid steel is employed.

The arrangements for holding the trial were good. Granite blocks, 3½x3½x5 ft. were set in a solid bed of concrete. Bars were solidly erected and connected by rail bolts and clamped to the concrete. Water connections were provided and air was supplied, being carefully measured through a Kennedy air meter, calibrated by Professor Orr, of the Transvaal University College. M. W. Wood acted as manager and the arrangements gave every competitor satisfaction. The accompanying table, taken from the *South African Mining Journal*, gives the results in a tabulated form.

SURFACE ELIMINATION TRIALS IN THE RAND STOPE DRILL COMPETITION.

Name.	No. of Machines Tried.	Average Inches per Min.	Order of Merit.	Cu.Ft. Free Air Used per Min.	Order of Merit.	Cu.Ft. Free Air Used per Foot Drilled.	Order of Merit.	Percentage of Total Time not Occupied in Drilling.	Weight. Pounds.	Dust Allayer.	Type.	Nature of Steel.
2⅛ Holman	2	2.397	15	75.1	12	376.58	11	26.3	99½	*a*	Reciprocating	Solid
*Bantam	3	0.875	19	43.2	4	581.03	18	18.8	82¼	*a*	Reciprocating	Solid
*De Fries	2	0.358	21	39.8	2	1,319.00	20	11.2	27¾	*a*	Hammer	Hollow
*New Century	2	2.873	10	79.8	13	335.90	10	35.7	34¾	*b*	Hammer	Hollow
*Ross Patent	3	0.386	20	86.3	15	2,449.20	21	53.0	61½	*b*	Hammer	Hollow
*Anderson[1]	2	2.482	11	91.5	18	442.30	17	55.4	99½	*a*	Reciprocating	Hollow
Anderson[2]	3	2.532	12	90.5	17	441.25	16	52.2	99½	*a*	Reciprocating	Hollow
Vlottmann	2	4.012	4	64.6	9	193.09	3	42.1	87¼	*b*	Hammer	Hollow
Westfalia	2	4.208	2	89.4	16	261.91	8	36.9	65	*c*	Hammer	Hollow
Climax Imperial	2	3.520	5	68.5	10	235.65	5	30.7	97¾	*b*	Hammer	Hollow
2¾ Holman	2	3.110	7	99.9	20	386.55	12	25.7	99¾	*a*	Reciprocating	Solid
New Century OO	2	2.271	16	53.4	8	283.85	9	38.1	91½	*a*	Reciprocating	Solid
Murphy	2	2.916	9	40.6	3	169.75	2	35.2	81¼	*b*	Hammer	Hollow
Konomax	2	2.476	13	29.6	1	144.40	1	29.2	91¼	*c*	Reciprocating	Solid
Holgate[1]	2	3.027	8	98.4	19	391.40	13	44.3	96½	*c*	Reciprocating	Solid
Holgate[2]	2	3.449	6	112.4	21	393.10	14	29.5	98½	*a*	Reciprocating	Solid
Siskol	2	4.337	1	74.2	11	206.35	4	50.7	95¾	*b*	Reciprocating	Hollow
Waugh	2	2.428	14	50.6	5	252.65	7	32.3	80½	*d*	Hammer	Hollow
Meyer-Fullerton	3	1.630	17	53.0	7	412.66	15	29.5	73½	*a*	Hammer	Hollow
*All Steel	2	1.027	18	51.6	6	604.10	19	26.7	97¼	*a*	Reciprocating	Hollow
Chersen	2	4.110	3	81.8	14	239.92	6	31.5	97¼	*a*	Reciprocating	Solid

*These have been eliminated as a result of the surface trials. [1]First trial. [2]Second trial. (*a*) Used either a dipper or a jet from main provided by the committee. (*b*) Jet through steel. (*c*) Separate spray from main. (*d*) Jet and air through steel.

The Qualifying Drills

The Holman, 2⅛ and 2¾ in., the Vlottmann, Westfalia, New Century OO, Climax Imperial, Murphy, Konomax, Holgate, Siskol, Waugh, Meyer-Fullerton and Chersen drills successfully passed the test of drilling 1 in. per min. and are entered for a further 3-day elimination trial underground. It will be noted that the Siskol piston drill had the best average speed of drilling of all competitors. This is somewhat curious in view of the statements made by certain American manufacturers. Had they been asked if it were possible to build a 100-lb. piston drill to outdrill a 100-lb. hammer drill the answer would have been decidedly in the negative. I do not expect this drill to survive the 6-month trial, but its success confirms my expressed opinion that the ideal piston drill is one using hollow steel with water injection and that its efficiency would approach or surpass that of any hammer drill.

The German hammer drills stand second and fourth in the list, but I do not expect the Westfalia to survive to the finish. The Chersen drill comes third, and this drill, I think, will come very near winning the competition. The Climax Imperial hammer drill stands fifth. This machine should be well up among the hammer drills at the end. The Murphy valveless hammer drill working without an anvil block stands ninth, beating the Waugh, which stands fourteenth. The interesting Konomax, the baby of piston drills, with only a 2-in. piston and a short 4-in. stroke, drilled faster than the Waugh. The two American machines are, however, strong and simple and will, I think, last through the trial.

Air Consumption

In air consumption, the Konomax leads easily with only 29.6 cu.ft. per minute. The Murphy is second with 40.6, beating the Waugh with 53.0. The Siskol stands third with only 50.6. The Chersen is higher, 81.8 cu.ft., but this is not high for a 2¾-in. piston drill. The air consumption per foot drilled is not an exact comparison, but here again a piston drill leads, the Konomax using only 144.4 cu.ft. The Murphy hammer drill, by also using air expansively on the forward stroke, is a good second with 169.75 cu.ft. The Chersen uses 239.9, the Vlottmann 193.1, the Climax Imperial 235.6, the Siskol 206.35 cubic feet.

Conclusions

Generally, it may be said that piston drills have more than held their own, while the valveless type of hammer drills has done well. Personally, I fancy the piston drills will last out the underground trials better, especially if their owners are farsighted enough to supply plenty of spares to keep them efficient, but there are several hammer drills in which most of the sources of weakness of this type have been carefully eliminated, and it is quite possible that the winner may be found in such a drill as the Murphy or the Climax Imperial.

The efficiency of the piston drills will tend to fall as soon as the chucks wear and the drill is not held truly, and as the pistons, cylinders and valves wear, air consumption will increase. Competitors are, however, allowed to repair machines, cost of such repairs being charged against them, and a bold policy in this respect will meet its own reward. Hammer drills may suffer from water leakage, cylinder wear, breakage of hammers and anvils, and must stand the extra expense of hollow steel, water hose and connections. Whatever the result may be, much will have been learned of the greatest value for future designers.

Fuller's Earth

Fuller's earth is an aluminum silicate containing more combined water than most clays; its chemical composition varies with its origin, and is of no value in the matter of determining the commercial qualities of a given sample. The properties and uses of fuller's earth are the subject of an extended article in *La Revue de Chimie Industrielle* which states that while the most common colors are brown and gray, it also occurs white, yellow, pale red, and even black. Its specific gravity ranges from 1.75 to 2.50. The earth will sometimes disintegrate when put under water, but more frequently a piece of it will hold its original shape. Certain earths are hard, like rocks. The best fuller's earths come from Dorset, Kent and Surrey counties, England.

When analyzed by the methods applied to rocks, some fuller's earths show a strongly acid reaction, although entirely free from acids. This apparent acidity arises from its absorptive qualities, and is directly proportional to its power of absorbing such bases as lime; it is not, however, at all proportional to its decolorizing power on oils. The apparent acidity varies from nothing up to the point at which 1.50 per cent. of oxide of lime is required to neutralize it.

Decolorizing and Oxidizing Power

Fuller's earths from certain localities have the unfortunate effect of giving to edible oils a rancid flavor, by oxidation, and this power is directly proportional to the absorbing capacity of such earth. Earths which possess this character to a high degree can be treated with lime-water, to counteract the apparent acidity, but at the same time their decolorizing power will be diminished; it is for this reason that earths high in lime are not good decolorizers. If the above treatment be limited to the partial neutralization of the acidity, the odorizing effect of the earth will be reduced while its decolorizing power will not be entirely lost.

When an earth of high apparent acidity is subjected, under water, to a strong electric current, the particles appear to be negatively charged, and move slowly toward the positive pole; this probably explains the fact that such earths give an acid filtrate after agitation with salt water, and the power of such an earth to remove the nitrogenous colors from an oil, exactly as would be done by a true acid.

Some earths possess a very active oxidizing power on oils; the oxidation is sometimes so violent that the cakes removed from a filter press, after treatment of an oil, will burst into flames from spontaneous combustion as soon as they reach the air. This event is most often noticed when working with rapid-drying oils.

The decolorizing power of fuller's earth has never been perfectly explained; some think that it is a chemical reaction, while others believe it to be purely mechanical. Cameron's experiments seem to indicate that it is merely an absorption, and that it takes place more rapidly in an oil than in a water solution. Practically all the coloring matter taken out of an oil by a fuller's earth can be recovered from the earth by alcohol, provided that the adherent oil is first removed by treatment with ether or benzine. This combined treatment will restore the decolorizing power of a used earth almost completely.

Treatment of Mineral Oils

The decolorizing of mineral oils is conducted in a different way, and with a different quality of earth, than that applied to animal and vegetable oils. For mineral oils, the Florida fuller's earths seem better than the English, and even an important amount of lime is no detriment. The operation is similar to that of clarifying sugar solutions by boneblack, consisting in allowing the oil to filter through a bed of fuller's earth. The first oil to come through will be almost colorless; thereafter it comes through less and less clear, until the filter bed becomes saturated with coloring matter and will absorb no more. The spent earth can then be regenerated by calcining in a rotary furnace; the high temperature to which it is subjected here does not seem to diminish its decolorizing power on mineral oils, though it does with animal and vegetable oils. The fineness of the earth should be adapted to the nature of the oil to be treated; heavy and viscous oils require the earth to be in coarse grains, while with a light oil, the earth can be ground to 200 mesh and over.

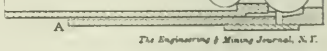
Animal and Vegetable Oils

The method of decolorizing animal and vegetable oils is to heat the oil in a receptacle containing a coil of steam pipe; add the necessary amount of fuller's earth; stir for two or three minutes, and conduct the mixture to a filter press to recover the earth and liberate the oil. The temperature varies according to the nature of the oil and the kind of product desired, but ranges around 100 deg. Centigrade. A lower temperature is often used.

The amount of earth required also depends upon the nature of the oil, and even for different lots of an oil of the same general nature, different amounts of earth will be required to yield a product of the desired whiteness. Lard oil generally requires 1 per cent., by weight, of fuller's earth, cottonseed oil requires 5 per cent., while tallows need very large proportions. The oil refiner selects his stocks of crude material so as to demand the least possible amount of fuller's earth to decolorize it, since he will thus not only economize in the consumption of earth, but will also lose less oil by adherence to the earth.

A Packingless Pump

The abolition of packing between the pump piston or plunger and the cylinder bore is proposed in the arrangement shown in the accompanying illustration. It is a suction and force pump with two concentric cylinders, *A* and *B*, with a certain amount of annular space between them, and each of which is closed at the lower end by a ball valve. In this construction it is intended that the liquid pumped shall play the part of packing between the two cylinders. The pump is especially intended for handling such liquids as muddy or sandy water or petroleum. It is the invention of Mark Pollatschek, of Bukarest.



PACKINGLESS PUMP

In 1908 there were produced in the United States, according to statistics collected for The Mineral Industry, 1,140,000 lb. of bromine ($103,410) against 1,062,000 lb. ($138,060) in 1907.

New Method of Extracting Oil from Boreholes

The Principal Feature of the System Is an Endless Cable Covered with Absorbent Material and Operated from a Drum at the Surface

BY FREDERICK A. TALBOTT*

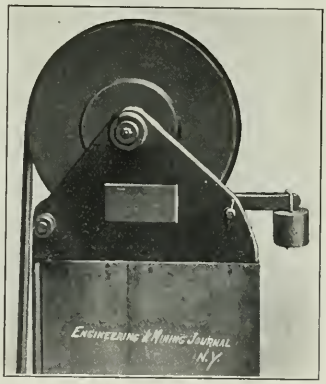
An interesting development in the petroleum industry among the oilfields of Galicia has been effected recently the results of which have been so successful that the principle is being extended throughout this oil-bearing area. Owing to the remote situation of these fields, the lack of highly-skilled labor, and the uncertain yield from the boreholes, the erection and operation of the usual types of pumping plant is attended with numerous difficulties. Repeated efforts have been made to devise simple systems for the extraction of the crude oil from the deep and narrow pits, easily, quickly, and cheaply, in order to suit the local conditions, but the success achieved has been only partial and commercially impracticable for all-round working. As a result of a prolonged investigation of the problem an entirely new system has been devised by Herr Bruno Leinweber, an engineer of Vienna, prolonged tests with which under the most exacting conditions have proved eminently satisfactory. It offers an inexpensive and easy means of extracting the oil from the boreholes and should prove eminently adapted for operation upon oilfields which from their remote situation and other conditions cannot be exploited in the usual manner at a profit. Though primarily devised for oil wells, it is equally applicable to the haulage of any fluids or even semi-fluids such as water and saline solutions thickly impregnated with organic matter.

The Leinweber System

Briefly, the system comprises an endless band or cable, covered on one side with an absorbing material, such as carpet shag, which is of sufficient length to become immersed at its lowest extremity in the liquid in the borehole. As the band travels through the liquid a certain proportion of the fluid becomes absorbed by the covering of the cable which, upon arrival at the surface, is passed between two rollers. These press out the liquid, which can either be caught in suitable vessels or, if the pit is merely being drained, deviated into conduits and thus led away. The plant at the mouth of the borehole comprises a timber staging carrying a drum around which the cable passes, and by means of which it is driven either by hand or other power, guide pulleys to lead the upward and downward traveling sections of the rope to and from the well, and the pressing rollers. It will thus be seen that the apparatus is of simple design and construction. Having few integral parts, it is not easily liable to breakdown.

The First Plant

The first plant was constructed for operation in the Kryg oilfield of the Galician-Carpathian Petroleum Company, the engineer and directors of which, impressed by the possibilities of the system, placed several of their boreholes at the disposal of the inventor for the purpose of practical experiment and demonstration. The plant was built in the railroad shops at Reichenberg, Bohemia, and was packed,



HEADSHEAVE OF LEINWEBER EQUIPMENT FOR SHALLOW WELL

mounted on two channel-frames, with the band properly adjusted, so that it could be erected immediately upon arrival at the oilfields.

In this plant the traveling cable was manufactured especially to suit the prevailing conditions It was of rectangular construction, being 3.1496 in. wide by 0.31496 in. thick, made of hemp and tested to withstand a strain of 9240 lb. The carpet shag with which the outer face of the cable was covered was 2.-3622 in. wide by 0.7874 in. thick and for the purposes of experiment three different kinds were attached to the traveling cable which was of hemp in three sections, the idea being to ascertain which class of shag possessed the greatest absorbent and yielding qualities. The whole was designed for working to a depth of 924 ft. and before despatch to the oilfields the band was severely tested, the ascending part being loaded to the extent of 2200 lb. in excess of the estimated weight of 550 lb., which it would have to withstand in actual use. This was done in order to test not only the cable, but the effect and stresses upon the winding jack which in this instance would have to be hand driven. It was found that the band traveled more smoothly and evenly when saturated with liquid than the descending dry section, since it secured a better adhesion upon the surface of the winding drum. The winding sheave worked steadily and without any accompanying slip or jerk.

First Test of the System

The borehole first selected was near Maryampolski and was 1881 ft. in depth. Only the upper part, however, was in a proper condition for work and this had a diameter of 9 in. Before the band was let down it was stretched out on the ground for measurement and preliminary preparations. Owing to the severity of the weather prevailing at the time of the trials the carpet shag became clogged with snow and was frozen hard when it was lowered into the borehole. Under these circumstances descent had to be made slowly and carefully, the lowering operation, after the two ends had been spliced together to secure an endless band, occupying 1.5 hours. The band was not cleaned, being lowered in its snow-clogged and frozen state, yet it was observed despite these unpropitious conditions to descend vertically and without touching the sides of the borehole. Moreover, as steam drive was unavailable winding had to be carried out by hand, so that a speed of only 0.66 ft. per second could be attained.

Owing to the condition of the carpet shag covering the cable it was some time before it attained its maximum absorbing capacity. The oil containing a large proportion of paraffin, owing to the low temperature prevailing, was of the consistency of fruit jelly. Notwithstanding these adverse conditions, the plant worked smoothly. The average yield obtained at the pressing rollers was found to be 4.13 oz. per foot of cable. This yield might have been increased had the rollers been fitted with skimmers to secure the oil which was brought up on the sides of the cable, and which by descending into the borehole, was lost. Fur-

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thermore, owing to the band being fitted with three different qualities of shag the yield varied, since one section was found to be particularly deficient in absorption. With the band traveling at about 5 in. per sec., an oil barrel was filled in 50 min. When, however, the shag became more pliable and a speed of 3.3 ft. per sec. was attained a yield of over 4000 lb. per hour was obtained. At the conclusion of this test the plant was dismantled and reërected at another borehole 1716 ft. in depth, where it is still in service.

Installation at Boryslaw

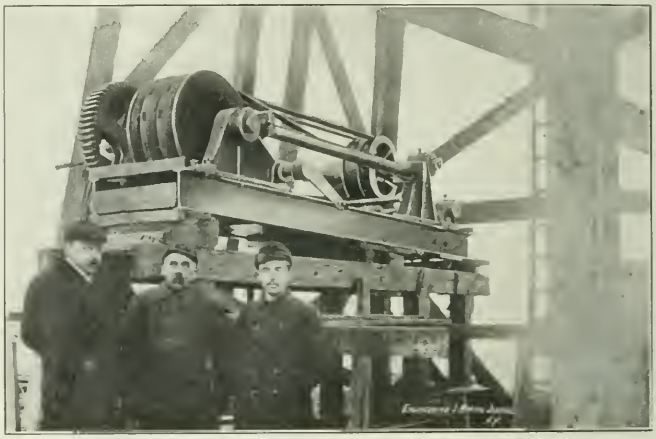
The preliminary tests having been considered successful, the construction of other plants was commenced for various pits on the oilfield. The inventor, in the first of these which has been erected at Boryslaw, was able to carry out certain modifications in the cable and shag which the experiments at Kryg had demonstrated as being advisable. The pit at which it is in operation is of great depth, the band working down to 2640 ft. The oil is thick and impregnated with from 7 to 8 per cent. of paraffin. The gases are sufficiently rich to cause the well to spout every alternate day when the yield is about 11,000 lb. per day. The cable is of steel wire of rectangular section, about 2 in. wide by 0.157 in. thick, covered with a long-haired pile on the outer surface, 0.78 in. thick. The cable has a breaking strain of 11,176 pounds.

The pit-mouth installation is similar to that erected at Kryg, the hand cranks simply being replaced by a pulley to take the driving belt of the steam engine. When the plant was started it was only found possible to attain a maximum speed of 9.25 ft. per sec., since the steam engine was not sufficiently powerful to drive faster. The average speed, however, was 4 ft. per sec., at which velocity the band yielded 4500 lb. of oil per hour. In this instance also the yield could have been increased if oil-strippers had been provided to secure the contents carried on the sides of the cable, but they were omitted in order to render all parts of the band and machinery accessible and under free observation. It was found that the weight of the ascending oil-laden section of the band was 2024 lb. and that of the descending dry section 1044 pounds.

Unfortunately in this instance the capacity of the plant proved too large for the flowing capacity of the well. Consequently, owing to the oil level in the pit decreasing so rapidly as to interfere seriously with the efficiency of the apparatus the latter was dismantled and transported to another well.

Modification of the System

Another installation is being made for the same fields, but a new system will be adopted for the surface plant. It is to work to a depth of 3960 ft. The band will be of the same type and dimensions as that used in the above-described Boryslaw installation. The pit-mouth apparatus will consist simply of a driving disk of large diameter around which the endless cable will run together with a pulley guide and a pressing roller. The experience gained at Boryslaw proved that although the existing plant is simple in design and working it might be made still simpler with corresponding advantages. The inventor will, as a matter of fact, revert to the system he first evolved in the course of his model experiments, the principle of which is shown in the accompanying illustration of a small plant working to depth ranging from 100 to 130 ft., constructed especially for the Technical High School at Carlsruhe, Germany. In this it will be seen that the driving sheave comprises a narrow wheel carrying two or three winds of the rope. It is mounted upon a small frame, the ascending section of the band passing through the pressing rollers mounted immediately below the axis of the driving wheel. This arrangement certainly possesses the advantages of being much simpler, while it occupies much less space and is more readily accessible. The plant devised in accordance with this principle will be utilized in connection with boreholes having depths of 4125, 4412 and 4468 ft., respectively.



LEINWEBER OIL EXTRACTION EQUIPMENT AT KRYG, AUSTRIA

Adaptability and Repair of the Plant

The efficiency of the system and its suitability to such conditions as prevail in the Carpathian oilfields, has been proved. The distance of the field from the industrial centers renders a breakdown a serious matter, since some time must unavoidably elapse before it is possible to secure duplicate parts or repairs. On the other hand, the Leinweber plant can be easily repaired should an accident occur. When in operation no attendance is required beyond the charging of the lubrication cups on the bearings.

The two sections of the band, before one part becomes soaked, balance each other so that the driving effort required is only that necessary to deal with the weight of the material being raised and the slight frictional losses. The band can be kept in a constant state of repair and efficiency. Should a stretch of the shag become worn, it is necessary only to remove the defective part and sew on another piece, it not being necessary to withdraw the band from the borehole for this purpose. When it is desired to remove the band, the splicing is simply released and one end made fast to the winding sheave or paid out and coiled as the drum brings it up.

The system is flexible and the traveling speed and consequently the yield can be controlled within a wide range; similarly the dimensions of the shag can be increased or decreased as occasion requires. The system is especially suitable to those boreholes which are not carried down vertically since there is always a certain tension between the drum and the lower bend in the band due to the weight of the absorbed material, while experience has proved that none or very little loss in yield arises from the band striking the side of the borehole. Should the band encounter any obstruction in its course a safety clutch can be fitted to the winding sheave to bring the machine to a stop and thus avoid any breakage of the traveling band. In the event of the oil containing water, the liquid upon exuding from the pressing rolls can be separated, while similarly should the oil be combined with sandy material the latter can be removed by a water jet or steam flush.

Although the exploitation of the invention has hitherto been confined to the Carpathian oilfields, its operation has been inspected by several engineers to whom its simplicity and immunity from breakdown has appealed. Arrangements are now being concluded for its development in other parts of the world where local conditions are not suitable to the utilization of the generally adopted facilities for such work.

Occurrence of Auriferous and Stanniferous Tourmaline in Sumatra

By L. Hundeshagen*

Some years ago I noted a peculiar rock consisting entirely of small rounded grains of quartz and cemented by talc about 2 to 3 km. to the southwest of Moeara Sipongi (residency of Tapanoeli, west coast of Sumatra) and in other localities of the neighborhood.

The rock carried small quantities of dark yellow gold and has occasionally been mined for gold by Malays. It rests on granites and is from 30 to 100 m. thick, being in places overlaid by more or less metamorphosed sandstone which consists mainly of quartz and feldspars and is in places intersected by diabasic dikes and sills. The capping of quartz-talc rock is probably a metamorphosed granite. It appears that a similar rock has not yet been mentioned as occurring in other parts of the world.

As regards the gold, it is not accompanied by sulphides, but it incrusts occasionally a blue-black nonmagnetic iron mineral not yet exactly determined. In the zone of quartz and talc, more especially where near diabasic rock, occur pockets and irregular masses of almost pure black tourmaline free of sulphides and with traces or no limonite. The magnetic segregations of crystallized tourmaline assay from 2 to 10 dwt. gold and a little silver, part of which is susceptible of amalgamation. Though the tourmaline is in places 2 ft. thick, it is not certain whether it can be profitably mined. Boulders of tourmaline, which mineral, as is well known, is very characteristic of the stanniferous deposits at the Straits Settlements and elsewhere, were found in 1901 by the government mining engineer about 30 to 40 km. northeast and east of Loeboe Sikaping (Uplands of Sumatra) where stream tin is being won by the Malays. Though this tourmaline, when finely crushed, rarely pans cassiterite, it at times assays, according to his report, appreciable quantities of tin, viz., a small per cent., and exceptionally even up to 10 per cent.

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Dredging Conditions in Colombia

By A. P. Rogers*

Colombia offers today several attractive features for gold-dredging operations, although the drawbacks should be well understood before anyone attempts to invest his money there. I spent several months upon a thorough examination, which resulted favorably, of a piece of land in that country and as far as I know, it is the first expedition ever sent down there that has drilled the ground in the systematic manner that such work is done in California and other established fields. The successful operation of a dredge upon this land will be watched with much interest, and it is bound to prove a stimulus to other similar projects within a short time, when the work of equipment has been completed and the extraction of the gold has actually begun.

The conditions under which one must work are radically different from those found in the United States. This land is all situated within 10 deg. of the equator, and most of it is at an elevation above sea level which is considered unfavorable to health in that latitude. The climate is tropical in every sense of the word, while the heavy and violent rainstorms during the wet season —lasting nearly nine months of the year —turn the flat areas, suitable for dredging, into veritable swamps which breed the malaria-infected mosquito by the million. To guard against these pests requires a strong constitution and a sane manner of living, which the Northern man is loathe to adopt until he has gone through the mill.

A tropical jungle that is exeeedingly dense and a cause of much annoyance must be cleared off most of the land. It must be understood that this country is very sparsely populated, and practically the only means of travel is by the large navigable rivers, or over frightfully rough and uncertain trails, blazed through long stretches of impenetrable wilds. Small settlements exist at intervals along the rivers, but behind them there is always the jungle until another river is reached. As a consequence, the traveler must carry his own camp equipment and food supplies upon any journey he intends to make into the interior, and a plentiful supply of netting to keep away the insects at night.

The gold content of the ground is often high enough to prove very attractive for dredge mining, especially when it is taken into consideration that you can work throughout the year with no fear of an interruption due to cold weather. The only thing one must guard against is the chance of a heavy flood, if the dredge is working on a river. Such an occurrence is liable to happen at any time during the wet season, and occasionally during the dry season, with great rapidity, and produce startling results. For this reason, it is preferable to work inland a short distance, where it is possible.

The gravel usually contains a small percentage of clay, but in most places this is not so much of a hindrance as the lack of uniform values. It is the usual thing for the owners to claim phenomenal values throughout their land, which must always be taken with a grain of salt. Rich spots are quite common, but their extent is usually rather limited, and one must discount these statements when a large area is figured on. There are so many rivers in this region flowing down from the upper Andes, that sufficient water power can be developed in numerous places for all the dredges that are ever likely to be installed, although one may have to go some distance from his ground to find the most suitable location for a power house.

The conditions under which the men must live are very trying in some respects. A Northerner going there for the first time should exercise the same precautions he would take if he lived in a swampy region here at home during very warm weather. All houses should be built off the ground upon some hilltop, have high ceilings with a double roof, and wide verandas. By clearing away the jungle from about the house, the warm sun will dry things up and a chance will be given to any breeze that may spring up. The soil over these low areas is exceedingly rich and fertile, so that a large variety of vegetables can be raised at your very door, while cattle seem to thrive. To prepare the food, an imported cook is a necessity, as the native knows nothing about this important art. To keep good men contented in such a country nothing pays better than to set an attractive table.

The government of Colombia is now considered fairly stable and it is anxious to help all legitimate mining enterprises as much as possible. There is an export tax of 1 per cent. upon all gold exported from the country, but mining machinery is practically free from duty. As far as labor goes, it is fairly efficient, for the wages that are paid. The peon is much like a small child and will work to the best of his ability, if treated properly. Probably the most difficult problem to solve for a foreign company, operating in this field, will be to secure the services of an efficient and honest corps of our countrymen to keep things going. It is a long way from home and the average man is apt to get homesick, if not really sick, and then his principal thought is how to get back North with the least possible delay. This condition of things necessitates a reserve corps to fall back on when the occasion arises. In spite of the drawbacks, I look to see considerable capital invested in dredging enterprises in Colombia within the next few years.

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Improvements in the Treatment of Slime by the Vacuum Filter Process

By Arthur W. Allen*

The idea of simultaneous displacement of pulp with wash solution in the working of a suspended-leaf type of vacuum filter was formulated and put into practice by me at the Palmarejo & Mexican Goldfields Company's slime plant at Zapote, Mexico, some months ago. The success that has resulted has given rise to the following description of what would be the most satisfactory type of installation on this system.

CHART OF OPERATIONS FOR VACUUM FILTER PROCESS.

Time.	Compartment No. 1.	Compartment No. 2.	Compartment No. 3.
1:55	Solution into No. 2.	Pulp into No. 3.	Charge 64
2:05	Replaced by water.	Replaced by solution from No. 1.	
2:15	Vacuum off.		Pulp agitated with pump.
2:20			Vacuum on.
2:25	Cake discharged.		
2:30	Gate closed.		
2:35	Charge 65.	Solution into No. 3.	Pulp into No. 1.
2:45		Replaced by water.	Replaced by solution from No. 2.
2:55	Pulp agitated with pump.	Vacuum off.	
3:00	Vacuum on.		
3:05		Cake discharged.	
3:10		Gate closed.	
3:15	Pulp into No 2.	Charge 66.	Solution into No. 1.
3:25	Replaced by solution from No. 1.		Replaced by water.
3:35		Pulp agitated with pump.	Vacuum off.
3:40		Vacuum on.	
3:45			Cake discharged.
3:50			Gate closed.
3:55	Solution into No. 2.	Pulp into No. 3.	Charge 67.

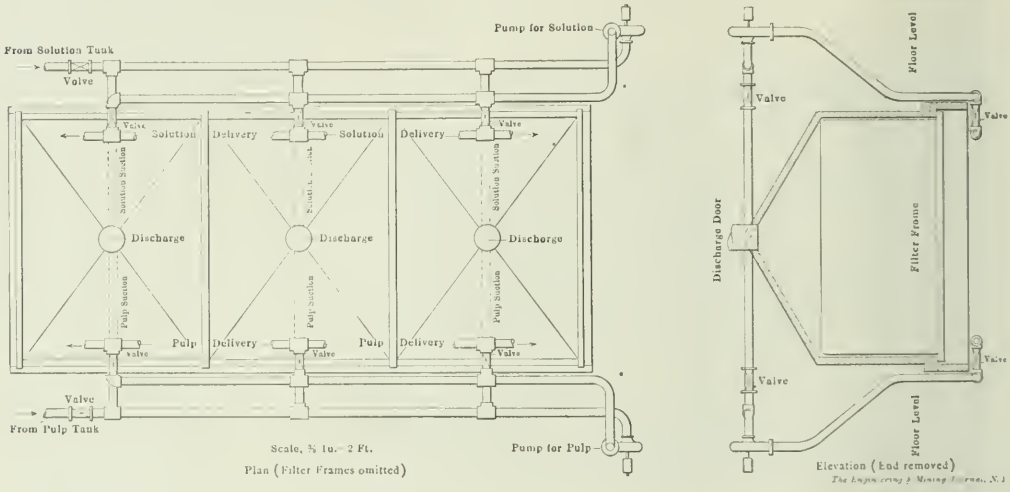

DIAGRAM OF FILTER SHOWING CONNECTIONS FOR SIMULTANEOUS DISPLACEMENT METHOD OF SLIME TREATMENT

The attached plans are diagrammatic and, for the sake of clearness, the water and vacuum pump connections have been omitted. The filter box consists of three separate compartments each having a discharge door and each containing an equal number of filter leaves. These latter are connected with a vacuum pump in the usual way and arrangements are made so that the vacuum in any particular compartment may be lowered or shut off

There are two systems of pumps. The one, which is used for pumping pulp from the bottom of either of the compartments into the top of either of the others, is also connected with the main agitation or storage vats. The other, for solution, is connected with the compartments in a similar way on the other side of the filter, and also with the solution pumps. Both the solution and pulp are delivered over the full width of the compartment by means of perforated canvas hose.

The cycle of operations is as follows: The first compartment is filled with pulp and, when ready, the vacuum is applied to the leaves and maintained until sufficient cake is formed. The vacuum is then lowered to a few inches and the pumps are started, the pulp being pumped into the second compartment and replaced at the same time with solution from the third. While the washing is being continued in the first compartment the vacuum is opened to the leaves in the second. When the cake is formed on the latter the pulp is pumped into the third compartment and is replaced by solution at the same time from the first compartment, the latter in its turn being filled with water. As soon as sufficient of this has been drawn into the cake to displace the solution the vacuum is shut off and the slimes are discharged. The gate is then closed and the compartment is ready for the pulp from the third compartment.

The accompanying chart is a complete section of a working sheet and will give some idea of the time taken by the various operations and the economy effected in this direction.

The advantages of the system are: (1) Large tonnage handled in a minimum time. (2) Minimum pumping. (3) Even deposition of sandy matter in cake as a result of top delivery of pulp. (4) Absence of necessity of removal of loaded leaves during operations with consequent jarring of the frames and cake (5) No drying or exposure of the cake to the air and in consequence no disarrangement of what might be called the molecular deposition of slime particles on the leaf, the practical result of which is a perfect wash in a minimum of time and with the aid of a few inches of vacuum only.

The Custom House returns published in the *Viestnik Finanssoff* (*Chem. Trade Journ.*, April 17, 1909) gives the exports of cement from Russia during 1908 as 1,006,000 poods, valued at 465,000 rubles, as compared with 4,417,000 poods, valued at 1,701,000 rubles in 1907

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A West African Gold Mine

SPECIAL CORRESPONDENCE

The report of Prestea, Block A, for the year ended Dec. 31, 1908 will be of interest not only to the shareholders, but to a wider circle who invested in West African mines during the recent boom on the expectation that under new management and with new methods, great improvements would be brought about in the financial results. On examining the report and accounts of the Prestea Block A Company it is evident that the improvement expected has not yet been realized. During the year 1908 the ore milled was 89,933 tons from which gold to the value of £154,763 or 34s. 5d. per ton was recovered. During 1907 the tonnage crushed was 78,164 tons yielding £195,837 or 50s. per ton. There has consequently been a great falling off in the grade of ore milled. An examination of the working costs is equally unfavorable. In spite of the fact that 10 more stamps were running in 1908 than in 1907 and that a reduction in the grade of somewhere about 30 per cent. was made, changes which might by themselves be expected to make a considerable reduction in the costs quite apart from the benefit of improved management, the costs, if compared carefully, do not reveal any marked improvement. The figures given in the reports for the two years are as follows:

			1907.	1908.
Tons milled			78,164	89,933
Stamps			50	60
	Cost per Ton Milled.		Cost per Ton Milled.	
Mining	16s.	3.4d.	17s.	4.64d.
Milling	11s.	3.1d.	10s.	5.57d.
General exp. mine	3s.	11.8d.	3s.	1.34d.
Development	3s.	11.3d.	1s.	1.11d.
General exp. London	1s.	8.2d.	1s.	2.16d.
Depreciation	....	....	2s.	7.51d
Total	37s.	1.8d.	35s.	10.33d.

In the 1907 accounts no charge was made for depreciation and if this item is, for purposes of comparison, deducted from the 1908 figures, the net result shows a reduction in 1908 over 1907 of about 4s. per ton. This is worth having, but it appears to be a fictitious rather than a real improvement, as about 3s. of it is obtained under the heading of development. No doubt the reduction in grade must have reduced automatically the cost of development per ton, but it appears questionable whether the charge made of 1s. 1d. in the 1908 statement of costs is a fair one, especially when the balance sheet shows mine development standing at £182,770 for ore reserves of 270,500 tons or a cost of over 13s. per ton. While no great improvement in the working costs is as yet visible, notwithstanding the great reduction in grade, it is fair to point out that the alterations of plant are not yet complete and that next year's returns may have a more favorable appearance. New ore-bins and crusher stations are in course of erection, as well as a suction gas plant. Before the close of this year it is hoped to be able to treat 14,000 tons per month. It is anticipated too that in the near future the branch railway connecting the mine with Tarkwa will be completed, and that will enable the work to be carried on more economically than at present. In the mine no sinking has been done during the year owing to trouble with water, but new electric pumps are being installed and it is the intention to sink during this year a further 300 ft. vertically in order to open up a sixth and seventh level. At the same time the eastern section of the property will be developed through the new incline shaft. The developments have been of a satisfactory nature, the ore reserves blocked out on March 31, 1909, being 270,500 tons of a value of 11.6 dwt. The company has already contracted a loan of £35,000 and further funds will be required for the equipment of the property and for development of the mine, so that the shareholders may have to wait some time before the dividend-paying stage is reached.

Fires in the Geological Survey Building

SPECIAL CORRESPONDENCE

A fire which occurred on the fourth floor of the Geological Survey building, in Washington, early on May 9, and resulted in the destruction of one of the laboratories of the Survey with a loss of at least several thousand dollars, has again directed attention to the unusual risk the Government is running in keeping records, valued at more than $5,000,000 in a building that is not fireproof. While the Survey officials estimate $5,000,000 as the value of these records, their destruction by fire would mean a total loss of $10,000,000, as the Government has already spent $5,000,000 in obtaining them, and it would be necessary to spend a like amount to replace them, and even then, certain records could not be duplicated under any circumstances.

The fire which was kept from spreading to the remainder of the building, owing to its discovery by an outside watchman and the prompt work of the firemen, is the third that has occurred in this building within the last six years. On Dec. 27, 1903, fire started on the sixth floor in the night time, destroying Government property to the extent of $10,200. On Dec. 16, 1908, another fire in the night on the fifth floor resulted in a loss of $15,810. In both instances, the presence of Survey officials, in addition to that of the night watchman, contributed to the prompt extinguishment of the fires with comparatively small losses.

Shortly after the second fire, James R. Garfield, then Secretary of the Interior Department, sent a communication to Congress, urging an appropriation of $2,500,000 for a fireproof building to be occupied by the Survey, the General Land Office, and the office of Indian affairs.

On April 19, of this year, Senator Guggenheim, of Colorado, presented a bill providing for the erection of a building to be used exclusively by the Geological Survey, the cost not to exceed $1,100,000. This bill is still pending. Survey officials believe that even before a fireproof building can be erected for the general use of the Survey, some small fireproof building should be provided at once for the various laboratories, as these are generally supposed to be the danger spots in the present building.

It is said that the fire in the laboratory on May 9 was caused by spontaneous combustion.

Esperanza

SPECIAL CORRESPONDENCE

The English company holds 449,800 shares out of a total of 450,000 shares in the American Esperanza Mining Company, so that the two companies are practically identical. The property is situated at El Oro, Mexico, and has up to the end of 1908 given a production of 49,114,860 pesos (Mexican currency) from the treatment of 1,176,117 metric tons dry weight. During the year 1908 the mine produced 145,451 dry metric tons of ore, having a gross value of $2,146,290 (U. S. currency), from which a net operating profit of $927,616 was obtained. The average yield per dry metric ton was $14.75 as compared with $20.63 in 1907. The operating costs for the year amounted to $8.48 per ton, which is approximately 17 per cent. lower than the costs in 1907. Considerable additions in the shape of tube mills, Pachuca tanks and Merrill filter-presses are being made to the mill and it is expected that the new improvements will be started in July, 1909; and that increased mill recoveries and reduced operating costs will result. A paragraph in the report that requires some explanation is that which says that the improved milling scheme, as compared with present practice, will increase operating profits by $1,000,000 by reduction of operating cost and increased mill recoveries for mine ores and recovery of values from dumps. It is not clear what tonnage this refers to and whether or not it is allowed for in the estimated operating profit from the ore reserves mentioned above, namely $2,117,222. The report is accompanied by an admirable set of plans together with full statistics of the metallurgical work.

Colliery Notes

Never fire a shot in a hole containing a cavity or break; there is a possibility of firedamp being present in the cavity, and if charged and fired, it may lead to disaster.

In firing shots, separate examinations for gas should be made after each hole has been fired. The position of all holes should be marked previous to firing, so that in case of a missfire, the relieving hole can be placed in a proper position.

According to the latest information, the Canadian-Northwestern coalfield contains over 45,000,000,000 tons of marketable coal. The product of this field, especially in the Fernie district, produces a good quality of coke, which, with improved methods of manufacturing, will equal the coke produced in many American fields.

It is interesting to observe that, although coal-cutting machines were introduced in Great Britain 50 years ago, in 1902 there were only 166 machines used in that country, while in 1907 there were 1493. In the United States in the year 1906, there were 10,212 machines in use, and the percentage of the total coal mined by machinery was more than 30 per cent. Each machine used in the United States showed an average annual production of 11,638 tons, which compares with 8630 tons in Great Britain.

Notwithstanding that public opinion is to the contrary, pit ponies in most districts are well treated. Although the animals fret for a few days when first consigned to the lower regions, they soon regain their natural gaiety and spirit. The ponies are regularly fed three times a day and groomed twice. Their feet and general physical condition are carefully looked after and attended to by experienced farriers. At all well-regulated mines, any cruelty to ponies on the part of the boys who work them is speedily punished. At many English collieries, an admirable plan is adopted, whereby the driver boys are encouraged to attend their ponies properly by the distribution of substantial rewards.

Some attention was attracted in one of the English coalfields, by the withdrawal of a pit pony from active service in a mine, after having been underground continuously for nearly 20 years. When the little animal was brought to the surface, he was stone blind, but otherwise in remarkably good condition. As is the custom at this colliery, the animal was killed, because there was no old-age pension awaiting him. In this and other adjacent mines, it is stated that many of the ponies are employed continuously underground for from 15 to 20 years without seeing daylight. It seems that after so many years of faithful service, mine owners should be able to devise some means for providing for these animals, even though (as it is claimed), the ponies are now painlessly despatched.

One important reason for regarding a mine's atmosphere containing blackdamp with suspicion, is the effect this mixture has on the miner's ability to detect firedamp, should this latter gas also be present. It is well known that the detection of firedamp is affected by the presence of blackdamp, and it is, therefore, important that a strict observance of a fixed blackdamp standard should be adhered to. It is a matter of common knowledge that in some instances, it is possible to have a mixture of blackdamp and firedamp, lighter than air and settling up in the roof. When a lamp is put into such a mixture, the light is immediately extinguished without any indication of firedamp. At such a point, the blackdamp renders the firedamp inexplosive, but if the mixture is given more oxygen, an explosive atmosphere soon exists.

The longwall system of mining is becoming more and more used in Continental coal mines. European engineers contend that longwall mining reduces mineral losses to a minimum, and affords better facilities for the application of mechanical power; this latter assertion is based on the fact that the longwall system presents a continuous working face, extending several hundred yards in length, which simplifies the working of a mining machine, to the one operation of undercutting the exposed seam, subsequently admitting of its easy cleavage by hand. It is also asserted that the longwall system as used in Europe lends itself to a more expeditious transit of the mineral by means of coal conveyers, since temporary tracks are readily laid along the entire length of the working face, and the coal is often broken down into the waiting receivers, effecting a net saving of from 12 to 15c. per ton on all coal brought to the surface under such conditions.

It is a question of dispute as to what percentage of firedamp, when present in mine air, justifies the withdrawal of the men working underground. At a majority of the collieries on the Continent the miners are withdrawn when 2 per cent. of firedamp is found. Regarding a standard as to contamination of the air with blackdamp, about the only sensible practice is to limit this standard to a condition where the lamp becomes dim. When such a decrease in the lighting power occurs, it is then time to withdraw all men. This standard should, therefore, be placed at about one per cent. of CO_2 and not less than 19 per cent. of oxygen. Every miner should always be able to rely on his lamp, and when this latter goes dim, it should be an immediate signal for exit. When blackdamp is present and a miner does not heed the decrease in lighting power of his lamp, it is certain that such an atmosphere will soon dull the miner's senses, and will make him less alive to the ordinary precautions respecting his own safety.

One of the important points brought out at a recent meeting of coal-mining men was with reference to the general tendency of attributing most of the recent mine explosions to coal dust as the destructive agent. A number of engineers now claim that the coal-dust theory is being brought in to explain explosions that are due to gas. Attention was called to the fact that in a number of recent cases, the miners, evidently realizing that something had gone wrong in the mine, were trying to escape by rushing to manholes when a second explosion occurred and killed them. First of all, there was an explosion caused, probably, by the firing of a shot, and a second explosion, accompanied by the production of a partial vacuum, ensued after a short interval. The general opinion was, that the second explosion was due to gas and was more disastrous than the first. One investigator called attention to experiments made in a gallery of boilers, where the real damage was caused by a detonation where there was an open end to the gallery, only three boiler lengths away. In explaining the results of this experiment the speaker said that when the first explosion had taken place, carbon monoxide was left behind, and in this particular instance, the carbon monoxide was detonated.

It is not advisable to place too much reliance on the safety resulting from watering a coal mine. In an examination of various collieries on the Continent where the practice of sprinkling was carried on, it was found that after an explosion, several districts of a wet character contained the largest quantities of charred dust. In this connection, it may be stated that it is necessary in sprinkling underground, to consider carefully what degree of saturated air a miner can stand. This latter point remains a matter of dispute, for some engineers claim that if the air is dry, a miner can stand 90 deg., while other authorities assert that a man cannot work in 87 deg. of saturated air without injury. Mr. Ashworth, in a recent lecture, argued that to use water effectively as a preventive of explosions, there must be 5 per cent. of vapor present in the air, and that this amount could only be obtained by means of steam. Mr. Ashworth continued by saying, that to get any safeguard in a mine from water, the men must be prepared to work in steam. He suggested that the superintendents make their roads right and the mines sanitary, giving the men as dry air to work in as possible, and never mind watering. This objection to watering on the part of Mr. Ashworth is rather unexpected, in view of the favor that has lately attended the practice of sprinkling.

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The Price for Copper in 1908

As in previous years we summarize herewith the reports of the Lake Superior copper-mining companies as to the amount of copper sold by them in 1908, the receipts for the same and the average price realized. The list is practically complete for Lake Superior with the exception of the Calumet & Hecla, which does not report its average price. All of the other Lake Superior companies are characterized by the fullness of detail that they communicate to their stockholders.

From the reports for 1908 it appears that the various Lake companies realized a remarkable uniformity of price, the averages of the majority falling between 13.3 and 13.4c. per lb. As in 1907 the Quincy realized the highest average. It is to be remarked, however, that the Quincy figure includes the net proceeds of the silver separated, which is not itemized in the report for that company. Aside from that the high price for the Quincy copper is easily explained by its exceptionally high quality and large number of steady customers who buy it without much regard to the competitive offering of other brands of copper. The low average received by the Victoria may be explained by the small amount of its sales, the bulk of which may have been effected during a period of the year when the price for copper was lower than the average.

Speaking generally, 1908 was nearly a normal year, i.e., there was a steady sale for copper throughout the 12 months. Consequently, as is usually the case, under normal conditions, the average actually realized by the producers came very close to the quotational average of the ENGINEERING AND MINING JOURNAL. Fifteen Michigan companies sold 125,949,248 lb. of copper for $16,907,498, an average of 13.348c. per lb. The average of our daily quotations was 13.424c. per lb. Comparison for a series of years is made in an accompanying table.

In 1906 and 1907 the producers fell far short of realizing the quotational average. This was because the conditions in those years were so distinctly exceptional. A repetition of them, or anything nearly like them, may not be seen in another 20 years. In 1906, the price for copper was boosted to the extraordinary figure of 26c. per pound. The latter part of the rise occurred on comparatively small sales which the producers, having disposed of the larger part of their output lower down, failed to realize extensively, wherefore they were outstripped by the quotational average. On the other hand in the precipitous decline of the second half of 1907 the quotations were again established by comparatively small sales and the producers were unable to effect large transactions until the market was near the bottom. In normal years like 1905 and 1908 the weighted average and the quotational average agree very closely.

SALES BY LAKE COMPANIES IN 1908.

Company.	Copper Sold, 1908.	Receipts for Copper Sold, 1908.	Average Price per Lb. of Copper Sold.
Ahmeek	5,788,890	779,130	13.46 c.
Allouez	3,047,051	406,753	13.349c.
Baltic	17,724,854	2,375,440	13.39 c.
Centennial	2,196,377	294,165	13.393c.
Champion	17,786,763	2,381,137	13.39 c.
Franklin	2,962,018	396,580	13.389c.
Isle Royale	2,788,852	370,596	13.29 c.
Mass	1,766,930	238,609	13.50 c.
Michigan	3,000,206	399,186	13.305c.
Mohawk	10,295,881	1,382,731	13.43 c.
Osceola	19,815,046	2,654,140	13.39 c.
Quincy	20,600,361	2,796,230	13.56 c.
Tamarack	11,091,254	1,485,500	13.39 c.
Trimountain	6,034,908	810,755	13.43 c.
Victoria	1,049,857	136,546	13.005c.
Total	125,949,248	16,907,498	13.348c.

AVERAGE PRICE REALIZED FOR LAKE COPPER.

Year.	Sales Reported.	Price Per Lb.	Quotation.
1905	82,372,955	15.597	15.699
1906	113,411,645	19.146	19.616
1907	66,316,025	18.043	20.661
1908	125,949,248	13.348	13.424

The Cost of Silver Lead Smelting

In the JOURNAL of Aug. 15, 1908, we published an article which aimed to show by scientific deduction what is the average profit realized per ton of ore smelted by the American Smelting and Refining Company, a figure that it has always carefully kept out of its official reports. In that article it was deduced that the total profit in the year ending April 30, 1903, was a little less than $2.20 per ton, and the opinion was expressed that the profit in smelting alone, properly considered, at that time might have been about $2 per ton. Since then the company has thrown some light upon the subject. In a recent statement to the New York Stock Exchange it said that the average amount of ore smelted is 3,500,000 tons per annum,

which alone does not afford the basis for any precise calculation. However, the latter is obtained in the statement by Mr. Brush, of the company, before the Ways and Means Committee, Dec. 16, 1908, that in the fiscal year ended April 30, 1908, the company smelted 3,372,750 tons of ore. The net profit in that year was $7,011,191. Consequently the total profit per ton of ore was a little less than $2.08. The actual smelting profit was, of course, something less, because the company realizes more or less from its various ventures that are not to be referred directly to its smelting business. Mr. Brush, in his testimony, several times mentioned $1.50 per ton of ore as being the profit in smelting, in which he may, in speaking offhand, have somewhat underrated the figure. However, the evidence is quite sufficient to prove the accuracy of the deductions that were made in the article in the JOURNAL above referred to.

The Smelting Company and its officers now having told so much, we see no reason why hereafter it should not incorporate a specific statement upon this point in each of its annual reports. We are sure that such a statement would be appreciated both by the stockholders of the company, who are fully entitled to such information, and to the producers of ore with whom the company does business. The stockholders would have a better line upon the position of the company than they can unravel from pages of mysterious figures, while the mine owners would be satisfied that the company is not exacting from them smelting charges that are exorbitant and unreasonable.

The Geological Survey Has Another Fire

The following is a recent newspaper despatch:

"Washington, May 9. For the second time within three months fire threatened with destruction today the building in which the Geological Survey is housed. The blaze was discovered early this morning, and after a sharp fight was extinguished, not, however, until the chemical laboratory was destroyed. It is not known how the fire originated, but it is practically certain that crossed electric wires were the cause of the trouble, as they were of the blaze three months ago. Valuable maps and charts stored in the building were again damaged by water. The frequency of these fires will be taken as an argument for a Government building for the Geological Survey. The building it now occupies is rented, and is a fire trap. In the case of a sweeping fire the Government would lose a vast amount invested in data and much of it could not be replaced."

We have repeatedly urged Congress to eliminate this danger by providing the Geological Survey with an adequate building. Inasmuch as it appears unwilling to do so, we recommend that the President by executive order transfer the Survey and its archives to Fortress Munroe, or some other safe place that the Government may happen to own.

The Copper Statistics

The report of the Copper Producers Association for April is of a nature to excite mixed feelings. The production was 3,785,810 lb. per day, against 3,776,000 in March. Obviously the curtailment of production by the high-cost producers has not yet offset the increase by such important districts as Ely, Cananea and Cerro de Pasco, which can operate at a profit on the recent level of price. This is an argument against the chances for a striking and permanent advance in price, which would cause production rapidly to increase still farther. On the other hand, it is certainly a source for congratulation that the deliveries for consumption in April gained so materially that the addition to the surplus was only a trifle more than 900,000 pounds.

In commenting upon the statistics for March, we remarked that "It would not be surprising if the production of refined copper should show a decrease in April and if the accumulated stock would begin to wane." Neither forecast was actually realized, but the tendency in both directions was so clearly manifested by the April statistics, combined with the fact that the monthly addition to the surplus has been steadily diminishing since February, that a distinctly favorable impression was created.

STATISTICS FOR MARCH AND APRIL

	March.	April.
Production	117,058,661	113,574,292
Deliveries	108,063,007	112,656,121
Surplus	8,995,654	918,171
Previous	173,284,248	182,279,902
Total	182,279,902	183,198,073

The reception of the April statistics was indeed so favorable that they, together with the influence of some large purchases by manufacturers, led to an advance in the price for the metal. The holders of the accumulated stock are in no uncomfortable position, money being still so cheap. They argue that copper is really worth more than it has been selling for lately and they propose to continue to carry the stock, if necessary. They are able to do so. This situation is well recognized by the manufacturing consumers, who do not expect on the one hand to secure any materially better bargains than have lately been going, and on the other hand do not in any way fear the prospect of having to pay the prices of a runaway market. Any idea of a runaway market under present conditions is, of course, highly absurd and probably does not exist in the mind of any but those whose wish for a boom in the stock market is father to the thought. Apropos of the subject of speculation it may be surmised that a part of the stock reported by the refiners really belongs to speculators who are holding it for an advance to a level much higher than exists at present.

The Missouri Geological Survey

The Missouri Geological Survey is again a storm center. Its career has been tempestuous ever since the days of Arthur Winslow. At present the trouble, as previously, is politics. There seems to be something in the air of Missouri that breeds these political-scientific storms. In view of the vicissitudes that have troubled the State geologist of Missouri, and the ax that is constantly hanging over his head, it is surprising that the organization has been able to do as much good work as it has been able to put on record. Indeed, the Geographical Survey of Missouri has been among the most active of State organizations, and has done some of the most important work in the field of economic geology.

In the present difficulty, charges and countercharges are flying like the volleys of gatling guns. As nearly as we have been able to unravel the tangle, from the newspaper reports, the situation is substantially as follows. The Geological Survey has been planning to absorb the State Bureau of Mines and Mine Inspection. This has naturally been resented by the latter organization, and it, together with

the owners of mineral lands in the central part of the State, have charged that the Geological Survey has been in collusion with the Federal Lead Company (Guggenheims) to prevent the development of the central lead district. In support of this charge, it is stated that E. R. Buckley, formerly State geologist, resigned that position a few months ago to become mining geologist for the Federal Lead Company, and at the same time H. A. Buehler, who had been mining geologist for the Federal Lead Company, was made State geologist at the solicitation of E. S. Gatch, vice president of the board of managers of the Bureau of Geology, who is president of the Granby Mining and Smelting Company (which is alleged to be controlled by the Guggenheims). To clinch matters it is stated that the Geological Survey recently made a report upon the lands of the Granby company. Other mineowners declare that this report "must have been worth millions of dollars to the Granby company," and one gentleman who owns property in the central lead district says that such a report on his mines would be worth several million dollars to him.

Obviously the grievances are (1) the projected absorption of the Bureau of Mines and Mine Inspection; (2) the adverse reports upon the central lead district by the Geological Survey, when in the opinion of owners of property therein the district contains "billions of dollars worth of lead that should be opened up instead of being kept in the background." Why should the Geological Survey have pursued this disdainful policy? Of course, so that the Guggenheims may be able to gobble up the district. Absorption of the Bureau of Mines and Mine Inspection is naturally to enable the Guggenheims to control them both. What a terrible octopus is this Guggenheim organization!

The way in which some honorable names are being bandied about in this Missouri dispute makes it distinctly worth while to throw some light on the matter, which we will do under the following heads:

(1) The only interest of the Guggenheims in Missouri is the Federal Lead Company, and we are disposed to think that it was more or less of a misadventure. The Guggenheims have feet of clay like many other mortals, and in their Missouri enterprise made initial mistakes that would have wrecked about ninety-nine concerns out of a hundred. With their command of great resources, they were able to overcome their setbacks and lay their plans to get out even, perhaps a little more, all of which has been beneficent to the people of Missouri, if we may judge from the extent to which the value of mineral land has been bid up in the southeastern district. We do not believe that the Guggenheims have any stomach to repeat their experience in the central district, but imagine that they would be pleased to see the mineowners of that district develop their property in order to supply the smelting works at Alton.

(2) The Granby Mining and Smelting Company has no more connection with the Guggenheims than the Calumet & Hecla has with the Amalgamated Copper Company. The Granby Mining and Smelting Company is, indeed, a Calumet & Hecla of the zinc business, being one of the historic companies in that industry. It owns an extraordinarily large area of mineral land in southwestern Missouri—far more than is owned by any other company—which is leased to individual miners, or small companies. The Granby property covers a distinct mining district. It was eminently proper that the Geological Survey of the State should make a report upon the Granby district, that report being undoubtedly to the advantage of the people generally. It is also eminently proper that a man holding the high position of Mr. Gatch in the mining and smelting industry should be one of the officers of the board of managers of the Geological Survey. It is, furthermore, proper that Mr. Gatch should be instrumental in naming the State geologist. The people of Missouri should congratulate themselves upon escaping the hand of some broken-down political hack and should prize the services of Mr. Gatch, who honors them by serving. No one in possession of his senses could believe for one minute that Mr. Gatch would ever act in any but the most public-spirited way.

(3) It is true that Mr. Buckley and Mr. Buehler exchanged positions, the place with the Federal Lead Company having been found for Mr. Buehler, while Mr. Buckley, whom he was to succeed, was engaged in finishing his work for the State. The people of Missouri are to be congratulated upon enjoying the services of geologists who are capable of securing important positions in private life.

(4) The central lead district was studied and described with much detail in Winslow's famous report. It has not yet shown any evidence of possessing the importance of either the southeastern or the southwestern districts.

The present dispute illustrates one of the difficulties under which a State official labors as compared with the official of a private company. The latter can dismiss off-hand any mine which the evidence indicates to be not worth the time and expense of an examination. The State official, on the other hand, must fritter away his time and the money of the people in visiting every insignificant prospect, or else be subject to the charge of ignoring "important mineral resources of the State," of course, to serve the purposes of private interests. Politics is the deadly nightshade to science and administration.

We think that the Missouri Geological Survey has made a mistake in planning to absorb the Bureau of Mines and Mine Inspection. The latter has done its work well and the work for which it is organized has nothing to do with the Geological Survey. One organization is to study and promote the development of the mineral resources of the State. The other is to inspect the operating mines and see that there is compliance with the laws of the State. If a State is able to support two such organizations, by all means it ought to do so, and it ought to keep them distinct.

As to the Guggenheims, we think that the people of Missouri have indulged so much in the habit of hunting octopuses that the game has got on their nerves, and they are now apt to mistake a lamb for a monster. The Guggenheims have plenty of troubles of their own. If, however, they show any sign of becoming voracious, we recommend the mineowners of Missouri to follow the plan of those in the Klondike and sell them their properties at as much over the real value as the Guggenheims can be fooled into giving.

The experiments upon smelting zinc ore in the blast furnace which were abandoned at Warren, N. H., two years ago, are to be resumed this spring at Philadelphia, under the direction of F. W. Gordon, who conducted the work at Warren. An entirely new furnace will be built at Philadelphia, on somewhat different lines from that at Warren.

Metallics

We notice this gem of a word in a recent article on organic chemistry:

TETRAMETHYLDIAMINODIPHENYLMETHANE

Platinum ingots as imported in the United States are approximately 5/16 in. thick by 2 to 4 in. wide and weigh about 100 troy ounces each.

According to L. B. Stilwell, the output of the plant of the Niagara Falls Power Company in 1908 was 560,000,000 kw.-hours, equivalent to a saving of more than 1,000,000 tons of coal per annum.

A miner who has been partaking too freely of intoxicants should never be allowed to enter the workings of a mine. He is a menace not only to himself, but to his co-workers. Many instances could be cited of serious accidents caused by the act of some intoxicated miner.

According to J. Bishop & Co., Malvern, Penn., their works was the first establishment for handling platinum in the United States, having been started by Joaquin Bishop in 1842. The process introduced by him for melting and manufacturing platinum for chemical, dental, jewelry and other purposes was subsequently adopted by European manufacturers.

The Dwight & Lloyd sintering machine has been introduced with success at the works of the Ohio & Colorado Smelting Company at Salida, Colo. An installation is now being made at the works of the Federal Lead Company, at Alton, Ill., which will be particularly interesting, inasmuch as a direct comparison can there be made with the Huntington-Heberlein process.

According to John D. Archbold, the Standard Oil Company in 1892 produced from crude petroleum 60,154,700 lb. of crude wax; in 1907 the production was 100,649,553 lb. In 1892 the production of refined wax was 11,271,479 lb.; in 1907 it was 96,564,187 lb. In 1892 the Standard Oil Company produced 2,943,202 lb. of candles; 22,419,073 lb. of candles were produced in 1907.

In keeping his eyes open for carelessness, the mine foreman will do well to pay almost as much attention to the old and experienced miner as to the beginner. The experienced miner often grows careless through long immunity from accidents, taking undue chances and performing some of his duties in a manner that would bring forth from the foreman a well-deserved rebuke if he were a green hand.

According to Edward Brush, in testifying before the Ways and Means Committee, Dec. 16, 1908, the cost of the Garfield smelting works up to that time was in excess of $9,000,000. That figure is higher than what was previously the common belief. However, Mr. Brush probably included the money expended in acquiring the great area of land to forestall smoke troubles, which must have been very large.

According to L. B. Stilwell, about 25,000,000 h.p., steam and hydraulic, are installed for industrial purposes. The aggregate power used by our railways is estimated to be approximately 4,000,000 h.p. The Inland Waterways Commission estimates that the amount of water power available in the United States at cost comparable with steam operations is 37,000,000 h.p., which exceeds our entire mechanical power now in use.

The success of the Warwick Iron and Steel Company with the Gayley process is attracting more attention to it. In 1908 nine licenses for equipping Western blast furnaces were given. The experimental plant at the South Chicago works of the Illinois Steel Company is said to have demonstrated that the process can be successfully applied to bessemer converters, the result being a better and more uniform grade of bessemer steel.

In 1908 the Old Dominion Mining and Smelting Company, of Arizona, changed from the use of Eastern coke in its smeltery to coke obtained from Dawson, N. M. It was found that the furnaces could be run with about as low a percentage of this Western coke as of Eastern coke. The lower cost of the Western coke will effect a saving of between $20,000 and $25,000 per month, or more than 0.5c. per lb. in the cost of producing the copper of the company.

The mineral rutile, which is now mined in Virginia, has found a new use as a component of the electrodes for arc lamps. However, the demand for it is still very irregular. Besides that which was used by the domestic electric companies a considerable exportation was made in 1908. The value of rutile, 97 per cent. pure, varies from $100 to $160 per 2000 lb. For use in the electric industry it must be quite free from most foreign substances. Anything that slags easily is bad for an arc lamp.

It is reported that the Gasmotorenfabrick Deutz, of Germany, is about to introduce an internal-combustion engine to be driven by solid napthalene, which is a cheap by-product obtained in the manufacture of illuminating gas. It is a solid, melting at 79 deg. C. The engines are to be furnished with a special tank in which the naphthalene will be melted by the waste heat from the exhaust and the cylinder water jacket. The air to be carbureted will be heated to avoid solidification of the napthalene.

In sighting at a plumb-bob string in underground surveying a piece of white paper held behind the string and as close to the candle, or other illuminant, as possible, is a great aid to the transitman in making the sight. A permanent and useful arrangement for such work is a cigar box from which the cover has been removed, and a piece of tracing cloth attached to its place. When a lighted candle is put in place in the box and the contrivance held behind the plumb-bob string, the transitman experiences no trouble in finding the sight.

Some of the zinc blende ore of Mexico is high in fluorspar, separation of which by ordinary methods of milling is difficult. The ore of the San Francisco del Oro and Tecolotes mines is of this character. Shipments of concentrates to European smelters have been rejected because of the presence of 5 per cent. of fluorspar. American zinc ores are generally free from that objectionable impurity, but it occurs at Marion, Ky. Some good separations of these ores have been made by fine grinding, very careful sizing, and treatment on pneumatic tables.

When it becomes necessary to enter an old or abandoned shaft, some idea of its general condition may be obtained by the use of an ordinary hand mirror. A sunbeam reflected into the shaft by means of the glass will illuminate the shaft for several hundred feet. If a hand mirror is not available, a highly-polished tape reel, the inner surface of a watch lid, or any other polished reflecting surface, may serve the purpose. Of course, it is necessary that the sun be shining and that the shaft be in the open. By the use of this simple expedient, it is often possible to determine whether or not the shaft is safe.

The customary method of exhibiting mill products is to bottle them. An ingenious and effective system is used by D. V. Keedy. He employs an ordinary album with stiff leaves, such as may serve for mounting photographs. Marking out a rectangle, say, 1x2 in., he coats it with Lepage's liquid glue and sprinkles on the concentrate, midlings, tailings, etc., just as sandpaper is made. Of course, this is limited to the fine sizes, say, 2 mm. and less. A single page may show a series of five or six products in one column, and the assays, remarks, etc., in a parallel column, thus making a highly effective presentation.

An alloy containing 47 to 50 per cent. silicon, 15 to 25 per cent. calcium and 2½ to 6½ per cent. of aluminum is now on the market. It is used for the deoxidation of another metal, silicon, aluminum and calcium being very energetic reducing agents. Added to molten steel in the ladle, it calms the steel and enables the tapping of sound ingots. The product of the reaction is a double silicate of calcium and aluminum, which melts very easily, the slags ascending to the surface of the steel. The new alloy is said to give better results than aluminum, even when it is added into the ingot mold itself, because it forms an easily fusible slag which disengages from the steel.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Tonnage Estimation in Dumps, Open Cuts, etc.

The article by R. J. Donaldson in the JOURNAL of March 27, 1909, on estimating tonnages in dumps, open cuts, etc., has suggested several practical cases that I have met with during my mining experience. Taking up the subject of open-cut measurements first, I am reminded of a system I used at the Bertha zinc mines in Virginia in 1890-91. The ore was originally extracted there by the open-cut method, and a contract had been let for stripping the overburden, paying for the same by the cubic yard.

Those readers who are familiar with the occurrence of the Bertha ores will remember that they lay in pockets and bunches upon the limestone, which had weathered away into an extremely irregular surface formed of deep cavities and high "chimneys." The limestone was overlaid by a deep covering of clay formed from its decomposition.

It was impossible, without consuming much time and labor, to measure the quantity excavated by any system of cross-sectioning, in which the numerous irregularities in the bottoms of the cuts could be taken and recorded. The original surface of the working area was, therefore, divided into 10-ft. squares, and the elevations taken at the intersection points. The elevations at the projection of these points were taken when the estimate measurements were made each month, and the volume determined by planimetering the plotted vertical sections of 10-ft. intervals.

The lines running in one direction were numbered 1, 2, 3, etc., and those at right angles to them were designated A, B, C, AA, BB, CC, etc. Three leveling instruments set at different hights were used, and a long cord having leather tags 10 ft. apart could frequently be stretched parallel to the face of the cut where jutting ridges permitted parallel lines of stakes to be set to fasten the cord. A ring, through which was passed a long line with a plummet attached, was placed on the tagged cord, and the rodman would flip the ring to a tag and determine the point on the ground with the plummet. Frequently all of the instruments would be set too high to take a reading on the rod, in which case the rodman would tie the ring of a tape to one end of the plumbline and pull it up until the cross hair of the instrument would cut the tape ring. The distance to the ground would then be called to the instrument man.

A unique system of note keeping was used, and as I remember it, was as shown in the accompanying sketch:

SYSTEM OF NOTE KEEPING.

Inst. No. 1. Ht. = 112.40			Inst. No. 2. Ht. = 96.30			
A1	A2	A3	A4	A5	A6	A7
10.4	8 6	12.5	3.1	7 6	10.2	12.5
B1	B2		B3	B4	B5	
9.8	12.4		6.2	8 7	10.2	

Inst. No. 3. Ht. = 80.42						
B6	B7	C1	C2	C3	C4	C5
2.1	6 4	0.5	8.3	10.8	12.5	15 2
C6	C7					
20.7	23 1					

The hights of the instruments were determined by turning points from bench marks in the usual way, recorded in another portion of the book, and copied on the page, as shown in the sketch. The remaining notes represent the stations at the intersections of the 10-ft. squares, with the rod readings placed under them.

While engineer for the Ducktown Sulphur, Copper and Iron Company, I was required to estimate a large quantity of ore that had been broken in the West vein of the Mary mine, and lay upon and around a timbered gangway. The ore had been stoped on contract by the ton, and as the mine was being closed down for some time, it was necessary to obtain a close estimate of the tonnage in the piles, in order to settle with the miners. As the surface of the broken ore was very irregular, and it was impossible to get at the sides of it, I was unable to measure it by a direct method. All of the ore from the vein had been stoped on contract by the ton, and a complete record of the tonnage trammed from it was available. I had taken precise cross-sections of the opening at 30-ft. intervals, and was able to compute the volume of the ore stoped from it. To get at the weight of the ore in place, I determined the specific gravity of several representative samples, and took an average of them. I found this to work out to almost exactly 9 cubic feet to the long ton, which was the unit used, the company being an English concern. By deducting the amount mined and shipped from the total quantity stoped, I derived a close estimate of the quantity remaining broken in the mine.

It frequently happens that an engineer for a mining company is called upon to estimate small quantities of broken material that has been left in the mine or on the surface, and is inconvenient for the company to move and weigh. This material has usually been broken or transported by laborers on contract, and it is essential to obtain an accurate estimate of its quantity. It is generally piled in irregular masses where the surface has not been previously determined. I have frequently attempted to make estimates of this kind, and I must say that Mr. Donaldson's statement, "when called upon to measure a dump on irregular ground, with no previous levels on record, a vivid imagination is exceedingly useful," is just as exceedingly true. However, I have sometimes found that the parties who are to be paid for the material have not much respect for my imagination, and where my estimate has been checked by shipping and weighing, I have learned that my imagination was not always sufficiently vivid to afford them what was due. It is extremely unsatisfactory to make an estimate of this kind, and should be avoided if possible.

I estimated the ore reserves of the Tennessee Copper Company, by calculating parallel cross-sectional areas through the orebodies and deriving the cubical contents from averaging them, and multiplying by the perpendicular distance between. The density factor used was 8 cu.ft. per short ton. After obtaining the total tonnage of the developed orebody, I would deduct the amount mined and shipped to obtain "ore in sight." I think this is a more accurate method when the prismoidal formula is used, than that which Mr. Donaldson suggests, of measuring the areas of sections of "proved unstoped ores," especially where the stoped portion cutting two successive sections varies greatly in area, as it certainly does in the Ducktown mines. Of course, the closer together the sections are taken the more accurate will be the results in any method used. Careful records of the ore mined and shipped should always be kept by a mining company.

It might be of interest to state that the weight of the slag produced in smelting the Ducktown ores is just about equaled by that of the ore smelted. I found this to be true by measuring the slag dump of the Tennessee Copper Company, and computing its volume and weight. From the records of ore shipments, the weight of the ore smelted was, approximately, equal

to the calculated slag weight in a total of over 500,000 tons.

B. H. CASE.

Asheville, N. C., May 1, 1909.

Alumina in Copper Blast Furnace Slags

In reference to the discussion concerning the part played by alumina in copper blast-furnace slags, Mr. Beardsley, in his letter to the JOURNAL, Jan. 23, 1909, has ably supported my contention, and from his personal acquaintance with the materials has apparently put the matter beyond question. His affirmation, however, that my statement regarding the lime content of the slag was incorrect is a misinterpretation; I quoted from Heinrich's slags, Nos. 1 to 4, as given in Mr. Shelby's original paper, and did not know of the slags 5 to 9, which, I presume, were given in the 1886 article. These had not been quoted at all previously, and my remark, as applied to the slags quoted, was correct.

In Mr. Shelby's article in the JOURNAL of Dec. 26, 1908, he suggests an error, which I must admit had crept into my letter. I should have stated that the magnetic oxide floated on the "matte" instead of on the "charge." It was to be found both in the slag and the matte, and unlike Mr. Shelby's experience, I found that it was easily separated analytically, owing to its insolubility in acids, being unaffected by fusion with alkalis and its affinity for the magnet.

HARLEY E. HOOPER.

Richmond, Nelson, New Zealand, March, 16, 1909.

Zinc and Sulphur in Mexico

The zinc production in Mexico has experienced some revival with the removal of all duties on zinc ores into the United States. Anticipating the enactment of the Payne tariff measure, considerable ore has been rushed from northern Mexico into the States. The importance of the zinc deposits in northern Mexico has been greatly exaggerated in the tariff campaign. Most of the carbonate and silicate ore from Nuevo Leon, Coahuila and Chihuahua, has come from old lead silver workings, from which it was easily obtained. The general result of the operations on deposits of this class of ore has been to prove that they do not extend in depth, and that they will not, in the future, individually or collectively, yield zinc ore extensively. The future great production of zinc in Mexico will come from the treatment, by special processes, of the complex zinkiferous ores, which abound in nearly all of the camps. Heretofore these have been either left in the ground, or sent to the smelters where the zinc passes into the slag and is lost. In the cyanide camps zinc sulphide is not considered as detrimental to the process up to a considerable per cent. and passes into the tailings from which no attempt at recovery has as yet been made. Magnetic and pneumatic separation devices have been installed and operated at Charcas and San Luis Potosi, at Santa Barbara and Calera in Chihuahua, and at Ocotlan, Oaxaca. It is probable that these processes will be more extensively installed in the immediate future, and that flotation and other methods will be used to beneficiate the complex ores, making a marketable zinc product and at the same time improving the grade and quality of the ore for smelting or cyaniding. Some shipments of zinc ore from Taxco, Guerero, have been made to Europe recently *via* Vera Cruz. This ore is high in iron and lead and is not desired by the smelters in the United States. Large quantities of zinc ore exist in the camps of Zaucalpam, Temescaltepec, and Sultepec in the south of the State of Mexico, but they are entirely unavailable at the present time, owing to lack of railroad connection. Recently some promising zinc operations have been undertaken in Jalisco, Sinaloa and Sonora, in the districts tributary to the Pacific coast ports. This ore is mainly sulphide, and will be shipped by boat to Europe or *via* the Tehuantepec Isthmus line. Many of the Mexican zinc-sulphide ores carry silver, and the smelters in Europe pay about half the market price for the silver content over 5 oz. There is no export duty on zinc ores from Mexico, and the silver in these ores under 250 gm. is exempt from export tax.

Sulphur is being shipped from Mexico to Europe from the Los Cerritos deposits between Tampico and San Luis Potosi. All the product is in demand at good prices. The sulphur deposits at Conejos, near Torreon, are being worked intermittently to supply the dynamite factory, at Gomez Palacio, and for local demand. Other important sulphur deposits exist in Tamaulipas and in lower California, but they are not being worked, owing to their distance from the railroad. The much vaunted Popocatapetl deposit in the volcano, near Mexico City, is a myth. It is true that the Spaniards obtained sulphur from the crater for the manufacture of gunpowder, and at other times small supplies have been obtained for local uses. A few years ago the deposit was exploited in the interests of certain New York capitalists, and it was reported that there were millions of tons to be obtained. The fact is the supply is very limited, being merely incrustations of native sulphur on the rocks in the bottom of the crater in which there are a few vents which give forth continually vapors and fumes. The volcano is 18,000 ft. high, snow capped, and difficult of ascent, and the vents are at the bottom of a crater 2000 ft. deep, with steep walls, so that, considering the limited supply, and the difficulties of operation, Popocatapetl can be eliminated as a possible source of a sulphur supply now and hereafter. An interesting sulphur supply is found at Sierra Mojado, Coahuila, in one of the mines belonging to the American Smelting and Refining Company. Native sulphur forms the matrix of an ore containing iron and lead carbonates with silver. An effort was made to extract the sulphur by the use of superheated steam, but owing to the physical character of the ore, the resulting product in the retorts formed a slimy mass which retained the liquified sulphur by capillary action and prevented a successful extraction. A modification of the method of treatment is being investigated and if successful this deposit may become a considerable producer of sulphur as a by-product. At none of the smelters in Mexico is the sulphur from the fumes saved.

Separating Metals in Solution

Herbert H. Dow, of Midland, Mich., and Walter S. Gates, of Worthington, Can., describe in U. S. Pat. 913,708 and 913,709, March 2, 1909, a process of separating metals, particularly iron, copper and nickel, from the same water solution as precipitates, each substantially free from the others. The basic principle is, the purification of any precipitated metal by agitating the precipitate in a solution containing soluble salts of the more insoluble metal. The water solution of iron, copper and nickel is agitated in any suitable vessel with powdered limestone in an amount equal to the chemical equivalent of the iron in the solution. This results in the precipitation of most of the iron as a hydrate and by a prolonged agitation of the precipitates in the original solution, the iron precipitate is purified. The excess of iron salt slowly dissolves the copper and nickel basic carbonates contained in the insoluble ferric hydrate, and precipitates in turn more ferric hydrate. After a prolonged agitation with a proper reagent the ferric hydrate is found to be substantially free of the copper and nickel basic carbonates, and the solution free of iron. Similar steps are taken for the precipitation of copper and nickel. This principle can also be applied to the separation of aluminum from nickel and copper, as well as iron in both conditions of oxidation.

All of the leading mining companies in the silver-lead district of Western Tasmania, according to Consul Henry D. Baker, showed a diminution in their earnings during 1908, with the exception of several companies engaged in mining coal; this was the only mineral product whose value showed an increase over that of 1907.

New Publications

THE MINING MANUAL FOR 1909. By Wal- R. Skinner. Pp. 1425. 5½x8½ in.; cloth, 21s. London, 1909: Walter R. Skinner.

HANDBOOK OF SOUTH AUSTRALIA. By David J. Gordon. Pp. 344, illustrated. 7x9½ in.; board covers. Adelaide, 1908: C. E. Bristow, Government Printer.

THE CHEMISTRY AND LITERATURE OF BERYLLIUM. By Charles Lathrop Parsons. Pp. 180. 6x9 in.; cloth, $2. Easton, Penn., 1909: The Chemical Publishing Company.

REPORT OF THE DEPARTMENT OF MINES, PROVINCE OF NOVA SCOTIA, 1908. Pp. 169, illustrated. 6½x9½ in.; paper. Halifax, N. S., 1909: Commissioner Public Works and Mines.

PEAT DEPOSITS OF MAINE. By Edson S. Bastin and Charles A. Davis. U. S. Geological Survey, Bull. No. 376. Pp. 127, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

FISIONOMIA MINERA DE LAS PROVINCIAS DE TAYACAJA, ANGARAES Y HUANCAVELICA. By Enrique I. Dueñas. Boletin del Cuerpo de Ingenieros de Minas del Perú, No. 62. Pp. 197; illustrated. 6¼x9½ in.; paper. Lima, Peru, 1908: Ministerio de Fomento.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1906 AND 1907, WITH SUBJECT INDEX. By F. B. Weeks and J. M. Nickles. U. S. Geological survey. Bulletin No. 372. Pp. 317. 6x9 in.; paper. Washington, 1909: Government Printing Office.

THE SIGNIFICANCE OF DRAFTS IN STEAM-BOILER PRACTICE. By Walter T. Ray and Henry Kreisinger. U. S. Geological Survey, Bull. No. 367. Pp. 60, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

THE MINING YEAR-BOOK, 1909, WITH DIRECTORIES OF DIRECTORS, SECRETARIES, MINING ENGINEERS AND METALLURGISTS; GLOSSARY OF MINING TERMS. Edited by A. N. Jackman. Pp. 1230. 5½x8½ in.; cloth, 15s. London, 1909: The Financial Times.

WESTERN AUSTRALIA GEOLOGICAL SURVEY. Bulletin No. 31. Part I—The Bonnievale and Kunanalling Districts, Coolgardie, Goldfield. Part II—The Black Range District, East Murchison Goldfield. By Charles G. Gibson. Pp. 120; illustrated. 5½x8½ in.; paper. Perth, 1908: Western Australia Geological Survey.

LES ACCIDENTS DUS A L'EMPLOI DES EXPLOSIFS DANS LES MINES ET CARRIERES SOUTERRAINES DE BELGIQUE PENDANT LES 15 DERNIERES ANNEES 1893 A 1907 INCLUS. *Extrait des Annales des Mines de Belgique, tome XIV.* By Victor Watteyne and Adolphe Breyre. Pp. 268, illustrated. 6¼x9½ in.; paper. Bruxelles, 1909: Ministère de L'Industrie Et Du Travail.

ELEMENTS OF OPTICAL MINERALOGY. An Introduction to Microscopic Petrography. By N. H. Winchell and Alexander N. Winchell. Pp. 502; illustrated. 6x9½ in.; cloth, $3.50. New York, 1909: D. Van Nostrand Company.

Contents: Certain phenomena of light. Elements of mineralogy. Application of polarized light to crystalline substances. Description of minerals. Analytical tables. Appendix.

TEXT BOOK OF PETROLOGY. By F. H. Hatch. Fifth edition, revised and rewritten. Pp. 404; illustrated. 5x7 in.; cloth, 90c. London, 1909, Swan Sonnenschein & Co.; New York, The Macmillan Company.

This well known treatise is a summary of the modern theories of rock genesis, and includes a description of the rock forming minerals and the chief types of the igneous rocks. It is one of the most satisfactory works upon the subject of petrology and students will be glad to have it in this thoroughly revised form.

MINING METHODS IN EUROPE. By Lucius W. Mayer. Pp. 169, illustrated. 6¼x9¼ in.; cloth, $2.50. New York and London, 1909: Hill Publishing Company.

Contents: Mining in Great Britain. Mining in Germany, France and other countries.

This book does not pretend to be a broad treatise on the subject implied by its title, but rather is the journal of a visit for technical study among some important mines in Europe. Several of the chapters composing the book have previously been published as papers in the JOURNAL and elsewhere. They describe some interesting and unique mining methods and are well worth perusal.

ASPHALTS: THEIR SOURCES AND UTILIZATIONS. By T. Hugh Boorman. Pp. 172; illustrated. 7x10 in.; cloth, $3. New York, 1908: William T. Comstock.

Contents: Discovery and early use of asphalt. Rock asphalt mastic or asphalt coulé. Trinidad asphalt. Petroleum residuum and California malthas as a fluxing material. Venezuela asphalts. Cuban asphalts. American bituminous limestone. Bituminous asphalt sandstone rock. Manjak and uintaite. Late European work. Turkish and other bitumens. Developments of asphalt industry up to 1903. Asphalts in 1908. Asphalt in building construction. Dustless roads. Methods of surfacing roads. Asphaltic oils, their classification and properties. Application of asphaltic oils. Sprinkling with asphaltic oils. Latest views of engineers on asphaltic surfacing. Municipal asphalt plants. Asphalt waterproofing. Asphalt in roofing. Asphalt for manufacture. Asphalt machinery.

This is an interesting and valuable treatise upon an important subject in which the author is a well known expert.

THE WORLD'S GOLD. By L. de Launay. Translated by O. C. Williams, with an introduction by Charles A. Conant. Pp. 242; 5½x8 inches; cloth, $1.75. New York, 1908: G. P. Putnam's Sons.

The sub-title of this important work is "Its Geology, Extraction and Political Economy." The last is the main subject, the geological occurrence of the metal and the methods for its extraction being discussed as leading up to it. The geological treatise is of much interest and value, as naturally to be expected from this distinguished author. The treatment of the methods of mining and metallurgical extraction are far less satisfactory. The economic section is of absorbing interest. This deals chiefly, of course, with the great question of the day, viz., "Has the value of gold depreciated?," or "Is the rise of commodity prices due to the increasing production of gold?" While fully recognizing the effect of gold supply upon commodity prices, Professor de Launay holds, like many other economists, that that effect, one way or the other, is generally offset by other factors, and in general he denies the depreciation theory that has lately found much acceptance. In this we fully agree with Professor de Launay.

MILLWRIGHTING. By James F. Hobart. Pp. 401, illustrated. 6¼x9½ in.; cloth, $3. New York and London, 1909: Hill Publishing Company.

Contents: The millwright and what he is. Factory location. Laying out the buildings. The builder's level and foundations. Foundations and the carpenter's level. Erecting building and machinery foundations. Erection of buildings. Walls and machinery supports. Roof timbering and trusses. Strength of materials. Laying out shafting. Putting pulleys in place. Belts and belting. Setting up machines. Babbitting, scraping and lubricating. Steam and water pipe fitting. Erecting steam engines. Steam boiler setting. Some shop work. Water wheel setting.

The scope of this book is indicated by the table of contents reproduced above, but even the latter fails to give a thorough idea of the great variety of subjects treated by the author and the minuteness of his details. As a matter of fact he takes up every kind of work that the millwright erecting a building, a mill or factory, and setting machinery is required to do and his advice is uniformly sound. A distinguishing feature is its eminently practical character. It is an uncommonly good book and will be highly useful to engineers, including the mining, metallurgical and chemical, as well as to millwrights and erectors.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

R. Gilman Brown has been in West Africa, and will soon return to London.

Edward L. Dufourcq has left New York on a professional trip to Colorado and Mexico.

Washington B. Vanderlip has opened an office as consulting mining engineer at 42 Broadway, New York.

George D. Reid, who has been examining copper properties in Idaho and Oregon, has returned to Denver.

A. M. Yonge has been appointed general superintendent of the Aguacate mines, San Mateo, Costa Rica.

Quincy A. Shaw, vice-president of the Calumet & Hecla, is in the Lake country, on one of his semi-annual visits to the property.

Dr. W. F. King, chief astronomer of Canada, has been appointed superintendent of the Geodetic Survey of Canada, just established.

J. W. Astley, of Victoria, B. C., is in Ontario, making a trip in the Cobalt and Gowganda districts, with a view to following his profession there.

Emmet D. Boyle is completing the erection of the Nevada Gypsum Company's new plant at Mound House, Nev., and will remain at that place until June.

W. S. Keith has been appointed assistant manager for C. Christopher and associates, of Seattle, Wash., who have bought the rights of the Cotton matting furnace for several of the northwestern States.

George E. Farish, of Denver, Colo., and Mexico City, left Denver on May 3 to examine some properties in southern Mexico. His address for the next three months will be 2 Bucareli, No. 35, Mexico City, Mexico.

A. R. Wilson has resigned as superintendent for the Maple Leaf Coal Company, Frank, Alberta, having been appointed a coal-mine inspector by the government of Alberta for the district east of Lundbreck.

C. H. MacMillan, formerly superintendent of the Dominion Iron and Steel Company, at Sydney, N. S., who has been resting in Maine for a year or so, has been appointed superintendent of the steel department of the company.

Prof. Charles Baskerville, director of the Chemical Laboratory, College of the City of New York, will sail for London on May 15 on the steamer "Kroonland," to attend the Seventh International Congress of Applied Chemistry. He will be abroad all summer.

Ernest V. Moore, Herbert Garnett and Francis J. Bulask have associated themselves under the name of the Peat Engineering Company and established an office in Toledo, Ohio, where they will act as consulting engineers on all questions relating to the utilization of peat and peat bogs.

Norman W. Haire has resigned as general manager of the properties that comprised the Bigelow group in the Lake Superior copper district and is succeeded by James MacNaughton, general manager of the Calumet & Hecla. Mr. Haire will make his permanent home at Houghton, Mich.

R. M. Atwater, Jr., Robert Linton and R. de Sallier have been examining the Dominion Copper Company's mining properties, in the Boundary district of British Columbia, for the protective committee of dissenting stock and bondholders, who are opposed to the reorganization scheme of the majority.

A. S. Dwight has not taken charge of the Humboldt works as general manager for the Consolidated Arizona Smelting Company, as has been erroneously stated in the press. He is at Humboldt as consulting engineer, to try to develop a rational and safe program for resumption of operations, and is being assisted by Francis N. Flynn, mining engineer, of Globe, Ariz. Mr. Dwight will go from Humboldt to Douglas and expects to be back in New York early in June.

Obituary

J. Fewson Smith, a pioneer among Utah engineers, died at Salt Lake City, May 5. He was born at Preston, England in 1834 and educated as a civil engineer. He went to Utah in 1863, and there engaged in active work. He was employed in the construction of the Union Pacific and the Utah Central railroads and the Oregon Short Line. Later he located and supervised the construction of several narrow-gage roads intended to open the mining districts of Utah—among them the American Fork, the Bingham Cañon and the Pleasant Valley railroads. At different times he conducted extensive explorations in southern Utah and Nevada, and he always predicted an important future for the mineral interests of those districts. He was not a civil engineer only, but had done much mining work. For many years he held a commission as deputy mineral surveyor, and many of the more important mining camps in Utah are built up around the claims he originally located. This is especially true of Bingham, where he did so much of the early work. He also made many of the earlier government-land surveys in various parts of Utah; did some municipal work, and has frequently been called into consultation in matters of hydraulic installations, both in Utah and other western States. In this way he was connected with the early placer mining in southern Nevada. Between 1891 and 1899 he spent much time in Mexico, where he was engaged in engineering and exploration work in Chihuahua and Sonora. He served some years as chairman of the water commission of Salt Lake City. Some of his later work was done for the United States Smelting, Refining and Mining Company, for which his son, J. Fewson Smith, Jr., is mining engineer. A few years ago Mr. Smith retired from active work on account of advancing age.

Societies and Technical Schools

Coal Mining Institute of America—The summer meeting will be held at Punxsutawney, Penn., during the last week in June.

Coal Mining Inspectors' Institute of America—This society will hold its summer meeting at Scranton, Penn., beginning June 8 next.

Institution of Mining and Metallurgy—The annual dinner of the institution was held in London last week under the chairmanship of Edgar Taylor, the president for the present year. There was a large gathering of members and guests. The important work that the institution is doing in promoting and in maintaining a high standard for professional conduct, was referred to by the speakers.

West Virginia Coal Mining Institute—The next meeting will be held at Elkins, W. Va., June 1 and 2. The meeting, in considerable part, will be devoted to the discussion of accidents and their prevention. Addresses or papers are expected from J. A. Holmes, Frank Haas, W. A. MacCorkle, Clarence Hall, F. C. Albrecht, D. T. Evans and A. G. Morse.

Canadian Mining Institute—The fifth general meeting of the Western Branch of the Canadian Mining Institute will be held at Coleman, Alberta, on May 25, when several papers by members on mining and metallurgical subjects will be read and discussed. The branch numbers about 200 members, including all members of the institute resident in western Canada and adjacent parts of the United States. Thomas Kiddie, manager of the Le Roi Mining Company's smelter at Northport, Wash., is this year's chairman, and E. Jacobs, Victoria, B. C., secretary.

California Mineowners—At a large meeting of mineowners, held recently in San Francisco, the result of the discussion and deliberation was formulated in a resolution to the effect that a fair interpretation of the term "period of employment for all persons engaged in work in underground mines" should mean work "at the face" and not include the time taken by miners and other employees in going to and from the face, or the time taken for meals.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Goldfield, Salt Lake City, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 8—The El Dorado-Placer Dredging Company has been organized at Auburn, Placer county, to mine by dredges the auriferous bed of the American river, which stream forms the boundaries of Placer and El Dorado counties. Los Angeles, San Bernardino and Tucson men are interested, among them E. K. Hum, W. J. Variel, M. E. Williams, D. H. Gillan, B. F. Bledsoe and Thomas F. Wilson. The company has been organized under the laws of Arizona. The Northern California Mining Company, which recently started a new suction dredge on the Klamath river near Hamburg, owns many miles of the bed of the Klamath river. There are many large rocks and bowlders to be encountered and predictions of failure of enterprises have been made by old-time miners. It is already found that wood fuel is too expensive and arrangements are being made to use fuel oil. The first gold dredge in the Butte Creek section of Butte county was put in operation last week after several preliminary tests. Work has been commenced six miles southeast of Chico. Los Angeles men are the principal owners in this new enterprise.

The Appellate Court has handed down a decision adverse to the appeal of the Grand Pacific Gold Mining Company involving the Bully Boy placer claim in Calaveras county. The decision is to the effect that the San Domingo Gold Mining Company is awarded the mine on the ground that its title was properly obtained.

On application of R. G. Hart, the Superior Court at Yreka, Siskiyou county, has issued an injunction against Mitchell & Fairchild ordering them from making any excavations or doing any work on the Inyo or Digger Squirrel claim in Humbug district, a few miles from Yreka. Hart claims that he is the original locator and that the others have located over the same ground.

The Idaho-Maryland mine at Grass Valley, which has had 20 stamps at work for some time will soon have the other 20 of the mill at work, there being now ore enough coming out to keep them all busy. The ledge being now worked is quite wide and runs over $10 per ton.

After a year or more of experimenting, those in charge of the electric iron-ore smelter at Heroult, Shasta county, consider that they have made a commercial success of the project. The large new furnace was tapped for the first time last week. It is expected that the furnace will turn out about 200 tons of commercial pig iron daily.

Butte

May 5—In the case of the South Butte Mining Company against the East Butte Mining Company, the motion of defendant for a new trial was recently denied, and an appeal will be taken to the supreme court of the State. The court some time ago decided that the South Butte Company was entitled to the ground over which the dispute arose and also awarded the South Butte Company judgment for $19,531 as damages for the taking of ore from the disputed ground. It is reported that the Northern Pacific railway is planning to build from Mandan to Glendive. The route was surveyed two years ago.

The Montana State Railway Commission held a hearing last week at which the advisability of establishing joint freight rates between the Northern Pacific and the Billings & Northern railways was considered. The commission has taken the matter under advisement.

In the case of the South Butte Mining Company against Frank H. Cooney, the Federal district court has recently entered a decree in favor of the mining company quieting its title to numerous mining claims near the tracks of the Great Northern railway in the southern part of Butte.

Denver

May 7—A celebration of the fiftieth anniversary of the discovery of gold in Colorado by George Jackson in January, 1859, was held at Idaho Springs today, when a monument was unveiled and dedicated. It was erected on Jackson Bar, Clear creek, where the first gold dust and nuggets were found. Many pioneers, now leading men of the State, attended the ceremonies.

There is considerable loose talk just now in the local mining and quasi-mining papers of this State about the discovery of radium ore, meaning the pitchblende (uraninite) of the Wood and other mines in Gilpin county. In this connection it is important to remember that Dr. Richard Pearce was the first to note the existence of, and to identify, pitchblende, the commercial source of radium in that district. He not only identified the ore, but purchased all in sight and sent it to Europe, realizing a neat sum on the transaction.

The agitation here by the tungsten producers and the commercial association, it now appears, will result in a delegation being sent to Washington, to endeavor to secure enough votes to carry the amendment of Senator Guggenheim providing for a 20 per cent. ad valorem duty on the ore.

At Leadville, the Yak tunnel is said to be advancing at the rate of 10 ft. per day and will reach and drain the Dolly B. mine during the summer. The tunnel has already drained the Resurrection No. 1 shaft to within 35 ft. of the bottom. The Leadville district mill has been reopened, and is treating the sulphide ores from the Ibex lease. Work has also been started again on the Colonel Sellars zinc dump, and the product is being sent to the Empire Zinc Company's plant at Canon City.

It is reported today that the Golden Cycle Mining Company has purchased the property of the Pikes Peak Coal Company, in addition to the 1500 acres which it already owns in the coalfield four miles north of Colorado Springs, and will build a power plant at the Pikeview mine to supply power to its mill in the valley and its mine on Bull hill. It is stated that the initial cost will be $200,000, and it will start with a capacity of 1200 kilowatts.

Work was commenced on the aërial tram from the Midget mine, on Gold hill, to the Gold Issue mill, on Carbonate hill, a distance of two miles. This is following the lead of the Cresson company, on Raven hill, whose tramway paid for its construction in less than one year. It is said that many other mines more or less remote from the railway will adopt this plan of delivering their ores direct into the cars.

At Crisman, near Boulder, the better price and outlook for silver has resulted in the installation of machinery for the reopening and working on a large scale of the Yellow Pine mine, which is credited with the production of about half a million dollars in silver.

The mining exchange of Colorado Springs has declined to contribute $5000 toward the completion of the Cripple Creek deep-drainage tunnel, on the ground that the brokers were large stockholders of companies which had already contributed.

At Idaho Springs the Albro mine, which is credited with a production of gold and copper to the value of $600,000, is to be developed at a depth of about 700 ft. below the surface by a tunnel 1500

ft. in length, and which is already in 700 ft. Work was resumed on the tunnel this week. In the same camp a strike is reported in the Lucania tunnel of lead and copper ore. This tunnel is already advanced over 4000 ft. from the portal, and 2000 ft. more will put the heading under the upper end of Russell gulch, and drain the mines of that section. At Georgetown a strike is reported in the Sunburst mine on Democrat mountain, 2 ft. of high-grade silver-lead ore having been encountered.

At the silver camp of Aspen, the improvement in the price of that metal has already caused greater activity, and in the Della S., leased by the Smuggler company, a large orebody is stated to have been opened on the ninth and tenth levels. A joint pumping arrangement has been entered into by the Aspen, Durant, Argentum-Juniata, Mollie Gibson, Park Regent, Mineral Farm and Smuggler, the managers of which are to unite in installing a big pump on the Free Silver shaft. The Smuggler, which has hitherto pumped for these properties, is also increasing its working force.

At the mines around Ashcroft the same activity prevails, and on the big silver-lead Tam O'Shanter mine a ten-year lease, with option of purchase, has been granted to responsible men, and operations will begin as soon as the snow at that elevation (12,000 ft.) will permit. The asbestos deposits on Casper mountain, Wyo., are to be developed this summer for immediate production by the North American Asbestos Company.

Indianapolis

May 11—One important mining case to be tried in the Circuit Court this term is that of Benjamin Simpson against the Big Four Railroad Company for damages in the sum of $200,000. The suit grows out of the flooding of the plaintiff's mines, in Clay county, through the alleged negligence of the railroad company.

The suit is important because it is the first of the kind in the State and mine owners are interested in the result.

Simpson owns and operates a system of mines in Clay county through which the St. Louis division of the Big Four runs. When the improvements were made in the tracks of the company, the grade was lowered to a considerable depth through plantiff's coal lands, and in blasting an opening was made into a tunnel which Simpson had constructed under the track. Soon after this heavy rains came and the mines were flooded. The railroad company defends on the ground that Simpson had no right to make these tunnels without its consent or knowledge, and that the State law provides that all mineowners shall file a complete plan of their mines in the county recorder's office in the county in which they operate, and also with the State mine inspector, neither of which Simpson has done, it is alleged.

The announcement of the Indiana Steel Company that the construction of coke ovens for the local plant at Gary will begin immediately is received with favor by Indiana coal operators. The first lot of ovens to be built will number 560 and will use nearly 7000 tons of coal a day. The ovens are expected to furnish coke for the operation of ten blast furnaces. The site of the ovens is on the Gary harbor, just east of the blast furnaces now in operation, and will cover 300 acres of land. The gas from the coke ovens will be used for fuel in the mills and throughout the city and vicinity.

Two new coal-mining companies were incorporated during the past week. The Optimo Mining Company, with home office in Indianapolis and the Alliance Coal Company, also of Indianapolis.

In the case of Frank B. Mahan *vs.* The Hymera Coal Mining Company the Indiana Appellate Court holds that when a coal-mining company permitted the "wall" between two entries to be reduced in thickness to 5 ft., and then permitted a shot to be drilled and placed in this thin partition so as to blow out the wall from the other side and injure a workman employed in the adjoining entry, who had no knowledge of how thin such wall was, the depth at which the shot was placed, nor that it was about to be fired, the company is liable in damages. The court further held that the negligence of a fellow servant in placing and firing the shot concurred with its own negligence to cause the injury, is no defense to an action based on a complaint alleging that the injury was due to insufficient and unsafe thickness of the pillars left standing between the entries.

Salt Lake City

May 7—The business of the Government assay office at Salt Lake City showed a marked increase for April. The total value of the bullion handled during April was $119,420. The number of ounces was 13,080, the value of the silver in the bullion being $2057. The large customers of the Salt Lake office are the Consolidated Mercur Gold Mines Company with an output of $60,000 to $70,000 per month and the Bamberger Delamar Company whose bullion product amounts to about $40,000 per month. The remainder of the receipts is made up from various sources.

The permanent organization of the Utah Stock and Mining Exchange is being completed. The election of four additional directors is to take place on May 8. The work of fitting up the call room for the exchange has been delayed. It is expected that the exchange will start transacting business about May 15.

Tintic ore shipments during the past week were as follows: Centennial Eureka, 45; Eagle and Blue Bell (leasers), 1; Eureka Hill (leasers), 3; Bullion Beck (leasers) 2; Utah Consolidated (leasers), 1; Sioux Consolidated, 14; May Day, 5; Mammoth, 6; Beck Tunnel, 3; Black Jack, 13; Brooklyn, 5; Iron Blossom, 41; Dragon Iron, 35; Colorado, 23; Yankee Consolidated, 4; total, 205 cars.

The International Smelting and Refining Company has completed six of the seven miles of railroad track that is being constructed to connect the new smelter site of the company with the San Pedro, Los Angeles & Salt Lake railway's main line. A 500-ft. steel trestle has also been finished.

The month of April was the greatest month in the history of Bingham in the mining and transportation of ore, 6128 cars of ore being shipped. The greater part of this tonnage was shipped by the Utah Copper and Boston Consolidated companies. Of a total of 337,040 tons produced by the camp, the Utah Copper Company shipped 264,550 tons; the Boston Consolidated, 58,905 tons; the Utah Apex and Bingham-New Haven, with a few other companies, contributed the balance of the ore shipped.

The annual meeting of the shareholders of the Silver King Coalition Mines Company will be held on May 17. Up to date the Silver King mines have returned to the shareholders earnings in excess of $12,000,000.

The silver-lead smelting plant of the American Smelting & Refining Company at Murray, is out of blast by reason of a walkout of the foreign laborers who wanted a 25-cent increase, a restoration of the schedule of wages in force before the panic. While the mechanics and other Americans employed were not directly connected with the movement of the Greeks and Austrians, nevertheless they decided to stay away until the matter has been adjusted. The Murray plant has eight blast furnaces, but only five were in blast at the time of the walkout. These have been banked. Notices have been posted at the works stating that all foreigners employed at the smelter were discharged and would not be employed at the plant again. It is understood that the employment of American labor only is being considered.

Goldfield, Nevada

May 6—The available figures show that the production of Goldfield for April was somewhat below that for March. This is due to two causes: namely, the output of the Consolidated was cut down by prospecting the walls of the Hampton stope, with the result that much low-grade material was broken. There was also a curtailment in the production from other portions of the property. Two accidents to machinery at the Florence mill handicapped the output of this plant.

The shipments from the Nevada Consolidated and Cumberland-Ely mines in April were heavier than for any month since the first unit of the mill was put in operation last July. A new record was made for a day's output—6,500 tons of ore. It is expected that the fourth unit of the concentrator will go into commission about July 15, and the plant will then be able to handle between 8000 and 9000 tons of ore daily.

There is considerable interest manifested in the control of the Mayflower-Bullfrog Consolidated Mining Company. A. C. Eisen, president of the company, has issued a call for a special meeting of the stockholders of the company to be held at the home office in Rhyolite, May 15. This action by Mr. Eisen is taken as an effort to secure control by ousting the present directors and electing a new board of his own naming.

The estimated production of Goldfield during the first week of May was: Goldfield Consolidated, $256,000; Florence, $25,000; Combination Fraction, $20,000; Daisy, $6000; and miscellaneous mines and leases, $10,000, making a total for the week of $317,000.

Mexico

May 5—The new mining law will probably not come up at the present session of the Mexican congress. During the recess many points in connection with the law were raised by interested parties, relating more particularly to other sections than those which were given prominence in early objections to the new law—the so-called anti-foreign clauses. Inasmuch as the law is intended to be a codification of all the existing laws and decrees, it is exceedingly broad in its scope, and touches on many points that are naturally open for discussion. It is said that the delay in enacting the law is due to the necessity of much consideration of these new points and phases. The law really includes the substance of the famous "Ordinance of Mining" enacted in 1784, for the Colony of New Spain, and continued in force practically 100 years with some important modifications in 1892. These ordinances have been pronounced by legal students as the most complete and perfect mining laws ever enacted. In the form of the enactment of the new law by Congress the old laws, based chiefly on the modifications of 1892, continued in force, and these, in the main, are very good and satisfactory to all the mining interests of Mexico, foreign and local.

Considerable capital is being invested in Mexico in mining and industrial enterprises. A deal in Santa Eulalia, Chihuahua, has just been made and last week the engineering firm of Denny Brothers, of London and South Africa, closed a negotiation for the San Martin mine at Ocotlan, Oaxaca, paying in the neighborhood of half a million pesos for it. The mine was developed by Frank Leonard, of Butte, Mont., who represented the interests of F. Augustus Heinze. Much of the stock was held in Mexico City. Other Canadian and English companies have secured the Greene road in Chihuahua and are planning large hydro-electric plants for northern Mexico.

London

Whether the number of accidents in mines could be lessened by employing a larger number of inspectors was the subject of a debate in Parliament during the week. The supporter of the motion urged that the official statistics understated the number of accidents that occurred and that it was only the more serious ones that were recorded. No complaint was urged against the efficiency of the mine inspectors; the demand was that their numbers should be increased so that there might be less chance of the statutory regulations being broken. The Government was also urged to assist financially in the establishment of rescue brigades with proper equipment ready to give prompt assistance in the case of an explosion. The spokesman of the Home Department, which is responsible for the proper carrying out of the Mines Regulation acts pointed out that it would be unwise to lessen the responsibility of the mine officials. Under the present system inspectors visited mines on three occasions. They made an inquiry after an accident to see if that accident had been caused by neglect and to find out who was to blame. They also visited a mine when any complaint reached them showing a *prima facie* case for inquiry, and they also made occasional visits to see that the regulations laid down by law were being observed. It was, however, recognized that, owing to the increase of mining operations and to the extended use of electricity, many new duties were thrown upon the inspectors and that, therefore, an additional staff was, perhaps, required. It was not proposed, however, to make any changes until the Royal Commission on Mines, now sitting, had presented a report, which was expected within the next few months. It was further a difficult matter to decide what class of new inspector was required, whether there should be additional men of the standing and attainments of the present inspectors, or whether another class of less highly trained men should be employed as sub-inspectors. Many of the accidents that occurred in mines are due to carelessnes of the miners, which no amount of inspection can prevent. Rules are made, but are constantly broken. Many statistics were given showing the reduction in the death and accident rate that had been made, compared with former years. One speaker said that within the last 36 years the death rate from accidents in mines had been reduced by 40 per cent., notwithstanding the greater depth and extent of the mines.

The deaths from accidents were now 1300 a year, but if they had gone on at the same rate as 40 years ago they would be over 3000 a year. The regulations and the greater scientific knowledge saved, therefore, some 2000 lives a year to the country.

In Great Britain the accident death rate was more favorable than in many foreign countries. In 1906 the death rate in France was 1.29 per 1000 employed; in Germany, 1.88, or 50 per cent. higher than in this country; in the United States 3.2 per thousand, or 150 per cent. higher. In Great Britain there has been a general decline in the death rate. In 1901 the proportion was 1.34 per thousand; in 1902, 1.23; in 1903, 1.25; in 1904, 1.24; in 1905, 1.35; in 1906, 1.29; in 1907, 1.31, and in 1908, 1.32 per cent. While these figures were encouraging, it did not mean that the actual irreducible minimum had been reached. Germany and the United States had worse statistics, but Belgium and France slightly better statistics than England.

The report of the South Crofty mine in Cornwall, which has recently been re-equipped, gives particulars of the work that has been carried on during the past year. The average grade of the ore won was 32 lb. per long ton of tin and wolfram mixed. The ore also contains a recoverable value of 2s. 6d. in arsenic, which is now refined on the mine and not sold, as formerly, as soot. The mill was one of 60 stamps and the operating expenses have been reduced to under 20s. per ton. These costs include all mine-working costs, but are exclusive of London charges and depreciation. The production has reached 28 tons black tin in the fortnight and it is hoped shortly to increase that production to 30 tons.

During the past year wolfram averaged £89 11s. 9d. and the black tin, £77 5s. 9d. The arsenic averaged £8 1s. 10d. The company is now making profits and better results are expected by the management in the future, as the mine gets opened out in depth.

In spite of the fact that particular attention is paid to the ore-dressing department, some tin appears to be getting away as an offer has been made by a tin streamer to erect a slimes-saving plant below the company's mill. This offer the company has accepted, the manager considering that the work of the streamer would be a useful check on the extraction of his own plant. The tin streamer has to pay dues on his catch and to allow the company to compete with him if they find additional plant pays.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Tennessee Coal, Iron and Railroad Company—The rail mill at Ensley has been closed down, and the date of its restarting is uncertain. Alice furnace in Birmingham is undergoing extensive repairs, and some of the coke ovens are being rebuilt; as soon as the furnace is finished it is expected that it will be put in blast. No. 1 furnace at Ensley is also being repaired. Most of the coke which would otherwise be used at the steel plant and furnaces at Ensley will be stocked instead of closing down the ovens.

Alaska

PRINCE OF WALES ISLAND

The Mt. Andrew mine is making a shipment of 2400 tons of copper ore to the Tacoma smelter. The working force at the mine has been increased to 40 men. This shipment will stimulate other important mining operations in southeastern Alaska.

Arizona

COCHISE COUNTY

Copper Queen—All the ore from the Queen properties, except the Lowell, is now being handled by the Sacramento shaft.

Calumet & Arizona and Superior & Pittsburg—The April output was approximately 4,500,000 lb. of copper.

Wolverine & Arizona—After five years' work the first shipment of 500 tons of copper oxide was made recently. The ore contained about 11 per cent. copper.

GILA COUNTY

Inspiration—At a depth of 100 ft. a body of copper sulphide was encountered. The ore is about 12 ft. thick and is said to average 3.72 per cent.

MARICOPA COUNTY

Octave—Electric hoists are being installed in place of the steam hoists now in use. The enlarged mill will be ready for operation within three months.

MOJAVE COUNTY

Gold Road—Manager J. L. Phillips expects to begin stoping on June 1, or as soon as the electric-power line from Kingman is installed. On the 500-ft. level of shaft No. 1, the development work of the past year has opened up an oreshoot 1000 ft long and an average width of 12 ft. Chutes are being built. The grading and foundations for the new 40-stamp mill, tube mills and Butters filter process are about completed, and it is expected that the plant will be in operation Oct. 1.

Tom Reed—The new hoisting equipment at No. 2 shaft is in place, and the work of sinking will be resumed at the 250-ft. level. Contracts for grading for the foundations of a modern slime plant, to replace the present mill, have been let. The new 80-ton mill is expected to be in operation in three months.

YAVAPAI COUNTY

Yavapai Water, Oil and Mining Company—A new company recently incorporated by William Lee, Frank Pederson and others; capitalized at $1,000,000; principal place of business, Jerome; place of operations will be near Jerome Junction, where prospecting for water and oil will be carried on. A carload of machinery is ready for delivery.

Arkansas & Arizona—The diamond drill recently purchased is being installed in the 600-ft. level, and 450 ft. from the working shaft.

North Verde—Three shifts of men are employed. This was made possible by the installation of the new Cameron No. 9 station pump, which is handling the water easily. Sinking will probably be continued to a depth of 1000 feet.

Mescal—It is confidently expected that work will be resumed during the coming month. The Arizona Power Company will, by that time, be prepared to deliver power to its consumers in this district.

Yarnell—A new company has secured this old gold mine. The 20-stamp mill will be remodeled. C. J. Price is president; T. J. Sparks, general manager.

California

BUTTE COUNTY

Bills—Quite an important strike has been made in this gravel mine on the old Blue Lead channel in Bangor district, 14 miles from Oroville.

CALAVERAS COUNTY

Bouward Extension—Thompson & Smith have resumed sinking on this mine near Angels and the pumping plant has been increased in capacity.

Reiner—The new 20-stamp gravel mill has been completed. The Cornish pump in the shaft will be run by steam, but the other machinery will have electric power. Superintendent John C. Benson has a large force of men at work. The channel will be drifted from the bottom of the new three-compartment shaft.

EL DORADO COUNTY

Alliance—This property near Newtown bonded to Burger, Benton and other Stanislaus county men, is having built a new gravel mill with a capacity of ten tons hourly. The body of gravel recently struck runs $3 per cubic yard. A new tunnel is being run. Rich quartz has been found in the same vicinity by the same men.

Cambrian—This mine near Coloma, idle for several years, is to be reopened under superintendence of C. E. Seymour.

Captain Ames—This old gravel claim in Chili ravine, idle for years and supposed to be worked out, has been reopened by Marshall & Harris and they are now taking out gravel worth $3 a carload.

Crown Point—James Richards is reopening this mine which has not been worked for some years.

HUMBOLDT COUNTY

Salmon Summit—At the annual meeting at Arcata it was decided to complete the erection of a small stamp mill and begin active development of the mines at Salmon Summit. F. A. Smith is secretary of the company.

INYO COUNTY

Red Rose and Ivanhoe—Ore is now being crushed in the arrastre of E. G. Rudolph which is driven by an overshot wheel.

Sacramento Mines Company—This company in the White mountains, 15 miles from Bishop, is having its machinery put in shape for increased development

KERN COUNTY

Sidney Annex—Good ore is being milled. A new compressor has been added to the equipment. The mine is three miles from Johannesburg, and as owned by D. V. A. Williams.

MARIPOSA COUNTY

Sarle—The new quartz mill has been started up on ore from this mine

MODOC COUNTY

Sunshine Group—Schaeur, Bassler & Laughlin, leasers, have been shipping ore to the Grigsby mill which averaged over

$100 per ton. Drifts are being run on the vein.

NEVADA COUNTY

Nichols—The pump has been started and as soon as the mine is unwatered and some development work done, values are to be determined.

Oustomah—This mine at Nevada City is yielding $40 ore at present. The shaft, now about 1000 ft. deep is being sunk deeper.

PLACER COUNTY

Three Stars—Superintendent A. Maltman has pumped out the Belmont shaft at Ophir, and as soon as the hoist is in order, will begin development work.

SACRAMENTO COUNTY

Stroup—On the new quartz mine being opened on the Uriah Stroup place near Folsom, a pump has been installed in the 135-ft. shaft, and increased development work may now be done.

Colorado

LAKE COUNTY—LEADVILLE

Iron Silver—An aërial tram is to be installed on the Tucson mine, to transport the ore 1200 ft. to Graham Park, to which point the railroad will extend the switch. A steady output is being maintained by the North and South Moyer and the Tucson mines; daily shipments are also being made from the Moyer dump.

Tenderfoot—The ore recently opened at a depth of 150 ft. has developed into a well defined shoot from which 30 tons daily are being shipped.

Big Six—Fourteen cars of iron ore were shipped last week from this property on Breece Hill.

Alps & Aztec Consolidated—It has been decided to develop the group of claims owned by this company on east Ball mountain, by means of a tunnel. The shaft on the Champion claim, however, will be continued. It now has a depth of 230 ft. Electric power is to be installed.

Silent Friend—A lateral is being driven to connect with the Yak tunnel through which the ore will be shipped.

Valley—Heavier machinery is to be installed after which the output will be doubled.

SAN JUAN COUNTY

Silverton Smelter—The old Kendrick-Gelder smelter, owned by the Ross Mining and Milling Company, has been sold to W. B. Lowe, of New York, the consideration named being $60,000. This plant is only equipped for copper smelting but it is stated that a lead furnace is to be added and the plant put in operation this summer.

TELLER COUNTY

Union Leasing Company—This company, operating the Gold Dollar Consolidated, Prince Albert, two blocks on El Paso, Pinto, Deadwood, Mountain Monarch and North Star mines, is credited with a production during April of 2100 tons of a gross value of $57,000.

Gold Coin—A strike is reported of 2 ft. of ore running 3 oz. in gold to the ton. This mine has produced about $6,500,000 in the past, and is situated within the corporate limits of the town of Victor. It is now operated by 30 sets of lessees and the April output is given at 2000 tons of $30 ore.

Modoc—Smelting ore has been encountered on the 900-level of this mine.

Drainage Tunnel—The deep drainage tunnel has now been driven a total of nearly 8500 feet.

CLEAR CREEK COUNTY

Humboldt—This property on Ute creek, has sent a $9000 bar of bullion, the product of a 30-day run, to the Denver mint.

Gem—A strike of 18 in. of high-grade silver-lead ore was made on this mine which is worked from the Newhouse tunnel.

Silver Horn—A body of gray copper ore, running high in silver, has been disclosed in an old stope in this mine on Ute creek.

Burns-Moore Tunnel—It is expected that this tunnel, the portal of which is in Chicago creek, and which is already driven 4000 ft., will during this year tap the Silver Horn and other former large shippers that closed down on account of the large volumes of water encountered.

Georgia

BARTOW COUNTY

Pittsburg-Bartow Mining Company—This company controls a tract of 600 acres of ore land and has practically completed the necessary construction work for active mining, including a tipple and sidings and the installation of loading and mining machinery. The plant has also been equipped with pumps and pipe lines, as the ore is such that some washing is required. The mine will be open-pit. The company expects to be shipping ore about the middle of May. For the present the company will sell its product as merchant ore to southern furnaces, but eventually other manufacturing operations are expected to be carried on. Thorough soundings and investigations of the deposits have been made and these show that a large block of ore is in sight. Geo. M. Koehnline, Wheeling, W. Va., is president and general manager of the company, and Walter Kennedy, Pittsburg, is serving as consulting engineer.

Idaho

SHOSHONE COUNTY

Black Horse—A 12-in. vein of rich zinc ore was encountered in a drift 400 ft. from the end of a 900-ft. tunnel.

Blue Bell—A contract was let recently for another 100 ft. of drifting.

Bunker Hill—A suit was recently commenced against this company by the Springston Lumber Company for the recovery of the value of certain logs alleged to have been appropriated by the mining company.

Pittsburg Lead—The suit of Joseph P. Keane against the Pittsburg Lead Mining Company involving the ownership of 20,000 shares of stock has been decided in favor of the defendant. A notice of appeal has been served.

Sheridan—Fourteen inches of good milling ore was recently opened at a depth of 200 feet.

Monarch—It is reported that the 75-ton mill will be increased to one of 250 tons capacity. To date nearly 1000 tons of concentrates have been shipped.

Indiana

SULLIVAN COUNTY

In a formal sale of the John R. Walsh and J. K. Seibert mining properties in this and Greene county, the bondholders represented by the Equitable Trust and Savings Company, of Chicago, purchased the property for $1,500,000. The bid made by the bondholders was the only one, the only other formidable competitor, the United States Steel Corporation, having been blocked from the deal.

The sale was made at 10 a.m., May 1, on the court-house steps in Sullivan, and the deal was consummated soon afterward. The sale includes more than 15 of the best mines in the territory, and the name will be changed from the Indiana Southern & Southern Indiana Coal Companies, to the Alliance Coal Company. The new company will have complete control of more than 20,000 acres of valuable coal lands in Sullivan and Greene counties.

Michigan

COPPER

Lake navigation has opened after an extended blockade by ice at the Soo. Boats are at the Calumet & Hecla docks, and also the Copper Range, loading with copper.

Michigan—The old adit on the Bee tract has been driven about 80 ft. and throughout its length good copper ground has been revealed. This opening lies about 2500 ft. east of "C" shaft and the strike is about 90 ft. north of the Calico vein.

Mass—It is planned that within 3 months the mine will be able to ship about 500 tons daily to the mill.

Lake—Drifting at the end of the cross-cut driven from the 3d level to open the

formation is underway. This drift is in 70 ft. and shows a very fine state of mineralization throughout. The north drift from the second level is also in good ground. It is expected that in the near future this company will issue 10,000 shares of stock at $25 per share to provide working capital.

Adventure—This company has decided upon the site for its new shaft to expose the three lodes that were cut by the drill cores. All the necessary machinery to handle this work is on the ground and sinking will be under way early in May. It is proposed to sink this shaft vertical until the first lode is cut, and then turn the shaft to conform with the pitch of the vein.

Ahmeek—The two new shafts are down over 200 ft. and are sunk at an angle of 80 deg. until the lode is reached, when they will turn to the angle of the formation. They start from a central point and diverge. It is expected that the Kearsarge lode will be cut at about 1200 ft. The lower levels of the two producing shafts are encountering some fine mass and heavy stamp copper. These shafts are equipped with a very efficient skip-loading device. On a trial run recently 148 five-ton skips were hoisted in eight hours. The framework of the stamp mill is completed and the building is rapidly being inclosed and, barring some unforseen delays, will be ready to handle rock early the coming fall.

Elm River—The report for the year ending March 31, 1909, states that the development work during the year was 750 ft., in shafts and crosscuts. The treasurer's report Jan. 1, 1909, shows mining and general expenses, $34,984; receipts from interest and rent, $3,402; balance on hand, $54,760.

Tamarack—At the annual meeting, May 6, the management was transferred to the Calumet & Hecla Mining Company by the election of a new board of directors as follows: Rudolphe L. Agassiz, Quincy A. Shaw, George A. Flagg, Alexander Agassiz, Francis W. Hunnewell, Francis L. Higginson and James McNaughton.

New Arcadian—The new company has filed articles of association. The formal transfer of the Arcadian property to the New Arcadian will be made within the next few days.

North Lake—This company has exposed three copper bearing lodes on its lands by means of drill cores, one lode being 30 ft. thick and showing about 10 ft of good copper rock.

Atlantic—This company continues sinking its Section 10 shaft and a depth of about 2200 ft. has now been obtained. No material change is being noticed in the character of the formation. Several of the drifts are in nearly 500 ft. from the shaft without encountering any consistent run of paying ground. The best showing to date had been made in the lateral openings from the 13th and 15th levels.

Missouri

St. Francois County

The strike of the miners for an advance of 30c. per day has spread to all the mines in the Flat River lead district, excepting the Deslodge and National Lead Company mines. As the Miners' Union is not well organized in this district, the strike is not expected to last long; thus far the men have been quiet and peaceable. Many of the old miners are leaving for Joplin and other mining camps.

Montana

Butte District

Amalgamated—Trouble with the gases generated by smouldering fires in the old stopes of the Anaconda Copper Company properties has increased within the past week. Operations have recently been practically suspended in the Anaconda, St. Lawrence, Neversweat and Parrot mines on account of the gas. At the annual meeting of stockholders of the Boston & Montana Mining Company, held recently in Butte, the following were elected directors for the ensuing year: Sidney Chase, John D. Ryan, B. B. Thayer, David B. Hennessy and Andrew B. Grafuis.

Butte Central Copper Company—Work on the Ophir claim, preparatory to the resumption of operations, has been started. It is expected that by June 1 the work of sinking the shaft from the 500- to the 1000-ft. mark will be started.

Beaverhead County

Gilmore & Pittsburg Railroad—The road is being built between Armstead, in Beaverhead county, and Gilmore, Idaho. Two locomotives and about 20,000 tons of steel rails have recently been ordered. It is possible that the road may be in operation by Jan. 1, 1910.

Fergus County

Cumberland—A. S. Wright has secured an option on this property, situated at Maiden.

Gallatin County

Gallatin Valley Electric Railway—Some work has been done on the grading for the new road. Charles B. Anderson, secretary of the company, is in Spokane for the purpose of purchasing machinery.

Storrs Mines—E. A. Bartel has secured a lease on the coal mines of the Amalgamated Copper Company at Storrs, and will begin operations within a short time. The mines have been closed down for several months.

Granite County

Hell Gate Coal Company—This company has recently been incorporated with a capital stock of $250,000. The properties are situated at Hell Gate. The following are the incorporators, all being residents of Missoula, Montana: Henry L. Shapard, William W. West, John J. Murphy, John E. Kane, Joshua Fleming, William Crawford and Walter W. Murphy.

Missoula County

Monitor—This property, situated at Saltese, has been closed down for the last two months. It is reported that operations will be resumed by June 1.

Montana-Clinton Company—This company has recently been organized to take over the property of the old Triangle Mining and Development Company, situated at Woodville gulch.

Nevada

Esmeralda County—Goldfield

Florence—The ore reserves are constantly being increased by new discoveries showing high grade, milling and shipping ore. The production of the mill for the month of April was lower than previously estimated due to accidents to machinery.

Consolidated—A shipment of one carload a day of high-grade ore is being made from the Hampton stope, one carload consisting of 33 tons gave returns of 72.84 oz. gold per ton.

Esmeralda County—Horn Silver

Great Western—In the winze being sunk from the 300-ft. level, 3½ ft. of ore was discovered last week. The mine is maintaining its regular shipment of three carloads per week.

De Votie Lease—A shipment of 16 tons of ore will be sent out this week.

Horn Silver Townsite Company—A contract was made last week for the sinking of a well. It is expected that a good supply of water will be obtained at a depth of 700 feet.

Nye County—Bullfrog

Montgomery-Shoshone—A body of good gold ore was recently opened between the third and fourth levels from which shipments are now being made. Stoping is carried on at the 500 level of the Polaris vein, from which a good grade of milling ore is being taken. Two machines are at work in the Glory Hole, the boundaries of which have not been reached. Additions are being made to the mill equipment and more machinery is expected to arrive about May 20.

Nye County—Pioneer

Pioneer Lease—Shipments of ore are maintained at the rate of 75 to 100 tons per day. At present six machine drills are being operated, two on the 156-ft. level and the remaining ones in the big stope on the lower level. The 12-drill

compressor plant has arrived and is being installed.

NYE COUNTY—TONOPAH

MacNamara—The main shaft was completed to a depth of 790 ft. April 25, and last week a station was cut at the 775-ft. level; a crosscut was started for the vein which was recently cut by the shaft.

Montana-Tonopah—The crosscut in the foot wall of the Triangle vein in the stope from the 390-ft. level has developed between three and four feet of high-grade milling ore. The drift on the Martha vein on the 515-ft. level is in continuous ore, with occasional bunches of high grade. The mill is making an extraction somewhat under the average, due to oxydized ore. Several improvements are now under way which it is thought will remedy this defect.

New Jersey

SUSSEX COUNTY

Lafayette Slate Company—This company has been incorporated to work the slate quarry at Lower Lafayette. The office is in Newton, and the incorporators are A. J. Graey, L. H. Morris and F. R. Snyder. The quarry has been opened for some years; the new company will extend the workings.

North Carolina

ASHE COUNTY

Standard—The Standard Mining and Milling Company was recently incorporated at Asheville. Capitalization, $20,000. Incorporator, R. S. Smith.

CHEROKEE COUNTY

Alba Mineral Company—This company was recently chartered at Kinsey to acquire and develop mining property. Capitalization, $10,000. Harold Smith, of New York, and others are interested.

CLEVELAND COUNTY

Catawba—Work is being done at the old Catawba gold mine near King's mountain. It is reported that a movement is on foot to resume work at the old tin mines in this vicinity.

JACKSON COUNTY

Consolidated Nickel—Machinery for this mine is now being freighted from the railroad. A 900-h.p. Corliss engine is being installed. The power house is 95x95 ft.; boiler room, 50x50 ft.; wareroom, 80x30 ft. Work of construction is under the direction of A. S. Watson and J. G. Van Hurst, of New York. G. A. Adams is head of the company.

South Carolina

ABBEVILLE COUNTY

Saluda Copper Company—It is reported from Anderson that work is actively being carried on at this property. The mine is near Donalds. A consignment of machinery has been received.

CHEROKEE COUNTY

Flint Hill Mining Company—This is a new company recently organized at Gaffney with a capital of $250,000. L. U. Campbell is president and general manager. It is reported that a system of modern machinery will be installed at an early date.

South Dakota

CUSTER COUNTY

There is now little doubt that tin mining on a large scale will be carried on in the Black Hills, provided careful prospecting and development bear out previous indications and reports. The Harney Peak Tin Mining, Milling and Manufacturing Company has been reorganized under the laws of Maine. Dr. A. R. Ledoux, for 15 years receiver for the old company, has been given the management under the new company.

LAWRENCE COUNTY

Lucky Strike—On May 5 the new mill was started. Twenty of the 30 stamps are now dropping and the management reports enough ore in sight to insure continuous running at full capacity.

Utah

JUAB COUNTY

Tintic Central—As soon as the power plant completes its connections, the new hoisting plant will be put in operation. The shaft is now at a depth of 235 feet.

East Tintic—The new plant, consisting of a 50-h.p. engine, 100-h.p. boiler, 5-drill compressor and a 50-light electric plant is now in full operation. Work has been started in the shaft and stations will be cut at the 130- and 230-ft. levels.

McKinley—The stock of this company will soon be listed on the Salt Lake Exchange. A winze is now 75 ft. below the 500-ft. level, and the shaft is to be continued and crosscutting done on the lower levels. The property is situated west of the Centennial Eureka mine.

Beck Tunnel—The ore, now being sent to the smelter is taken from the old workings and from the 300-ft. level of the new workings.

Virginia

TAZEWELL COUNTY

Big Vein Pocahontas Coal Company—This company has leased the Browning properties and will extend the present workings, putting up new buildings and machinery. The company was recently organized in Baltimore; A. D. Macfarland is engineer in charge at the mines.

Washington

Col. C. Christopher and associates of Seattle have purchased, from the State Mining and Smelting Company, the patent rights of the Cotton matting furnace for the States of California, Oregon, Nevada, Arizona and New Mexico.

LEWIS COUNTY

Mendota Coal and Coke Company—Twenty dwellings are to be erected for the use of the employees at the mine at Tono. The camp will have a water system, school house and other improvements, thus indicating a permanency of coal-mining operations at this point.

Wyoming

CARBON COUNTY

United Smelters, Railway and Copper Company—Treasurer I. N. Nennock announces that more than 85 per cent. of the outstanding stock of the Penn-Wyoming has been sent in and exchanged for securities of the new company. This means that more than $7,500,000 par value of the Penn-Wyoming stock is now owned by the new company. The Penn-Wyoming is capitalized at $10,000,000, but of this only $8,963,000 was issued.

Philippine Islands

BENGUET

Benguet Consolidated Gold Mining Company—This company reports for February a production of 150 oz. gold and 200 lb. cyanide bullion.

Poracale Gold Dredging Company—The dredge returns for February show a return of 630 oz. gold.

Philippine Gold Dredging Company—The new dredge of this company is now being installed on the Paracale river, above that of the Paracale Dredging Company.

CAMARINES

Much prospecting is going on, according to the *Far Eastern Review*, of Manila, and the indications are that there will be much activity in placer mining this year.

Delabaybay Dredging Company—The machinery for the gold dredge has been received, and is being put together.

San Mauricio—Preliminary work is being done for the 20-stamp mill at Mambulao. The old workings in the mine have been cleared out and retimbered. About 1500 ft. of development work has been done.

Tumbago—Preparations for active work are well advanced. The old workings have been cleared out and are being extended. A five-ton Huntington mill will soon be ready to run. A stamp-mill will be added later, if results prove as favorable as expected.

Canada

ALBERTA

Canadian-American Coal and Coke Company—General Manager Muller, at

Frank, is opening two levels from the shaft sunk earlier in the year, at 240- and 350-ft. depth, respectively. The headings are in a seam of clean coal varying from 10 to 14 ft. in thickness. These new workings will add 200 tons per day to the output, making about 700 tons in all.

British Columbia

G. O. Buchanan, of Kaslo, supervisor of lead bounties for Canada, has announced that the total amount earned as bounty on lead mined in Canada during the fiscal year ended March 31, 1909, is $307,433, this representing the bounty paid by the Canadian government on an output of 41,986,475 lb. lead. Revised official figures show a production of nearly 43,200,000 lb. of lead in British Columbia in the calendar year 1908.

British Columbia—Lardeau

Ferguson Mines, Ltd.—F. C. Merry, of Ferguson, superintendent, has resumed shipment of ore from the Silver Cup mine, navigation on Trout lake being once again practicable after the winter freeze-up. Last year's output was about 1560 tons averaging more than 100 oz. silver per ton and nearly 30 per cent. lead.

British Columbia—Nelson

Eureka—After tunneling about 700 ft. about 10 ft. of good copper ore has been encountered at a depth of approximately 300 ft. below the surface.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ended May 1 were: Buffalo, 44,620 lb.; Cobalt Central, 43,270; Chambers-Ferland, 40,000; La Rose, 254,500; McKinley-Darragh, 57,340; Nipissing, 120,660; O'Brien, 128,018; Temiskaming, 132,800; Trethewey, 191,988; total, 1,013,196 pounds.

La Rose—The number of men employed is 260, and large additions to the force will be made during the next few weeks, when active development of the Lawson, Princess and University is undertaken. Very rich ore is being taken from No. 3 shaft, averaging 10,000 oz. to the ton. The vein at the bottom of the shaft shows 5 in. of this grade in addition to wall-rock rich in native silver. A raise has been made from the level in MacDonald tunnel 80 ft. to the surface and stoping has been started.

Yukon

The new Herbert district, tributary to Forty-Mile, including also Little Dome creek, is also the scene of much activity as indicated by the applications at the gold commissioner's office for ground. A good development is predicted.

Yukon Basin Gold Dredging Company—A gold dredge with a capacity of 3000 cu.yd. per day, for use in the Klondike, has been shipped from Vancouver, B. C., to Skagway, Alaska, whence it will be taken to its destination on Stewart river. It is of a New Zealand type, was manufactured in Glasgow, Scotland, and prepared for shipment north at Vancouver. The company has large concessions along Stewart river.

Mexico

Chihuahua

Parral Output—The production of the camp for the week ending April 30 was 9120 tons, of which 5650 tons were of milling grade and were treated locally.

New Camps—Two new camps, the Vallecillo and Real de Nogales, in the municipality of Zargosa, Hidalgo district, readily reached from Parral, are giving considerable promise. The former shows ores of copper-gold content and the latter lead-silver.

Rio Plata—The report of March operations contains the following items; Net returns on shipments of concentrates and crude ore, $26,671; operating expenses, $8000; paid account mine indebtedness, $18,670 leaving an indebtedness of $31,275 on the mine.

Mexicana—Geo. B. Jacobs and associates are sending out from this mine in the Cerro Colorado section, near Ahumada, a small tonnage of high-grade lead-silver ore. It is the intention to install machinery shortly.

Mexico

Mexico Mines of El Oro, Ltd.—Report for April: Yield of bullion, $110,120; total expenses, $45,540; profits, $64,570; expenditures on permanent improvements, $1000; net value of 20 tons shipped during month not included in the above profit, $6570.

El Oro Mining and Railway Company, Ltd.—Report for April: Yield of bullion, $215,190; total expenses, $130,410; profit, $84,780; profit on railway, $4000; total profit, $88,780; expenditures on permanent improvement, $8000.

Central America

Costa Rica

Aguacate Mines—At these mines, San Mateo, a 100-stamp mill is being erected under charge of Thomas D. Murphy. The Pardy Engineering Company is putting in a hydroelectric plant, which is expected to furnish 4500 h.p. The mines are in charge of A. M. Yonge as general superintendent.

Africa

Rhodesia

Gold output in March was 48,030 oz. fine, being 2286 oz. more than in February; for the three months ended March 31, the total was 142,305. By values the reported production was $2,879,275 for the first quarter of 1908, and $2,916,692 in 1909; an increase of $162,583 this year.

Other production reported in March includes 20,454 oz. silver, 72 tons lead, 9 tons copper, 2730 tons chrome ore and 24 tons asbestos. Coal mined was 11,859 tons.

Transvaal

The mine labor report for March shows that at the close of the month there were at the mines 162,043 negro laborers and 9997 Chinese. This was an increase of 4205 negroes and a decrease of 37 Chinese during the month. As compared with March, 1908, there was an increase of 32,183 negroes and a decrease of 16,507 Chinamen. The new laborers coming to the mines at present are chiefly from Portuguese territory.

The gold production of the Transvaal in April is reported at 607,100 oz. fine, a decrease of 399 oz. from the March report. For the four months ended April 30, the total output was 2,242,992 oz. fine in 1908 and 2,395,432 oz.—or $49,513,579—in 1909; an increase of 152,440 oz. this year.

West Africa

Gold production of the Gold Coast and Ashanti in March, is reported at 23,186 oz. bullion, being 1783 oz. more than in February. For the three months ended March 31, the total was 76,924 oz. bullion in 1908, and 67,406 oz. in 1909; a decrease of 9518 oz. The bullion reported this year was equal to $1,318,270, or 63,777 oz. fine gold.

Australia

New South Wales

Broken Hill Proprietary Company—In the controversy between this company and its men, the company has given notice of an appeal. The appeal is not against the schedule of wages fixed by the Conciliation and Arbitration Court, for the law does not permit of objection on that score. But the court included in its award the decisions regarding two matters extraneous to the plaint. First, that the number of shifts at Port Pirie be reduced from seven to six per week; and, secondly, that there shall be no extension of the contract system beyond the point to which it is at present applied. The hearing on this appeal was expected to delay for some time the resumption of work.

New Zealand

The Mines Department reports the exports of gold in February at 41,265 oz. For the two months ended Feb. 28 the total was 92,515 oz. bullion in 1908, and 77,230 oz. in 1909; a decrease of 15,285 oz. The bullion reported this year was equal to $1,507,285, or 72,923 oz. fine gold

Exports of silver for February were 154,258 oz. For the two months the silver reported is 244,504 oz. in 1908, and 198,084 oz. in 1909; a decrease of 45,910 oz this year

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 12—Coal trade in the West continues to advance, though still rather slowly. The Lake trade is still in some doubt, owing to the late beginning of shipments and also to the controversies over rates on coal to Lake Erie ports, which are still unsettled. The demand for steam coal, however, is undoubtedly better than it was a month or so ago, though the trade is still backward enough to cause sharp competition for orders.

It is reported that the Steel Corporation has decided after all to make a large quantity of coke at Gary for the use of its plants there. It is also understood that the Corporation has secured control of a number of Indiana mines for the purpose of supplying the coal for use in that plant.

In the East the bituminous trade is less active than in the West and there is a good deal of complaint about the dullness in Seaboard territory and New England.

The report that the Pennsylvania Railroad Company has secured the stock in the Chesapeake & Ohio, which has been on the market for some time has tended to quiet the discussion over the competition of West Virginia coals in the Seaboard trade. It is generally believed that with the Norfolk & Western and the Chesapeake & Ohio both under Pennsylvania control, rates will be equitably adjusted. The Virginian railway, whatever it may do in the future, is not yet in a position to make heavy shipments.

The anthracite trade, now that all strike troubles are over, has settled down into the quiet usual at this season. Domestic trade is fair and the companies are preparing for the usual summer shipments to the West. An incident in this trade is the reported cutting of prices at Springfield and other leading points in the central part of New England. The trade there has been mainly in the hands of the New York, Ontario & Western, which is controlled by the New York, New Haven & Hartford company. It is said that this company has resented some attempts of the Erie to secure trade in what it has regarded as its special territory and has cut quotations accordingly to drive out the so-called intruders. This action is rather characteristic of the New Haven company.

Ohio Railroads and the Hepburn Law—The Interstate Commerce Commission has been making an investigation into the ownership of coal-mining companies by the Hocking Valley and other Ohio and West Virginia railroad companies; also into some charges of discrimination in coal rates and shipping facilities on those roads.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 1, short tons:

	1908.	1909.	Changes
Anthracite	1,798,691	1,778,316	D. 20,375
Bituminous	10,886,619	11,715,037	I. 829,418
Coke	2,325,077	3,306,992	I. 980,915
Total	15,011,387	16,801,345	I. 1,789,958

The increase for the week was 192,233 tons. Total increase, year to date, was 11.9 per cent.

Anthracite coal shipments in April were 5,891,176 long tons, being 441,198 tons less than in March. For the four months ended April 30 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	3,911,998	4,655,959	I. 643,961
Lehigh Valley	3,500,040	3,551,618	I. 51,578
N. J. Central	2,735,067	2,734,096	D. 971
Lackawanna	3,176,498	3,179,787	I. 3,289
Del. & Hudson	2,279,469	2,239,202	D. 40,267
Pennsylvania	2,023,907	2,070,596	I. 46,689
Erie	2,337,552	2,694,373	I. 356,821
N. Y., Ont. & West.	910,943	957,368	I. 46,425
Total	20,875,474	21,982,999	I. 1,107,525

The total increase this year was 5.3 per cent. Six companies showed gains, those of the Philadelphia & Reading and the Erie being the largest. Two companies—the Delaware & Hudson and the Central Railroad of New Jersey—had decreases, the latter being very small.

New York

Anthracite

May 12—Trade at present is dull, owing to the fact that many large consumers laid in extra stocks during March in anticipation of a possible stoppage of production. Now that the labor troubles are settled they will use up these stocks before purchasing more coal. Quite a number of the collieries in the anthracite region are running short time, and this condition may last for a month or more.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor. Washery pea can be had for 5 or 10c. less.

Bituminous

The Seaboard bituminous trade is unmistakably dull. Few orders are coming from the far East, although most people believe that that section is pretty near bare of coal. Along the Sound there is a regular business, but it is much smaller in amount than is usual. New York harbor is rapidly becoming a dumping ground, where purchasers are watching for bargains in the way of cheap coal. Prices continue unchanged. All-rail trade continues about on the same level as for several weeks past. Transportation is good and car supply abundant.

There is some inquiry for coal for outside shipments to Southern ports, chiefly Gulf ports, and a fair quantity of coal is being sold for such shipments.

In the regular Coastwise trade there is not much doing, and vessels are in good supply, being inclined to hunt for cargoes. Rates for large vessels from Philadelphia are: To Boston, Salem and Portland, 55c.; Portsmouth, 70c.; Lynn, Newburyport and Bangor, 75c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

May 10—The Alabama coal market is still dull and the production is about 50 per cent. off. Some of the principal mines of the State are running on half-time, while some of the commercial mines are on less. There is much complaint among the mine workers. Sales agents of coal companies are working hard in the pick-up orders but they are not so easily found. The coke demand is steady in the furnace quarters. Foundry coke is in fair demand. The coke production holds up fairly well.

Chicago

May 11—Cool weather following a spell of summer temperature has helped the domestic trade in the last week, and steam consumption fully holds its own. The interest of the trade is largely in contracts, many of which are being made at low prices; this assures a good movement of coal, and open-market conditions will continue to dominate the trade. The general supply is so well regulated that demurrage evils are largely suppressed, while confidence of consumers increases.

Illinois and Indiana coals are unchanged in price, carlots of lump and egg selling at $1.75@2.25; run-of-mine at $1.65@1.75 and screenings at $1.40@1.70. Eastern coals are in good condition, only Hocking showing some over-supply and selling at $2.85@3.15. Smokeless is in steady demand at $3.30@3.45 for lump and $2.95@

3.05 for run-of-mine. Youghiogheny is steady at $3.15 for ¾ in. lump and Pittsburg No. 8 somewhat dull at $2.75@2.85. Anthracite is selling well under the stimulus of the cool weather and generous advertising of April prices.

Cleveland

May 11—Lake coal trade drags yet, the shipments being slow. There is much interest in the controversy over freight rates to Lake ports. The strike is making a good deal of noise, but does not seem to delay the sailing of vessels.

Domestic trade is naturally slow, but there is some buying by dealers. Massillon is quoted at $2.30 for lump and $2.15 for run-of-mine at mine.

Steam coal is more active and sales are larger. Slack is in rather good supply. Ordinary grades of steam coal sell at $1.35 for lump and $1.10 for run-of-mine, at mines; smokeless, $1.50 and $1.20 at mine. Kanawha coal is offered here at $1.35 for lump and $1 for run-of-mine at mine.

Indianapolis

May 11—The change in ownership of the John R. Walsh coal companies—the Indiana Southern and the Southern Indiana—which were sold under order of court a week ago, will mean a resumption of work in at least a score of mines in Sullivan and Greene counties within the next four weeks. The mining property was bought by Chicago men, who are said to be identified with both the Steel Corporation and the Illinois Central railroad. Either the Steel Corporation, it is reported, will take over about 15 mines, or will place large contracts for coal to be used in the Gary plant with the mines in question. In either event, resumption of work in mines that have been idle for the past two years is certain. The Illinois Central has made offers for mines at Farnsworth, Dugger and Linton, on the line of its Indianapolis-Effingham branch.

The general mining situation in Indiana is far better, as a whole, than for a year or more.

Pittsburg

May 11—Lake shipments are light, as very little ore is coming down. One ore and coal interest has been making fair shipments, while the railroads are shipping some coal across the Lakes. Prices continue low and unsatisfactory, and the market is a trifle weaker than it was a fortnight ago. Ordinary lots of mine-run are selling at about $1.10, while on large lots $1 is done and occasionally shaded. Slack remains at 55 to 65 cents.

Connellsville Coke—It is regarded as certain that the Connellsville coke merger will be put through, but it will not include all the independent interests. The project is backed by two Pittsburg banks which can swing the deal without difficulty. While on the surface the project is merely one to consolidate independent coke interests, it is believed in well informed quarters that the real motive in the operation is to get the coke operations together to form an adjunct to the consolidation of independent steel interests which has been worked upon in a more or less desultory fashion for about six months.

Standard Connellsville furnace coke is selling at $1.50@1.60 for prompt shipment, while $1.75@1.90 is quoted on second-half contracts. Spot foundry coke is held at $1.75 and contract at $2@2.25.

The *Courier* reports the production in the Connellsville and lower Connellsville fields at 229,507 tons, a drop of less than 1000 tons from the previous week. Shipments were 9061 cars, an increase of 76 cars, and divided as follows: to Pittsburg district, 3972 cars; to points west of Pittsburg, 4249 cars; to points east of Connellsville, 840 cars.

Foreign Coal Trade

Belgian Coal Trade—Imports and exports of fuel in Belgium, three months ended March 31, metric tons:

	Imports.	Exports.	Excess.
Coal.....	1,400,670	1,189,385	Imp. 211,285
Coal, 1908...	1,139,121	1,050,805	Imp. 88,316
Coke.....	71,434	260,773	Exp. 189,339
Coke, 1908..	94,472	202,177	Exp. 107,705

The chief imports are from Germany and Great Britain; the chief exports to France.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 1: Best Welsh steam, $3.90; seconds, $3.78; thirds, $3.60; dry coals, $3.66; best Monmouthshire, $3.60; seconds, $3.48; best small steam, $2.88; seconds, $2.52. All f.o.b. shipping port. This is a sharp advance on all coals, varying from 18 to 24c. per ton.

Iron Trade Review

New York, May 12—The iron and steel trades continue to show a fair degree of activity. In various lines this amounts to a strong business, though in others there is still some lagging.

Pig-iron orders have increased in volume of individual orders and in the aggregate. Some foundries, quite a number in fact, are placing orders running into the third quarter and are showing a degree of confidence in future business which has not been manifested for a good while. Some large orders for basic iron have also been placed within the week. Pig-iron business has been more active in Eastern territory than in the West, however. The furnaces have accordingly stiffened somewhat in their views. They are not attempting to advance prices on current business, but are less inclined to make concessions; and many are asking a little higher price for third quarter deliveries than for spot iron.

In finished material structural steel continues the most active section of the market. A good business is also being done in bars, and the demand for plates is improving. Wire and wire products have been active since the reductions in price announced last week.

One large order for rails has been announced, the Chicago, Milwaukee & St. Paul Company having placed a contract for 63,000 tons of standard section with the Steel Corporation. The rails are to be rolled by the Illinois Steel Company. It is stated that the order was taken at the old price of $28 per ton, which would contradict the report that lower prices were to be made on rails. The business in light rails is increasing and the principal companies making them have advanced their prices $2 or $3. Recently there has been considerable competition for these orders and some had been taken as low as $22 per ton.

Pig-iron Production—The reports of blast furnaces, as collected by the *Iron Age*, show that the aggregate weekly capacity of the coke and anthracite furnaces in blast on May 1 was 413,700 tons, an increase of 4500 tons over the report for April 1. Making allowance for the charcoal furnaces, the production of pig iron in April was, approximately, 1,755,000 tons; for the four months ended April 30 it was 7,182,000 tons.

Electric Iron and Steel—The installation of Heroult electric furnaces in the Pit River district in California is reported to be past the experimental stage and ready to begin the smelting of iron and steel on a commercial scale. It will be the first working plant of the kind in this country.

Baltimore

May 11—Imports for the week included 4188 tons cupreous pyrites and 7835 bars converter copper from Spain; 17,700 tons iron ore from Cuba.

Birmingham

May 10—The pig-iron market in this section appears to be as strong as it was a month ago, if not stronger. There are some sales still being made and prices continue to hold strong, at $11.50@12, No. 2 foundry, the first named price being the minimum, with the latter secured by more than one furnace company. An estimate is made that over 450,000 tons of iron have been sold by Southern iron manufacturers since the middle of March. While much of this iron was sold at $11, it will mean steady operation for some time to come. The Tennessee company blew in two of its Bessemer, Ala., furnaces the past week and will have two

more ready in the Birmingham district before the end of the month.

The cast-iron pipe concerns in this district continue to secure business.

The steel plant at Ensley is being repaired. It is not believed the shut down will be long lived. Three thousand men were thrown out of steady employment, though many of the number are being employed in other parts of the district.

Chicago

May 11—The pig-iron market is unmarked by any change of importance, but evidently is strengthening day by day. Southern holds firmly up to $11.50 Birmingham ($15.85 Chicago) and on some sales for delivery late in the year $12 is obtained. Most of the buying is in small lots—up to 500 tons—but occasionally a 1000-ton lot is taken. Melters are as yet cautious about contracting for large supplies ahead. The increasing movement of iron and steel products has much to do with restoring confidence. Northern iron sells evenly at $16.50@17 for third-quarter delivery and with every prospect of increased demand. Both Northern and Southern appear to be settling into something of the usual summer quietness. Lake Superior charcoal iron is firm and quiet at $19.50@20.

In finished products general conditions are bettering. Lower prices have brought about large sales, railroad supplies and structural material especially showing improved demand.

Coke remains at $4.70 for the best Connellsville, with sales increasing but supply abundant.

Cleveland

May 11—An increased movement of ore from docks is noted. Nothing definite has been done as to new ore prices, and it begins to look as if there would be no change from last season. The unions have not yet succeeded in stopping vessels ready to start up the Lakes.

Pig Iron—Many small sales are being made, which foot up a big total tonnage. Furnaces are stiffer in their views and are not making concessions. Prices are about on a basis of $15@15.25 for No. 2 foundry.

Finished Material—There is a good trade in bars and structural steel. Plates are selling better, especially in small lots.

Philadelphia

May 12—The pig-iron market has developed a good deal of activity during the last few days. The heavy sales recorded at Southern furnaces have indirectly helped this market and in some instances makers are asking a trifle more money than a week ago. Basic iron is stronger than any other kind. Foundry, especially No. 2, has been taken quite freely, though in small lots. The mills continue to buy forge iron in a moderate way at 15c. Basic is quoted at the same price. Two or three good-sized lots of malleable iron were taken Monday. Special brands were quoted today for quick delivery 50c. higher than a month ago. The sentiment among furnace interests here is that there will be no more serious competition from the South.

Plates—A large business has been done in steel plates in the Pennsylvania mills.

Structural Material—A general improvement in structural material has set in and a large volume of business has been transacted, concerning which office men do not care to give any details. Orders for bridge-building material are dropping in every day or so.

Pittsburg

Moy 11—Another advance of $1 per ton has been made in bars, plates and shapes, making bars 1.20c. and plates and shapes 1.30c. These prices are now the minimum of the market for any delivery, and are not being made in any case for delivery beyond Jan. 1. The advance was made independently by the different producers. The first advance, about three weeks ago, was not a general one, as it represented rather the withdrawal of special prices by producers who had been most eager for business.

The latest advance puts the market on bars, plates and shapes back to where it stood immediately after the February break. However, it is less than three months since then and it is regarded as favorable that the market found bottom and made a partial recovery so soon.

The great bulk of the agricultural-implement business in steel bars has been placed, the latest business being booked last week, just before the advance. Usually this business is placed at a flat price, for deliveries July 1 to June 30, but this year the minimum prices were made only to Jan. 1, all contracts calling for some kind of an advance for 1910 deliveries, the price in some cases $1 per ton; while in other cases it was stipulated that the price should advance with the market, but not above a stipulated price.

A considerable part of the buying of finished-steel products in the past few weeks has been of a more or less speculative character, and one of the motives of the mills in advancing prices was to check this tendency.

Pig Iron—Basic iron is quoted at $14, Valley, for early delivery and has not been over-firm at that figure, while it is impossible to obtain an advance for delivery in the second half. Bessemer has been a trifle weak, and has sold in several cases at $14.50, Valley. Foundry iron is slightly firmer, owing to the withdrawal of several sellers at the $14 price, but iron can still be had at $14, Valley, for May and June delivery. For third quarter an advance is generally asked, but consumers are not disposed to pay any advance for forward delivery when stocks are as large as they are. On the whole the pig-iron market has not justified the more optimistic tone which was observable a week ago.

Steel—Deliveries continue good on old contracts, but there is scarcely any new business going as consumers are well covered. In the local market billets are firm at $23 and sheet-bars at $25.50, as formerly.

Sheets—Demand is only fair. The mills are running at 65 or 70 per cent. of capacity. Prices remain on the basis of 2.25c. for black and 3.25c. for galvanized, 28 gage, ordinary carloads, while on very attractive orders these prices are sometimes shaded $1 per ton.

Ferromanganese—The market continues rather weak, being quoted at $41, Baltimore, or $42.95, Pittsburg, for ordinary lots. On an attractive order this price could probably be shaded.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the three months ended March 31 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $42,699,772 in 1908, and $35,151,008 in 1909; a decrease of $7,548,764, or 17.7 per cent. The leading items of export were, in long tons:

	1908.	1909.	Changes.	
Pig Iron	6,766	8,754	I.	1,989
Billets, ingots & blooms	50,460	24,407	D.	26,043
Bars	15,329	14,947	D.	382
Rails	35,425	50,791	I.	16,356
Sheets and plates	24,223	33,559	I.	9,336
Structural steel	33,592	24,628	D.	8,964
Wire	35,636	33,192	D.	2,344
Nails and spikes	12,147	12,472	I.	325
Pipe and fittings	27,267	31,565	I.	4,298

These increases and decreases were about evenly divided.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States three months ended March 31 were valued at $5,470,091 in 1908, and $5,807,463 in 1909; an increase of $337,372, or 6.2 per cent. Leading items of imports were, in long tons:

	1908.	1909.	Changes.	
Pig iron	29,129	31,415	I.	2,286
Scrap	1,510	1,313	D.	197
Ingots, blooms, etc.	2,261	3,339	I.	1,078
Bars	9,958	5,072	D.	4,886
Wire-rods	3,091	3,243	I.	152
Tinplates	15,544	11,791	D.	3,753
Sheets and plates	650	1,005	I.	355

The most notable change this year was the decrease in tinplates.

Iron Ore Movement—Imports and exports of iron ore in the United States, three months ended March 31, long tons:

	1908.	1909.	Changes.	
Imports	190,459	275,658	I.	85,199
Exports	19,815	20,023	I.	208

Of the imports this year 193,232 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore, three months ended March 31 were 71,894 tons in 1908, and 37,118 tons in 1909; decrease, 34,776 tons.

Metal Markets

New York, May 12—Many improvements in the current markets are reported, and the general feeling seems to be improving; sales are increasing.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1909..	$21,252,462	$ 5,161,648	Exp. $15,090,814
" 1908..	1,447,206	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,024	Imp. 13,437,021
Silver:			
Mar. 1909..	5,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,359	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,556	" 1,755,531

Exports from the port of New York, week ended May 8: Gold, $1,177,303, chiefly to Paris; silver, $1,065,326, chiefly to London. Imports: Gold, $32,226; silver, $39,647, both from the West Indies and South America.

Gold—There has been less competition for the metal in the open market in London and prices are slightly lower, 77s. 9⅜d. per oz. being paid for bar gold. Paris is still taking a little and the Bank of Germany has also been in the market. Some small shipments of gold have been made from New York to Paris and more is expected to go.

Platinum—The market is quiet, sales being regular but not larger than for some time. The quotations made by dealers in New York are still unchanged, at $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our special correspondent reports from St. Petersburg under date of April 29, that the market is dull and inactive. The small dealers and miners still hold some platinum, which is keeping down prices. These small miners are offering crude platinum, 83 per cent. metal, in Ekaterinburg at 4.50 rubles per zolotnik—equal to $16.92 per oz. In St. Petersburg quotations are nominal in the absence of business at 18,000@19,000 rubles per pood—average $18.13 per oz. The conference on the platinum industries under the direction of the Imperial Council has begun its sessions.

Silver Owing to resales on China account, silver has not maintained the high figure of 24s. 8d. reached in London May 5; but no great decline is looked for.

SILVER AND STERLING EXCHANGE

May.	6	7	8	10	11	12
New York....	53 3/8	53 1/8	53 1/8	53	53 1/8	52 7/8
London.....	24 3/16	24 1/8	24 1/16	24 1/8	24 1/16	24 1/16
Sterling Ex..	4.8750	4.8755	4.8755	4.8755	4.8770	4.8775

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 29

	1908.	1909.	Changes.
India.....	£ 2,536,438	£1,471,800	D. £1,064,638
China.....	511,400	1,038,200	I. 526,800
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,138,038	£2,592,800	D. £ 545,238

Imports for the week, £2500 from Mexico and £180,000 from New York; total, £182,500. Exports, £67,500 to India and £55,000 to China; £122,500 in all.

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
6	13 @13⅛	12½ @12⅝	58¾	29½	4.20 @4.25	4.12½ @4.17½	4.87½ @4.92½
7	13 @13⅛	12⅝ @12¾	59¼	29⅝	4.25 @4 27½	4.15 @4.20	4.87½ @4.92½
8	13 @13⅛	12⅝ @12⅞	....	29¾	4.25 @4.27½	4.15 @4.20	4.87½ @4.92½
10	13⅛ @13⅜	12¾ @13	59½	29¾	4.25 @4.30	4.17½ @4.20	4.87½ @4.92½
11	13⅛ @13¾	12⅞ @13	59⅝	29½	4.25 @4.30	4.17½ @4.22½	4.87½ @4.92½
12	13⅛ @13⅜	12⅞ @13	59 13/16	29½	4.30	4.17½ @4.22½	4.87½ @4.92½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The improvement reported in our last issue made further progress during the week May 6-12. Large orders were placed by domestic and foreign buyers from day to day, the aggregate of the sales running to many millions of pounds. Under this influence prices gradually advanced and close firm at 13⅛@13⅜c. for Lake copper and 12⅞@13c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper was 12⅝@12¾c., the closing price being 12¾@12⅞ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire has been advanced ¼c. to 14¼c. base, carload lots at mill. Business has been quite active.

The figures of the Copper Producers' Association for April will be found on an editorial page.

A great deal of speculation concentrated upon the London standard market, and prices advanced from day to day, three months' option several times crossing £60. At the close the tone is somewhat easier at £59 1s. 3d. for spot, £59 15s. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.; best selected, £62 10s.@£63 10s.; strong sheets, £74 10s.@£76 10s.

Copper exports from the United States for the three months ended March 31 are reported by the Bureau of Statistics at 59,082 tons. For April exports are estimated at 21,235 tons, making 81,217 long tons for the four months.

Tin—In sympathy with copper, tin has advanced in the London market, and while not fully maintaining its gain, closes steady at £132 15s. for spot, £133 15s. for three months.

A fair business was transacted in the domestic market, where consumers have of late shown somewhat more interest. Consumption of the metal seems to be very satisfactory. At the close tin can be bought at about 29½ cents.

Visible stocks of tin on May 1—including 6942 tons afloat—were: Great Britain, 12,122; Holland, 1387; United States, excluding Pacific ports, 5316; total, 18,825 long tons, a decrease of 383 tons during April.

Exports of tin from the Straits in April were 4904 long tons. For the four months ended April 30, the exports were 18,580 tons in 1908, and 18,050 in 1909; decrease, 530 tons.

Spelter—There has been no change either in the volume of business or in the level of prices, and the market closes the same as last week at 4.87½@4.92½ St. Louis, 5.02½@5.07½c. New York.

The John Wahl Commission Company reports to us from St. Louis, under date of May 12, that spelter is strong, but very quiet. Sales are at 4.92½c. for prompt metal, 4.95c. for June.

New York quotations for spelter May 6-12, inclusive, were 5.02½@5.07½ cents.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The market in London is unchanged at £21 17s. 6d. for good ordinaries, £22 2s. 6d. for specials.

Lead—Consumption has been broadening from day to day and heavy orders have been placed from all sources. Under their influence, together with that of the strikes in Missouri and Utah, prices advanced steadily. The American Smelting and Refining Company raised its price to 4.25c. on May 7, and to 4.30c on May 12. The market closes firm at 4.17½@4.22½c St. Louis, and 4.30c. New York.

The John Wahl Commission Company reports to us from St. Louis, under date of May 12, that lead is strong and higher. Latest sales are on a basis of 4.25c. for Missouri brands, and even at that price there are more buyers than sellers. Forward metal cannot be bought below 4.30c. today

The London market shows only narrow fluctuations and closes steady at £13 5s. for Spanish lead, £13 7s. 6d. for English.

The International Lead Company has been organized at Bayonne, N. J., to manufacture white lead under patents owned by John W. Bailey. The company, which was incorporated at Trenton May 11, with a capital of $1,500,000 will operate a factory at Bayonne for the manufacture of

white lead and kindred products. The incorporators are John W. Bailey, the patentee; John Josten and Harry G. Robinson, of the Newhouse staff. It is stated that the enterprise has no connection with the Newhouse mining properties, and will buy its raw material on the open market.

Other Metals

Antimony—Quotations are 8¼@8½c. for Cookson's; 7¾@8c. for U. S.; 7¼@7½c. for outside brands. Prices are still supported by the expected duty on the metal. Business is lighter than at last report.

Aluminum—Business is quiet and prices unchanged. No. 1 ingots, 22@24c. per lb. base for large lots; wire, 31@32c., and sheets, 33@34c. base.

Quicksilver—Sales are about as usual, and price unchanged. New York, $44.50 per flask of 75 lb.; San Francisco, $44 for domestic and $42 for export trade. London, £8 7s. 6d. per flask, with £8 3s. 9d. quoted from second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Platteville, Wis., May 8—The highest price paid this week for zinc ore was $42 per ton; the base price was $40 per ton of 60-per cent. zinc. For 80-per cent. lead ore, $53 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 8.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	567,760	.....	81,700
Linden	479,470	.....	.....
Benton	343,850	.....	.....
Hazel Green	302,800	.....	.....
Highland	196,700	.....	.....
Strawbridge	175,000	.....	.....
Days Siding	175,000	.....	.....
Cuba City	170,310	50,500	.....
Livingston	160,000	.....	.....
Galena	88,000	.....	.....
Harker	44,040	.....	.....
Total	2,704,930	50,600	81,700
Year to May 8	36,325,494	1,264,060	2,964,800

In addition to the above there was shipped to the American Zinc Ore Separating Company, 668,750 lb., and to the Joplin Separator Works, 60,000 lb. zinc concentrates.

Joplin, May 8—The highest price reported paid for zinc ore was $43 per ton. The high base declined to $40, ranging down to $37, a decline on all grades of $1 per ton for sulphide ores. Silicate ores remained on a base of $17@19 per ton of 40-per cent. zinc, with the high price at $22. Average all grades, $36.96. A little lead sold as high as $57, but the high price generally was $55.50. The average for all grades was $55.26 per ton. A decreased shipment of sulphide ores, with the usual shipment of silicate ore run the average price, all grades, down $1.70 per ton lower than last week.

The shipment is a decrease of 1024 tons of zinc and 34 tons of lead, compared with the previous week. With the shipment lowered to 5131 tons and an output of approximately 5700 tons, there is added to the reserve stock a little over 500 tons. Week-end buying was even lighter than early in the week, with a weaker tendency apparent.

SHIPMENTS, WEEK ENDED MAY 8.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,909,030	800,670	$ 96,689
Joplin	1,439,140	265,000	35,286
Galena	813,830	99,910	16,568
Alba-Neck	582,510	.....	11,650
Duenweg	407,890	147,670	11,361
Aurora	482,520	.....	8,654
Badger	399,520	.....	7,990
Granby	550,780	29,560	7,600
Oronogo	229,460	119,710	7,638
Miami	230,480	96,780	6,510
Spurgeon	229,900	71,710	5,607
Carthage	278,840	.....	5,576
Prosperity	199,090	29,530	4,607
Zincite-Sherwood	201,870	.....	3,835
Cave Springs	142,390	3,050	2,932
Sarcoxie	123,590	.....	2,347
Stott City	41,020	.....	779
Totals	10,261,860	1,663,580	$235,619
19 weeks	213,989,210	34,794,610	$4,775,277

Zinc value, the week, $189,653; 19 weeks, $3,863,212
Lead value, the week, 45,966; 19 weeks, 1,012,06

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	60.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	56.63
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Petroleum

Another cut of 5c. per bbl. in all grades of crude oil was announced in Pittsburg, May 11, by the Standard Oil Company. This makes the second reduction in the price within a week, prior to which time there had been no change in the price in more than two years. Pennsylvania oil is now quoted at $1.68. Large stocks in storage in Oklahoma and a decline in demand caused the cut.

Chemicals

New York, March 12—The market is about the same as last week. Current business is fair, and deliveries on contracts about the same.

Copper Sulphate—Sales continue only fair. The cutting in prices, which was done recently, has been recognized by a decline. Current quotations are $4.22½ per 100 lb. for carload lots and $4.47½ per 100 lb. for smaller orders.

Arsenic—Current quotations are 2⅞@3c. per lb. for white arsenic.

Nitrate of Soda—The market has been quite active, and a fair business was done at ruling prices, which are 2.15c. for spot and 2.12½c. for futures.

Phosphates—Exports of Florida phosphates through the port of Savannah in March are reported by J. M. Lang & Co. at 550 tons, to Germany.

Mining Stocks

New York, May 12—The general stock market during the past week has been active and strong. Speculation for the rise followed closely after the commodities clause decision rendered by the Supreme Court, and interpreted favorably by the large financial interests. The plain evidences of improving business have increased the courage of those favoring a rise in stock values. The improved outlook for copper metal has also been an important factor in aiding the rise in copper stocks. It is, of course, not necessary or certain that a bull movement in the stock market should always terminate in excited trading and million-share days; however, important rises in stock values do often culminate in this way. Careful observers of market conditions are at present cautious in commitments, believing that the present average range of prices is at a point where bad news will have a decided effect. The technical market situation is still strong, notwithstanding the gradual advance for many days past.

The Curb followed the general market, being especially inclined to boom copper stocks.

One sale of Homestake, of South Dakota, was reported during the week, $93 per share being paid for 200 shares.

Boston, May 11—A much better feeling is manifest in the mining-share market and there is hope of its continuance. If it were not for the gyrations of North Butte, prices might be higher. As it is they show substantial advances from a week ago. An improvement is noted in the metal market. Money continues easy and brokers report that they are carrying a comparatively small amount of stocks for customers. Speculative temper is now optimistic and the public, with proper coaching, can be induced to come into the market. Manipulative tactics are now occurring in some specialties with a view of marking prices up.

North Butte has had an extreme fluctuation of almost $6 during the week, breaking from $68.50 to $62.75 with subsequent recovery to $64.75 and the close tonight $62.75. Apparently the same tactics as occurred in Boston & Montana and Butte & Boston, just previous to their being taken into the Amalgamated camp some years ago, are being pursued at the present time. Boston Consolidated enjoyed a spurt from $12.50 to $17.25 last week although it has since reacted to $15.12½. There has been a good demand for Lake and North Lake.

Lake Copper will probably issue 10,000 shares of treasury stock at $25 per share soon to provide working capital.

Shannon Copper sold up $1.50 to $16.75. This company is to issue $600,000 in 6-per cent. convertible bonds for the construction of a railroad to connect the mines with its smelter. They will be convertible into stock at $20 per share within three years. This will require an additional 30,000 shares of stock. The right to subscribe is a $1000 bond for every 500 shares of stock. There is an underwriting commission of 5 per cent. The Copper Range report shows $3.29 earned on the stock, against $4 paid for 1908. Amalgamated had a $6 rise to $84.50 and closed but $1 less.

Giroux Consolidated has been taken from the Curb to the unlisted department of the Stock Exchange. All the better class of stocks on the Curb are higher with an increasing volume of business.

STOCK QUOTATIONS

NEW YORK	May 12
Name of Comp.	Clg.
Alaska Mine	.43
Amalgamated	83⅛
Anaconda	51
Balaklala	‡2¼
British Col. Cop.	7
Buffalo Mines	3½
Butte Coalition	26¾
Colonial Silver	¾
Cum. Ely Mining	8½
Davis-Daly	6¾
Dominion Cop.	12½
Douglas Copper	2¾
El Rayo	2¾
Florence	3⅛
Foster Cobalt	.32
Furnace Creek	.11
Giroux	8½
Gold Hill	¼
Goldfield Con.	8
Granby	103½
Greene Gold	¾
Greene G. & S.	6
Guanajuato	1⅝
Guggen. Exp.	100
Hanapah	15
Kerr Lake	8¾
McKinley Dar.	.90
Miami Copper	15⅛
Micmac	⅜
Mines Co. of Am.	⅛
Mitchell Mining	1⅞
Mont. Sho. C.	‡1½
Nev. Utah M. & S.	2¼
Newhouse M. & S.	3
Nipissing Mines	10½
Old Hundred	7⅛
Silver Queen	.40
Stewart	½
Tennessee Cop'r	43¾
Tri-Bullion	⅛
Union Copper	1⅛
Utah Apex	6½
Utah Copper	52
Yukon Gold	4⅛

BOSTON	May 12
Name of Comp.	Clg.
Adventure	9
Allouez	41
Am. Zinc	25¾
Arcadian	5¾
Arizona Com.	45⅛
Atlantic	10¾
Boston Con.	15⅛
Calumet & Ariz.	104¼
Calumet & Hecla	650
Contennial	‡30½
Copper Range	80
Daly-West	10
East Butte	14
Franklin	16½
Greene—Can.	11
Hancock	‡10¼
Isle Royal	27⅛
Keweenaw	2⅞
La Salle	14⅛
Mass.	14⅛
Michigan	12½
Mohawk	65
Nevada	21⅝
North Butte	63
Ojibway	11⅞
Old Colony	‡.60
Old Dominion	55
Osceola	133
Parrot	34
Quincy	93
Rhode Island	14⅝
Shannon	16¾
Superior	41¾
Superior & Bost.	14⅞
Superior & Pitts.	15
Tamarack	‡73
Trinity	14⅝
U. S. Smg. & Ref.	45¾
U.S. Sm. & Re., pd.	46¾
Utah Con.	42
Victoria	5⅛
Winona	6
Wolverine	148
Wyandotte	2⅝

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	40
Am. Smelt. & Ref.	94¾
Am.Sm. & Ref., pf.	109⅞
Colo. Fuel & Iron.	40
Federal M. & S., pf.	91½
National Lead	88
National Lead, pf.	‡107
Pittsburg Coal	112
Republic I. & S.	26⅝
Republic I. & S., pf.	86
Sloss-Sheffield	80⅞
Standard Oil	675
U. S. Steel	57¾
U. S. Steel, pf.	119¼
Va. Car. Chem.	51

BOSTON CURB	Low.
Ahmeek	‡155
Black Mt.	1
Chemung	‡16
Globe Con.	6
Helvetia	3¾
North Lake	‡7½
Ray Central	3¾
Ray Con.	15⅝
San Antonio	12⅝

ST. LOUIS	May 8	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettle	.09	.06
Center Cr'k	2.00	1.60
Cent.C.&C.	81.00	79.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	115.00	100.00
Columbia	9.00	6.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.30	.20
St. Joe	12.50	11.00

LONDON	May 12
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton'sInd.	0 3 1½
Camp Bird	1 2 6
Esperanza	2 15 0
Tomboy	1 1 3
El Oro	1 7 3
Oroville	0 11 0

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS. May 12.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.48
Best & Belcher	.37
Caledonia	.14
Challar	.06
Comstock	.29
Con. Cal. & Va.	.66
Crown Point	.44
Exchequer	.27
Gould & Curry	.09
Hale & Norcross	.18
Mexican	.76
Ophir	1.30
Overman	.12
Potosi	.16
Savage	.19
Sierra Nevada	.26
Union	.32
Utah	.04
Yellow Jacket	.64
TONOPAH STOCKS	
Belmont	.93
Extension	.65
Golden Anchor	...
Jim Butler	.17
MacNamara	.25
Midway	.22
Montana	.80
North Star	.03
Tono'h Mine of N.	7.00
West End Con.	.30
GOLDFI'D STOCKS	
Adams	.02
Atlanta	.16
Blue Bell	.04½
Booth	.18
Columbia Mt.	.12
Comb. Frac.	.91
Con. Red Top	.06
Cracker Jack	.04
Dia'dfield B. B. C.	.06
Goldfield Belmont	.04
Goldfield Daisy	.35½
Great Bend	.15
Jumbo Extension	.15
Kendall	.06
Lone Star	.06
May Queen	.04
Oro	.09
Red Hill	.10
Roanoke	...
Sandstorm	.13
Silver Pick	.18
St. Ives	.11
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.04½
Homestake King.	.01
Mont. Shoshone C.	1.75
Tramp Cons.	.06
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1.37½
Nevada Smelting.	.87½
Nevada Wonder	.60
Nevada-Utah	2.81½
Penn-Wyoming	.02
Pittsburgh S. Pk.	.61
Rawhide Cool't'n.	...
Round Mt. Sphinx	.13

COLO. SPRINGS	May 7
Name of Comp.	Clg.
Acacia	‡.06½
Black Bell	....
C. C. Con.	‡.03
Dante	.06
Doctor	.09
Elkton	.63½
El Paso	.47
Findlay	.14⅛
Gold Dollar	.10
Gold Sovereign	.03
Isabella	.20¼
Jack Pot	.06⅝
Jennie Sample	.07
Jerry Johnson	.05¾
Mary McKinney	‡.37
Pharmacist	‡.03
Portland	.88
Un. Gold Mines	.06½
Vindicator	.60
Work	.06¾

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Apr. 15	May 7	$0.01
Blue Wing, Ida	May 8	June 5	0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Comstock, Nev	Apr. 26	May 17	0.20
Con. Imperial, Nev	May 26	June 17	0.01
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Exchequer, Nev	May 5	May 26	0.05
Hecla M. & M., Utah	May 15	June 14	0.05
Imlay, Nev	Apr. 6	Apr. 28	0.03
Julia Con., Nev	May 24	June 17	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Savage, Nev	Apr. 8	May 5	0.10
Sierra Nevada, Nev	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Utah, Nev	May 6	May 27	0.03
Yerington Gold, Nev	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.884
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	51.428	25.133	23.708
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.583	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.684
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93½	58.331	57.363
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.600	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.818	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.813
March	3.838	3.986	3.835	13.976	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.615	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.613	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.787	4.527	4.607	21.078	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.876	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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The Diamond Bearing Highlands of Bahia—II

Miscellaneous Mineral Resources of the Diamond Country Are Extensive but Have Received Only Slight Development. Mining Laws Favorable

BY J. C. BRANNER*

There is much manganese in the Minas series of the Chapada Diamantina. It was found to follow the strike of the rocks along the east face of the Serra de Jacobina, always in about the same stratigraphic position. The presence of the mineral is shown by the lumps of ore (psilomelane) scattered over the surface of the ground. At one place, just west of the city of Villa Nova and on the base of the eastern slope of the Jacobina range, the deposits have been prospected somewhat but no attempt has been made to mine or ship the ore. Near the same horizon this manganese is exposed again near the east base of the Serra de Sant 'Anna on Fazenda Amarante.

One might suppose that the long railway haul from the interior to tide water at Bahia, and the change of gage at Alagoinhas would be an insurmountable obstacle to the mining of manganese in this part of the state. It should be remembered, however, that the haul by rail from the interior of Minas Geraes to Rio de Janeiro is still longer and yet the Minas mines are among the best paying manganese deposits in the world. The railway haul from the Morro de Mina deposits in Minas is 468 km., and the haul from the mines at Miguel Burnier is 498 km. Villa Nova, near which the Bahia deposits occur, is 444 km. from the port of Bahia, and the railway haul could be shortened considerably by building a piece of railway from Entrocamento on the São Francisco line to reach the tide water at Santo Amaro or Cachoeira.

No reference is here made to the manganese deposits in the region near Nazareth in the State of Bahia. Those deposits are near the coast, are well known, and the mines have already been in operation several years. I have briefly described them in a paper[1] entitled, "The Manganese Deposits of Bahia and Minas, Brazil."

Copper

Copper is found on an estate called Carnahyba, about 40 km. west of Angico, a station on the São Francisco railway. This property was examined by an English company and an unsuccessful effort is said to have been made to purchase it. The writer did not personally visit the place, but sent an assistant, Roderic Crandall, through the region for the purpose of getting an idea of the general geology. Mr. Crandall made no detailed examination of the property but reported that the copper ore impregnated a basic eruptive that was deeply decomposed.

The rocks in which the ore occurs is an eruptive that varies from a pyroxenite to a norite or hypersthene gabbro, and belongs to the pre-Cambrian crystalline series mentioned above. No attempt was made to obtain an average sample of the ore but a specimen, taken pretty much at random and probably rather above the average, was assayed and found to contain 3.83 per cent. of metallic copper. In all the specimens seen the ore is in the form of malachite and chrysocolla which form a multitude of small veins through the altered rock.

The copper-bearing eruptives are found at several other places within the area of crystalline rocks east and northeast of Angico as far as Patamuté. Some specimens of copper ore given me in 1907 and said to have come from the Serra de Muribeca, 80 km. south of Capim Grosso, have the copper in the form of malachite

THE VALLEY AT MOSQUITOS

Seven kilometers south of Lencoes; the serra of the diamond-bearing rocks in the background; the valley in the foreground is deeply filled with the waste from old diamond washings.

JUNCTION OF THE ANDARAHY AND PARAGUASSU RIVERS

Low grounds, three kilometers southeast of Andarahy. Taken at time of high water. The diamond-bearing serra in the background.

Farther north the ore is found along the east base of the same range two or three kilometers west of the village of Jaguarary. It occurs again on the east slope of the range a few kilometers west of the station Itumerim. In the vicinity of the city of Jacobina the manganese appears on the east side of the range in about the same stratigraphic position. It was found in the usual form of loose lumps of ore in the red soil, about one kilometer east of the Engenho de João Dias on the *sitio* Cruz das Almas. The same kind of ore is reported from several other points along the east face of the Jacobina range.

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[1] *Transactions* of the American Institute of Mining Engineers, Vol. XXIX, pp. 756-770, New York, September, 1899.

and cuprite. An assay of this ore shows it to contain 39.1 per cent. of metallic copper. The specimen is apparently a picked one.

If these copper deposits are found to be of sufficient magnitude and richness to be workable, a branch railway can readily be constructed from Angico to the mines, owing to the flatness of the country. The scarcity of fuel and water would make it difficult to reduce the ore on the ground. Occasional specimens of copper have been reported from several other portions of the state of Bahia, but so far as the writer has been able to learn the region above referred to is the only one that holds out much promise of becoming productive.

The facts here given can only be regarded as suggestions which may be worth following up. A sentence from a recent publication[2] on the minerals of the state of Bahia expresses the popular idea of the importance of the Carnahyba deposits: "The Carnahyba mine alone could furnish copper enough to supply the whole world for 100 years!"

work certain hydraulic properties at Caldeirão, where placer gold has been mined, but after spending much money the company is reported to have abandoned its projects. Considerable gold was formerly taken out in the vicinity of Rio de Contas, but the industry is said to have been abandoned many years ago. That particular region was not visited by the writer, and nothing authoritative can be said of it here.

Salt Production in the Interior

In every list one can find of the mineral products of Bahia rock salt is always mentioned. Whether rock salt really exists in Bahia cannot be stated positively, but the writer has never been able to find it, though diligent search has been made and many clews have been followed up. Search has also been made for salt-water springs but thus far without success. It now seems probable that the expression "rock salt" has been used without a clear idea of its meaning. Large quantities of salt are annually manufactured in the interior of Bahia, but in every case that has come to the writer's knowledge, this salt is made by leaching the upper layers of the dry earth where lakes, ponds and pools have evaporated.

It will be noted that a large part of this region is covered with limestones.

ANALYSES OF SALT FROM SALITRE VALLEY, BAHIA.

L. R. Lenox, Analyst.

	Tabua.	Varzea do Sal.
	Per Cent.	Per Cent.
Moisture and organic matter	0.50	1.60
Insoluble matter, mostly sand	1.32	0.63
Magnesium sulphate ($MgSO_4$)	0.36	0.86
Calcium sulphate ($CaSO_4$)	2.68	1.78
Calcium chloride ($CaCl$)		0.63
Sodium chloride ($NaCl$)	95.20	94.68
Total	100.06	100.18

Throughout this limestone area most of the country is flat and the streams, when they exist, are sluggish. The result is that in seasons of rain the water gathers in shallow ponds that soon dry up. This process of concentration carried on for long periods has left the salt and other easily soluble minerals from these waters in the soft, limy earth in the bottoms of the ponds. After the water evaporates the people gather up the thin upper layer of this earth, leach out the salt and boil the water down in iron kettles or allow it to evaporate in wooden troughs. In this way almost all of the salt supply of the interior is obtained. Of late years the prolongation of the railways has made it possible to ship better grades of salt into the interior, but those who live far from the railway lines still manufacture their own salt or buy it near at hand. In 1907 the railway freight on a sack of salt from Bahia to Joazeiro, a distance of 574 km., was from 66 to 82c. American money.

Although much has been written about salt in the interior, hitherto no one seems to have taken the trouble to have the salt examined chemically. It is common experience of persons traveling in the interior to be troubled with temporary and sometimes serious intestinal derangements that are attributed to the salt. Analyses do not seem to bear out this theory. Specimens of the salt made in the interior were brought away and analyzed, the results being shown in the accompanying table.

The sand in this salt could readily be eliminated; otherwise the analyses show the Salitre valley salt to be quite as good as the sea salt from Turks island or Lisbon.

Saltpeter

One hears many reports of the existence of large quantities of saltpeter in this region. The Salitre (saltpeter) valley covers an area of 12,500 sq.km., and it is supposed that Rio Salitre took its name from the abundance of saltpeter within its drainage basin. There are large areas of limestone in that valley, and caves are common in the limestones, and these caves contain more or less saltpeter. However, I have never found any large quantities of saltpeter in the many caves I visited though the earth in the caves is generally more or less impregnated with it. In the regions of the Caboclo shales there are also a good many caverns which contain saltpeter. Such caves are common in the mountains lying about the eastern end of the Calmon valley, and about the Almas valley.

CHARACTERISTIC VIEW ACROSS SALITRE VALLEY

It is covered with catinga forests. An abundance of excellent water can be had from wells in this region.

SURFACE LIME ROCK ALONG THE RAILWAY NORTH OF ANGICO

Gold

Gold was formerly mined at many places in the Chapada Diamantina of Bahia. A few years ago it was mined along the mountain streams in the vicinity of Jacobina. The stream gravels are so far exhausted, however, that it cannot be said that there is any systematic gold mining now carried on in these gravels. In the vicinity of Jacobina are some properties said to contain gold associated with various forms of pyrites, but at the time of the writer's visit to that part of the state none of these properties were being operated. Some gold is commonly found in washing for diamonds and carbonados, but there is not enough of it to constitute a gold-mining industry.

Gold is known to exist in the southern part of the Serra do Assurná, and there has been some gold mining done in the vicinity of the village of Gentio. The gold is chiefly from stream gravels, but gold-bearing quartz is said to occur in the shales thereabout. A few years ago a gold-mining company was organized to

[2] Antonio J. de Souza Carneiro, *Riquezas Minerais do Estado da Bahia*; p. 47. Bahia, 1908.

The saltpeter seems to have been formed in many instances by the reactions produced by the potash minerals and the droppings of small rodents, called *mocoto,* that live in the caves. In some cases it seems to have been washed in from the surface.

It is quite probable that an important saltpeter industry might be established by leaching the earth from the dry caves of the interior. The dryness of the atmosphere of the region would do away with the necessity and expense of artificial evaporation. Though the local demand is too small to warrant such an industry, foreign markets would readily be found for the output.

Mineral Pigments

In the Caboclo shales there are at many places ochers that will probably be valuable when transportation facilities will have improved. Such ochers appear to be abundant in the region about the Almas valley and east of the Calmon valley. On the road leading from Morro do Chapeo to Lençoes on an estate known as Roça Grande the yellow ocher beds are also well exposed at many places. A sample gathered about 2 km. south of the house at Roça Grande was analyzed by L. R. Lenox with the following results: Hygroscopic water, 0.73 per cent.; loss on ignition (water and organic matter), 7.14; sodium chloride (NaCl), 2.15; potassium oxide (K_2O), 1.32; sodium oxide (Na_2O), 0.13; oxide of iron (Fe_2O_3), 10.47; alumina (Al_2O_3), 20.71; silica (SiO_2), 56.54; lime (CaO), none; magnesia (MgO), 0.64; total, 99.83.

In the vicinity of Lençoes the diamond washers find some deep red rock fragments associated with the diamond-bearing gravels. These fragments, called *caco de telha* or tile fragments, are regarded as good "signs" of diamonds. They are simply lumps of impure iron ore that form beds of great thickness and wide distribution in certain parts of the diamond district. Their brilliant red color suggests the possibility of their being used for the manufacture of red paint. The following analysis shows the composition of some of the larger lumps: Hygroscopic moisture, 0.65 per cent.; loss on ignition (water and organic), 9.80; silica (SiO_2), 24.54; oxide of iron (Fe_2O_3), 50.84 (equivalent metallic iron, 35.57); alumina (Al_2O_3), 14.03; lime (CaO), none; magnesia (MgO), 0.21; total, 100.07.

Marble

Much of the rock shown on the accompanying map as limestone is marble. The beds are often so folded and the rocks so thinly bedded that they have no value as a marble. In other cases, however, the beds are thick enough to form good building stones, and the beds are horizontal or in position to be readily quarried. The colors vary from a straw color to a vermilion red and to a bluish black. There are also brecciated marbles of great beauty, while the travertine or "onyx" marbles are abundant and remarkably fine. At present no use is made of the marbles of this region.

At one place white saccharoidal marble was found among the rocks of the old crystalline series. This locality is on the line of the São Francisco railway at and about km. 435, or 4 km. north of the Carnahyba station.

Limestone Other Than Marble

There is a large demand for lime in Brazil and with the exception of accumulations of shells and the coral reefs along certain parts of the coast, there is but little limestone in that country within reach of water transportation. The railway from Bahia to Joazeiro on the Rio São Francisco crosses a zone north of Angico in which limestone covers the surface of the ground over an enormous area. It was formerly supposed that this limestone was paleozoic and that the quantity of it was, for all practical purposes, unlimited. Years ago Mr. Derby expressed the opinion that the limestones in this particular belt were of fresh-water origin, and a careful examination of the entire section from Angico to Joazeiro shows that Mr. Derby's conclusion is practically correct. With the single exception of certain marbles mentioned above, the beds are all superficial and are spread over a wide flat plain to a depth which was nowhere found to exceed 10 meters.

On the line of the railway the limestone extends from km. 391 just north of Angico to km. 433, a short distance north of Carnahyba station. At several places, however, the drainage has removed it, and the underlying crystalline rocks are exposed. At and about Carnahyba the rock has been quarried for building purposes, and some of the stations of the railway are made of this limestone. It is also extensively burned for lime for which much of it is well adapted.

Although this limerock is of considerable local importance, owing to its convenience to railway transportation, there is not enough of it to meet any large demand or to maintain a constant output.

The great limestone areas of the state are in the valleys of the Salitre, Jacaré, and Rio Verde, and in a north-south belt lying along Riacho Utinga and Rio Una. The total area covered by limestones (and marbles) in these basins, and not including the great limestone regions lying north and west of the Rio São Francisco, amounts to about 25,000 sq. km. This estimate does not include the areas of recent land and fresh-water deposits such as those along the railway between Angico and Carnahyba.

The day will come, sooner or later, when some of these limestones will be used for the manufacture of portland cement. At present no portland cement is manufactured in Brazil. The cement used in that country is imported from Europe.

SALT FACTORY AT TABUA ON THE UPPER RIO SALITRE

The earth is scraped up in the foreground; the leaching troughs are under the trees near the heaps of the leached earth.

Close to the limestones there is an abundance of clays and clay shales, especially in the Caboclo beds, that would answer perfectly for the manufacture of portland cement.

Mica and Other Minerals

In the area of the old crystalline rocks many occurrences of mica of commercial importance are known. None of them, however, is worked at the present time. On the road between Jacobina and Villa Nova, I found a pegmatite dike containing beautiful crystals of mica, many of them measuring 10 cm. and some of them 15 cm. in diameter. Other similar dikes with equally large crystals are reported from many places in the valley of Rio Itapicurú. I have seen some fine mica plates said to have come from the vicinity of the falls

of Paulo Affonso. Many other localities are said to contain mica of commercial sizes. Mica mining would certainly be undertaken in this region if someone acquainted with the methods of mining, separating and marketing it would start the work and give the people a little practical experience of how it should be done.

Many other minerals occur in this region, but though they will doubtless be of great importance at some time in the future, they are of but little actual value under existing economic conditions. Among such minerals may be mentioned iron ore, iron pyrites, abrasives, refractory materials, building stones, slates, clays, glass sands, etc.

The Water Supply

In a region affected by droughts that sometimes draw themselves out for several years, the water supply is a matter of prime importance. Although the map shows many rivers traversing the diamond district of Bahia, as a matter of fact during the greater part of the year most of the streams shown on the map are stream channels rather than streams. The rural population lives chiefly by cattle raising and by farming on a small scale. In times of droughts nearly all of the smaller streams dry up, and to get water for domestic use and to water the cattle, rude, open pits are dug in favorable spots in the stream beds. When the droughts are prolonged beyond a certain period water for domestic use has to be brought for many leagues, and the cattle must be driven away or left to perish of thirst.

A study of the structural geology shows that water is really abundant throughout almost all the diamond district and can be had by means of ordinary open wells, by driven wells and even by bored artesian wells. The gently folded geological structure and the character of the rocks lend themselves readily to the use of artesian wells over a large part of the area. In the Salitre valley there is a series of gravels and sands usually lapping back against the bases of the mountains, especially along the western side of the valley. Water flowing from the mountain ranges sinks into this formation as soon as it reaches its margins and passes out toward the axis of the valley. It is very evident that these gravels contain an abundance of excellent water that can be reached almost anywhere in the gravel area.

Unfortunately the people living in this region know nothing about wells of any kind, and being very conservative, they are not disposed to try new methods of obtaining water, until someone proves by actual experiments that the water can certainly and cheaply be found. The writer has seen water for domestic use carried a distance of 26 km., when a well driven on the spot 4 m. deep would have obtained all the water required, and of excellent quality. Other cases are reported where the water had to be carried as much as 40 km. The manufacturers of some cheap forms of driven wells and pumps could build up a good business in the interior of Bahia by putting down two or three such wells, and showing the people how to use and care for them.

Soils

The soils of this region are naturally divided into the alluvial soils of the large rivers, the soils of the limestone areas and the soils of the area of crystalline rocks. The other formations have yielded each its own residuary soil, but these areas are of minor importance.

The alluvial soils of the Rio São Francisco are as fertile as such soils ever are and their proximity to an unfailing water supply in that great river makes them especially desirable for certain kinds of agriculture.

The limestone soils are as fertile as can be found in any part of the world, and over enormous areas they stretch as far as one can see like great prairies with just enough slope to drain them well. Unfortunately there is very little of this excellent soil now under cultivation. Along some of the streams like the Rio Salitre, Rio Jacaré and Rio Verde, the narrow flood plains of those streams are planted in sugar cane, in corn, or cotton, but over most of these plains the aboriginal *catinga* forests still grow undisturbed.

In the area of the crystalline rocks the soils are not so good as those of the alluvial plains or of the limestone regions. Still they support a considerable population. Cotton is grown in small patches, sugar cane flourishes along the streams and much coffee is grown in the mountainous districts. Unfortunately modern agricultural machinery is unknown. Not a single plow was seen in the thousands of miles traveled by our party. Almost all agricultural work is done by hand with large, heavy hoes.

Mining Laws of Bahia

Persons wishing information concerning the details of the mining laws of Bahia should consult law 624 of Sept. 9, 1905, of that State, and the general mining regulations relating thereto. These regulations were translated and published in English by *The Brazilian Review* at Rio de Janeiro in 1907. Space will not allow any extended quotations from or discussions of the mining laws and regulations. The following points may be of interest:

Unless otherwise stipulated in the original grant the State owns the minerals on private lands, in the beds of navigable streams, all lands classified by law as diamond lands and all abandoned claims. Persons wishing to do prospecting on State lands must obtain formal permission of the government; such permission may not be for more than 24 months, and the area to which prospecting is confined must not exceed 1000 sq km.

The discoverer of mineral deposits is required to have surveys made and registered and a fee is charged. When the applicant owns the land, the fee is 50 milreis (about $16); when he is not the owner of the land, the fee varies from 200 to 2000 milreis (from $66 to $660.) When a mine is on private land and cannot be purchased, the State may expropriate it. Concessions and leases can be transferred only with the previously obtained consent of the government.

Most minerals taken from mines are taxed on their gross values at rates varying from nil to as high as 50 per cent. on monazite sands. The tax on diamonds and gold is from two to ten per cent. on the gross values at the mines. Until Sept. 1915, iron and manganese mines are exempt from these taxes. The government may make differential rates for the purpose of encouraging an industry.

Foreigners are subject to the Brazilian laws and courts in matters relating to mining operations the same as if they were Brazilians. In case of lawsuits against mining establishments embargoes may be placed upon the product of the mine, but not upon the establishment itself. Mining operations are encouraged by expropriations of land, water and timber required for the operation of mines and by preferences in the concessions of water rights.

General Observations

The writer finds so much misinformation regarding Brazil in general that he uses this opportunity to correct some of it. Persons who expect to do business in Brazil should endeavor to see things in a large way, and they should make up their minds to conform to a reasonable extent to the customs of the country. Those who are not willing to make such small concessions should not go there.

For those who have business in the interior it is worth remembering that wagons are but little used, and consequently there are but few wagon roads. Freight that has to go into the interior beyond the railway lines must generally be carried on mule back. For this reason everything should be so packed that it can be readily loaded on animals and can withstand the bumps and kicks to which such packages are usually subjected.

The climate of the mining regions is for the most part remarkably fine. Reference is here made to the interior of Bahia and to Minas Geraes and Goyaz. Being in the tropics, it is to be expected that the climate is a hot one, but these regions are elevated and during most of the year are dry and healthful. Along some of the rivers there is malaria especially during certain seasons.

Nearly all kinds of supplies required by prospectors and miners can be had in Rio de Janeiro. Many such supplies can also be had in Bahia and other large cities but one cannot always count on finding special forms of machinery, transit instruments and the latest devices of every kind. When

large quantities of any one thing are required it is hardly safe to depend on the local markets, except for food, clothing, lumber and such things as the country itself produces or are in constant demand by the people.

Labor is cheap and when promptly paid and properly treated it is very good. In the manganese mines of Minas Geraes unskilled labor is paid at the rate of about a dollar a day for a 10-hour day. In the vicinity of Bahia laborers get about 75c. per day. Owing to the uniformly high prices in the diamond district, labor there is somewhat higher.

The language of the country is not Spanish; it is Portuguese. And bad Spanish is not good Portuguese. Neither will some other language do just as well. In the largest coast cities one finds many foreigners who speak English, French, German, Italian and almost any other language, but those who have business to transact with the government, or with the people, or who have to live in or travel through the country must speak the language with some sort of fluency or they must pay the price for their inability to speak it.

Gaseous Currents in Meyer's Tangential Chambers

By V. P. Davis*

In *Zeitschrift für angewandte Chemie*, Nov. 6, 1908, Dr. K. I. Beskow, of Helsingborg, describes a series of experiments, which were made with a view to proving that the gaseous currents in Meyer's chamber system really follow a tangential course, flowing in a circular path along the chamber walls.

The experiments consisted in placing a piece of glass tubing about 2½ in. in diameter and 1 ft. long horizontally at various points and in different positions within the chambers and determining the quantity of acid condensed in each instance in equal periods of time. The tube was bent up on the lower edge at each end to form a "boat" or receptacle for the acid, and in order to increase the condensing surface, a spiral of glass was fixed within the tube.

The different positions of the tube were as follows: In the entrance pipe, parallel and perpendicular to the gas current; in the chamber about 24 in. above the bottom lead, 20 in. from the side lead and 85 ft. from the entrance pipe, parallel and perpendicular to the side lead; half way between chamber top and bottom, 20 in. from the side lead, and about 47 ft. from the entrance pipe, parallel and perpendicular to side lead.

The distance from the entrance pipe is taken along the periphery of the chamber. The chambers are cylindrical, 9.8 m. (32 ft.) high and 9.6 m. (30 ft.) in diameter. In the entrance pipe the tube condensed 8.8 gram H_2SO_4 when parallel, and 3.7 grams when perpendicular to the gas current, or in about the ratio of 2½ to 1. Within the chambers the ratio of condensation in the tube (parallel-perpendicular) varied from 2½ to 3½ : 1.

Beskow aptly terms the position of the tube when perpendicular to the side lead as the "radial" position. He shows several interesting diagrams plotted from the table of results and draws the conclusion that there is unquestionably a strong tangential motion of the gases within the chambers.

It has been stated that the good work of the Meyer system is due rather to greater hight than to any actual tangential current of the gases, but the foregoing experiments would indicate that Dr. Meyer's claims rest on a most substantial basis.

*31 Union Square, New York.

A Mexican Malacate in England

By H. Maplethorpe*

The accompanying illustration is from a photograph of a horse-power winding drum that has been in use for many years at the Forge colliery, Forge Lane, Wednesbury, Staffordshire. The drum, or malacate, as it is called in Mexico, has been superseded by a modern steam hoisting plant, but is still kept in reserve, ready for use. It is used from time to time for sinking.

MALACATE IN USE AT FORGE COLLIERY, STAFFORDSHIRE

*2 Salisbury street, Walsall road, Darlaston, Staffordshire, England.

The Rising Sun Oil Company is preparing to build a large refinery at Hakata, Japan. It is probable that oil from Borneo will be used principally.

The Tasmania Gold Mining Company

The report for the twelve months ending Sept. 30, 1908, has been issued. The results of the year have not been profitable, as, notwithstanding gold production of a value of £128,646, the accounts show a small adverse balance. The number of tons milled was 70,272, giving a yield of 36.6s. per ton. The reduction works consists of a stamp mill with a chlorination and cyanide plant. Additional cyanide plant is being considered to take the place of the chlorination process, which is expensive to run.

The development of the mine at the bottom, or 1250-ft. level, has been disappointing, but it is hoped that it is merely a poor zone that is being passed through, and that the lode will improve at greater depth. The ore reserves are only 59,125 tons, and it is evident that development work wants pushing.

The mine is heavily watered, but the pumps have been equal to the work given them. The heaviest flow of water on one day was 4,894,760 gal., or 3400 gal. a minute. This amount of water makes pumping charges a serious item, the total for the year being £19,186, which is about 18 per cent. of the operating expenditure at the mine.

According to statistics collected for The Mineral Industry, the production of alundum in the United States in 1908 was 3,160,000 lb., valued at $189,600, against 6,751,444 lb., valued at $405,086 in 1907. This abrasive substance is made only at Niagara Falls, and by the Norton Emery Wheel Company, of Worcester, Mass. It is used in the manufacture of artificial corundum for grinding wheels.

Gold and Other Minerals of Eastern Siberia

The Province of Baikal Has Rich Gold Quartz Veins; Amurski Oblast Possesses Placer Deposits from Which Gold Is Won by Primitive Methods

BY S. F. G. WHITE*

In this article I shall deal only with those portions of eastern Siberia that I have visited. On one trip I had occasion to investigate reef mining in this little known country.

Province of Baikal

The following described quartz mines (in the true sense of the word) are the only ones in the province of Baikal that have been systematically worked by Russian companies:

1. A stockwerk formation of a granitic nature with a pay streak 35 ft. in width, situated on the slope of a hill and dipping at an angle of 30 deg. The ore varied from 4 dwt. to 4 oz. gold per ton. Adits were driven on several levels, the total length being over 1500 ft. One shaft was sunk at the base of the hill to a depth of 110 ft. to water level when operations were abandoned. Following the first operation, a French engineer attempted to work the mine as a quarry, the latter method destroying all timbers and completely closing up all approach. A mill of 24 stamps of 640 lb. each was built on the creek side. Most of the tailings were dumped into the creek without regard to their possible value. Copper plates were used in the mill. The stamps were all of local make and most of the plant was of wooden structure.

2. A quartz vein in a schistose formation traversed by dikes of granite. The vein traversed both formations having a width of from 1½ to 3 ft., striking northwest and dipping at an angle of 25 deg. This mine was worked during a period of 13 years and has produced 80,855 oz. of gold. These figures are taken from the company books, kept according to the laws of the country. One level was driven through the hill a total length of over 2000 ft., of which 1400 ft. was stoped out. A lower level was driven to a length of 1200 ft. when operation ceased. No connection was made. Great difficulty was experienced in inspecting this mine owing to levels being nearly full of ice. The timbers, however, were all sound and the vein still well defined. In this case the mill was built in the bed of a creek about two miles distant, and the ore was hauled in carts. The tailings were dumped into old placer workings and neglected. A cyanide plant was operated with which 1575 oz. gold were extracted. Sumps and percolators were all made of wood, standing in the open, and the result of a winter's freezing in a semi-arctic country can well be imagined.

3. Situated 3½ versts from the above mine is a vein having a width, where exposed, of 1 ft. 4 in. Its strike is north 50 deg. east, and the dip 50 deg. This mine was worked during a period of five years and crushed 5017 tons that averaged 12 dwt. 19 grains. But little work was done. One level was driven to a length of 600 ft. and a lower one 200 ft., when the mine was closed owing to a dynamite accident. In the immediate neighborhood of these two mines are four other auriferous quartz veins. I was told by an old workman that the rock was so rich in places that it resembled a brass samovar, and that the miners used to steal the stone and crush it at home with a pestle and mortar. Labor is plentiful and cheap, while supplies can be freighted from the railway at £4 9s. per ton. Timber and water are obtainable with little difficulty.

About 200 versts from the above mineral belt other quartz reefs have been located, so far eight in number, and of various widths. The vein matter consists of quartz, iron and arsenical pyrites, with gold finely divided and at times visible to the naked eye. The veins have a general strike of north-northwest, with a dip of 45 deg. Tests made by amalgamation only are reported to have shown in many cases very high results. Assays of pyritic ore showed no visible free gold and gave results of 3 dwt. only. It is worthy of note to remark that all these veins are immediately adjacent to what were formerly very rich placer workings. The mines are worthy of a careful study from a dredging point of view.

Other Mineral Resources

Of other minerals in the Baikal province, graphite, asbestos, copper, tin, iron and coal exist in payable quantities. Tin was discovered for the first time on the Onon river in 1811. Numerous excavations spread over the surface, especially in places where the deposits were found to be particularly rich, indicate that the mining of tin was once carried on in early periods by the natives (Bourists). It appears that articles made of tin which were found to a very large extent in the possession of the native population were the chief objects of local trade, whereas there are but very few traces of these articles having been imported from Western Russia during the early part of last century. Tin was worked in 1813, 1815 and 1817 on both sides of the Onon river. The ore was mostly tinstone accompanied by quartz. Smelting was done in ordinary small furnaces. The first placer deposit of tin was discovered in 1829 by a certain Kooreagin, the leader of a prospecting party. The method applied for saving the tin was the same as that applied to gold. The average amount extracted per ton of gravel amounted to 363 lb. These notes are taken from a very old Russian book which ends by stating that owing to the high cost of production in these days the mines were closed down in 1843. Most of the placers in the Baikal province have been worked by the Czar's cabinet with convict labor. The manner of working the gravels was of the most primitive type and a big loss in gold was the result. Steam-thawing methods are absolutely unknown in the country, and wet ground is passed over unless there is a very small overburden. Owing to the unsystematic method of taking out the pay dirt, a lot of good ground is lost.

It will be noted in my remarks on the Baikal province, that I have dealt only with mines which have been worked and located; it was not my aim to look for new prospects in so vast a country. Attention is drawn to the fact that all my travels were south of the railway as far as to the Mongolian frontier. To the north of the railway I could hear of no quartz mining ever having been carried on, with the exception of that of one English company at present working in the Nerschinsk district.

Province of Amurski Oblast

Descending the Amur river, the province of Amurski Oblast is entered at the village of Pokrovka, a day's journey by steamer from the town of Srèlinsk, the Siberian terminus of the Trans-Siberian railway. This railway is now being constructed along the left bank of the aforesaid river to connect with the Vladivostok branch line at the town of Kharovsk. The whole of this vast province is a network of rivers and creeks, in all of which gold is found in varying quantities. Ascending one of the largest tributaries about 600 miles, I was enabled to visit many of the old placers from which enormous quantities of gold have been recovered. The extent of these workings is so great that many months could be spent in simply taking a casual look at them. On one river the operations being carried on were so interesting that I give in detail a description of them. The deposit is of an average width of

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150 yd. and is from 2½ to 14 ft. in depth. The stream flows at from 1 1/7 to 1½ miles per hour. Work is conducted every summer by gold robbers, or snipers; in some cases they work the banks, in others they work the bed as far as they are able to reach it by wading out into the water, one man shoveling up to another who washes by the simple panning method. On one spot there were 12 hand-dredges at work, each dredge consisting of two rafts, one 13 yd. in length, the other 7 yd. in length. On the former was the dredge, consisting of a shovel 21 in. deep by 17½ in. wide. On one end of the raft was a windlass with a wire rope attached to the shovel by two chains, one on each side. In the center of the raft for a distance of 10 yd. was an opening 2 ft. wide. The shovel was taken to the far end of the opening and rammed into the bottom of the river by a man who stood on a piece of wood, or rung, let through the shaft; thus the shovel was kept down while the windlass dragged it along the bottom the distance of 10 yd. and to the surface. On the second raft were a long tom and hand pump into which the gravel was dumped and washed, the gold being caught on blankets with 1-in. riffles.

These machines were working in 11 ft. of water. The gravel washed was purely surface, but in spite of this each machine averaged a saving of gold amounting to 328 grains per day of 10 hours. One clean-up, which I personally checked, showed a recovery of 26 grains per cubic yard. This, no doubt, was a particularly rich patch, but samples which I took many miles lower down the same river, from the banks at a depth of only 8 in., showed returns of 13 grains to the ton. One important feature of this river and others in the neighborhood is that they never freeze to bed rock in mid-stream. The method above described is carried on during the months of May, June, July, August, September and part of October. Access to these places is easy, steamers running all the way from Novi-Nikoliesk, at the mouth of the Amur, as also from Kbarovsk, the aforesaid railway terminus of the Vladivostok & Amur river lines. All supplies can be obtained at small cost. Timber is plentiful and labor, formerly scarce, is now obtainable, owing to the great inrush of emigrants from European Russia.

No quartz mining has, as yet, been carried on in this province, but as evidence of the gold being of local origin, I saw a Russian empty out two saddle bags containing about 40 lb. of coarse gold, two-thirds of which had been hammered out flat to get rid of the accompanying quartz. I was shown samples of quartz containing visible gold, which came from a reef that was being opened up some distance out of my way, and from assays and plans shown me at a later date, it was surprisingly rich. I regret to say that scarcity of time prevented my visiting the district. The country is entirely schistose and is traversed by dikes of granitic rocks and intrusive masses of gneiss, while large areas are covered with the detritus of primitive rocks. Of other minerals large deposits of copper and beds of coal have been located, but as yet no development work has taken place. With the advent of the Amur river railway, great changes will surely take place in this province.

Other Provinces

The Primorski Oblast, or Maritime, province is as yet but little explored, owing to the Crown's past unwillingness to allow mining or prospecting. From information obtained from old Polish political prisoners, I understand that conditions will change, and as his Majesty, the Czar, has now seen fit to lift his veto and permit exploration, we may, before long, hope to hear of active mining operations. I could obtain but little information of the Yakutsk province, and owing to its inaccessibility from the Pacific sea coast, I decided to leave it alone.

In order to bring out the importance of Eastern Siberia as vividly as possible, I would lay stress on the fact of its easy accessibility from Vladivostok as a seaport, its great water ways for internal communication, its railroads now in active construction, and its cheap labor and abundance of fuel. Having worked there summer and winter and seen it under every conceivable condition, I am, I think, fully justified in expressing this opinion. I can but end these few words in expressing my thanks to the people of the country, who were always ready and willing from the highest to lowest to help a foreigner over any little difficulty and give him of their best in hospitality.

Laboratory Methods for Making Alloys of Iron and Vanadium*

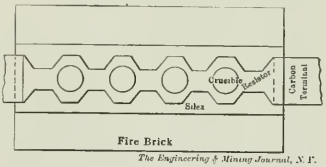
By W. L. Morrison†

Binary alloys of pure iron and vanadium free from carbon can be conveniently made by two methods: (1) Goldschmidt's method, using pure aluminum and hammer scale from puddled iron, and mixing a little ferrovanadium with charge. (2) By use of electric resistance furnace, using a crucible in the resistor to melt puddled iron and ferrovanadium.

Goldschmidt's process is very simple and requires but little apparatus. The iron oxide or hammer scale is analyzed and sufficient aluminum is added to combine with the oxygen present; usually 5 per cent. excess is added on account of oxidation of some aluminum by oxygen in the atmosphere.

The reaction between the oxide and aluminum is brought about by external heat, or by ignition of a mixture (barium peroxide and aluminum) which is usually placed at the bottom of the charge and electrically ignited. For small charges of 2 lb. or less, it is most desirable to apply external heat in order that the reduced iron may separate cleanly from the slag. If internal ignition were used the cold walls of the containing vessel would chill the molten iron before it separated from the slag. A gas furnace or an ordinary forge is very convenient for heating the crucible containing the charge. The resulting alloy upon solidifying may then be removed and forged in a bed of quicklime out of contact with carbon since alloys are to be carbon free.

The electric furnace was of the resistance type carrying four 1-lb. magnesia crucibles. The resistor was baked carbon, 16 and 17 mesh in size. The terminals were of 2x4-in. carbon. Carbon terminals were used in preference to graphite on account of their low heat conductivity. The walls of the furnace were of common fire-brick, the interior being lined with silex. The furnace was covered with silex slabs to prevent radiation losses. In order that the bottom of the crucibles might heat evenly, the crucibles were placed on a small graphite block. A thin layer of decomposed graphite was used between resistor and carbon terminals to give better contact. The construction of the interior of the furnace, as shown in the accompanying illustration, is for the purpose of giving uniform resistance throughout the bed.



RESISTANCE FURNACE

The source of current was a 33-kw. Westinghouse alternater delivering 1100 volts. Six transformers of ordinary line type were connected in parallel and the secondary coils so connected that 110 or 55 volts could be used. During all the runs 110 volts were used. The rise in amperage was so slight that the iron melted before the wattmeter registered 20 kw. The time required to melt 1 lb. of puddled iron in each of the four crucibles was 5½ hours. Power used was 65 kw.-hours. The puddled iron was introduced into the crucibles before the heat, then ferrovanadium after the melt. Many different crucibles were tried and the magnesia was the only serviceable one.

*Brief of thesis work done at Case School of Applied Science.

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Determination of Lead and Cadmium in Spelter

By Eric John Ericson*

In a former article in the Journal, July 25, 1908, I described a rapid technical method for the determination of lead in spelter, requiring only about one hour's time for execution. This was the first application of my method to spelter and may be designated as method No. 1. I desire now to present our latest scheme, or method No. 2, which gives lead to the thousandth of a per cent. whereas the first gave accurate results to 0.01 per cent. Besides greater accuracy the new method affords at the same time a separation from cadmium since the filtrate from lead may be used for the former's determination.

Solution of the sample is here effected by dilute hydrochloric acid according to Oswald Günther[1] or dilute sulphuric acid (Nissenson[2]) until nearly all zinc is dissolved. The insoluble lead and cadmium is filtered off and dissolved in dilute nitric acid. This procedure makes it possible to operate on a larger sample, and each 0.1c.c. of the potassium permanganate solution (0.568 grams to the liter) equals 0.001 per cent. lead. Particular care must be taken not to dissolve the sample too fast as there is danger of cadmium going into solution. In cases where lead alone is wanted the dissolution may be hurried some without impairing the accuracy. In this laboratory it is customary to run duplicate determinations on spelter, chiefly to guard against and detect any possible loss of cadmium.

The substitution of trichloracetic acid according to Fox[3] for any one of the mineral acids usually employed in separating cadmium and zinc, has been found advantageous, since it is not dissociated to the same extent as hydrochloric or sulphuric acids, and even concentrated solutions do not prevent the complete precipitation of cadmium. In the case of mineral acids the strength must be kept within narrow limits as is well known. A slight excess prevents the precipitation of cadmium, while insufficient acid causes much zinc to be precipitated along with cadmium and makes several reprecipitations necessary. By means of trichloracetic acid only one reprecipitation is called for, unless it has been found that more zinc remained undissolved originally than was aimed at, as may be seen later

Method No. 2 for Spelter

Weigh out 19.2 grams of the sample and place in a No. 3 Griffin beaker Add 50 c.c. distilled water, and 50 c.c. hydrochloric acid (1.10 sp.gr.); warm gently and from time to time add more dilute hydrochloric acid until nearly all zinc is dissolved and only 1 to 1.5 grams remain, plus the insoluble lead and cadmium. Do not hurry the dissolution when cadmium is to be determined. A good plan is to add insufficient acid at the start and allow to stand over night. In the morning, continue the addition of acid gradually and give it time until the proper stage has been reached. Filter off metallics and wash thoroughly with hot water (not necessarily until all chlorides have disappeared).

Transfer whatever metallics are on the filter back into beaker by means of a fine jet of water. Now add 10 c.c. concentrated nitric acid, boil until brown fumes cease to appear and filter if traces of tin or antimony are indicated, which is seldom the case. If filtered and washed the volume will probably be large enough. If not add 75 to 100 c.c. water, 30 c.c. strong ammonia and 4 to 5 grams solid ammonium persulphate. Should the lead be unusually high, say over 1 per cent., it is best to add the persulphate before the ammonia. This insures perfect oxidation even where lead runs high, but requires a standardization of the factor, as in the case of lead concentrates. Boil five minutes, allow the liquid to settle 10 min. and filter while warm through double 11- or 12.5-cm. filters. Wash four times with hot 10-per cent. ammonia water and five times with hot water.

Transfer filter with precipitate back into beaker in which precipitation was made; add 25 or 50 c.c. hydrogen peroxide solution (10-40 c.c. H_2O_2 U. S. P. strength to the liter) depending on the percentage of lead. Stir until dissolved, add 15 c.c nitric acid (1.20 sp.gr.) plus 100 c.c. water and titrate the excess of hydrogen peroxide by the standard permanganate solution. For instance if 25 c.c. H_2O_2 blank require 60 c.c. $KMnO_4$, and the sample 28.5 c.c., then the lead equals 0.315 per cent. The accompanying examples taken from practice show how closely the new method checks with the chromate determination.

	Erieson Method. Per Cent.	Gravimetric as Chromate. Per Cent.[4]
Refined spelter	0.082	0.083
Refined spelter	0.043	0.044
Prime western spelter	0.530	0.538
Prime western spelter	0.533	0.531

Cadmium Determination

For the determination of cadmium, evaporate the ammoniacal filtrate from lead until it is nearly neutral and zinc and cadmium commence to be precipitated, add 35 c.c. dilute sulphuric acid (1:3) and boil down to about 150 c.c. volume. Saturate with hydrogen-sulphide gas, add 25 c.c. water and warm. Sometimes it is necessary to add a few cubic centimeters of dilute ammonia to start precipitation. Allow the precipitate to settle, filter through double filters and wash. Test filtrate for cadmium and if none is present reject it. Redissolve the cadmium sulphide, contaminated with zinc sulphide, in dilute hydrochloric acid (1.10 sp.gr.) and wash with water. If copper is present its sulphide remains insoluble on the filter. It may be ignited and weighed as copper oxide.

The filtrate containing cadmium and zinc chlorides is neutralized with dilute ammonia, and trichloracetic acid dissolved in water added until the precipitate is redissolved. Dilute to about 150 c.c. volume and reprecipitate, adding hydrogen sulphide and water alternately. Settle and determine by any one of the usual methods,[5] preferably as sulphate or phosphate.

Should the color of the cadmium sulphide from the sulphuric-acid solution be yellow, it indicates considerable zinc, which may be largely eliminated by boiling the solution of the mixed chlorides to expel hydrogen sulphide, adding sodium hydroxide in slight excess to precipitate cadmium, filtering, washing and redissolving the cadmium hydroxide on the filter in trichloracetic acid, diluting and reprecipitating with hydrogen sulphide, when a pure cadmium sulphide will be obtained. Should the duplicates not agree, reprecipitate the one giving the highest result since it may still retain some zinc. If still too far apart, repeat the entire analysis.

Higher Factor for Method No. 1

In this connection I wish to add to my previous article concerning ores that further investigations have shown the factor in the equation, 1.92x iron value of permanganate = lead, to be correct on spelter and alloys wherever a direct determination can be done, but it is too low on ores, owing to slight losses as lead sulphate and carbonate in the preliminary separation. The factor 1.95 is recommended, hence weigh out 1.95 grams instead of 1.92 grams as originally suggested. As the lead content in the zinc ores is usually very low, the difference in factor does not cause any serious error, but in lead concentrates it would be considerable. This was realized at the outset and, therefore, suggested to check the potassium permanganate solution against a standard lead ore put through under identical conditions. To insure perfect oxidation in high-grade lead concentrates, add the ammonium persulphate to the nitrate solution before making it ammoniacal.

According to the fourteenth annual report of the Rand Mines, the cyanide works treated 3,195,242 tons of ore during 1908 The yield was 301,736 oz. of gold.

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[1]Bericht der Internationalen Analysen-Kommission an der VI Internationalen Kongress für angewandte Chemie, Rome, 1906, page 51.

[2]Ibid.

[3]*Journ.*, Chem. Soc., London, 1907; page 964.

[4]Fritz, Praktischer Leitfaden für Zink hütten Laboratorien, page 27.

[5]Buskett, *Eng and Min Journ.*, April 18, 1908

Bitumen and Oils in West Africa

By T. Hugh Boorman*

Early in 1906 much interest was evinced in London at the discovery of bituminous deposits in Lagos and southern Nigeria. Syndicates were at that time marketing stocks in companies for their development. I was at that time much amused at an effort being made to compare the asphaltic oil deposits with Trinidad and Bermudez asphalts and at the queer errors that ensued in the attempt to make comparative analyses.

Samples of "Nigeria asphalt" then received were described as a mixture of water and gas, bitumen, organic matter (not bitumen) and fine mineral matter. These constituents were present in the following proportions: Water and gas, 23.33 per cent.; bitumen, 45.75; organic matter (not bitumen), 2.90; mineral matter, 28.02; total, 100 per cent. The asphalt was first found in one concession comprising about 300 sq.m., bounded on the west by the Oshun river, on the east by the Oni river, and on the south by the Lekki lagoon; the second concession, comprising 100 sq.m., was situated north of the village of Aiye, approximately 12 miles by land and 120 miles by water from Lagos.

Another concession is near the Oluwa river. Here a deposit of bituminous grit outcropping in the slope at the foot of a bench is to be found. The top of the stratum was about 6 ft. above the level of the low ground near the river. A small shaft was sunk in the bituminous stratum for a depth of 6 or 7 ft. Some pieces cut from the ground at the top of the shaft yielded from 15 to 74 per cent. bitumen. This area is about 15 miles by land and 120 miles by water from Lagos.

An accompanying table shows the comparative composition of crude Trinidad, Bermudez and Nigeria asphalts. The areas of the deposits compare as follows: Trinidad, 127 acres; Bermudez, 900 acres; Nigeria, 216 acres (located in 1906). Other tables show a comparison of refined asphalts, and a comparison of the ultimate composition of pure bitumen from asphalts.

West Coast of Africa

From reports made in December, 1908, to various companies, it appears that petroleum oil with an asphalt base is probably present in immense quantities on the west coast of Africa, and that the material originally proposed to be marketed as bitumen is of the nature of Santa Cruz bituminous sand, since the chairman of the Nigeria Bitumen Corporation stated that "the samples of bitumen which were tested showed the presence of sand, which had evidently been torn out of the rock in its upheavel, "and that" the light oil which that sand contained had evaporated and left it in the form of bitumen." They had endeavored to extract the bitumen, but met with great difficulties, the greatest of these being that of transport. They believed that when the colony opened out they would be able to make a profit on their bitumen, not only by exporting it, but in its use in the colony itself.

Sir Boverton Redwood said that when the previous meeting was held he emphasized the fact that the company was engaged in determining whether or not petroleum was obtainable in Nigeria in commercial quantities, and he now had the pleasure of congratulating them upon an affirmative answer of a most unqualified character having been given to that question.

AVERAGE COMPARATIVE COMPOSITION OF CRUDE TRINIDAD, BERMUDEZ AND NIGERIA ASPHALTS.

Composition.	Trinidad.	Bermudez.	Nigeria.
	Per Cent.	Per Cent.	Per Cent.
Water and gas	29	28	24
Organic matter (not bitumen)	7	3	3
Mineral matter	25	2	28
Bitumen	39	67	45
Total	100	100	100

COMPARISON OF REFINED ASPHALTS.

	Trinidad.	Bermudez.	Nigeria.
	Deg. F.	Deg. F.	Deg. F.
Softens at	180	160	75
Flows at	190	170	110
	Per Cent.	Per Cent.	Per Cent
Bitumen	56 4	95 0	70 68
Organic matter	6.7	2.5	9 10
Inorganic matter	36.9	2.5	20.22
Total	100	100	100
Sulphur	6.2	4.0	1.50

COMPARATIVE TABLE SHOWING ULTIMATE COMPOSITION OF PURE BITUMEN FROM ASPHALTS.

	Trinidad.	Bermudez.	Nigeria.
	Per Cent.	Per Cent.	Per Cent.
Carbon	82.33	82.88	80.48
Hydrogen	10 69	10.79	9.29
Sulphur	6 16	5.87	1.50
Nitrogen	0 81	0.75	0.68
Oxygen	..	....	8.05
Total	99 99	100.29	100.00

At a meeting of the Nigeria Investment Company, held in London on the same day, C. H. Harley Moseley, ex-colonial secretary of Lagos Nigeria, said that at the recent Franco-British exhibition, while the known products of southern Nigeria were very fully represented at the exhibition, there was one product that had only recently been discovered, but the existence of which has long since been more than suspected, which did not figure among the exhibits; that product was mineral oil. Mr. Moseley said: "Gentlemen who are well acquainted with facts and can speak authoritatively have made a profound and practical study of the matter, and have satisfied themselves by expert reports and by all those other investigations which are necessary before one can class a new discovery as a commercial asset. These gentlemen have told me that they are satisfied in every respect, and in what I am saying now I am taking it for granted that commercially and colloquially speaking, we have struck oil. I am taking it for granted not only that oil has been found, but that the conditions surrounding this find are of a nature to make it possible to place it on the market in competition with the oils of Russia and America."

Exploration and development work had already been carried out by the Nigeria Investment Company for two years prior to deep drilling, and test bore holes were put down under the superintendence of Bernard A. Collins, a mining engineer. This gentleman says: "I am now satisfied that the oil will be found by deep boring, and that the bitumen can be mined in unlimited quantities and of a high grade, and that the most important point now to be decided is that of outlet toward a shipping port."

The directors of the Nigeria Bitumen Corporation, Ltd., in their recent annual report to the shareholders state: "The fact that after passing a small show of oil in sandrock, oil was struck at a depth of 633 ft., which rose to within 98 ft. of the surface and did not decrease after four days' baling; that after getting the casing down farther and drilling an additional 26 ft. the manager reports that the oil is increasing, and that the production was 145 bbl. per day, is absolute proof that the quantity of oil in those strata is large, and that there is considerable pressure behind it."

According to the Right Hon. W. S. Churchill, late under-secretary for the Colonies, the Colonial Office has been impressed with the potentialities connected with obtaining mineral oil, as is shown by the fact that even creating a precedent was not permitted to stand in the way and a considerable grant of public funds to aid in drilling operations for mineral oil was authorized. That the Colonial Office and its advisers were not mistaken in their prognostications is evidenced, it is claimed, by the fact that oil was found in the western Nigeria, in addition to the bitumen November, 1908, and every succeeding cable relating to the further boring operations goes to confirm the view that southern Nigeria, in addition to the bitumen which is to be found over large areas, is in the very near future to become a petroleum producer, with all its numerous uses and the by-products which follow in the wake of this important natural development.

It is proposed to send out at once a staff of practical oil drillers from Canada. It would seem to me more desirable to have them sent from California as I cannot but believe that the deposits discovered are of a very similar character to some of those on the Pacific coast.

*Civil engineer, 59 Pearl street, New York City.

Amatrice, A New Gem Stone of Utah

This Matrix Stone Consists of Variscite and Chalcedony, with Wardite or Possibly Other Hydrous Aluminum Phosphates, and Quartz

BY EDWARD R. ZALINSKI*

Recently a gem stone has appeared on the Salt Lake and eastern jewelry markets which on account of its beauty and individuality is attracting considerable attention. Amatrice is essentially a matrix stone, and consists of the minerals variscite and chalcedony, with wardite or possibly other hydrous aluminum phosphates and cryptocrystalline quartz. The amatrice locality was discovered in 1905, but until the past year little development or mining was attempted. The first locations were made for copper but assays showed no copper present and the claims were abandoned. It is the purpose of the present article to briefly describe this new gem material together with its geological occurrence.

AMATRICE HILL IN CENTER FOREGROUND

OUTCROP OF TYPICAL QUARTZITE

The name "Amatrice" was given to it by the owners because it is fittingly descriptive of the stones. It is derived from "matrice" a synonym for matrix, prefixed by the letter "A" of the word American to denote their American origin. Up to date they have been found at only one locality in Utah, though variscite of a different type is found at another point.

In "Mineral Resources" for 1894, Sixteenth Ann. Report U. S. G. S., pt. 4, p. 602, mention is made of a compact nodular variscite found in Clay cañon about 2 miles south of Mercur, Utah. The name utahlite was suggested for this occurrence of variscite, but it is also known as chlor-utahlite. The amatrice locality is about 20 miles northwest of Mercur and is mentioned under utahlite, in "Mineral Resources" for 1905, pp. 1323 and 1350, as a new occurrence of this gem stone. The variscite here, however, differs in its physical character from that of the Clay cañon occurrence, and partly on this account and also from the fact that the name "utahlite" is very similar to "utahite," a basic ferric sulphate found in the Tintic district, the same amatrice was given to the variscite and associated minerals, from the locality under consideration. The gem is described by Douglas B. Sterrett in the advance chapter from "Mineral Resources" for 1907, pp. 42 and 43, under the heading "Amatrice or Variscite Matrix."

Location

The amatrice mines are situated in Tooele county about 40 miles southwest of Salt Lake City and about 8 or 9 miles west of Stockton, on the S. P. L. A. & S. L. R. R. The property lies in the foothills of the Stansbury range, on the eastern slope, a few hundred feet above the valley. The ground slopes from Amatrice hill easterly over the old lake-bed terraces toward the railroad. Amatrice hill is a small rounded knob of elliptical shape, with greatest length north and south. It rises 200 ft. above the adjacent bench lands on the northwest side of Rush valley, and lies about 1½ miles north of Hickman cañon. By barometer the altitude is 5700 ft. The surroundings are arid, but some dry farming is done in the neighborhood. No water exists on the property, and at present is hauled a distance of 16 miles.

Geology

The country rock in the neighborhood of the amatrice deposits is limestone and quartzite. On the surface the limestone is a light grayish color with numerous silicious and cherty portions which weather out above the softer stone forming lumps and nodules. Where freshly broken the rock is dark blue. Amatrice is found in certain beds of this cherty limestone along fissures which strike north 20 deg. west (magnetic reading), and dip 70 to 80 deg. west. Northeast of Amatrice hill on the footwall side of the amatrice beds, silicious limestone appears but normal limestone is again exposed in a small gulch. The ground rises from here and the rock becomes more silicious going up hill, passing through beds of granular quartzite or sandy silicious limestone to typical quartzite at the top of the rise. A bed of the latter outcrops prominently about 15 ft. above the surface and for several hundred feet in length. All beds are conformable to the amatrice-bearing limestone. So far no amatrice has been found in the quartzite. Along the south side of Amatrice hill the limestone is fossiliferous. The bedding is well exposed and strikes north 20 deg. west dipping 60 deg. west. Fossils found here proved to be of Upper Carboniferous age.

Occurrence

Amatrice occurs in a crushed and frac-

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tured zone in the limestone which strikes approximately parallel to the bedding. It appears in places on the outcrops in green or yellowish concretions. Where exposed in the open-cut workings it is found in nodular masses from the size of a pea to several inches in diameter. These are intimately associated with silicious material, in many cases being cemented together in irregular bunches and coated and mixed with chalcedony. The rock is cut by fissures striking north 20 deg. west and dipping 70 to 80 deg. west. These appear to have been the mineralizing fissures and are the strongest ones noted. They show limonite staining and in some cases small particles of fresh pyrite inclosed in a matrice. Chalcedony is one of the most abundant minerals of the deposits, while fractured and iron-stained chert is common. A second set of fissures striking north 60 deg. east cuts the limestone bedding at nearly right angles and dips steeply to the north; they show no mineralization. The amatrice-bearing ground is of limited extent. The gem has been found only on the eastern slope of Amatrice hill, over a distance not more than 350 ft. in a north-south direction and roughly estimated 150 ft. east and west. Development work indicates the deposit to be of local origin. No gem in place or amatrice float has been found to the north or south. The vertical depth so far proved has been less than 12 ft. beneath the surface, but amatrice has been found lower down the hill 30 ft. vertically below the present workings.

Mineralogical Notes

As mentioned before, the chief constituent minerals of amatrice are variscite and chalcedony. Wardite and probably other hydrous aluminum phosphates occur, as do quartz and chert. Wardite and variscite occur together and furnish the chief coloring material. The color varies from pale green through all shades of green to deep green; the latter color is usually translucent. The related phosphates are yellow, gray and white, while in the matrix the chalcedony and chert vary from white to dark red, yellow and brown. An oolitic and wavy structure is sometimes apparent in both the varascite and matrix. Small nodules of variscite are cemented together with chalcedony and all possible combinations of these two minerals occur. Crushing and fracturing have taken place at successive periods, with subsequent deposition of minerals of different shades in the cracks and seams.

Amatrice is hard and compact; it breaks with a conchoidal to uneven fracture. Variscite and wardite are rated at 4 and 5 in the scale of hardness respectively, but so intimately are they associated with chalcedony and in places impregnated with it that the hardness approaches that of this mineral. A rock section under the microscope would show the thoroughness of this impregnation. In some cases it may be seen in hand specimens. Fragments of the apparently pure variscite will readily scratch window glass. The individuality and charm of amatrice which distinguishes it at once from normal variscite is due to the wide range of colors of the minerals composing it and the combinations of color and structure these minerals make with one another.

Development

Development consists of a tunnel and open cuts on the eastern slope of Amatrice hill and has exposed three distinct types of amatrice, in workings some distance apart. These types are called apple-blossom, cobweb, and jade. The apple-blossom type resembles white blossoms on a green background. It is due to fine concretions of variscite intimately mixed with portions of the white phosphate, and associated with chalcedony. Dark-brown chert adds contrast to the variscite.

The open cut where the cobweb type occurs is about 250 ft. southwest of the apple-blossom occurrence. In the face of the cut fissures striking north 10 deg. west and dipping 80 deg. west, carry nodules of yellowish phosphate material mixed with chert and chalcedony. Variscite may or may not occur in these nodules. When present it is irregularly distributed. Light-green variscite with a network of deep-green lines gives rise to the cobweb or turtle-back type, which occurs with a matrix of different colors. The cobweb amatrice is due to fracturing of one generation of variscite and matrix, and recementation with variscite of a different color or by chalcedony, with often hematite or limonite staining along the cracks. This type carries some deep translucent green variscite with a tendency toward the jade type.

In the jade type of amatrice the variscite is a deep translucent emerald to apple green and resembles jadeite in color. The open cut where it is mined is the farthest southwest of any of the present workings. A specimen from here showed the limestone almost entirely replaced by silicious material. The variscite is in nodular masses ¼ to ¾ in. in longest diameter, and also of irregular outline. The color changes are gradual or abrupt; the abrupt changes are often due to fracturing and displacement but also to deposition of variscite of widely different colors. On the border the nodules are frequently translucent green, and light green or nearly white in the center. They may contain fragments of chert or silicified country rock. The matrix is extremely silicious surrounding the nodules and carries large amounts of chalcedony.

Genesis

Regarding the genesis of amatrice the following points may be mentioned: The variscite and chalcedony were deposited in a crushed and fractured zone in the limestone and replaced the rock in the neighborhood of the mineralizing fissures. Pyrite in small fresh crystals and veinlets is sometimes present with the amatrice; it furnished the limonite by oxidation. Movement occurred during and after the deposition of the gem-forming minerals, and was one of the important factors in producing amatrice, though some of the peculiar structure cannot be assigned to this cause alone. A large amount of chalcedony was deposited and brecciation of both the variscite and matrix took place. The component minerals were deposited at successive periods and possibly under different conditions.

Production and Uses

Amatrice is used in all kinds of gold jewelry. The colors are in harmony with the color of gold and it is mounted in scarf pins, rings, cuff links, brooches, lavilliers, necklaces, pendants, etc. It is also used in art jewelry on account of the individuality of the separate gems. The extreme irregularity of the variscite, chalcedony, and cementing medium, with its hardness and capability of high polish, furnish material for an ideal matrix stone. After cutting and polishing it is difficult to find two gems alike. Amatrice is usually cut *en cabochon* or elliptical with a low convex surface. It is sold by the carat and ranges in price from $1 to $3.

According to "Mineral Resources," the production of finished gems from the material mined in 1907, amounts to about 20,000 carats. In 1908 the Occidental Gem Corporation reports production in the neighborhood of 45,000 carats, a portion of which was exported to Europe. During the latter part of the year they were unable to supply the demand on account of lack of manufacturing facilities. The company is now installing its own lapidary plant in Salt Lake City.

The oilfields of the island of Sakhalin, off the Siberian coast, have long been productive. A company composed of Russians, Germans and Chinese, has secured a concession to a large tract north of the town of Nikolaievsk, and will begin to explore it as soon as the necessary machinery can be secured from Germany.

The actual percentage of extraction of gold at the Rand Mines, in 1908, according to the fourteenth annual report, was 94.421.

Microstructure of Copper Examined with a New Etching Reagent

By Robert R. Abbott*

During 1906, in attempting to examine the structure of the contact between copper and steel, as formed in the various methods of rail bonding, I was confronted with the difficulty that none of the etching reagents in present use would bring out the structure of the copper sufficiently to permit the required examination, although the development of the structure of the steel side presented no difficulties.

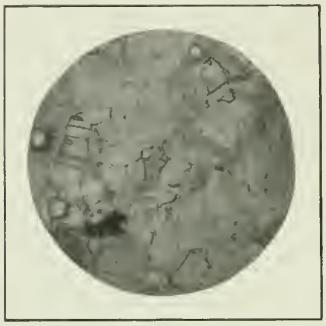

FIG. 1

FIG. 2

FIG. 3

FIG. 4

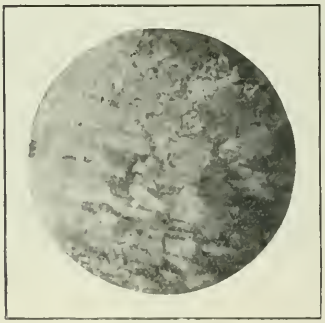

FIG. 5

FIG. 6

The literature at hand was carefully reviewed in the hopes of finding some previous work along this line, but with little success. In fact, as far as I am aware the only previous microphotographs which have been published showing with any degree of clearness the true structure of copper were those of Professor Huntington, in the Journal, of Dec. 16, 1905. Professor Huntington etched his specimen with nitric acid. This reagent would not give detail enough.

I then began experimenting with various methods of etching and finally found that ammonium persulphate ($(NH_4)_2SO_4$) gave excellent results. The method of etching with it which has given the best satisfaction is to polish the section very carefully on the Sauveur machine and, after washing free from the rouge, place it in a dish of boiling water, add sufficient persulphate to make about a 10 per cent. solution. Allow it to boil until the brightly polished surface becomes dull and crystalline. This usually requires from one to 10 seconds. Wash the specimen and dry in the usual way with alcohol. Quite often a film of red oxide forms on the surface, which will disappear in a few seconds; if it does not, a slightly stronger solution will be required. This method gives very good results with copper alloys.

The accompanying photographs give a few examples of the structure of copper and also the structure of copper containing copper oxide and phosphorus. Fig. 1, 175 diameters, shows the copper after having been annealed five minutes out of contact with the air and just below the melting temperature. Fig. 2, 475 diameters, and Fig. 3, 875 diameters, are of cast copper. The different shades in the crystals are due to the various orientations of the crystal axes. The tendency to form what are apparently twin crystals is remarkable, in fact, sufficient etching has usually brought out traces at least of twinning on almost every crystal. This tendency decreases with the presence of very small amounts of copper oxide or phosphorus. Another peculiarity of the structure of pure copper is the fur-like appearance under the higher powers of magnification. In many cases this might be mistaken for a eutectic structure. Figs. 2, 3 and 5 show this excellently.

Fig. 6, 175 diameters, shows the structure of electrolytic copper. The specimen was taken from a cathode plate. This radiating structure was not met with in any but electrolytic copper. Fig. 4, 475 diameters, is a longitudinal section of copper wire after drawing; it was made of lake copper. Fig. 5, 475 diameters, presents the structure of the wire shown in Fig. 4 after annealing. Fig. 7, 875 diameters, shows the structure of native copper coming from the Calumet & Hecla conglomerate. Fig. 9, 875 diameters, is a specimen of copper which has been melted in the air and kept in the liquid condition for some time; it is known as burned copper. The large white areas are the Cu_2O and the spotted and striped areas consist of the eutectic of copper and copper oxide. A very small amount of copper oxide can be detected under the microscope; just how small I have not been able to determine thus far, but hope to do so soon. Fig. 8, 875 diameters, shows the appearance of copper containing 0.31 per cent. of phosphorus. It consists, apparently, of an excess substance and eutectic. The further study of the microstructure of

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copper and copper alloys, as brought out by etching with ammonium persulphate is now being carried out in this laboratory.

The Mysore Gold Mine

SPECIAL CORRESPONDENCE

The report of the Mysore Gold Mining Company, of Mysore, India, for the year 1908 is again a record of prosperity. The mill crushed 206,170 tons of ore, from which gold to the value of £848,145 was recovered, or an average yield of 82s. per ton, just under 1 oz. fine gold per ton. The profit earned on revenue account was £458,285, out of which £350,055 was paid in dividends, equal to 115 per cent. on the nominal value (10s.) of the shares. The large difference between profits and dividend is due to the adoption of the policy of meeting expenditure required on capital account out of revenue and not by the issue of new shares. During the year under review about £79,000 was spent out of revenue on new buildings and machinery. For the last three years the operations of the company have been as follows:

	Tons Crushed.	Gold Realized.	Dividends.
1906	185,900	£809,413	£418,674
1907	194,838	820,114	409,071
1908	206,170	848,145	350,055

The mine superintendent gives a favorable report on the development of the mine. At the Ribblesdale section at a depth of 3900 ft. the reef has a width of 2 ft. 9 in., and a value of 28 dwt. At Tennant's section the reef at the deepest section (about 2500 ft.) is 5 ft. wide, assaying 58 dwt. In the southern end of the property, McTaggart's section, the developments are also good in the bottom. At the deepest point worked (2470 ft.) the lode was 6 ft. wide, assaying 24 dwt.

The ore reserves at the end of the year were estimated at 969,920 tons, excluding a quantity of low-grade ore, representing an ore supply sufficient for five years for the mills at the present increased rate of extraction. The average value of the ore reserves is not given. A new vertical shaft is to be sunk in the McTaggart's section to cut the lode at 1485 ft., which will correspond with the present 2460-ft. level. This shaft is badly needed for facilitating hoisting and for ventilation. Edgar's shaft, which has been sunk vertically 2628 ft., is expected to be equipped for hoisting by the end of the year. This shaft will command the lower workings of the Ribblesdale section and will be of great benefit to the general working of the mine.

The mill consists of 210 heads of stamps, the majority of which are in good running order. Having regard to the good grade of ore being met with at the deepest points reached, the prospects of the company may be said to be as satisfactory as at any period of its history. The mine may be regarded as the best in the Kolar goldfield.

Determination of Copper

John W. Root (*West. Chem. and Met.*, W. pp. 269-270) describes in detail the "hypo" method for the determination of copper. The method while not new, is not in as general use as it deserves. The analysis is conducted in the usual manner up to the point of the precipitation of the copper with zinc or aluminum. At this point the copper-sulphate solution is diluted with water to half fill a No. 4 beaker, a glass stirring rod inserted into the beaker, the beaker covered and its contents brought to a boil. A boiling solution of hypo (7 to 10 grams in 100 c.c. of water) is then cautiously added to the copper solution and the solution boiled hard from 15 to 30 minutes until clear.

The precipitate, which is more or less granular, is filtered through a No. 597 filter and washed well with hot water. The filter containing the precipitate is placed in a small porcelain cup, dried and ignited at a temperature just sufficient to burn off the free sulphur and consume the filter paper, gradually raising the heat until all the carbon is burned. The ignited residue is placed in a No. 3 beaker and the cup washed out with nitric acid by warming the nearly filled cup until any remaining oxide is dissolved. The acid in the cup is transferred to the beaker and the solution evaporated nearly to dryness and the determination finished by either the cyanide or iodide method.

The essential details are to have the copper-sulphate solution dilute and hot and to add the hot hypo solution carefully. Also the solution should be boiled hard till clear, the precipitate dried thoroughly before burning and the burning conducted at a temperature low enough to avoid fusing the native sulphur and yield a clean dry residue of copper oxide. This method insures a complete precipitation of the copper.

The known tin deposits of Alaska that promise some future commercial importance are situated in the extreme western part of Seward peninsula. Adolf Knopf states that at present four localities are being prospected for tin. They are included within an area of 400 square miles, situated about 100 miles northwest of the city of Nome, the supply point of the region. In geographic order from north to south, these four localities are Ear mountain, Buck creek, Cape mountain and Lost river. The tin occurs in both placer and lode form. Up to the close of 1908 the total production of the entire region was 160 tons of cassiterite concentrates, all of which, except a few tons from lode deposits, came from the stream tin of Buck creek.

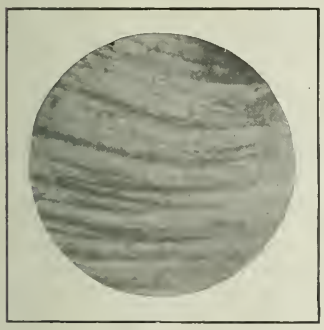

FIG. 7

FIG. 8

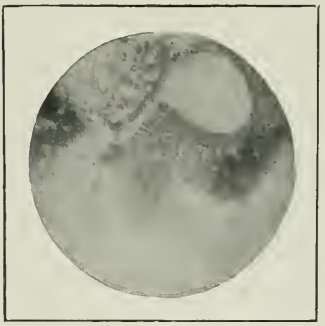

FIG. 9

Manganese ore has been discovered in the Devil's peak (Table mountain), Cape Colony, according to the *Cape Times*, Feb. 27, 1909. The deposits are believed to be rich and cover an extent of about 1000 acres.

The development work in the Rand Mines during 1908 was 122,726 ft. (*Fourteenth Annual Report*). This includes all shafts, winzes, drift and crosscut work.

A Comparison of Coal-cutting Machines

With Statement of Costs, Showing Economy of Machine Mining and a Discussion of Compressed Air, as Compared with Electric Power

BY SYDNEY F. WALKER*

When I inquired into the working of coal-cutting machines in 1900, the disk machine, with very few exceptions, was favored by all colliery managers in the United Kingdom who had adopted coal-cutting at all. The punching machine had hardly obtained any footing; it had been tried at several collieries in the different coalfields and had been abandoned in nearly all of them; the reason being the jarring which the runners received when working this machine. On the other hand, I was told by a colliery manager in Scotland who had adopted the Harrison puncher machine for a short time, that some of his men got into the trick of handling them after a short time, and were able to do as well with them as the Americans who came over to act as instructors.

In America then and now, the puncher machine has always been a great favorite. On this side of the Atlantic, the puncher has made considerable progress, but as explained below, it is largely by altering its character, though there are signs that in its original form, it will have an increasing vogue. In 1900 the disk machine was preferred before all others, for longwall work, because it could be relied upon, with reasonable care and attention, to keep going, providing that power was supplied to it. If the power was there, a well made disk machine would go through almost anything. I have recorded more than once, where a disk machine electrically driven, has used 100 h.p. for a short time, while 50 h.p. for a limited interval was fairly common. The important thing was, the machine would keep on working.

In one case which came under my notice, several machines had been continuously at work for five years, at the face in a colliery in Yorkshire. At that time, in 1900, the bar machine, though it was older in its inception than the disk machine, and was much liked, was not largely used, because it was somewhat unreliable. The gearing was liable to become much worn, the motor driving the machine was apt to vary its speed considerable, according to the different substances the bar was cutting through, and there were other troubles. Since then, most of these troubles have been overcome, and the bar machine may now be said to be a thoroughly practical apparatus, and to take its place in the contest with other machines, on strictly commercial lines.

At the present time, there are several makers of bar machines, where there was only one in 1900, and there are two forms of this machine as described below.

The Jib Machine

In 1900, the jib machine, which had been introduced much earlier by Archibald Baird & Company, of Scotland, and by Winstanley in Lancashire, had been abandoned. At the present time the jib machine has been resuscitated, but in a different, and in a more practical form The present jib machine is really a modification of the chain-heading machine, that has been upon the market for a long time, and that is so largely used in the "pillar-and-stall" system employed in American coal mines; this machine has also had a large vogue in the United Kingdom for driving headings.

In the present jib machine which is made by several firms, the chain with its cutters, runs around a frame, just as in the heading machine, but the frame is held between two narrow plates, which project under the coal, just as the disk does. The chain carries pick shaped cutters and does the same work as the disk machine but in rather a different manner.

The operation of the four machines mentioned, the puncher, the disk, the bar and the chain, are distinctly different though all are aiming at the same result, to imitate the work of holing done by hand labor in the past, and if possible to improve it. The puncher machine in the original form, consisting of the drill with its air cylinder behind it, carried on a pair of wheels, appears to answer more nearly to the work of hand holing than any of the others. Strictly speaking, the puncher is a pick, with a power machine behind it, wielded by the runner and it has nearly all the flexibility of the hand pick.

Whenever a machine is arranged to take the place of hand labor, the machine is always at the disadvantage that it has not the flexibility of hand work. In the case of holing under the coal for instance, the skilled miner could work around balls of pyrites, and could literally pick his way, on the line of least resistance. The puncher machine arranged with its wheel carriage, is able to closely follow this. On the other hand, the bar and the disk and the chain, all have to cut more or less uniformly, and more or less blindly. There is no flexibility about them, except as will be described below. The action of these three again is different.

The cutting tools of the disk machine remove the dirt, or the coal, whichever they may be cutting in, by scraping. It is more or less the action of a carpenter's chisel. The bar machine with its reciprocating and rotary motion, claims that its action is that of the pick, but the work is divided up among a large number of very small picks. In the chain machine it is claimed by the makers, that the action of the cutting tool is closely similar to that of the pick, and the material brought out by the cutters, bears this out to a large extent in a great many instances. With the disk and bar machines, the holing dirt is usually dust, with the chain-jib machine the holing substance is brought out in small lumps.

Merits of the Different Machines

The bar machine has claimed an advantage over the disk, that in case of the coal settling down upon the machine, the friction is nothing like as great, and the bar could go on working, while the disk might have to be stopped; this is evidently correct. Both the bar and the chain machines have the great advantage that the coal can be spragged right up to within a few inches of the cutting tool itself, while in the case of the disk the spragging of course, has to be some distance behind the disk itself. Further, the chain machine appears to have a distinct advantage, in the fact that the plates between which the rollers upon which the chain-runs are held, does not move in the same sense as the disk moves. It moves on as the machine moves, and as the cut moves, but it is not in continual motion like the disk is, and therefore the friction is considerably reduced. This is borne out in practice by the fact that the chain machine works with approximately half the power of the disk machine for any given work.

The bar machine also works with considerably less power than the disk machine, and approximately the power for chain and bar machines for the same work, are about equal. By the same work

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is meant, cutting in the same material, and to the same depth. It is understood of course that the power required for cutting in different materials, is different. The smallest power required is for cutting in soft kinds of coal, the largest for cutting in hard fireclay. Both the bar and the chain machines also have the advantage, which is now a thoroughly practical one, in the machine on the market, that they are able to avoid obstacles, such as the nodules of pyrites that are the *bete noir* of the coal-cutting machine. Both the bar and the chain are arranged to be inclined upward or downward, so as to avoid any piece of hard substance, and that without interfering with the general arrangement of the machine platform.

All three forms, the bar, the chain, and the disk, are now arranged to cut at practically any level that is met with in a coal pit, and all of them are made practically for any thickness of seam. All of them also are made to run on wheels resting upon rails, that are laid in front of the coal face, or on skids, which make their own floor. The skids were originally introduced by the makers of the chain machines, but the makers of disk and bar machines quickly followed suit.

A New Form of Bar Machine

A form of the bar machine that is somewhat different from the remainder of those on the market but which is really an older form of machine resuscitated, is that known as the Simplex. It is the Goolden machine, which was introduced some 20 years ago, into several of the English coalfields, with important modifications. All gearing has been suppressed. In the other bar machines, the bar receives motion from the armature shaft, or the crank shaft of the engine through a somewhat complicated arrangement of gearing which provides the necessary reduction of speed, and also the reciprocating motion, and the ability to work around obstacles mentioned above. In the Simplex machine, which is also noteworthy for the fact that it has been developed by colliery engineers, at the Walsall Wood colliery in Staffordshire, the bar is directly attached to the axle of the motor, the motor itself being fixed in the center of the machine.

The bar itself also is slightly different from that employed with the other bar machines, of which the Hurd is the type. In the Hurd, the Picquick, and similar machines, the bar is either conical or cylindrical, the smaller end of the bar, when tapered, being on the inner end of the cut, and the bar has a screw thread cut in it, the cutting picks being sometimes fixed in the bottom of the thread, and sometimes on the top of the thread. The object of the groove is to act as an Archimedean screw to bring the dirt out. In the Simplex machine the bar is square, but tapered, the cutting picks being fixed on the square faces, and arranged to be quickly tapped in and tapped out.

Disk Machine Still the Favorite

In spite of all the improvements in the bar machine, and the advent of the chain machine, the disk machine is still leading. According to the Home Office Reports for 1905, the number of disk machines in use still exceeded those of the whole of the remaining types of machines together, but there are signs that the proportion is being reduced. The disk machine is still liked by a large number of mining engineers, on account of its greater strength, and its greater ability to deal with any class of work. On the other hand, its greater weight, in the case of the majority of disk machines, is against it, because of the time and labor taken in "flitting" after a cut. Some forms of disk machine, however, in particular the Diamond, are arranged to cut to and fro across the face, and therefore it is only a question of filling out the coal that has been brought down from the previous cut, and where as in many collieries, the coal is cut at night, and filled out during the following day, the disk machine working to and fro, answers very well.

It will be understood that the above remarks refer to "longwall" working, which is so largely employed in collieries in the United Kingdom. A great deal of good work is being done by heading machines, as mentioned below. Exceptions to the heavy weight of the disk machines, are the Gillott machines, the oldest disk machine in this country, practically the parent of disk machines, which weighs only from 15 cwt. to a ton, and the Jeffrey, an American machine, which weighs 30 cwt. The majority of the disk machines weigh 2 tons.

The Puncher *vs.* Disk, Bar and Chain Machines.

As mentioned above, the punching machine has received a new development in the last 7 years. The development commenced with a machine worked out in Germany, known there as the "Eisenbeis." It was brought over to the United Kingdom and known as the "Champion," and is now known as the "Siskol." It has been followed by several others, the "Radialax," made by the Ingersoll Rand Company, the "Little Hardy" made by the Hardy Patent Pick Company, and others. The essential feature of these machines is, the drill is held upon a vertical pillar, consisting usually of a tube, arranged to be extended, or shortened, and fixed between blocks on the floor and the roof.

The connection between the body of the machine and the support, is practically a universal joint, and the drill is arranged to sweep over an arc, either in a horizontal, or vertical plane, or in any plane at any angle that may be desired. The method of working is, a drill of a certain length is placed in the machine, and is made to sweep out an arc, in the plane in which it is set, cutting a groove in the coal, or whatever the substance may be, to the depth the drill is capable of working. The drill is then removed, and a longer one placed in the machine, which cuts the groove deeper, and so on.

It will be seen that this arrangement allows of grooves to be cut in any position, and under practically any conditions. When the groove has been cut to the required depth in one position of the drill, the pillar is taken down, moved forward along the face, a fresh cut made, and by properly overlapping the arcs, a practically continuous cut is obtained. Some forms of this machine are not able to work in thin seams. It will be seen that while a considerable amount of work may be done with this form of apparatus, it has not the flexibility of the puncher on wheels. It does not represent so closely the man behind the pick. It has more of the limitations of the machine.

A later development of this arrangement, which has been adopted in the county of Durham, is, the machine is mounted on a carriage fixed horizontally, the machine standing horizontally, and cutting its arc from that position. The carriage has wheels which run on the usual mine rails.

The smaller types of these machines are useful to assist the disk machine. For instance, in room work, where a disk machine is working across a fairly long room, something on the lines of the system adopted in America, the little punching machine is handy to cut a vertical "nick" after the undercut has been made, to assist in getting the coal down. The power taken by the puncher in its original form on wheels, with the runner spragging the wheels with a shoe on his boot, is practically the same for the same work, as that of the machine carried on the vertical pillar, or on the horizontal carriage.

There is the same variation in the power expended, with both of these machines, according to the substance in which cutting is being done, but both require from 70 to 100 cu.ft. of air per min. at 60 lb. pressure. The puncher machine, and in particular the one on wheels, has the advantage, which is being more realized as coal cutting is being more and more employed, that the coal undercut by it comes down better than

when undercut by any of the other three. The coal undercut by the tapered bar, also is found to come down better than that cut by the chain or disk. The working, as in other cases, depends upon the kind of coal that is cut, but there are complaints that with the ordinary parallel cut, and particularly with a small thickness of cut, the coal, where the joint with the roof is not strong, simply settles down upon the floor, when it is free to do so, in one mass, and has to be broken up by shot firing, before it can be filled out. On the other hand, with the cut made by the puncher, which can be arranged in any form the runner likes, and which is usually more or less of a V shape, or the section of a right-angled triangle, the coal is able to fall forward cleanly, just as when hand holed, and it breaks up much better with the parallel groove. With the V-groove made by the tapered bar, which may be as much as 7½ in. at the front, against 3½ in. at the back, the coal has again a better chance of breaking clear from the roof, and of breaking up. It is stated that a higher price has to be paid to fillers for filling out coal after parallel cuts, than after the cuts made by the puncher.

It should be mentioned that so far, all punching machines are worked by compressed air. No electric puncher has yet established itself, though there have been several tried.

[An electric coal puncher manufactured in this country at Syracuse, New York, is being satisfactorily used at a number of American mines.—Editor.]

Cutting in the Coal is to be Favored

A point also may be mentioned in connection with the question of cutting in the coal and cutting in the underlying fireclay. Cutting in the floor enables the whole of the coal to be obtained, but it is claimed by Mr. Mavor, a member of the firm who are makers of one form of the bar machine, that by cutting in the coal, a larger quantity is undercut in a given time, and for a given amount of power, and the quantity of coal got in the specified time is therefore larger, and though the quantity of small made is also greater, the final balance is in favor of cutting in the coal.

It may be mentioned, that in the controversy between the makers of bar machines and the manufacturers of disk machines, apparently bar-machine makers prefer to cut in softer material, while disk machine makers do not mind what the material is.

Cost of Getting Coal

The cost of getting coal by the disk machine, which varies necessarily with the material cut in, and with the other conditions, ranges from 26c. per ton to $1.10, the latter being an exceptional price, 40 to 62c. being the general range. The saving with coal-cutting machines over hand labor, ranges from 2c. per ton up to 39c. per ton. In the majority of cases, the savings are from 8 to 16c. per ton. The question of compressed air and electricity is dealt with farther on, but it may be mentioned here, that there does not appear to be any great difference between the costs when driving by compressed air and by electricity, under similar conditions. Further, the costs as obtained by impartial observers, appear to show that the disk machine is still the one working at the smallest cost all told, though again, with the same conditions, there does not appear to be any great difference.

The question of the actual machine to be employed depends entirely, as in so many other engineering questions upon the whole of the conditions present. As explained above, where the work to be done is heavy, it is at least wiser to use a disk machine, notwithstanding the disadvantages mentioned, while where the holing is light, one of the other machines may be employed with advantage.

One important advantage that arises incidentally from the use of coal-cutting machines, is the increased output per man employed. In the United Kingdom, with the increasing output of coal, the number of skilled men available is becoming proportionately less, and therefore any increase in the output per man is of value, both from this cause, and also because it lessens the outlay that has so often to be undertaken in providing houses for the miners.

Collieries are usually located where houses are not easily obtainable. Most frequently what are practically new villages have to be built, to accommodate the men working at the colliery, and the outlay under this head is often a considerable item in the capital account. Coal owners and coal mining companies find it absolutely necessary to provide houses, and of an increasingly comfortable class, for the working miners, or they cannot get them to come to the colliery; hence, anything which reduces this item of outlay, is of importance.

Driving Headings

In driving headings, the struggle is between the well known chain header, represented in this country principally by the Jeffrey, and the puncher represented by the Ingersoll-Rand machine on wheels, and the different forms that have been mentioned, in which the machine is carried on a vertical pillar or horizontal carriage. Apparently the chain header is holding its own, but the struggle is fairly keen, and in particular a large number of the "Champion" or "Siskol" machine, as it is now called, are being employed for the work. The great portability of the machine is of enormous advantage in driving headings, and in all narrow work, such as the "bord-and-pillar" working, of which there is still a considerable amount going on in the United Kingdom.

Compressed Air *vs.* Electricity

In 1900, by far the largest number of coal-cutting machines in use in the United Kingdom, were driven by compressed air, the proportion between those driven by compressed air and by electricity, being nearly as 5 to 1. But with the development of the use of electricity that has been going on so rapidly since then, the number of electrically driven machines has been steadily increasing. The number of coal-cutting machines in use has increased from 316 in 1900, to 1133 in 1906, but the machines that have been brought into use since 1900, have been, a large number of them, electrically driven. In 1906 the proportion was 682 run by compressed air, and 451 by electricity. If the work the different machines are capable of doing is taken into consideration, the proportion would now be largely in favor of electricity, for among the machines run by compressed air, are a large number of the punchers of the "Champion" and similar types. Recently, however, there has been a revulsion on the part of colliery managers, against electric driving of coal-cutting machines, principally because of the greater danger to life. Electrical apparatus in mines, in the United Kingdom, has unfortunately taken a somewhat large toll of life, and the toll has been particularly heavy in electrically driven coal-cutting machines.

The following instance, which was the subject of an inquiry in Scotland, illustrates this point: The flexible cable connecting the gate-end switch box with the coal-cutting machine, was inclosed, in the neighborhood of the machine, in an india-rubber tube; the tube passed through the hole in the frame of the machine, through which the cable was carried, and formed the protection for the cable, against the cutting action of the metal in the hole. The rubber tube was cut or worn through, and in time the conductor became connected with the frame of the machine, and the man who was engaged in moving the haulage rope in front of the machine, received a shock, which killed him. Apart from the humanitarian question, it is certain that no colliery manager would allow the use of machines, unless a reasonable chance of safety to the attendants was assured; with the "Workman's Compensation Act" in force, the killing of a man makes

rather a serious charge upon the cost of getting the coal. A man's relatives may have as much as $1500 awarded them as compensation for his death, and it will be seen that this makes a charge of about 12c. per ton upon 12,000 tons of coal. From the figures given in a previous portion of the article, for the saving in cost obtained by the use of coal-cutting machines, it is evident that something like one such accident a year would neutralize in many cases, the whole of the saving obtained by the use of the machine.

Why Electricity is Favored

The principal reason why electricity has been so largely introduced into mining work, for power purposes, and hence has been adopted for coal-cutting machines, is the greater efficiency of transmission. It is practically acknowledged that when air is compressed at the mine, an efficiency of only 25 per cent. or at most, 30 per cent. in transmission to the face, can be hoped for, while with electrical transmission, 50 per cent. can nearly always be relied upon, and 60 per cent. can often be obtained. But while this argument has an important bearing upon the question of the power used underground in a colliery as a whole, and particularly in the collieries of the United Kingdom, where the distance over which the mineral has to be hauled, and the quantities to be hauled, the water to be pumped, etc., are so steadily on the increase, the argument is by no means so sound, when applied to coal-cutting machines. Of the total cost of getting coal by means of coal-cutting machines, the cost of the power is not such an important item. I have before me, figures taken from actual work, with different types of machines, in different kinds of coal. The amount of energy expended per ton of coal obtained, ranges from 0.25 of a "Board of Trade" electrical unit, or kilowatt-hour, up to 1 kilowatt-hour. The cost of generating electricity at a colliery, is in the case of the latest modern installation, less than 1c. per unit, and in even small installations, not laid out so economically as those that have been mentioned, the cost per unit will not exceed 2c. In my opinion, 2c. per unit would be a high price.

Two-stage air-compressing machinery of the straight line type, driven by compound engines, is at least as efficient as electric generating machinery. It is a question whether it is not more efficient, if the question of the heat in the air is omitted. Hence, allowing that the efficiency of electrical transmission is twice that of compressed-air transmission, when the latter is compressed at the mine, the costs for power would range from ½c. per ton, up to 4c. per ton, the latter being usually in cases where the total cost of getting the coal is high, owing to the general conditions. It will be seen at once, that the question of the saving in the cost of power, so far as coal cutting is concerned, is not really serious, and that as a question of economy, electricity does not prevent any great advantages over compressed air, in a great number of cases.

But there is another and very serious aspect of the question, and that is the difficulty that is so often experienced in maintaining the necessary power at the face, with compressed air. The efficiency of transmission by compressed air, as is well known, is largely reduced by leakage. The sides and roof of mines unfortunately work, and the joints in the compressed-air pipes are apt to be sprung, resulting in the leakage of the air, which is an important item. Further, in the case of coal-cutting machinery, the flexible hose which connects the air-pipe service with the coal-cutting machine, is liable to be damaged.

One colliery owner who had adopted an electrically driven coal-cutting machine, informed me that he was led to do so because when inspecting different coal-cutting machines at work, he had seen more than one in which the hose had been damaged, and the air was coming away freely at the face, instead of working the machine. This is one of the troubles that there should be no difficulty in overcoming, and I believe it has been overcome by the use of flexible metallic tubes; however, it illustrates forcibly the weak point of driving coal-cutting machinery by compressed air. Again and again in the reports of tests that have been made, the remark occurs, the pressure of the air at the machine was not greater than such and such a figure, and therefore the machine could not do its best work.

The Difficulty of Maintaining Pressure at Face

The above applies quite forcibly to the case of the puncher machine. To perform its best work, whether on wheels or supported on a pillar, it requires a pressure at the machine, of not less than 60 lb. per sq.in., and it is difficult to maintain this pressure when the air is compressed at bank. It is necessary to compress to a very much higher pressure than is usual, and therefore the efficiency of the system is lowered, and notwithstanding the higher pressure at bank, it is still difficult, partly owing to the higher pressure, to maintain the necessary pressure at the face.

The development of electrical power in coal mines provides the solution of the problem. In Germany, a good many years ago, the system was introduced of placing the air compressor as near the working face as possible, and driving it by an electric motor, taking power from the electric service of the colliery. At first sight, as in so many other cases, it looks as if the arrangement could not be economical. The energy of the steam engine has to be converted to electrical energy, to be transmitted through cables, which take their toll, to be converted to mechanical energy in the motor, and then the compressor has to be driven.

A consideration of the whole theory of the working of compressed air in coal mines will show that notwithstanding the double conversion, the arrangement is economical, and practical experience confirms this. It is perfectly practicable to compress air, in the neighborhood of the coal face, to such a pressure that it can be delivered at the coal-cutting machine with practical certainty at 60 lb., and the coal-cutting machines are thereby enabled to do their best work. It will be remembered that apart from the leakage of air that has been mentioned, the great source of loss with transmission of power by compressed air is the fact that the heat which is liberated in the air during the act of compression, is obliged to be wasted. It would be lost in any case during the passage of the air from the surface to the coal face, and in practice it is found more efficient to as far as possible, carry off the heat from the air as it is liberated. The reason for this is, of course, that larger quantities of free air are taken in at each stroke of the piston, when the air is cooled and the compressor itself is cooled, than when both are allowed to heat and expand.

Preventing the Freezing of the Moisture

But with the conditions ruling at the face the problem is a different one. One of the troubles in connection with the running of compressed air engines at the face, it will be remembered, is the freezing of the moisture carried by the air, in the ports of the engine, and the consequent throttling of the air, resulting in reduced efficiency and reduced output of the engine employing it. This has been overcome by the improved arrangements that have been introduced during the last 15 years or so. Where the air is compressed in the neighborhood of the face, it has been suggested by makers of compressed-air machinery, notably by Mr. Reavell, who has developed the electrically driven portable air compressor, for use at the face, that the air need not be cooled; that it should be delivered to the engine that is to use it as nearly as possible at the temperature to which it is raised in compression. Mr. Reavell has succeeded, by insulating the pipe lead-

ing from the compressor to the motor engine, in delivering the air at such a temperature that the exhaust air from the engine is still hot, and there is no tendency whatever towards freezing, etc. Mr. Reavell suggests that the matter might be carried further than this. It is well known that with compressed air the lower the pressure the higher the efficiency, and he therefore suggests that the air shall be compressed to only 20 lb. or thereabouts, adiabatically, and delivered to the motor engine, with, as far as possible, all the heat present that has been delivered to it.

He further suggests that the motor engine might be arranged to work expansively, and that by employing a slightly higher pressure, say 22½ lb. instead of 20 lb. per sq.in., and cutting off at 0.6 of the stroke, instead of 0.9, as usually arranged, a considerable economy in air and in power would result.

Mr. Reavell informed me that he has not yet had an opportunity of carrying out this plan, but he has succeeded in delivering the air hot to the motor engine, as explained. It appears to the writer that the matter may be carried still farther, and that the plan adopted by the Ingersoll-Rand Company for one of their drills might be adopted for coal-cutting machines with advantage, and the air kept continuously in circulation from the compressor to the motor engine and back to the compressor again. This would get rid of all possible troubles from moisture, such as might arise when the air of the mine from which the suction for the compressor was taken was muggy, as occurs at certain times of the year.

There should be no difficulty also in arranging to thermally insulate the pipes leading from the compressor to the coal-cutting machine, and back to the compressor. There are a number of substances on the market, that could easily be applied to the outside of metallic tubing, and that would maintain the temperature of the air, with very little loss between the compressor and the coal-cutting machine.

It should be possible also, with such an arrangement, if it is worth doing, for the sake of economy, to work the engines driving the coal-cutting machines more expansively. Obviously it would be to the advantage of the whole system to expand the air to as low a pressure as possible. The arrangement in fact would be a counterpart of that which is done with cold-storage compressed air apparatus.

Concerning the question of working the punching machines at lower pressures, if the suggestion to work at lower pressures is worth considering on the ground of economy, there should be no difficulty in meeting. It would merely mean a small increase in the areas of the cylinders.

It should be mentioned also, that the compressed-air motors driving coal-cutting machines have also been very much improved during recent years. The motors employed for the early coal-cutting machines had one cylinder only, then two cylinders were employed, and two cylinders were the universal practice until very recently. Now four cylinders are employed, giving a much more even turning moment to the crank shaft, and providing a more efficient machine.

Quebec Mining Law

Special Correspondence

Some important changes in the mining laws of Quebec province have been made by a bill introduced by Hon. Charles Devlin, Minister of Colonization, Mines and Fisheries, which was passed by the provincial legislature on May 8. It assimilates the law as regards prospecting and the acquisition of mining claims to that of Ontario. The former "prospecting license" is abolished, but the rights of present holders of prospecting licenses will be continued until Jan. 1, 1910. It will be replaced by the issue of miners' certificates, which can be obtained on payment of a fee of $10, and confer the right to prospect on all lands, whether public or private, the mining rights on which are vested in the Crown. In case of discovery the prospector must erect a discovery post on the chief point and four corner posts inclosing his claim. In unsurveyed territory the area of a location cannot be less than 40 nor more than 200 acres, while in surveyed territory a license may be granted for one acre and upward to 200 acres, which is the limit in both cases. After staking, the Mines Department is to be notified at once, and within four months from the date inscribed on the posts application must be made for the issue of a mining license. The application must be accompanied by a fee of $10 in addition to a sum equal to $1 per acre of the location. The mining license is good for one year and can be renewed on payment of the same fee and acreage tax. The mine can be worked for any length of time on this license.

Mining land can be purchased, as before, at any time on payment of the price, $10 per acre for superior minerals and $2 for inferior minerals, if at a distance of 20 miles from a railway; and $20 per acre for superior minerals and $4 for inferior minerals, if situated less than 20 miles from a railway. All sales are on condition that *bona fide* working of the mine is to commence within two years and the patent is to issue only after an expenditure of $500 for each acre purchased has been made. Failing these conditions the sale may be set aside.

This act is intended to remove the great objection to the old law that tracts of mineral land could be purchased and held indefinitely by speculators who had no intention of working them. Its enactment has been urged for several years by J. Obalski, long head of the provincial Bureau of Mines.

Oil and Gypsum Locations in California

Special Correspondence

There is some excitement at Watsonville, Santa Cruz county, Cal., over the discovery 12 miles distant, of an oil well yielding 250 bbl. daily and plenty of natural gas. Santa Barbara men are about to commence drilling for oil on 1700 acres of bonded land south of Red Bluff in Tehama county. This is far north of any point where oil has thus far been found in the State. Another item of interest in the oilfields is the discovery of auriferous sand at a depth of 300 ft. in the McKittrick oil district, Kern county.

Recently large areas of land in the known oil belts have been located for gypsum, though it has been an open secret that oil was what was wanted. An agent of the Land Office has been looking into this matter and where patents were about to issue to gypsum locators, they have been notified that receipts have been issued under a misapprehension of facts. They are also informed that the gypsum to be mined must have a commercial value, and in this value accessibility must be considered. If at a point remote from a railroad where the cost of mining and hauling would preclude the possibility of selling at a profit, its commercial value would be nullified. The miners do not take kindly to the Land Office determining both mining and commercial possibilities for them when passing on mining locations. The miners think they know more about this than the Land Office.

Consul Henry D. Baker reports that in the silver-lead mining district of Western Tasmania there was considerable embarrassment during 1908 on account of the closing of the smelter at Zeehan, owing to lack of profit in successfully treating complex ores, with low prices ruling for the products extracted. Owing to the distress occasioned by the closing of the smelter, the Government loaned the company money with which it could resume occupation.

A Volumetric Method for the Determination of Mercury

By W. H. Seamon*

The following method has been well tried out in my laboratory, first on salts of mercury mixed with varying amounts of the salts of such other substances as might interfere with, or influence, the reactions; and finally with ores of mercury carrying cinnabar with a lime, iron, silicious and clayey gangue. The method is based upon the formation of mercuric iodide when potassium iodide is added to feebly acid solutions of mercurial salts, the end reaction being determined by the formation of the characteristic blue color made by iodides in the presence of small amounts of nitrous acid in contact with starch paste.

Scheme

Weigh out half a gram of the pulp and transfer to an Erlenmeyer flask of 125 c.c. capacity; add 5 c.c. of concentrated hydrochloric acid and allow it to act for 5 to 10 min. at a temperature of about 40 deg. C. Then add 3 c.c. of concentrated nitric acid and resume the gentle heat until all the cinnabar is decomposed, which will occur in a few minutes. Then add 3 c.c. of strong sulphuric acid to precipitate lead salts, if present, after which 5 c.c. of strong ammonia is added with care, drop by drop, followed with 25 c.c. of water. Filter, collecting the filtrate in a 150-c.c. beaker, washing the filter carefully twice and keeping the bulk of the filtrate as low as possible; then add 2 c.c. of strong nitric acid which has been discolored by exposure to strong light and cool to room temperature. The solution is then ready for titration.

Standardization

The standardizing solution is made by dissolving 8.3 grams of potassium iodide in a liter of water. A solution of this strength will have a value of 0.005 gram of mercury to each cubic centimeter. It is standardized with solutions of mercuric chloride. The usual solution of starch paste, cooled to room temperature, is kept ready for use and small drops of it are placed on a color plate. The titration is made by setting aside one-third of the solution and running in the standard solution from a burette, withdrawing a drop of the solution from time to time, until a strong end reaction is obtained; then add the reserved portion and continue until a faint blue coloration is found. Deduct ½ c.c. from the burette readings when the bulk of the liquid is over 50 c.c., unless the standardizing is done with varying amounts of mercuric chloride, corresponding to the percentages of mercury in the ore.

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Accuracy

In the trials I have made I have found the results on the same ore to check within one-tenth of 1 per cent. and have worked with ores carrying from 1 to 15 per cent. of metallic mercury. Working on weighed amounts of mercuric chloride, treating them as described above for ores, I have found the method accurate for weights of mercuric chloride ranging from 0.005 to 0.35 gram.

In titrating, the characteristic precipitate of mercuric chloride will not show under the conditions described unless there is about 4 per cent. mercury present and in some instances, when larger quantities of acids, etc., may have to be used, the precipitate may not show, even though there be 15 per cent. mercury present. Although the absence of a precipitate may be regarded as unsatisfactory, yet the accuracy of the method is not affected, for the double decomposition of the two salts goes on just the same and the end reaction will not show until the proper amount of iodide of potassium is added.

Effect of Free Chlorine

The presence of free chlorine destroys the accuracy of the method, giving the end reaction on the addition of the first amount of iodide of potassium. To overcome this difficulty, free chlorine being generated by the mixture of the hydrochloric and nitric acids, was the occasion of much labor. Evaporation of the first solution on the water bath is the surest way of driving off the chlorine, as well as the excess of acids, and makes the method more accurate and the formation of the precipitate more certain at the time of titration; but this requires more time than is always convenient in a technical laboratory. Boiling the solution, before the addition of ammonia, was tried, using a larger amount of sulphuric than directed; also adding more water; but in all trials made it was found that enough chloride of mercury was volatilized to sensibly lower the results. It was finally found necessary to keep the amount of acids used in decomposition to as low a point as possible and to add the ammonia as described. The presence of ammoniacal salts hinders the formation of the precipitate of mercuric iodide; otherwise they have no effect.

Decomposition of the Ore

The decomposition of cinnabar is not easy and it is best to have the pulps as fine as 200 mesh, and the hydrochloric acid should be allowed to act for a few minutes alone before adding the nitric acid; failure to adhere to these instructions will cause a failure in solution.

The following method of decomposition gave satisfactory results, but was not adopted owing to the frequent breakage of the flasks: The weighed pulp was introduced into a pear-shaped flask of 200 c.c. capacity, to which was added 7 to 10 c.c. of concentrated sulphuric acid, ½ gram of crystallized tartaric acid and 7 grams of acid sulphate of potassium. The flask was heated in a gas flame, or that from a Dangler lamp, until the solution became almost colorless; then 5 grams of potassium nitrate was added and heating continued until all, or nearly all, of the sulphuric acid was driven off. The flask and contents were allowed to cool and the mass dissolved in water, with the aid of heat, the solution filtered, 2 c.c. of brown nitric acid added, the solution cooled and then titrated. In the trials made and completed, the results were found to be good and the method more satisfactory than the one adopted. There were so many losses from breakage of the flasks that it was abandoned. No loss by volatilization occurred.

Presence of other Compounds

Small amounts of nitrous acid are necessary to give the end reaction, setting free the iodine. I have found 2 c.c. of nitric acid, which had been exposed to the sun long enough to be discolored, sufficient. Soluble salts of lead are precipitated by potassium iodide, consequently they must be removed. If known to be absent the addition of sulphuric acid may, and should, be omitted. I added weighed amounts of lead nitrate to the pulps used and found that the method described eliminated all the lead far enough not to affect the results when as much as 0.2 gram of lead nitrate was employed. The soluble salts of silver are also precipitated by iodide of potassium. No special tests were made to determine if the hydrochloric acid employed eliminated it sufficiently to prevent interference.

One-tenth of a gram of a salt of iron, copper, antimony, arsenic and bismuth were added separately to a pulp and it was found that their presence did not change the results.

Comparison of Wet and Dry Method and Conclusions

Five different pulps were employed and the results obtained by the dry and iodide methods were as follows, the first figures being the percentage found by the dry method, and those in parentheses the percentages found by the iodide method: (1) 0.8, 1.1, 0.9 (1.2, 1.1, 1.2); (2) 3.5, 3.0, 3.4, 2.9 (3.6, 3.5); (3) 7.5, 8.1, 7.0 (8.3, 8.2, 8.4); (4) 10.5, 9.0, 10.3, 10.0 (11.7, 11.6, 11.6, 11.7); (5) 12.5, 11.2, 13.8 (15.1, 15.0, 14.9).

The method is quick and reliable. The treatment with sulphuric acid can usually be omitted, as lead is seldom found associated with mercurial ores, so far at least as my own experience may be relied upon. Care must be employed to use as little acid as possible to secure perfect decomposition, and to eliminate free chlorine and the presence of hypochlorites; in efforts to accomplish this do not

fail to remember that mercuric chloride is volatilized on boiling, freely, solutions of mercurial salts in the presence of free hydrochloric acid.

Efficiency in the Administration of of the Public Lands of a Nation*

By A. C. Veatch†

Van Dieman's Land was once chiefly remarkable as the site of a most notorious British convict settlement. Today this country, renamed Tasmania, furnishes a most inspiring record of efficient public service. Viewed from our own sad experience the record there is almost incredible and is both an incentive and a promise.

Gold was discovered in Tasmania in 1852 and the mineral wealth of the country began to be slowly developed. In 1871 the future of Tasmania as a great mining region was assured, and a great vista of promise opened up by the discovery of the now famous Mt. Bischoff tin mine, which up to the close of 1906 had paid dividends to the amount of £2,083,000. Other discoveries followed, principal among which were the rich silver mines at Zeehan, discovered in 1882, and the famous Mt. Lyell copper-gold mine, found in 1886. This mine in the year 1904 paid dividends to the amount of £150,000; in 1905, £175,000; and in 1906, £420,000.

Disposal of Mineral Lands

All these mines were discovered at a time when there was absolutely no law forbidding the sale of mineral lands. Whether they were sold or leased was entirely a matter of executive discretion, and yet so faithfully have the land officials discharged the trust imposed on them that not only are all these important mineral properties still owned by the State, but except for small areas of coal lands, alienated in the early history of the colony, no mineral deposits of importance have passed into the hands of private owners. So insignificant are the coal areas that the only coal mines in this territory which are now being worked are operated on Government lease. Indeed, the total mineral production of Tasmania today, and in 1905 it equaled that of Nevada, comes from Government leasehold. These results contrast very markedly with those obtained in the United States. Here, while the law of July 4, 1866, expressly forbids the alienation of mineral lands under the agricultural land laws, enormous areas of such lands have been acquired in this way.

So far did the Tasmanian officials deem it advisable to carry this policy of reservation from sale of lands known or supposed to contain minerals, that it became necessary to provide some form of surface holding within the mining areas. The Waste Lands Amendment Act of 1881, therefore, provided for the sale of lands in mining settlements subject to the right to mine on payment of damages. The act of 1885 gave to the holders of business and residence areas the right to purchase the same after an expenditure of a certain sum on improvements, but in all cases with the reservation of the right to mine at a depth of not less than 50 ft. The act of 1889 went a step farther and declared all lands in mining areas open to selection but with the reservation of the right to search for gold and the right to mine at depths of not less than 50 ft. In 1891 the depth was reduced to 20 ft. and in 1900 the reservation included the right to search and mine for gold and other minerals. The Crown Lands Act of 1903 marks the natural conclusion of these several steps by providing that thereafter all grants should contain a reservation of the right to mine for all minerals at a depth of not less than 50 ft. on payment of damages. The Lands Act Amendment of 1905 waived all question of depth and provided for the reservation of all minerals in all grants.

Leasehold vs. Freehold

The Tasmanians regard the policy of government leasehold not as primarily a method of obtaining a direct revenue, but as the best way of securing the proper development of the mineral wealth and resulting increase in the population and ordinary tax revenue of the State. There is no theoretical consideration that the State should control all things. There is only the practical consideration that certain things should be done because the best results can be attained in that way. Had leasehold proved unsatisfactory, or if freehold were shown to be the best way of promoting the attainment of the desired result, there is no question that the mineral lands would have been and would now be sold, but there is among mining men in Tasmania the same abiding feeling of satisfaction with the general principle of mineral leasehold that is found throughout Australia.

In response to the question, "What are the defects in the present law from the standpoint of the prospector and capitalist?" the Secretary for Mines replies: "No complaints from either prospectors or capitalists have been received; I presume they are satisfied." In answer to the question: "Does the policy of leasehold retard mineral development, as compared with freehold?" the Secretary replies with the unqualified monosyllable "No!" Lindsay Tulloch, a director of the Mount Lyell mine, the richest man in Tasmania, states most positively that he considers leasehold a better method of promoting development than freehold. Col. F. C. Hughes, vice-president of the Victorian Chamber of Mines, and a mining man interested in properties all over Australia, including several in Tasmania, states that the mining men of Australia with practical unanimity indorse leasehold as a better method of promoting mining development than freehold, and in his wide acquaintance among mining men, he knows of but one who seriously advocates freehold.

Tasmania thus affords not only a convincing indorsement of the practical success of government leasehold of minerals, but is an inspiring example of efficient public service. The record of the Lands Department of this State for over 50 years of important mineral development is one of which the country may well be proud, and shows that a patriotic and efficient administration of the land affairs of a State is not a human impossibility.

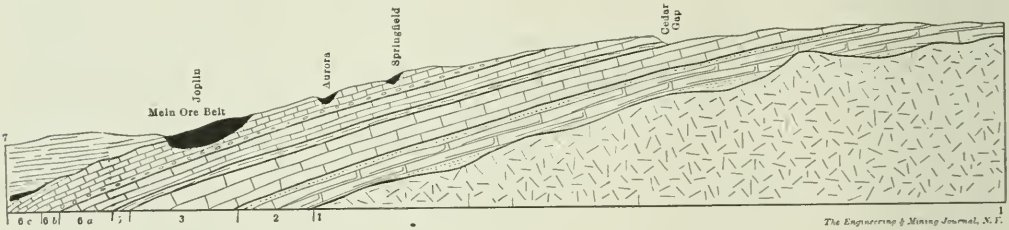

FIG. 1. POSITION OF JOPLIN ZINC BELT AT FOOT OF THE OZARK UPLIFT

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†Of the U. S. Geological Survey, Washington, D. C.

Migrations of the Joplin Zinc Belt

By Charles R. Keyes*

There is one quite remarkable feature concerning ore deposition in the Ozark mineral fields generally, and in the Joplin zinc belt in particular, that has never received the practical consideration that it deserves. It is not only important from a strictly mining standpoint, but from a purely geologic point of view it is of great interest. It is the constant shifting of position which the ore belt appears to have undergone since the present Ozark dome began to take shape and orebodies commenced to localize.

It is now pretty well understood that the present orebodies of the Ozark region are recent depositions, that they are now being formed about as rapidly as ever orebodies were in the past or as any ore deposits ever are, that they are not scattered about over the uplift promiscuously, but in accordance with definite geologic structures, and that they are confined in the main to a relatively narrow, but well defined, belt which is traceable without break for a distance of several hundreds of miles. The geologic reasons for this peculiar disposition of the orebodies are now not hard to find. Present evidences also go to show that the position of the ore belt has not always been the same as that which it occupies today, but that it formerly was much higher upon the back of the great dome.

The most noteworthy generalization regarding the geographic distribution of these ore deposits is that they are mainly restricted to a narrow band which completely encircles the broad dome at its very base. While this belt reaches practically unbroken around the entire dome, the unequal richness of the orebodies owing to local peculiarities of geologic structure, has given rise to the general impression that the ore deposits are accidentally located in a few comparatively small and indifferent areas. The impression is further strengthened by the fact that in consequence of the mining camps being segregated they have been considered as distinct mineral districts.

Later Geologic History

The possible change of position of the ore belt is a theme which for a full explanation involves something of the later geologic history of the region. These episodes began immediately before the last upraising of the region into the present dome at the beginning of which period the Coal Measures probably extended nearly or quite over the center of the area. This covering was relatively thin, having been beveled off previously. As the present dome arose the thin layer of soft shales was rapidly stripped off the hard sloping limestones beneath. A low Coal Measures escarpment, if it might be so called, everywhere faced the middle of the dome as it does today.

Considering specifically the Joplin ore belt, it was probably at one time located near the crest of the dome near Cedar Gap, but as the Coal Measures were constantly removed through general surface erosion it followed down in the pitching syncline the ever-retreating margin of the shales, which always acted as a barrier, or dam, to impound the vadose waters, or to raise the local groundwater-level. Doubtless many minor orebodies now existing between Cedar Gap and Joplin once belonged to the main ore belt at a time when it occupied that altitude, but being cut off from the parent body in some way or other remained intact without being weathered or carried away in solution to other and lower levels. The general relations of the ore belt to the geologic structure are best shown in Fig. 1.

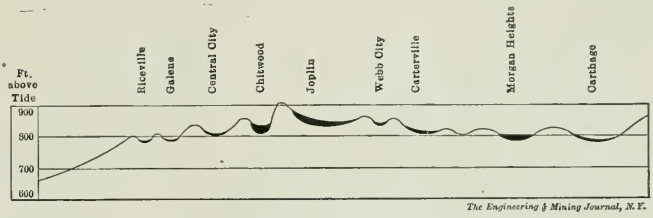

FIG. 2. PROFILE OF GRAND FALLS CHERT HORIZON SHOWING OREBODIES IN BOTTOMS OF STRUCTURAL TROUGHS

The influence of the Coal Measures margin and the so-called cross-bars of Joplin upon the movement of the ore belt down the slope of the dome is well shown in the Joplin district. For many years it has been noted that, in the vicinity of Joplin especially, the most notable inclinations of the rock-beds often strike in a northwest direction. Among the miners who are most familiar with the local conditions of the area it is agreed that the Ozark uplifting could have had no effect upon the geologic structure because the sharper bendings of the strata trend northwest instead of northeast. This idea is given greater prominence by the recent contour map of the Federal survey. While only a single prominent arch is here noted there are within the limits of the map no less than four such arches all parallel to one another. The towns of Galena, Joplin, Cartersville and Carthage lie on the eastern slopes of the several anticlines. There are other arches of the series. Significantly the main ore deposits also lie almost entirely on the east sides of the arches. With the great Joplin-Springfield syncline pitching westward and radially down the slope of the dome the minor cross-bars, or arches, act upon the general underground waters somewhat as do dams placed at regular intervals in a stream. The vadose waters are partially impounded. A model of the structure would be not unlike a system of riffles in a gold-washing sluiceway.

Considered tectonically, the cross-bars were manifestly formed at a geologic period far removed from that during which the larger Joplin-Springfield syncline originated. The latter is thought to be associated with the system of foldings now more or less pronounced that make up the Boston mountains and the Ouachita mountains to the south and that were formed before the upraising of the present Ozark dome. The former belong to a wholly different system; they are themselves flexed longitudinally. The location of the orebodies with reference to the minor warpings of the strata in the Joplin district are indicated in Fig. 2.

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According to a consular report from Hobart, by Consul Henry D. Baker, several new companies have recently been organized for the purpose of treating the complex ores of the silver-lead district of Western Tasmania. One company has a patented process for the treatment of ore containing zinc, the object being the production of zinc oxide and the recovery of silver, lead and gold as a lead bullion, and of copper as a precipitate. Another company has just obtained a concession from Parliament for a 12-months' reserve of lands near the headwaters of the Derwent river, containing valuable water-power rights, where it is proposed, if found entirely feasible, to produce electric power at low cost for the operation of works where complex ores are treated.

Greece possesses many mines, writes Consul-General George Horton, of Athens; the chief minerals are those of iron, lead, zinc, silver, etc. The mines are found chiefly on the eastern shores of the peninsula and in the islands of Aegean. Notwithstanding this mineral wealth, the industrial development of the country has been slow on account of the lack of fuel, which is nowhere found in quantity. For this reason, most of the minerals are exported in a crude state after the simplest preparation.

Gold Dredging in Russia

By I. I. Rogovin*

The Permanent Consulting Committee of the gold and platinum industries at St. Petersburg has recently published some data on dredging for gold in Russia during 1907. There were in all 64 dredges at work in that year, 25 in the Ural and 39 in Siberia, nearly all in the Yenissei Taiga. The latter, it may be remarked, work under conditions of climate, etc., quite similar to those found in Alaska and the Canadian Yukon.

In the districts studied the working season is limited by the weather, as it is impossible to operate a dredge in the winter. The average number of working days decreased from 173 in 1906 to 137.1 in 1907, with a consequent decrease in results. The following table shows the average per dredge—calculated on the whole number from which returns were received—the figures being reduced to American measures:

	1906.	1907.	Changes.
Working hours per dredge	2,837	2,259	D. 578
Gravel handled, cu. yd.	159,540	139,260	D. 20,720
Gravel handled per hour, cu.yd.	56.1	64.4	I. 8.3
Gold bullion recovered, oz.	1,082	1,140	I. 58

The increase of 15 per cent. in the average of gravel handled per hour is considered encouraging. It shows that the average capacity of the dredges is increasing. This is due to the fact that the newer dredges are heavier and more powerful, with larger buckets.

Some time ago the Permanent Committee appointed a special commission to determine the cost of running the average dredge during one season. After examination this commission put the working cost at 30,000 rubles—$15,450—per dredge in the Ural, and 38,000 rubles—$19,570—in the Yenissei Taiga; these sums not including cost of general management nor amortization.

It is calculated that 1 pood of the gold bullion recovered is worth about 18,000 rubles. This would make the bullion about 850 fine. One pood of crude platinum, 83 per cent., has the same value—which is equivalent to $9270 in United States money. Reducing the Russian figures to American weights and money, the committee considers that a dredge in the Ural district must recover at least 880 oz. gold bullion or crude platinum to meet the working expenses. In the Yenissei Taiga the amount required would be 1110 oz. gold bullion. These amounts, however, cover only actual working expenses; if there be added the cost of general management of the property and depreciation, or amortization of the original cost of the dredge—which items would approximate $5150 yearly—it will be seen that the average recovery in 1907, as given above, would be sufficient only to cover the cost in the Ural, while in the Yenissei there would be a deficit. To run a dredge for a season in the Ural without loss there must be a recovery of at least 1050 oz. gold or platinum in the Ural, and of 1300 oz. gold in the Siberian district.

Complete returns from 46 dredges show results as in the following table, the Russian measures being reduced to Troy ounces of gold won during the season:

	Dredges.
Between 2632 and 2895 oz. gold	1
Between 2369 and 2632 oz. gold	1
Between 2106 and 2368 oz. gold	2
Between 1842 and 2106 oz. gold	2
Between 1580 and 1842 oz. gold	8
Between 1316 and 1580 oz. gold	3
Between 1053 and 1316 oz. gold	6
Between 790 and 1053 oz. gold	6
Between 526 and 790 oz. gold	10
Less than 526 oz.	7
Total number	46

No less than 23 of these dredges fell below the amount of gold estimated by the committee as necessary to pay the yearly operating expenses. That is, one-half of the dredges must have been run at an actual loss.

*Mining engineer, St. Petersburg, Russia

Electric Power for Wisconsin Zinc Mining District

Special Correspondence

The Interstate Light and Power Company, with a capital of $750,000 has just been incorporated, with headquarters at Galena, Ill., for the purpose of constructing a large electric power plant with a capacity of about 5000 kw., and of building about 26 miles of primary power lines and 16 miles of secondary lines, these to extend throughout Jo Daviess county, Ill., and La Fayette, Grant and Iowa counties, Wis. The main transmission line will extend from Galena, Ill. to Platteville, Wis., furnishing 24 hour-lighting service to these two cities and all of the intervening towns.

This new company has acquired all of the properties, franchises and power contracts of the Tri State Light and Power Company, of Galena, Ill., and the Platteville Electric Light and Power Company, of Platteville, Wis. A large number of the principal mining companies now operating throughout this district have already made arrangements to use this electric power for operating their mines and mills, thus reducing operating expenses and removing the difficulties of coal haulage, boiler repairs, etc.

The use of electric power is particularly of advantage to new properties, which by its use may avoid investment in power station, thus confining the investment in cash more directly to the actual operations of milling and of underground development. In well developed properties the great advantage in electric drive comes through the fact that as the property extends and more power is required, the mere purchase of a motor is all that is necessary, even though this additional power is needed some distance from the mill. Electric power is the principal power used in all the great mining districts today and the Wisconsin district is to be congratulated upon the introduction of this highly economical element at this time for bringing out the undeveloped resources of the region.

The individuals interested in this project are men well known in this line of business, whose experience will insure its good management from the start. The designing engineers are H. M. Byllesby & Co., American Trust building, Chicago, Ill. The directors of the power company are as follows: A. O. Fox, Madison, Wis.; Fred Krog, Platteville, Wis.; Geo. B. Caldwell, Chicago, Ill.; M. S. Sickle, Platteville, Wis.; O. E. Osthoff, Chicago, Ill.; A. T. Rogers, Madison, Wis.; M. F. Fox, Madison, Wis.

Monel Metal Wire

In the Journal of May 15, page 988, there appeared a short note concerning wire made from Monel metal. The Orford Copper Company informs us that, while the figures concerning the tensile strength, etc., of the wire are substantially correct, the statement that the sole right to make wire from the metal had been granted to the Driver-Harris Wire Company is entirely incorrect. No exclusive rights to manufacture wire from Monel metal have been granted to any concern.

Correction

In the article "Impressions of a New Ontario Camp—Gowganda," by H. E. West, in the Journal of May 1, 1909, the expression "Rocks of the Keewatin horizon," in the first paragraph on page 901 should read "Rocks of Keewatin age," and in the third column on this page, "The Gowganda section possesses" should read "The North Gowganda section possesses."

The following notes by Professor Neumann, on the electric iron-ore reduction furnace of the Elektrometall-Aktiebolaget Ludvika, at Domnarvfet, Sweden, appear in the *Electrochemical and Metallurgical Industry*, taken from *Stahl und Eisen*, Feb. 24, 1909. The furnace is of 1000-h.p., three-phase type, with carbon electrodes and with a shaft, similar in design to a blast furnace. The hight of the shaft is 5.5 m. (18 ft.) The consumption of coke per 1000 kg. of pig iron produced has been reduced to 275 kg. Though the ore and coke used contained sulphur (0.55 per cent.) the sulphur content in the pig iron was only 0.005 per cent. The slag contained only 0.35 per cent. iron.

The Australian Oil Shale Industry

SPECIAL CORRESPONDENCE

The report of the Commonwealth Oil Corporation, Ltd., for the year ending June 30, 1908, has been issued. The company owns oil-shale deposits and coal mines in New South Wales. The oil shale is partly exported for gas-making purposes and is partly retorted on the spot. The report states that 15,000 tons of shale have been mined, of which two-thirds, being of high quality, was exported. The average yield of the entire thickness of the seam gave over 100 gal. of crude oil per ton, while the shale retorted locally contained about 70 gal. crude oil per ton. About 5000 tons of this second-class shale has been retorted at the works at Torbane. As to the extent of the shale beds, it is stated a tunnel has been driven for nearly a mile in length along the bed, the average thickness being 4 ft. without break or fault and continuing all the way of exceptionally high quality, averaging over 100 gal. crude oil per ton.

The coal mine has been opened by two shafts sunk 200 ft. to the upper coal measures; upward of 4 working places have been opened out, giving a daily production of 800 tons. The coal is used for making coke and also supplies the needs of the railway, brickworks and other consumers. Early in this year 104 coke ovens are expected to be at work. For some months 44 ovens have been in operation producing an excellent coke for which there is a ready sale. A large amount of work has been carried out in connection with the construction of crude oil works and refineries in the Wolgan Valley. The first of the series of benches, each containing 64 retorts, is well advanced. The corporation has constructed a railway line from the Government railway at Newnes Junction to the mines and works in the Wolgan valley, a total distance of 32 miles. At the Torbane works 32 new retorts have been working since August. The crude oil obtained was superior in quality to that produced by the old retorts. The crude oil has a pale olive green color with a specific gravity of 0.880 and is an excellent oil for refining. The Hartley Vale refinery is being extended, and it is expected that refined oils will shortly be placed on the market in addition to the candles and other products now being marketed.

The company hopes that the Federal Government will encourage the oil-shale industry in Australia by giving a bonus. This matter is now under consideration. The Melbourne correspondent of the *Financial Times* (Dec. 28, 1908) says that 2d. a gallon of crude oil is wanted by the Australian producers. The present consumption of petroleum in Australia is equal to 100,000,000 gal. of crude oil, which would mean the mining of 2,000,000 tons of shale per annum. A duty of 1d. on imported oil would yield nearly £100,000 per annum, the Australian consumption being now about 20,000,000 gal. Experience has shown that 1d. duty will not increase the price of oil ¼d. therefore 90 per cent. of any bounty, by which the Australian oil-shale industry can be established will be paid by the Standard Oil Trust, because nine-tenths of all the oils used in Australia come through that organization.

Lehigh Coal and Navigation Company

This company owns a large coal estate in the Lehigh section of the Pennsylvania anthracite field. It owns the Lehigh and the Delaware Division canals and several short railroads used in its coal operations. It owns the Lehigh & Susquehanna railroad, but does not operate it, leasing it to the Central Railroad Company, of New Jersey. It owns a large interest in the stock of the Lehigh & Hudson River railroad. The report for the year 1908 shows capital obligations including $19,113,000 stock and $19,188,083 in bonds.

The income account for the year, condensed, is as follows:

Net receipts from coal lands	$1,613,298
Railroad earnings	110,473
Miscellaneous receipts	243,670
Rental Lehigh & Sus. R. R.	2,198,800
Total receipts	$4,166,241
General expenses	$120,805
Rentals paid	101,743
Taxes	288,483
Interest	885,124
Depreciation	300,000
Sinking fund, 5c. per ton coal mined	149,611
Loss on canals	38,305
Total charges	$1,884,071
Surplus for the year	$2,282,170

From the surplus dividends of 8 per cent. on the stock, amounting to $1,457,648, were paid, leaving a balance of $824,522. This, with $110,073 from adjustment of accounts, was added to undivided profits, the total of which was $4,294,163 at the close of the year. The net receipts from coal lands show an average of 46.6c. per ton of coal mined.

The earnings of the Lehigh & Susquehanna railroad, as reported by the lessee, were $8,387,444, a decrease of $999,935 from 1907. Of the earnings last year $5,134,355 were from transportation of coal. The anthracite coal tonnage carried was 8,671,909 tons, a decrease of 85,407 tons from preceding year.

The Delaware Division canal was opened for business on April 6 and the Lehigh canal on April 18, closing on Dec. 4 and Dec. 9. During this period a total of 252,039 gross tons was moved, 200,846 tons of it being anthracite coal. The total tonnage during 1907 was 248,820 gross tons, of which 190,205 gross tons was anthracite coal. The operating revenue fell $38,305 short of meeting operating expenses, as compared with a shortage of $33,011 during 1907. The increased deficit is principally due to unusually heavy charges for dredging and repairs.

The coal statement for the year is as follows, in long tons:

	1907.	1908.	Changes.
Mined by company	2,973,172	2,826,197	D. 146,975
Mined by tenants	269,564	290,448	I. 20,884
Total shipments	3,242,736	3,116,645	D. 126,091
Used at mines	353,845	347,733	D. 6,112
Total	3,596,581	3,464,378	D. 132,203

Of the shipments last year 124,416 tons were from lands of the Alliance Coal Company. The coal used at mines was 9.8 per cent. of the total in 1907, and 10 per cent. in 1908. A number of improvements were made during the year at collieries and breakers.

At the Lansford power plant the output during the year amounted to 3,870,105 kw.-hours, against 3,138,873 kw.-hours in 1907. The output of power is now so near the capacity of the plant that it will be necessary to make some additions during 1909 to provide the current which will be required for extending the underground haulage systems and for other mining purposes.

The chief improvement in progress is the Lausanne drainage tunnel of which the report says: "Good progress has been made in this tunnel. The face which was driven from daylight stood 5130 ft. from the portal at the close of the year, having been advanced 3067 ft. during 1908. While it is impossible to estimate the exact point at which the basin of the Buck Mountain vein will be encountered, the information available indicates that the remaining distance in rock will be between 1800 and 2000 ft. It must be remembered, however, that a very considerable portion of the drainage system will be within the Buck Mountain vein. A gangway is being driven eastward in this vein from the foot of No. 2 shaft, which will be a part of the system, and it is proposed to sink a slope about midway between the face of this gangway and the point where it is expected that the rock tunnel will encounter the Buck Mountain vein, with a view to making two additional points of attack, and thus hastening the time when this improvement will be available. The total distance in rock and coal yet to be driven before the pumps at No. 1 colliery can be abandoned is about 12,800 ft., and the time required probably 2½ to 3 years."

The 1908 production of ammonia and ammonium sulphate in the United States, according to figures collected for THE MINERAL INDUSTRY, is estimated at 87,600 short tons, valued at $5,247,240, against 89,000 short tons, valued at $5,511,770 the previous year. These figures include the production of all forms of ammonia expressed in equivalent sulphate of ammonia.

Colliery Notes

The present welfare of the coal-mining industry will be better advanced by the enforcement of existing State laws rather than by the enactment of new measures further to restrict mining operations.

When used by untrained men, the present designs of rescue apparatus are neither more nor less than death traps. However, when such an apparatus is used by a skilful man accustomed to it, the machine is almost certain to minimize the danger of colliery disasters.

Recent investigations at 36 mines, by a committee of engineers, showed that machine work, as compared with hand labor, insured a saving in cost of from 12 to 15c. per ton; the itemized cost being, for hand labor, from 36c. to $1.30, while that of machine labor averaged from 26c. to $1.12, the cost varying according to the prevailing thickness and hardness of the seams, which were from 1 to 6 feet.

The effectiveness of machinery in coal mining is well illustrated by comparing the advances of the coal industry in Great Britain and in the United States. In the United States we employ 940,618 persons in our coal mines; in Great Britain, a total of 1,059,028 persons are employed in this same industry. It is, therefore, an interesting fact that with fewer men, we, in the United States, produce 60 per cent. more coal than our British cousins.

In the establishment of a proper system of ventilation, the engineer must always remember the law of diminishing returns, and not forget that with a given fan, when we double the amount of power used, the quantity of air circulating is only increased about 25 per cent. For this reason it is always best to install a fan that is properly proportioned for the work at hand. If more work is to be done, another fan should be installed rather than overload the first one.

At one of the larger mines in Illinois where Goodman machines are used, the machine runners each get 3½c. per ton for their work; at this mine, it is common occurrence for both miners and loaders to earn $200 per month in wages. The average tons loaded per man is 15; the highest tonnage per man is 25; the lowest is 10. The percentage of screenings through a 2-in. round perforated shaker screen is never more than 30 per cent. of the output. It is said that this mine holds the State record for work done by mining machines; 200 tons of coal have been produced per single shift for each machine

According to the most recent statistics, of the total number of mining machines in operation in America, 5011 are designated as of the pick or percussive type; 4144 of the chain-breast pattern, and 157 of the longwall-chain type In Great Britain, in the year 1907, there were 802 longwall-disk machines, 222 of the bar type, 79 of the chain type, and 364 of the different percussive makes. The longwall-disk machines in Great Britain are generally operated by compressed air, and the chain and bar types by electricity. Chain-breast machines are as uncommon in Great Britain as the longwall-chain machines are in America.

Accidents due to absolute thoughtlessness on the part of miners continue to be recorded. A case of this sort recently occurred when a miner attempted to insert a charge in a hole that had blown out in a hard heading; the shot-firer in this instance failed to consider the high temperature that remains in a shot-hole after a blow-out shot occurs. In this case, there was sufficient temperature remaining in the hole to ignite the second charge, instantly killing the two men who were engaged on the work. At the inquest which followed, it was stated that even cold water had been splashed into the shot-hole before recharging, yet the second explosive was fired.

A fair knowledge of the geology of a coal seam is not only of great practical value to the superintendent and mine manager, but is also sure to be a valuable aid to the foreman and the miner himself. Every miner should carefully study the coal bed in which he works so that he will be able to recognize readily the cleavages of the coal, as well as its other physical peculiarities. Such a practical knowledge on the part of a miner, if applied in daily work, will not only enable a greater individual production, but will make visible many treacherous disturbances that occur in the strata, which will permit the miner to attend properly to his roof, or to handle water and gas that may be encountered. Geology can be applied at the face of a chamber underground, as well as in the engineer's office on the surface.

During recent years, several European countries have enacted laws limiting the working day to nine, and in some cases even eight hours. In this connection the great problem involved has been with regards to whether or not this plan of limiting the working day would result in an increase in production. An examination of the problem in Austria, where the law limits the day to nine hours, shows that this restriction of the hours of work has not increased the output of the miners; also that the daily wage is slightly higher for a lessened output. The most important result of such legislation in Austria was the enforced introduction of mechanical coal cutters and conveyers at the faces. The law is also said to be responsible for the migration of many good miners to Germany and America in order to earn the high wages which the local limitation has prevented them from obtaining.

An English investigator after a careful study of colliery rescue work, stated that although the various oxygen-breathing apparatus have passed the experimental stage, they are far from having reached perfection. He says that the great difficulty attending rescue work is the act of maintaining apparatus at the mines in a constant state of efficiency, for serious risks are attached to the use of such machines when they are in an imperfect condition. In speaking of the value of such apparatus, he did not refer so much to rescue work after an explosion as to the use of such apparatus in overcoming underground fires. This authority stated further that not less than five sets of apparatus should be kept in readiness at each colliery, and that no party composed of less than five persons should be permitted to enter a mine for exploring purposes; his reason for suggesting that each rescue corps be composed of not less than five rescuers is to prevent any accident in case of a mishap to one or more of the men. He says: "The splitting of a party should never be permitted under any circumstances. Everyone who has had to deal with underground disasters has experienced the difficulty of restraining men, under the influence of excitement, from undertaking rushes from which they would shrink in calmer moments."

The time is fast approaching when the manufacture of briquets in the United States will become a profitable industry. There are thousands of tons of coal dust, of small commercial value, available in all of our important coalfields, and it is almost certain that this fine coal could be made more salable if manufactured into some patent fuel. The manufacturers of briquets in Wales are now doing a prosperous business, and the fuel manufactured in the Swansea district is being exported to France, Italy, Algeria, Egypt and other countries, besides the large quantities of briquets that are sold locally in the United Kingdom. These briquets manufactured in Wales retail at 2c. each, weigh about 9 lb., and form a useful and economical fuel for the poorer classes. The heat given out is equal to that of good steam coal. Before conversion, the coal dust is well washed to reduce to a minimum the content of shale, clay, or pyrites. Bituminous coal dust, dry-steam coal dust and anthracite coal dust are mixed in such proportion as to make the briquets burn with as little smoke as possible. The dust from coal containing about 12 per cent. volatile matter, forms the bulk of the material used in manufacturing these briquets. Smokeless briquets are principally made from anthracite coal dust and a smokeless cementing material. There are many places in America where coal is so cheap that briquets could not be profitably sold; however, this patent fuel is so compact and stands transportation so well, it is safe to say that in many places where the price of coal is high, such a fuel could be sold at a material profit to the manufacturer.

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The Margin on Zinc Ore

After a highly prosperous time in 1906, extending up to the middle of 1907, when the zinc smelters enjoyed the advantage of a margin between spelter and ore much larger than the average, conditions began to go against them, the margin running down to nearly $10 per ton in the second half of 1907. Throughout 1908 the margin was small, the minimum, on monthly averages, having been $6.90 in January, while the maximum was $11.74 in June. The average for the year was $10.07. In computing the margin on zinc ore, we take the difference between the value of 1020 lb. of spelter at St. Louis and 2000 lb. of blende, containing 60 per cent. zinc at Joplin. The margin is, therefore, the amount out of which the smelter must pay for the carting and railway freight on the ore, the cost of smelting, freight on the spelter to St. Louis, selling expense, and some minor items. The aggregate of these costs is a good deal more than $10 per ton of ore, wherefore, with a $10 margin, every smelter in the United States is losing money on the face of things.

However, the adversity of a $10 margin is ameliorated by several conditions. Some smelters by especially skilful work are able to recover a little more than 1020 lb. of spelter. (We are aware of claims of much higher extraction and some records appear to show it, but these are generally found to exceed the percentage computed on the basis of the input and output of a year). Some of the spelter product may be marketed, under favorable conditions, at a premium as "specials." Some smelters may secure an advantage by purchasing ores higher in iron than the average, obtainable at a profitable discount from the base price for standard ore. But all of these advantages fall short of enabling the smelter to come out even on a $10 margin.

How then can the smelters afford to buy ore for so long a time upon so unprofitable a basis? The explanation is that the Joplin product is taken to a very large extent by the zinc smelters who also make sulphuric acid out of the ore. Consequently, in buying the ore at a nominal loss they are as a matter of fact paying more or less, perhaps fully, for the sulphur value of the ore, the sulphur value being approximately $2.50 per ton of ore. These concerns are naturally a dominant element in the Joplin market. Joined with them are those concerns which buy selected ores and make especially high-grade spelter that almost always commands a substantial premium. If the concerns that make a specialty of buying ore high in iron be added, there remains but little Joplin ore for the outsiders.

In 1907 and 1908 there were in the United States 18 zinc smelting companies that were in the market for Joplin ore. The major portion of the output of the Joplin district in 1907 was purchased by six companies, each of which obtained therefrom supplies of ore in excess of 23,000 tons. In 1908 the smelters received from the Joplin district 270,000 tons of ore, of which 212,500 tons, or about 80 per cent. of the total, was taken by seven concerns, three of which made sulphuric acid, their purchases alone running to nearly 90,000 tons. The conditions in the Wisconsin ore market are similar, practically the entire production of that field being absorbed by four concerns, all of which make sulphuric acid.

Consequently it happens that when the price for spelter is high, as it was in 1906-07, and the supply of ore from the Rocky Mountain States and Mexico is abundant, the less favorably situated smelters do not have to compete so strenuously in the Joplin market, and while the price for ore in the latter may be high the margin is apt to be favorable to the smelters. But when the price for spelter is low, and consequently the price for ore is low, the supply from Colorado, New Mexico and Mexico is diminished and the smelters are forced more to the Joplin district with the natural result of narrower margin. If the supply of ore be permanently diminished by a tariff on the Mexican and Canadian product the outlook will be for narrow margin all the time, which would indicate that some of the smelters might have to go out of business.

An amendment introduced by the Finance Committee of the Senate on May 18, making the duty on spelter 1⅓c. per lb. and making zinc in ore dutiable upon a graduated scale, rising to 1c. per lb. when the ore contains upward of 30 per cent. zinc, does not materially improve the prospect for the smelters. They do not import any ore with less than 30 per cent. zinc. The concession upon lower grades is simply to throw dust in the eyes of the ignorant. The addition of ⅓c. per lb. to spelter will give the domestic industry just so much more protection against the im-

portation of foreign spelter. However, the smelters will remain in the uncomfortable position between the millstone of shortage of ore supply on the one hand and the competition of foreign spelter on the other hand. Even now spelter is from time to time imported under the drawback privilege, a practice that is certain to increase.

Mr. Lawson's New Process

Thomas W. Lawson's latest philanthropy to the public, which he wants to see get rich quick, loudly heralded in advance, turns out to be the offering of the stock of the Santa Rita Mining Company, and the "Process Copper Company." The mining company owns the old mines at Santa Rita, Grant county, New Mexico, which various persons have tried to work during their long and checkered career. According to John M. Sully they possess large deposits of low-grade ore. Mr. Lawson now thinks that he has found the key to success in a new hydrometallurgical process, invented by Charles S. Bradley, who is well known by the invention of some details that were of importance in the aluminum industry.

Mr. Lawson introduces his new scheme by publishing an octavo volume of xlviii+252 pages about it, in which italics and black-letter type of various sizes are profusely employed. Let not the reader expect, however, 300 pages of unalloyed pleasure, or anything like another "Story of Amalgamated," distributed gratis. In the present volume, pages 1 to 74 are occupied by a report by Mr. Sully on the Santa Rita mines. Pages 75 to 248 give the result of 8094 samples, which far outdoes old Homer's catalog of the ships, and would hold the record for aridity were it not for Vega's tables of logarithms. Alas, Mr. Lawson, that you should be uninteresting!

We have looked through these 300 pages with a microscope to discover something of the nature of the Bradley process, but although we used an instrument of 100 diameters magnifying power, we failed to find more than a trace, the latter a remark that the process is being applied on a practical scale within gunshot of New York. Mr. Lawson also in an "important amendment" on page xxxii disclaims all previous statements that the process will extract 100 per cent. of the copper of the ore, and conservatively remarks that he means the recovery of "a very large proportion of the copper which remains in any ore after every other known process has extracted the copper up to its limit."

The Consolidation Coal Merger

A good deal has been said in the press during the past week about the formation of a "soft-coal trust," the moving cause being the announcement of the merger of the Fairmont and other coal companies in Pennsylvania and West Virginia with the old Consolidation Coal Company, of Maryland. As a matter of fact, the change brought about by the merger is only one of form. The Consolidation Coal Company was the first and the largest operator in the well known Cumberland or George's Creek basin on the Maryland side of the upper Potomac. It developed that field, which produced a coal of unusually high grade, and built the railroad which connected the mines with the Chesapeake & Ohio canal and the railroads at Cumberland. The field is one of the oldest producers in the country; it has been mined for the best part of a century, and the managers long ago foresaw its approaching exhaustion. To provide for this they acquired control of coal lands in the adjoining Fairmont field in West Virginia and in Somerset county in Pennsylvania. These lands were held by separate companies, but control of these was retained by the Consolidation Company. The merger, therefore, adds nothing to the actual holdings of the company, but will only simplify its management.

While there is nothing in the nature of a trust, it may be said the company owns one of the largest and best blocks of coal land in the country, its total extent being about 200,000 acres, and the underlying coal of the best quality. Its technical management has always been good, and its mines have been well and economically worked, as a rule. The company has had very few strikes in its history, and its miners have not been willing to leave it, largely because mining on the Big Vein of the Cumberland regions is much easier work than in the mines in the Pittsburg and other districts.

It may be noted that a controlling interest in the Consolidation Coal Company was for many years held by the Baltimore & Ohio Railroad Company. About the time of the passage of the Hepburn law that company sold its stock to a group of Baltimore men, who were independent, but yet inclined to work with the railroad, in which also they were interested.

In our issue of May 1, 1909, in reporting the production of copper in North America and in the world, we made a mistake in giving the production of Canada in 1908 as 55,781,992 lb. That figure was indeed the aggregate of the figures reported by the smelters, but we neglected to deduct 2,056,779 lb. of copper in ore shipped to them from the United States. The failure to make this deduction, of course, caused a duplication in the statistics for the United States and Canada. The correct figure for Canada in 1908 is 53,725,213 lb. Carrying forward this correction to the statistics for the world, and also making a change in the statistics for Russia for which we have later received the official figure, the production of copper in the world in 1908 was 760,773 metric tons against 722,655 in 1907.

The iron and steel trades do not seem to be suffering very severely from the "open market," from which some operators—and some of our contemporaries—predicted such dire results would follow. The current reports of production show that mills which were operating to 50 per cent. of their capacity and even less, are now running up to 75 and 80 per cent., and even full in some cases. Eighty per cent. is a pretty good return for a capacity which has, in most cases, been adjusted to boom times. Moreover, a number of the larger companies which reduced wages in April have announced that they will return to the old schedules on July 1; this action being voluntary on their part, with no hint of strikes. All of which seems to show that the open market has its advantages.

Henry H. Rogers died May 19. His record as president of the Amalgamated Copper Company has often been commented on in the JOURNAL; it is sufficient to say here that he made of it one of the great industrial enterprises of the country. His latest work was the construction of the Virginian railway, intended especially to promote the coal trade of West Virginia.

Tungsten Industry of Boulder County, Colorado, in 1908

By R. D. George*

The financial stress which developed in the latter part of 1907 paralyzed the tungsten-mining industry, and for several months the camp was very quiet. Several of the larger Colorado producers in Boulder county closed down completely, a number of the smaller companies went out of business, and consolidations still further reduced the number of producers. It was not until the latter half of 1908 that the camp began to come to itself again. Since that time activity has increased, and the present year promises a large measure of prosperity.

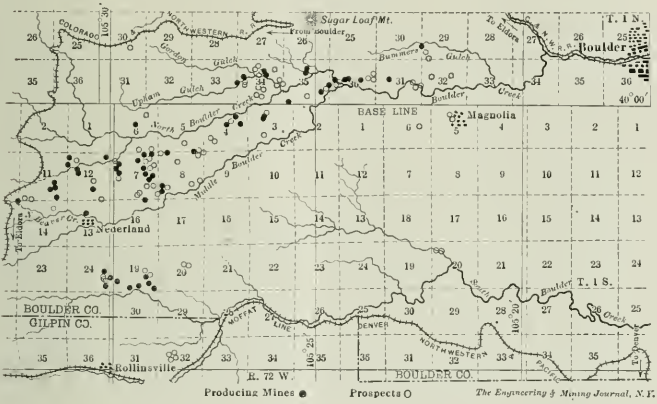
One of the notable events of the year was the organization of the Primos Mining Company, which bought the tungsten mines of the Cardinal company, and those of the Stein & Boericke company. C. F. Lake, formerly manager of the Cardinal company, is the manager of the new company. The Philipp Bauer company, which held a lease on the Rogers group of about 2000 acres in the tungsten district, gave up the lease and retired from the field. Eugene Stevens, formerly manager for the Philipp Bauer company, now holds the lease, and has already commenced the vigorous development of some of the mines.

The Cardinal company kept a force of men on development work, and has opened up in the Conger, one of the largest, if not the largest, body of tungsten ore yet found in Boulder county. Promising finds have been made in other mines formerly belonging to this company, but now held by the Primos Mining Company.

The principal producers for the year were: The Primos Mining Company, the Philipp Bauer company and the Wolf Tongue company. Probably 75 small producers contributed to the total output largely, however, as a result of the development work undertaken. Most of their ore was treated at the Wolf Tongue mill at Nederland. A number of good finds were made in the southern part of the district, particularly near Manchester lake. High-grade ore in promising quantities has been opened up in the Boulder Falls part of the district, and this area is likely to make a good record when mining activity is fully restored. Some development has been done in the vicinity of Ward, not far from Gold lake, but no shipments have been made.

In the matter of concentration, some progress has been made. The Cardinal mill was improved by the addition of a large area of stationary canvas. The Clarasdorf mill built by the Philipp Bauer company uses a jaw crusher and rolls instead of stamps. The problem of concentration is still a difficult one owing to the character of the ores. Ferberite is an extremely friable mineral and under the stamps slimes badly. Much of the gangue is hornstone and silicified country rock which are by no means friable. Again, a portion of the ore is in the form of minute grains of ferberite in a hornstone matrix. This needs very fine crushing in order to make anything like a satisfactory saving. The millmen of the district are alive, and are undoubtedly nearing a solution of the problem.

As to the future of the district, the producing area is today larger than ever and the deepest workings show no falling off either in quantity or quality of ore. With satisfactory prices for the product, the camp would show an increased production. The production for 1908 was as follows: Ore mined and concentrated, 3450 tons; high-grade ore ranging above 25 per cent. of tungstic oxide, 180 tons; concentrates, 407 tons; total value, $167,257.



MAP OF THE BOULDER COUNTY TUNGSTEN FIELD

*Director, State Geological Survey of Colorado.

Mexico's New Mining Code

Special Correspondence

The new mining code for Mexico is up for discussion in the Chamber of Deputies and the proceedings of the legislative branches on this matter are watched with much interest. The failure of Congress to enact the law at the December session, after it had been referred by the President and the cabinet, with the so-called anti-foreign clauses eliminated, created a feeling that some strong influences were at work which might be able to revive the objectional clauses for discussion and possibly enact them into a law. This impression was given color from the fact that the code, or law, was a measure, which, by special act of Congress, in accord with other similar cases, the President could, at his option, decree, enforce or refer to Congress for approval. It is likely that the reference of the law to Congress was because of its great importance and its broad scope.

The delay, however, lent color to the belief that the advocates of the anti-foreign clause would, at least, make an attempt to overrule the expressed policy of the executive.

The preliminary discussion on the law was related to the fundamental question of federal and states rights. The new law increases federal jurisdiction in matters relating to mining and it is on this that argument is made against the law. The ordinances of Philip II, in 1584, made the central government supreme in matters relating to mining. The famous "Ordinances of Mining," promulgated in 1784 reasserted the principle of crown ownership of minerals and the right of control by the crown. These remained in force, with some modifications, after independence. In 1857 a new constitution for the Republic was adopted which specifically left the states free to enact their own laws in regard to mining, and did not recognize the power or right of the general government as was established from the time of the ordinances of 1784. Only two states, Durango and Hidalgo, took advantage of this and enacted special codes. In 1883 the federal constitution was amended conferring on the general government exclusive power to legislate upon mining matters and in 1884 a new mining code was adopted which superseded all other laws, state and federal. This remained in force until 1892 when it was superseded by the present code. Both the laws of 1885 and of 1892 recognized the full federal control of mining but they did not go so far as to jurisdiction in regard to legal questions as does the new code now under discussion. The question has other bearings also and is likely to be fully discussed by the deputies.

Manganese Deposits of Virginia

By S. Mays Ball*

The manganese deposits of Virginia have for years afforded the principal domestic supply of high-grade manganese ores. The deposits, however, are pockety and are higher in silica and phosphorus than the Brazilian ores, but are suitable for many purposes. Deposits of manganese ore, according to the reports submitted to Commissioner G. W. Koiner, include high-grade oxides and manganiferous iron ores, and occur widely distributed throughout the State, particularly along the James river valley, and the Shenandoah, or Valley of Virginia.

At the Crimora mine, which is one of the most important deposits, a synclinal basin in the Potsdam sandstone approximately 900 ft. long by 500 ft. wide, has been filled with the clay derived from the decomposition of the ferruginous shales overlying the massive sandstone. The manganese, originally disseminated through the rock, has now become concentrated in the clay resulting from its decomposition. The ore, which is psilomelane with a little pyrolusite, is found irregularly distributed through the clay in nodular masses varying from pebble size to lumps a ton or more in weight. These deposits have been developed by means of a shaft with levels driven at 75 and 105 ft. The maximum thickness of the Crimora ore-bearing clay is apparently about 300 ft. The ore is crushed, washed and screened to remove fines, and after drying is ready for shipment. The lump ore has been mostly sent to England and the fines to Pittsburg. This mine has produced up to 50 tons per day of the highest grade ore, the composition of which is shown by the following analysis, made by Prof. A. S. McCreath: Mn, 57.291; Fe, 0.373; P, 0.075 per cent.

At other points in the James river valley and the Valley of Virginia, deposits have been opened and developed to some extent. Near Norwood, on the James river, and about two miles from Midway Mills, a deposit of high-grade manganese was opened some years ago and about 500 tons of ore of excellent quality was mined and shipped. This mine, however, was shut down on account of insufficient equipment to handle the water. The ore produced contained about 58 per cent. manganese, 1.5 per cent. iron and about 0.15 per cent. phosphorus. In the same locality, near Warminster, another deposit was opened and yielded a considerable quantity of ore similar in character to that mined at Norwood. Farther up the river, in the vicinity of Mount Athos, a deposit of good quality was mined to some extent.

At several other places on the southwest continuation of the Middle James river iron belt through Campbell and Pittsylvania counties, deposits of promise have been opened. One of the most recent openings near Hurt Station in Pittsylvania county has indications of a considerable deposit of high-grade ore. From the large number of surface samples received by the commissioner there seems to be numerous deposits along this iron belt that are worthy of investigation. A few miles southeast from Mount Athos at Concord in Appomattox county, several openings have been made and some good ore exposed. From those openings analyses of two samples show a manganese content of 66.6 and 52.9 per cent., respectively. Deposits are also reported in the vicinity of Willis mountain, Buckingham county, and near Spiers mountain, but only surface samples have been obtained from those localities. Undeveloped but prospected deposits have also been reported from Albemarle and Orange counties.

In the northern portion of the Valley of Virginia the manganese production has been chiefly in the form of manganiferous iron ore, though deposits of high-grade ore have been opened at a few points. In Page county, manganiferous iron ore has been mined about three miles east of Milne's station and a promising deposit of high-grade ore, apparently of considerable extent, was found on the Garrison tract about two miles east of the railroad. The following two analyses by Prof. A. S. McCreath show the character of the ore: Fine ore, Mn, 52.691 per cent.; Fe, 2.325; P, 0.324; SiO_2, 2.795; lump ore, Mn, 53.656 per cent.; Fe, 1.537; P, 0.327; SiO_2, 1.955. In Rockingham county manganiferous iron ore of quality suitable for the manufacture of spiegeleisen has been opened on Big Run creek.

In Augusta county the clays derived from the Potsdam sandstone have yielded manganese ores at several places north and southwest of Crimora. North of Crimora a deposit was opened at Grottoes yielding ore carrying 48.7 per cent. manganese, with a silica content of 6.08 per cent. and 0.40 per cent. phosphorus. A few miles northeast of Elkton an opening was made from which samples of high-grade ore were taken. Near Sherando a number of years ago several hundred tons of high-grade ore were taken out of open cuts, the results pointing to the existence of a large amount of ore in this locality. At Lyndhurst station deposits are also reported and a few miles southwest of Lyndhurst the Kennedy mines produced a considerable amount of 43-per cent. ore. Cutting southwest at Vesuvius, in Rockbridge county, there is a deposit of rich manganese ore and at Midvale in the same county, another deposit exists from which good ore was obtained.

In Botetourt county a highly manganiferous iron ore has been extensively mined and shipped from the Houston mines, near Houston station. In places the bed contains pure manganese ore. The following analyses by Prof. A. S. McCreath show the composition of the manganiferous iron ore: Mn, 24.7 per cent.; Fe, 29.1; P, 0.138; SiO_2, 7.7. In other parts of this county prospecting has been carried on and more or less ore taken out at different places. In Roanoke county prospecting was done some years ago, a few miles southeast of Roanoke, and some high-grade ore was found.

Occurrences of manganese and manganiferous iron ore are reported from the southwestern counties of the State. In Lick and Draper mountains, Wythe county, Flat Top mountain near the Bland county line and in the mountains in the western part of Bland county, surface work has been carried on and some promising ore exposed. In Smyth county, near Marion, the Stalie's Creek Manganese Iron Company has opened a bed of high-grade psilomelane which it is developing. Many other surface samples received from the southwestern portion of the State indicate the occurrence of manganese deposits over a large area, the extent and economic value of which can be determined only by further development.

*Atlanta, Ga.

The Montana Mining Company

Special Correspondence

The report of the Montana Mining Company for the year ended Dec. 31, 1908, states that there was a loss for the year on revenue account of £4582. Legal expenses, incurred prior to the existing lawsuit, amounted to £1776. At Marysville, Montana, the injunction on the compromise ground put a stop to operations and the only revenue derived was that obtained from shipping ore recovered by leasers and from the clean-up of the mill. There was an expenditure of $20,416 on shaft sinking on the Compromise ground and of $2513 in connection with pending litigation.

At the Lucky Girl group of mines at Edgemont, Nevada, 4531 ft. of development work was done on the Lucky Boy or Upper Vein, and 1136 ft. in driving the Deep Tunnel. The output from Jan. 1 to Nov. 30, when the mine was temporarily shut down, was 19,800 tons of ore from which bullion to the value of $127,857 was realized, being an average of $6.46 per ton. The working expenses amounted to $102,872 or an average of $5.19 per ton. The operating profit was reduced to a deficit by charges for fire insurance and prospecting expenditure in the upper levels of the mine.

The Nevada property was worked for eleven months. In November the stopes suddenly and simultaneously became impoverished, and could not be worked at a profit. It was decided, therefore, to shut down pending completion of the tunnel and installation of electric power, when

the low-grade ore exposed in the upper levels of the mine can be more economically and expeditiously handled than it is possible to do at present.

As regards litigation, the St. Louis Mining and Milling Company applied to the Federal Court for the State of Montana for an injunction on the Compromise ground, which was granted on Jan. 27, 1908, thus bringing work there to a full stop. Against this injunction the Montana company appealed to the Circuit Court of Appeals at San Francisco, the result of which was to affirm the action of the lower court; the consequence being that the company was tied up as it was last year. The suit is set for trial on June 14 of the present year.

Electric Hoisting and Pumping in the Cripple Creek District*

By S. A. Worcester*

The fact is gradually becoming appreciated by mining operators in this district that electric power is now being furnished for the various operations of mining and milling, at rates that are lower than are made elsewhere in the State, and so low that, except for temporary plants, steam power cannot approach the electric plant in economy. My experience with induction motors, using current from central stations, for mining purposes in various mining districts, has inclined me strongly toward this convenient and economical form of power. While small electric hoists have come quite largely into use in this district, they have seldom, if at any time exceeded 30 h.p. in size, and no balanced electric hoisting has yet been done in the district.

A Fifty-h.p. Electric Hoist

A 50-h.p. electric hoist, using a skip and overbalance weight, also an automatic side-dump waste car, designed by me, is now about ready for operation at the intermediate shaft of the drainage tunnel. An interesting feature of this plant is the weight; this consists of a steel water tank partly filled with water. As soon as connection has been made from the intermediate shaft to the tunnel portal, this tank will be filled with water, when the skip is at the tunnel level, so as to overbalance the loaded skip, which is then hoisted, the speed being regulated by the hoist brake. When the load has been hoisted and dumped, the tank, being then at the bottom or tunnel level, is automatically emptied, the water passing out through the tunnel. The empty skip then overbalances the tank and is lowered, using the brake as before. A stream of water which flows near the shaft will thus be made to furnish power for the hoist. The tank will be filled and emptied automatically. The electric side-dump car, operated by the engineer from his station at the hoist, saves one man's wages per shift and is an inexpensive arrangement. It is provided with a safety switch, so that if the engineer fails to stop it at the end of its outgoing trip, no damage will result, and the car will dump itself and return without attention.

Saving in Power Cost

The saving in cost of power by using electric current instead of steam, will approximate 50 per cent. for this plant. The estimated saving per day for a 100-h.p. overbalanced electric hoisting plant, which I designed several months ago, over a modern steam-hoisting plant, was $14 in two 8-hour shifts. The overbalanced hoisting system, now used by several mines in this and several other States, has great advantages over any other system, as applied to the majority of our metal mines in the Rockies. Four ore-handling plants on this system are now in operation in this State, the largest being the 5½-ton electric skip-hoisting plant of the Liberty Bell mine, at Telluride. This mine has the largest skip in use in the State, with a tail rope and tension carriage, and an overbalance weight of 14,000 pounds.

A few figures will show clearly the saving effected by overbalanced hoisting, as compared with unbalanced hoisting. Assuming an ore load of 2000 lb., and a skip weighing 1500 lb., to be hoisted a distance of 1000 ft., using ¾-inch steel rope, the total starting load is 4390 lb., and the average load during the hoist is 3945 lb. By using an overbalance weight of 2500 lb. the total starting load is reduced to 1890 lb., and the average to 1000 lb., or one-half of the load of ore, power being used in both directions. The necessary size of motor or engine will be in the ratio of 4.39 for the unbalanced plant, to 1.89 for the overbalanced hoist, or 2.32 to 1, and the power consumption will be as 4390 to 2000, or 2.2 to 1. If, as in the case of the Liberty Bell plant, a tail rope with tension sheave is used, the unbalanced rope load at starting is eliminated and the starting load becomes 1000 lb., the uniform load from beginning to end of hoist. The ratio of the size of motor or engine to that for the unbalanced hoist then becomes as 1 to 4.39, an immense difference, and the efficiency of the motor is much better, owing to the uniform load. Friction, which should not exceed 10 per cent. with any arrangement, has been ignored in these figures. If a steam hoist is used, a very small boiler capacity, relatively, is needed for the overbalanced plant, because of the much smaller and more frequent demand for steam. In a recent design of an electric-hoisting plant it was found that with the unbalanced arrangement the power company refused to furnish current for the large motor required, unless a rotary converter or equivalent device were installed, in order to reduce the immense drop in line voltage which would result from starting so large a motor at full load. By using the overbalanced tail-rope system the size of motor was reduced so as not to be objectionable and the cost of the electrical equipment became about one-third of that of hoisting unbalanced.

The great majority of mine shafts in Colorado have but one hoisting compartment, and the expense of enlarging these shafts, or sinking new ones, in order to use two compartments for balanced skips or cages is in most cases prohibitive. By simply lengthening the skip, or using a long or deep skip, as is done at the Findley and Liberty Bell mines, in this State, and the Original and Stewart mines, in Butte, is is possible and highly economical to hoist an immense tonnage through a single-compartment shaft.

Pumping

Estimates recently made for two of the larger mines of this district show that their pumping can be done by electric power at a cost of about one-half that of the present cost of pumping by steam. The simple expedient of attaching a substantial crank and gear-driving movement to the plungers of the present steam pump, eliminates the expense of a complete new pumping plant. The cost of additional equipment for electric pumping in these cases will be saved in three to five months of continuous operation. Owing to the fact that pumping gives a uniform 24-hour load, the power companies make a lower rate for this service than any other. In some cases it is possible, by allowing a large sump to fill during working hours, to do the major portion of the pumping during hours when the power company is underloaded, in which case the rates will be made extremely low, on account of the desirable character of the load. It is now very generally known throughout the district, that for continuous operation, lasting for a considerable period of time, even the most economical steam plants cannot compete with electric power in economy.

*Mechanical engineer, Victor, Colo.

The Clark Copper Company

Inasmuch as it was announced in the personal column of the Journal (a statement that the Journal was fully justified in making) that I had assumed the management of the Promontorio mines in Mexico for the Clark Copper Company, I beg to state that I am no longer connected with that company in any way, and I disclaim any responsibility whatsoever for any of its projects, either mining or milling, now in hand, or to be undertaken.

Percy E. Barbour.

Los Angeles Cal., May, 7, 1909.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Rowland Cox, of New York, is in Monterrey, Nuevo Leon, Mexico.

A. G. Larson, superintendent of the Le Roi mine at Rossland, B. C., was in Utah recently.

H. M. Montelius, of New York, has been examining property in Clear Creek county, Colorado.

S. J. Speak, of Hooper & Speak, left London on May 1, for West Africa, on professional business.

Rodolphe L. Agassiz has returned to Boston after an extended visit to the Lake Superior district.

Walter Ragland, formerly a mine inspector of the State of Missouri, is mining at Neck City, near Joplin.

J. Morgan Clements, mining geologist, has returned to New York from a professional trip to Cananea, Mexico.

Thomas G. S. Hersey, an English mining man, who is largely interested in Gowganda properties, is in Toronto.

Sir Robert Perks, of London, is in Ottawa in connection with the construction of the projected Georgian Bay Canal.

Lt.-Col. H. Alexander Judd, who has been examining mines in New Mexico for London capitalists, has returned to England.

Fred McL. Strout, of Denver, has taken the management of the Protective Gold Mining Company, near Central City, Colorado.

George H. Hall, secretary of the Cleveland Rock Drill Company, Cleveland, O., has been in New York, on business for the company.

John O'Dea, manager of the Geneva Extension Mining Company, of Georgetown, Colo., has returned from a business visit to Fort Worth, Texas.

R. Randolph Bruce, formerly manager of the Paradise mine in Windermere district, East Kootenay, has returned to Wilmer, B. C., from a trip to Scotland.

Capt. Hiram Griswold, formerly manager of the Union Copper Mines, of Gold Hill, N. C., has taken charge of the Blue Wing Copper Mine at Virgilina, Virginia.

Louis Janin, Jr., well known as a mining engineer, and formerly on the staff of the JOURNAL, has recovered from a long illness, and is now in San Francisco.

S. E. Bretherton, of San Francisco, is spending a few days in Shasta county, Cal., on business for the Friday-Lowdon Copper Company whose property joins the Mammoth mines.

Alexander E. Outerbridge, Jr., has returned to Philadelphia from Jamaica, where he made an examination of the work in progress on a copper claim which is now being explored.

Henry P. Lowe, of Denver, who is managing director of the Frontenac Mines Syndicate, Ltd., operating in Gilpin county, Colo., has left for London, England, on a mining business trip.

W. W. Leach, of the Geological Survey of Canada, was in Victoria, B. C., recently, on his way north, to resume his geological work in the Skeena river district of British Columbia.

Ernest Stenger, formerly with the Denver & Rio Grande Western railroad, has been appointed general traffic manager for the Utah Copper and the Ray Consolidated Mining companies, with office at Salt Lake City.

H. Irving Jones, who has been manager of the Aztec Mines Company at Central City, Colo., for the last two years, has accepted the position of superintendent for the Sunnyside Mines Company at Eureka near Silverton, Colo., and has assmued his duties.

Dwight T. Randall, late engineer-in-charge of fuel tests, Technologic Branch, United States Geological Survey, has associated himself with the Arthur D. Little Laboratory of Engineering Chemistry, of Boston, in charge of the Department of Fuel Engineering.

Sir W. Thomas Lewis having been unavoidably prevented from accepting the presidency of the Iron and Steel Institute, to which he was elected at the recent annual meeting, the council has requested Sir Hugh Bell, the retiring president, to serve for another year, and he has consented to do so.

Thomas Kiddie, of Northport, Wash., manager of Le Roi Mining Company's smelter, has been appointed representative of the Nicola Valley Coal and Coke Company on a board of conciliation and investigation under the Canadian law to deal with a labor dispute between the company and its men employed at the Middlesboro' colliery.

Obituary

Walter Dusenbury, a mining engineer, was accidentally killed by a train on the West Shore railroad at Bogota, N. J., May 12.

Robert S. Brown died at Easton, Penn., May 16, aged 61 years. He was for many years a prominent slate operator and quarryman in the Bangor district in Pennsylvania, and had been president of the American Slate Company since its organization.

Ambrose H. Douglas died at the Leonesa mine, Matagalpa, Nicaragua, on May 1. He was well known at Silver Peak, Tonopah and other Nevada camps as a miner of ability and a man of upright life. He went to Central America from Nevada not long ago.

John Strang died at Salt Lake City, Utah, May 9, aged 39 years. He was born in Clackmanan, Scotland, and came to this country with his parents in 1878 and settled in Ogden. When a lad be engaged in mining with his father at Almy, Wyo., and later went to Scofield, where he became an employee of the Utah Fuel Company. He worked in the mines at Scofield and Winter Quarters and also at Castle Gate, where he assisted in opening up that vein of coal under the superintendency of W. G. Sharp. About 1892 he turned his atention to metal mines. He supplemented his practical experience with a close study of the theory of mining. He followed mining in Eureka, Utah. About eight years ago he was placed in charge of the Tetro mine and since remained at that mine as foreman and as superintendent

Societies and Technical Schools

Montreal Technical School—The contract for the erection of the new Montreal Technical School building has been awarded to Peter Lyall & Sons, of Montreal, for $387,000. The architect is J. S. Archibald and the building will be erected on Sherbrooke street, between Mance and Church streets.

Canadian Mining Institute—Secretary H. Mortimer Lamb has received the following letter from Hugh F. Marriott, of London, England: "Mr. W. Frecheville, Mr. R. E. Commans and myself, as members of the Institution of Mining and Metallurgy, having a lively recollection of the friendly feeling engendered and the delightful hospitality experienced at the hands of the members of your society, wish to farther express our appreciation in a small way, which we hope will be acceptable to your council. We offer a prize of $250 for the best paper written for your society, to be decided by your council during the year 1909, on mining and metallurgical subjects within the Dominion of Canada, describing the advancement made in the branch selected, in the 12 months following the conclusion of our recent excursion. Competition to be limited to the younger members of the various grades of the society, say, under 30 years of age. These are the outlines on which we consider the prize will give a stimulus to your younger members, both to show their ability and to produce a paper of particular interest to those of your friends who will recall their experiences on the visit."

The gift has been accepted by the council of the Institute and a special committee —consisting of Professor J. Bonsall Porter, H. E. T. Haultain and J. C. Gwillim —has been appointed to see that the conditions are properly carried out. Papers must be in the hands of the secretary before Jan. 1, 1910.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Mexico, London, Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 12—At the recent meeting of mineowners in San Francisco, to consider the eight-hour law, it was resolved, as stated last week, to count as working hours only the time actually spent "at the face." As further indicating the sentiment on this particular question of interpretation to be given the law pending the trial of a test case, a number of mine owners and operators suggested the following interpretation of the provisions of the law.

1. That eight hours' work shall be done at the face underground, the men going to and from their work on their own time.

2. That the time shall count from the time they commence work at the face, or their working place underground, and extend until they quit work at their working place.

3. That neither the law itself nor these foregoing provisions apply to men working on the surface, except those actually employed in reduction works.

4. That all employees, both on the surface and underground, shall be paid by the hour for time actually at work.

In making these suggestions the committee of mineowners desired that all the acts of the operators, managers and mineowners, during the pendency of the test litigation, should be fair and should be aimed at a conservative construction of the law, so as to avoid misunderstandings with employees and to avoid disagreeable features of arrest and court proceedings throughout out the State.

It is generally believed, nevertheless, that the interpretation as suggested by the operators in Tuolumne and Calaveras counties, should be generally accepted by the owners and operators throughout the State, so as to observe uniformity. The law will be fully observed in the event that it is declared constitutional and it is suggested to the various owners, operators, superintendents, etc., to inform their employees that the law is being tested with a desire to determine its validity, and of course, if valid, it will be upheld. Pending this determination by the courts, however, the employees have been asked to join with the operators in a fair temporary interpretation so as to avoid unnecessary disputes and court proceedings. This request has not been uniformly complied with as many of the miners relied upon their local unions to take up their side of the question and compel immediate compliance with the law on the part of the operators. The mineowners of the State are now collecting funds to test the case and are collecting them on the basis of 50 cents per man employed.

The eight-hour law for underground miners and men employed in mills, smelters and other reduction works, which went into effect May 9, has already commenced to start trouble between mining companies and their employees. At the Sierra Buttes mine, Sierra City, the men were getting $2.25 per day and board and this was reduced to $2 per day and board, whereupon the miners quit work and the plant has closed down. At the Penn Chemical Works, Campo Seco, Calaveras county, the company has ordered that the men go to their work on their own time instead of owners' time, and the entire eight hours must be spent in actual work. It is expected that this copper property will also close down. At the mines of the Standard Consolidated Mining Company, Bodie, Mono county, where they pay $4 per day for 10 hours work—the highest wages in the State—the miners threaten to strike if wages are cut down when the eight-hour schedule is in force by law. A number of other instances of similar nature might be cited, and within the next few days there will be hundreds of other cases of strikes in the mines and mills.

The 7000-ft. Spring Garden tunnel of the Western Pacific Railway company, near Quincy, Plumas county, has been completed, benches and all. The Chilcoot tunnel, 6400 ft. long, in the same county will be finished this month. Though in the midst of a mineral section where there are numbers of quartz mines, not a sign of mineral was discovered in either of these railroad tunnels, much to the disappointment of the mining men of that region.

The Associated Oil Company of this State has voted to issue bonds to the amount of $25,000,000. Of this sum $6,000,000 will be expended immediately in constructing a pipe-line from Coalinga, Fresno county to San Francisco bay, and another from McKittrick, Kern county across the mountains to Gaviota on the Santa Barbara county coast line.

Butte

May 13—J. Herbert Anderson, president of the Panhandle Smelting Company, was acquitted, at a preliminary hearing, of the charge of embezzlement preferred against him by John Mocine, receiver of the company, and it is probable that the case will go no further. The charge was that Anderson had drawn a check for $1750 on the funds of the company with which to pay a personal debt. A suit asking that a receiver be appointed for the Amador Consolidated Mining and Development Company has been instituted in the local district court as Missoula by 750 stockholders representing about 580,000 shares of the company's stock. The complaint alleges mismanagement of the company's affairs for a long period of time, and it is stated that the officers and directors of the company are not acting in the best interests of the stockholders.

The purchase of the Pittsmont company's property having been ratified at a special meeting of stockholders of the East Butte company held this week, the latter company now intends to issue 60,000 shares of its treasury stock for the purpose of forming a working capital. The stock will be issued to stockholders on the basis of one new share for four of the old. J. H. Reid, of Pittsburg, one of the largest stockholders in the Pittsburg company, will become a director of the East Butte company. Three hundred thousand shares of East Butte stock will be used to acquire the securities of the Pittsmont company, now held by the banks of Pittsburg. The United States Fidelity and Guaranty Company has instituted action against the Reins Copper Company for the sum of $1250, and Morely & Thomas, Butte real estate dealers, have instituted suit against the same company for the sum of $637.37. The company's Ella and Combination quartz claims also have been attached.

The State Board of Railway Commissioners will hold a hearing some time this month at Helena to consider the question of establishing a connection between the Chicago, Milwaukee & Puget Sound and the Billings & Northern railways at some point in Fergus county. The roads parallel and cross each other, but have no connecting point and it is for the purpose of suiting the convenience of shippers by making some connection that the hearing will be held. The application of certain stockholders for the appointment of a receiver for the Kimberly-Montana Gold Mining Company was recently denied, the court holding that, since the Federal court had under consideration a petition that the company be adjudged a bankrupt, the State court was without jurisdiction to appoint a receiver.

Denver

May 15—The Doctor-Jack Pot Mining Company, in the Cripple Creek district, will pay a dividend on June 1 of $14,000. The company has $65,000 in the treasury and the property is now being operated by 15 sets of leasers. The total production of this property to date is about $2,840,000. The shaft, now 700 ft. deep, is to be equipped with a new electric hoist and compressor. The Gaylord cyanide mill at the Jerry Johnson mine, on Ironclad Hill, is now running on the low-grade ores from that mine. It is expected to treat 50 tons daily. The El Paso Consolidated Gold Mining Company, which is credited with a gross production of $423,000 last year, has now granted 31 leases, and is also operating a portion of its territory on company account. About 150 miners are now employed, and this number will be increased. The El Paso mine will be the first to be reached by the deep drainage tunnel. An important strike, proving the continuity of rich ore with depth, is reported in the American Eagle, of the Stratton Estate, at a depth of 1500 ft. from the surface, this being the deepest shaft in the district.

One of the big mining enterprises in Clear Creek county of which little is said in the press is that of the Waldorf Consolidated Mining Company, which owns 600 acres of mineral ground and has over 40,000 ft. of underground workings. The mines are developed by a crosscut tunnel 6000 ft. in length, intersecting the fissure veins of Mount McClelland, and exposing by drifts and raises ore of an estimated gross value of $5,000,000. Two concentration plants at the mine have a capacity of 100 tons per diem and additional concentrating machinery has been ordered. Owing to the low price of metals, no production was made last year, and the work was confined to creating reserves of ore, but heavy shipments are to be made this year. The company owns its own railway, the Argentine Central, connecting with the Clear Creek branch of the Colorado & Southern, and by this route the concentrates are shipped to the Denver smelter. The character of the ore in the upper levels is silver-lead, which at depth in some instances has changed to auriferous copper and iron pyrites.

Leadville has been watching with much interest the action of the senate in regard to the tariff on lead. Several of the properties in this district are low grade and the fact that the tariff has been allowed to remain will enable mining men to carry on operations profitably.

Indianapolis

May 17—State mine inspector Epperson has taken steps to bring all mines in the State, no matter what their size, under the mine laws. At present the laws apply only to mines employing ten or more men, and the smaller mines are allowed to operate as their owners pleases. There are over 400 small or wagon mines in the State, employing anywhere from one to nine men, and some even as high as 15 men, in violation of the law.

Mr. Epperson's plan is to bring all these mines under the State law and he is hopeful of being able to convince the legislature that it is necessary. The regular State inspectors would look after the large mines as at present, and 17 men, appointed in counties where there are wagon mines, would be paid by their own counties. Mr. Epperson says the loss of life in small mines is greater than in large ones and the application of law to them is very necessary.

The Indiana Supreme Court, in the case of Pugh vs. Collins Coal Company has decided that when the information that timbers are needed in a coal mine was actually given by the workmen to the company operating the mine, its failure to supply and deliver to such workmen the needed timbers constitutes a violation of the duty imposed by law on such operator, without regard to the manner or form in which the notice is given.

Salt Lake City

May 13—Last month the big concentrating mill of the Boston Consolidated at Garfield was running at two-thirds capacity, and it is expected that this month it will handle 3000 tons of ore daily, its maximum capacity. The mine workings have been extended to a more or less leached and oxidized surface zone to provide ore that is more amenable to concentration. During April, 10 units of the mill were working and the other two will be put into commission this month.

John D. Ryan, president of the International Smelting and Refining Company, which is building a large smelting plant in Tooele county, visited the smelter site last week. In an interview in Salt Lake City he said: "The smelter will be built as rapidly as possible with an initial capacity of 2000 tons per day. It will be so constructed that the capacity can easily be increased. It will be operated on the usual competitive lines of a customs plant, and when we are able to secure a sufficient volume of ore the character of which is not adapted to the smelter as its original unit is being planned, and which can be treated at a reasonable profit, the works will be added to or altered and adapted to the needs of the case." The latter portion of the remarks quoted is generally understood as indicating the possibility of the International company entering the lead smelting field whenever conditions seem to warrant this step. During his visit Mr. Ryan was for several hours in conference with Jesse Knight, and it was expected that something definite would be released concerning the talked-of deal for the Tintic smelter, the Colorado and Iron Blossom mines. Nothing was announced, however, and the impression is that the matter will receive further consideration before an understanding of any character is reached.

The Murray plant of the American Smelting and Refining Company has resumed operation after a brief shutdown owing to the walkout of the foreign laborers, who were later followed by the American employees. Last week the American workmen decided to return to work. On May 17, one furnace was started and it is expected that the plant will be in normal operation by the end of the current week. Some of the foreign laborers are being reëmployed, but at the same schedule of wages as before the strike.

A plan for the reorganization of Newhouse Mines and Smelters is under consideration, which will result in the holders of the $1,300,000 bonds agreeing to accept for them income bonds convertible into 260,000 shares of new stock at $5 per share, while the holders of the present 600,000 shares of outstanding stock will pay an assessment of $1 per share. Such an arrangement would enable the company to pay off its floating debt and leave upward of $300,000 in the treasury.

Authority has been asked of the courts to re-open the U. S. copper smelter under the system introduced successfully in the lead smelter for restraining the smoke and neutralizing the sulphuric fumes. However, it is expected to be a matter of eight months or so before smelting can be resumed in any event.

Mexico

May 12—The action of a recent popular convention in declaring for the reëlection of President Diaz and Vice-President Corral has cleared the political atmosphere and given reassurance to all business interests, particularly those in which foreign capital is invested. The broad and liberal policy of the president toward foreign investments has been fully evidenced in the past and it is well known that he has experienced no change of policy in this respect. The election will take place in 1910 for a term of six years. Should the president die during that term he will be succeeded, under the constitution, by the vice-president, who presumably now will be Sr. Corral. Business men, generally, feel full confidence in Sr. Corral's ability, progressiveness, and his liberal attitude toward foreign interests. He was formerly governor of Sonora, and has extensive mining interests there. He has been in close touch with the operations of Americans in the republic, and has always shown encouragement to the Americans in their Mexican undertakings. It is known that he joined with the president in the suppression of the anti-foreign, so-called, clauses in the new mining law.

While the low price of silver has held back a good many development enterprises

in Mexico, yet it is probable that the number of tons of silver-bearing ore produced is as great now as ever before, and that the output in ounces for the current year will show an increase over any previous year. Some of the companies find reasonable profit even at the present prices. Others treating low-grade ore, on which operations were installed on the basis of 60c. silver have seen their profits practically wiped out by the fall in the price. They have continued operations and have made desperate attempts to introduce the utmost economy in operation and treatment, and have been successful in reducing costs materially, in many cases much below the engineer's estimates. Most of the companies have been forced to practice unexpected economies in connection with the management and general expense charge. While the percentage of saving with the cyanide plants, which treat a large part of the Mexican silver ore has steadily increased over the first years of operation, it has not generally reached or exceeded the expectations of the engineers or managers. The Mexican silver mines generally carry very little gold, from 5 to 10 gm. of gold to 1 kilo of silver. The little gold with the Mexican silver has proved to be a safety factor during the period of low silver and it is carefully considered now. Formerly, with the patio process, it was largely lost. The production of silver and gold in connection with the copper operations in the Republic is steadily increasing, and promises to become an important factor.

London

May 8—The statutory meeting of the Abbontiakoon Mines, Ltd., a reconstruction of the Abbontiakoon (Wassau) mines and of the Abbontiakoon Block 1, Ltd., West Africa, was held recently. Under the amalgamation scheme the debentures and loans of the Block 1 Company have been paid off. The total number of shares issued to date is 903,876, of a nominal value of 10s. each, and there are 423,654 shares under all. The authorized capital of the company is £700,000 divided into 1,400,000 shares of 10s. each. The ore reserves on April 30 are estimated at 117,000 tons, averaging 13 dwt., over a width of 50 in. With the fresh capital raised by the amalgamation it is proposed to carry on vigorous development work and some alterations are also to be made to the plant. The directors are considering the advisability of shutting down the mill until the ore reserves are increased, anticipating a reduction in costs when working on a larger scale. Having regard to the smallness of the ore reserves and to the large capital that is invested, it is evident that the management has a hard struggle before them to earn fair dividends for the shareholders.

The latest process for the concentration of ores is that known as the Murex magnetic process, the advertisement of which had led to hostile criticism from another company interested in the same line of business, the Ore Concentration Company, owning the Elmore patents. An infringement of patents having been suggested, the Murex company wrote to the Ore Concentration company, saying that it was ready to exhibit its process to a committee of independent experts and to accept their decision whether the new process was an infringement of previous patents or not, each side to put up £1000 to cover expenses. This challenge the Ore Concentration company has so far not accepted. As to the merits of the new process the writer is not yet in a position to express an opinion, and the following information is extracted from an official circular. The Murex magnetic process is a wet process. The mineral particles in an ore are separated out by being made magnetic through the addition of a small percentage of magnetite. The process may be divided into two parts. First, the separation of mineral from gangue, and secondly, the separation of mixed minerals from each other. The ore, after being crushed, is treated with a "magnetic solution," mixed with a small quantity of water and then passed over a single magnet. In the second process the concentrates are again treated with a Murex solution and then passed over ordinary concentrating appliances, whereby the different minerals are separated from one another. All this sounds mysterious, and engineers will want more detailed information as to the nature and properties of the solutions used before accepting the process. In the circular referred to, the assay results, certified by a well known assayer, of the products obtained from a test on a low-grade Broken Hill ore are given, but as the weights are not published, the figures have little value. The Murex magnetic company has erected an experimental plant in London and invites engineers to make their own tests, an invitation which will in no doubt lead to fuller information being shortly published as to its value and novelty.

The Carmen Mines, of El Oro, is a new company starting business with an issue of £120,000 in £1 shares. The company owns claims to the north of the Sirio and El Suceso blocks of the Esperanza, Ltd., at El Oro, Mexico. Development work is to be started from the Carmen shaft, which is to be sunk an additional 300 or 400 ft., "to get through the poor zone and into the level of the sulphide ore, which has been found so rich in the neighboring mines." Perhaps the company may meet with success, but the prospectors fail to make it clear that the Esperanza claims, under which it is going to work, are the poor portion of the property where development work has not so far proved anything of much value. The Esperanza mine proper is a considerable distance away.

Paris

May 12—The Compagnie Française des Gisements Aurifères du Comoé et Affluents sent a 3½-cu.ft. open-connected bucket dredge to Ivory Coast at the end of 1908 to work the deposits it owns on the Comoé river. The pontoon is 82x30 ft. and 6 ft. deep. It is made of timber as well as the gantries. The ladder is designed to dredge at a depth of 24 ft., when inclined at 45 deg. It turns concentrically with the upper tumbler shaft. The revolving screen is about 20 ft. long and 5 ft. in diameter. Gold is to be saved over eight Turner gold-saving tables fitted with cocoanut matting and expanded metal. Stones are rejected by a Robins belt elevator. The dredge is steam driven and equipped with a Babcock & Wilcox boiler of the portable type, having a heating surface of 759 sq.ft. The company reports that, notwithstanding difficulties, transport is proceeding regularly and that it expects that all the material will soon be on the spot ready for erection.

The Société des Forges et Aciéries de Commentry-Fourchambault has just concluded an arrangement with the Campagnac collieries in order to increase its coal reserves. Its iron-ores reserves are insured by its interest in the Joudreville mine (Briey district), by the Muret mine bought from the Aciéries de France and by iron ores in the Pyrénées which form a part of its smelting charges.

The Compagnie du Boléo, at the general meeting held in Paris on April 28 declared a dividend of 150 fr. per share of 500 fr. and of 87.714 fr. per one hundredth part, as against 200 fr. and 124.67 fr. last year; 312.50 fr., 1907, and 212.228 in 1906. The production of copper was 12,470 tons in 1908 against 11,150 in 1907 and 11,000 in 1906. The average tenor of the ore was 3.68 per cent. copper against 3.46 in 1907. The profit was $938,640 against $1,273,429 in 1907. The company has spent some $400,000 in new installations, a third of which was for the harbor. The new furnace fitted with 24 tuyères is giving complete satisfaction and still better results are expected with the 30-tuyère furnaces.

The Société Nouvelle des Minas de la Lucette, the plant of which was lately described briefly in the JOURNAL, has declared a dividend of 40 fr. per share of 100 fr. against 35 fr. in 1907 and 30 fr. in 1906. Profits were $323,592. Sales of antimony ore, regulus and oxide were $273,000 against $525,800 in 1907; and $523,000 worth of gold and concentrates, against $210,000 in 1907 and $62,600 in 1906. The difference in value of antimony products is due almost entirely to the considerable diminution of the price of antimony since 1907. However, the working costs of this enterprise were covered to the extent of 80 per cent. by the sale of the antimony products.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

CHICAGOFF ISLAND

Golden Gate—A tramway and stamp mill are being installed. The machinery has already been shipped from Seattle. A 300-h.p. hydroelectric plant will also be installed by this and the Chicagoff Gold Mining and Milling Company, to be used in common.

Chicagoff Gold—In the main tunnel, 800 ft. long, a rich body of ore was recently opened. It is said that enough ore has been shipped to more than pay for driving the tunnel.

KASAAN BAY

Mt. Andrew—Regular shipments of ore are being made to the Tacoma smelter.

SEWARD

James Dinsmore and Nels Peterson will soon arrive with a large consignment of placer mining machinery.

Alaska Central Railway—A new board of directors was elected in Seattle last week. A contract for 30 miles of road was let to Snow & Watson.

Arizona

GILA COUNTY

Old Dominion—The April production of copper was 2,845,000 pounds.

Arizona Commercial—The Eureka shaft has been unwatered, and work will begin at once on the 600- and 700-ft. levels. The pumps handle 1,500,000 gal. water daily.

Arizona-Michigan—Copper ore was recently encountered at a depth of 325 feet.

Warrior Copper—During the month of April the company shipped to the Old Dominion smelter at Globe, Arizona, 1000 tons of copper ore. Eighty per cent. of this ore was from development work, and the average copper returns were 11 per cent.

GRAHAM COUNTY

Arizona Copper—The copper production for April was 2,686,000 pounds.

YAVAIPAI COUNTY

Arizona Power—The tower line is completed into Jerome, and the work of stringing the copper wire is now going on. The wire camp is now within three miles of this city. Power will be ready to deliver over this line by June 1. The United Verde Copper Company will be a heavy consumer of power.

Grand Island—The work of unwatering the shaft is now completed, and work has been resumed after a short interruption caused by the installation of the new steam hoisting plant.

California

AMADOR COUNTY

Garibaldi Hydraulic—Coarse gold is being taken in good quantities from the sluices before the general cleanup is made. Bedrock has not yet been reached.

INYO COUNTY

Greenwater Copper—A 60-ft. ledge of 5 per cent. copper is reported as being recently crosscut on the 1000-ft. level. The sinking of the shaft is still being carried on to the 1500-ft. level, from whence the same ledge will be cut.

KERN COUNTY

Kern River Mining and Power Company—H. C. Shippee, manager and secretary, states that a large mill is to be erected near Havilah. The mine is on the Kern river near the plant of the Kern River Power Company.

Zenda—McCarthy & Johnson are preparing to reopen the Zenda mine at Amalie.

SHASTA COUNTY

Tarantula—This group of mines in the western part of the county has been placed under bond to Chas. Kunz. There is a 10-stamp mill on the property and a force of men will soon start work on a large scale. Mr. Kunz is acting for the Stauffer Chemical Company of San Francisco.

Lucky Spot—This company has been incorporated at Anderson with W. C. Barkuloo as president and James E. Isaacs, of Redding, is secretary. The mine is an old placer, near Ingot, which has been idle for years owing to litigation. The courts decided adversely to the Southern Pacific railroad and favorably to the miners, so the mine will now be worked.

SIERRA COUNTY

Cold Spring—At this mine, Mount Vernon, Asa L. Wilson is taking gold from the channel. It is worth at the mint $20.05 per ounce. The gravel will be washed as soon as the water flows.

SIERRA COUNTY

Gravel—F. S. Clark is opening his gravel claims near the Four Hills power house, 16 miles from Downieville. Mr. Clark relocated this ground lately after having left it for 41 years.

SISKIYOU COUNTY

Eastlick—It is expected that this hydraulic property, with its ditches, pipe lines, etc., will be purchased by Gardner & Weed, of Oro Fino.

Corson & Cradle—Newcomb & Cradle have uncovered a rich ore-shoot in this quartz mine at Oro Fino.

TRINITY COUNTY

Birdie M.—In this mine at New River, H. S. Nonemaker, the owner, has opened a 3-ft. ledge running $16 gold and $3 silver. per ton.

Trinity Center Gravel—A large acreage of gravel underlying the entire town of Trinity Center is being prospected by drills to see if it is valuable enough for dredging.

TUOLUMNE COUNTY

Gold Spring Cottage Ranch—This prop-between Sonora and Jamestown is being worked as a mine by McLaughlin, Heeseman and Bedig who are to pay Mr. and Mrs. E. J. Doherty $10,000 for it. Work on the property has commenced.

Horseshoe Bend—This property has been conveyed to the Empire Gold Mining Company. Considerable money has been spent on the mine.

Black Oak Mining Company—The mill at this property, Soulsbyville, is now at work on ore found on the seventh level. For over a year past S. A. Knapp and associates have been at work reopening the mine.

App—Ore of "candle box" value has been struck in a drift on the 1300-ft. level. The property is owned by W. A. Nevills. Five stamps are running.

Gold Crater—After four years' work at Knight's creek, J. H. Adams and associates have tapped a good vein at 220 ft. depth.

Sell—This old mine at Sonora has been leased for ten years to S. C. Irving, of Berkeley, who will now develop it on a large scale.

Colorado

BOULDER COUNTY

United States Gold Corporation—Arrangements have been made by Secretary John R. Wolf, of Boulder, to build a mill of 150-tons capacity which will handle the ores of the company at Sugar Loaf as well as custom ores.

John Jay—This property at Jamestown,

now controlled by J. A. Reynolds, of Chicago, Ill., will be equipped with a cyanide plant for the handling of the low-grade ores. About 200 tons of high-grade smelting ores were recently shipped.

Vaucleuse—This company has purchased the Yellow Pine mine at Crisman, near Sugar Loaf and will install machinery. Rufus C. Wood, Boulder, Colo., is manager.

Bailey Mill—John H. Kemp, of Boulder, Colo., who has been in the East to finance this property, has written that arrangements have been completed for the remodeling of the mill and making its initial capacity 50 tons per day. The mill is located in the Eldora district.

Clear Creek County

Allen Group—Texas men have become interested in this group of 17 claims in the Cascade district and the property will be developed through the Burns-Moore tunnel.

Banner Consolidated—A large amount of development work has been outlined by Manager Fred H. Nye, of Idaho Springs, and it is the intention of the company to take out the product through the Rockford tunnel on Clear creek, where a mill is to be built.

Geneva Extension—Fort Worth, Texas, capital has become interested in the Star group in the Peru district, and liberal development will be carried out.

Empire Tunnel Company—This company will install a new system of ore dressing, and it is said that the company controlling the Michaelson patents have made a proposal to take a 10-year lease on the property and erect a 200-ton plant. The property is at Empire, Colo.

Dorit—Extensive operations are to be carried on through the Peters tunnel, including the installation of an electric-power plant, also the future erection of a 100-ton plant for treating ores. William Broad, Idaho Springs, Colo., is manager.

Silver Horn—Robert McLean, of Idaho Springs, has opened a high-grade vein in the adit of this property.

Alice Gold Mines Corporation—Plans are well under way for the erection of the 300-ton plant for handling the low-grade bodies of the Alice mine in the upper Fall River district. Several buildings are now being erected for the use of the men and with fine weather the construction work will be rushed. A. H. Roller and W. L. Shaffer, Idaho Springs, are in charge.

Gilpin County

North Gilpin—Denver and Eastern men have become interested in a group of claims in Moon gulch and will install machinery. J. S. Fagrelius, Rollinsville, Colo., is manager.

East Boston—The property of this company situated in the Central City district was sold at trustees' sale and was bid in by Amos F. Adams, of Boston, Mass., for the sum of $22,686.

Senator—This company contemplates the installation of an air compressor for driving the tunnel. M. J. Ryan, Central City, Colo., is superintendent.

Idaho

Shoshone County

According to reports filed with the county assessor, the net profits of the principal mines in the Cœur d'Alene district, for 1908, were as follows: Bunker Hill & Sullivan, $901,721; Hercules, $383,752; Hecla, $108,799; Standard, $693,124; Last Chance, $221,610; Morning, $16,855; Snowstorm, $162,149. The Tiger-Poorman shows a loss of $41,860.

Indiana

Bartholomew County

The coal deposit found on the Ott farm, near Lowell, is creating considerable interest. Investigation is said to have proved the existence of a vein of coal 8 ft. thick. This is the first coal discovered in this territory and development will be pushed.

Clay County

Treager Coal Mining Company—This is the name of a new organization incorporated during the week. The company is well financed to carry out its declared purpose of carrying on the business of mining for coal, clay and shale. William F. Treager, John H. McLaughlin and Samuel R. Treager, directors.

Greene County

Miners in the Jasonville district are encouraged over the outlook for steady work at the mines this summer. The selling of the Walsh property they regard as a good omen, since the new company has already begun to make arrangements to start the idle mines.

Pike County

Pike County Coal Company—This company, with headquarters in Huntingburg, which has been operating the Winslow mines, has ceased operation.

Sullivan County

On May 11, $100,000 was paid out in wages to the miners in this district. It was the largest amount that has been paid at any one pay day in this county for the past 10 months.

Keystone Mine—A fire was started from a windy shot May 11, and continued to burn for five days. The fire was in the part where there was a large area of old workings, and the draft was such that men could not approach within 100 ft. of the blaze. Sixteen men fought the fire at a time, shifts being changed frequently. These attempts proved futile and the Pittsburg and the Urbana rescue stations were appealed to for assistance. The rescue men brought with them oxygen helmets and were able to get quite close to the fire and began playing on it with two streams from hose.

Vanderburg County

Ohio Valley Coal Company—The mine, near Evansville, started May 12 and several hundred miners were given work. The mine had been closed for several weeks because of slack demand for coal.

Vermillion County

The total payroll for the miners of the Clinton field for the past two weeks amounted to $70,000. The recent change in the control of the Dering mines, which have been leased by the Brazil Block Company, has been followed by better work at the mines of that company.

Vigo County

Vandalia Mining Company—A controversy has started with the officials of the United Mine Workers over the demand of the men that they be permitted to remove the top coal at mine No. 65 east of Terre Haute. When the company ordered that coal be left at the top, the mine committee ordered the men to quit work, and the superintendent in turn discharged the committee. The company contends that the coal must be left as a support to the roof of the mine; that the State mine inspectors has served notice that it must not be removed. The miners say they have a right to mine all the coal of the vein, and if any is left they are entitled to extra pay.

Maryland

Consolidation Coal Company—It is announced that arrangements have been completed for merging in this company the Fairmont Coal Company, the Somerset Coal Company, the Clarksburg Fuel Company, the Pittsburg & Fairmont Fuel Company and their subsidiaries, including railroads, floating equipment, docks and other property owned. The companies own about 200,000 acres of coal lands in Maryland, Pennsylvania, West Virginia and Kentucky. Their combined capital stock is $37,600,000, but it is not stated what amount of new stock will be issued to complete the merger. No important change in management is involved; the Consolidation Coal Company —which is the oldest and largest company in the Cumberland, or George's Creek basin, and which owns the Cumberland & Pennsylvania railroad—has held controlling interests in the other companies named for some time. The merger will place the entire property under one head and simplify the management and accounts.

Michigan

Copper

Michigan—This company has opened up the crosscut that was extended from "C" shaft several years ago to cut the lode recently opened in the old adit working on

the Bee tract. The lode at this point was practically void of copper and nothing further was done at the time, but owing to the exceptional good showing on the Bee tract it was decided to drift on the formation from this point.

Oneca—Diamond drill work is in progress in view of opening the same formation that was revealed on the lands of the New Baltic Exploration Company. This lode traverses the entire tract of the Oneca.

Mass—This company is operating two drills in drifting on the new lode recently opened by the crosscut from the 17th level.

Winona—All activities are centered at No. 4 shaft, blocking out stoping ground. Operations at No. 3 shaft have been temporarily suspended as sufficient ground has been blocked out to supply a stamp head for several years. This company contemplates the erection of a stamp mill in conjunction with the King Phillips property. Plans and a site have been selected. As soon as this is completed, production can go forward from these two shafts without interruption.

Quincy—Sinking is going forward at the No. 9 shaft and a depth of about 400 ft. has been obtained. Copper indications are appearing from time to time, but it is not expected commercial values will be encountered before the 2000-ft. level has been reached. The company is operating four producing shafts, Nos. 2, 6, 7 and 8, and shipping about 4000 tons of rock daily to the mill.

New Baltic—This company is operating a core drill on its lands and has a hole down about 150 ft. A core has been taken out showing some copper.

Wyandotte—This company continues driving the crosscut from the bottom of its exploratory shaft, a distance of 700 ft. from surface. Several copper bearing formations have been cut.

Ojibway—The No. 2 shaft has reached the lode by means of the crosscut from the 800-ft. level, about 60 ft. from the shaft and found it well charged with copper. This is what is known as the footwall bed and when opened in the level above carried practically no copper. No. 1 shaft has also cut this bed in the station at the same level. Sinking has been temporarily suspended in both shafts while crosscutting is underway.

Iron—Marquette Range

Empire—At this mine, in the Cascade district, the working force has been increased, and shipments will be pushed.

Richmond—Work has been resumed and 100 men are now employed.

Volunteer—Diamond drilling is in progress. The property was recently bought by Thomas F. Cole and others from the Alger estate

Minnesota

A test case is to be made in a suit to be brought by the attorney-general of the State, under the law recently passed, which declares that the State is the owner of all ore beneath meandered lake beds. Lake beds, whether farm land, ore land or something else, belong to the owners of the land around them, known as the riparian owners, unless the State declares its ownership, and even then there is some question of the validity of such a law. This suit will be brought against the operators of the Long Year Lake mine on the Mesabi. They have not only stripped the land between the meander line and the water line, but test pits have been made in the water and in some places ore has been found under the lake. The right to mine this ore will be tested.

Iron—Cuyuna Range

The new Cuyuna Range Railroad Company is making contracts to carry iron ore, in which it is agreed that the railroad shall be finished by June 1, 1910. The road will connect with the Minneapolis, St. Paul & Sault Ste. Marie railroad.

Rogers-Brown Ore Company—A four-compartment shaft is being sunk near Dearfield, in the Rabbit Lake district. Some ore has already been taken out.

Iron—Mesabi Range

Good progress is being made with the extension of the Great Northern railroad from Nashwauk, and it is expected that trains will be running in August.

Crosby—Shipments are being made from this mine, near Nashwauk, owned by the Cleveland Cliffs Iron Company.

Leetonia—The Jones & Laughlin Company has begun shipments from this mine near Hibbing.

Pearson—This mine, near Nashwauk, is shipping this season for the first time. Development is still going on. The mine is owned by Joseph Sellwood.

Higgins—This mine, at Virginia, has been started up. It is a Steel Corporation property, and was not worked last year.

Mahoning—This mine, near Hibbing, was one of the first shippers on the range this year. It is expected to send out about 1,000,000 tons for the season.

Morton—The sinking of the concrete shaft at Tod, Stambaugh & Co.'s new Morton mine, at Carson lake, two miles southwest of Hibbing, is making satisfactory progress. A depth of 150 ft. has been attained. The ledge which caps the orebody will be encountered at a depth of, approximately, 100 ft., after which the shaft will be firmly anchored in the rock and the work of development will be undertaken.

Silver—M. A. Hanna & Co. are putting down a new spur to the railroad at Virginia, with a view to shipping largely this season.

Missouri

Joplin Zinc-lead District

Alladin—Fire destroyed the mill on the St. Paul ground at Spring City. A new mill will be built. Don McRuer is manager.

Continental Zinc Company—This company is making a splendid run for the first month after production has been resumed. Mules have been put in the mine to haul the cars and the steam shovel has been discontinued.

J. Woolcy—A new 100-ton mill has been completed on the American land east of Joplin, near the old Dividend, and is ready for production.

Montana

Butte District

Davis-Daly—The company is expending about $30,000 monthly on development work. Negotiations are pending for contracts with the Amalgamated interests whereby ore may be shipped to the Washoe or Great Falls smelters for treatment. It is possible that the smelter of the Basin Reduction Company may be used in the event that satisfactory contracts with the Amalgamated cannot be made.

Butte & Superior—A strike of copper ore has recently been made on the west drift on the 1400-ft. level. The grade and extent of the lead cannot be determined until further development work is done.

Butte & Milwaukee—It is reported that operations will be resumed shortly. The property lies immediately north of the Butte & Superior ground.

Fergus County

Cumberland Mine—The mine is producing steadily under the direction of A. S. Wright, who has a lease on the property. A short time ago a shipment of 28 tons of gold ore was made which netted $250 per ton.

Granite County

Bimetallic—Work has been begun on the company's new cyanide plant at Philipsburg. Five 100-ton concrete tanks will be built. President Fusz, of the company, has arrived from St Louis and will attend the annual meeting of stockholders to be held in June.

Missoula County

Black Traveller Mining Company—The property is a copper prospect and is situated near Saltese. A tunnel is now in a distance of 1050 feet.

Nevada

Esmeralda County—Rawhide

Mint Lease—The shaft is in good ore at the 320-ft. level, and three shifts are employed.

Marigold Lease—High-grade ore ship-

ments are made every week. The rich streak still continues on the 160-ft. level.

Grutt Ballon—This lease, which is considered the best in the camp, is shipping regularly to the sampler at Hazen, Nev. The ore will average $300 to the ton.

Prosky No. 1—This lease has rich gold ore on the 100-ft. level, and is shipping high-grade ore to the mill.

Kaufman Lease—A 4-in. vein of high-grade gold ore was recently struck on the 100-ft. level and is now being sacked for shipment. This is reported to be one of the richest stringers ever struck in the camp.

Black Eagle—A new 6-h.p. hoist has been erected on this property in the western part of the district. The mine is being investigated by an Eastern firm with the view of purchasing.

King-Heisner—It is expected that the cyanide mill will be ready for operation by June 25. The mill will have a complete sampler.

ESMERALDA COUNTY—HAWTHORN

Lucky Boy—It is reported that the United States Smelting, Refining and Mining Company has an option on this silver-lead property. One hundred and thirty men are employed.

ESMERALDA COUNTY—LUNNING

Toft—This group of copper claims is now being examined by Boston people, with a view of purchasing.

New York

ESSEX COUNTY

The usual yearly report of the discovery of gold in the Adirondack region has come; this time from the neighborhood of Lake Placid, where it is said a prospector has found a vein, specimens of which assay very high in gold. It is not likely that this will amount to more than previous "discoveries" of the same sort.

North Carolina

RANDOLPH COUNTY

Ashboro Gold—A charter was recently granted the Ashboro Gold Mining Company, of Asheville. The capital stock is $50,000. Incorporators, W. W. Taylor, of Chicago; W. P. Johnson, of Philadelphia, and J. T. Winslow, of Ashboro.

ROWAN COUNTY

Union—Under the management of Walter George Newman, this mine is producing gold bullion steadily from the 20-stamp mill.

Gronite Quarry—Secretary of State has granted a charter for the amalgamation of the Balfour Pink Granite Company, the Rowan Granite Company and the American Stone Company. Capital of the new company is $1,250,000 paid in. Over 2000 men will be employed. The quarries are three miles from Salisbury. Branch offices will be established in New York, Philadelphia, Toronto and other important centers.

Oklahoma

OTTAWA COUNTY

Miami Zinc District—The Wauhillan mill has been completed and is ready for production. The Little Maxine is erecting a mill. The Last Chance and Blue Bell have contracted for mills.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—This company's statement for March and nine months of its fiscal year from July 1 to March 31 is as follows:

	March.	Nine Mos.
Earnings	$2,855,541	$25,658,967
Expenses	2,591,997	24,234,153
Net earnings	$ 263,544	$1,424,814

For the nine months there were decreases of $2,748,896 in earnings, of $2,116,150 in expenses, and of $632,746 in net earnings, as compared with last year.

BITUMINOUS COAL

Pittsburg Coal Company—This company's fiscal statement for the three months ended March 31 is as follows:

	1908.	1909.	Changes.
Net earnings	$ 615,993	$ 429,199	D. $ 86,794
Charges	641,381	694,652	D. 46,729
Surplus	$ 126,388	$ 166,453	I. $ 40,065

The charges this year were $106,998 for depreciation of coal lands: $231,967 for depreciation of plant and equipment; $255,687 for interest on.

South Carolina

YORK COUNTY

Darwin—At this property the Cripple River Hydraulic Company, of New York is sinking a 100-ft. shaft in order to exploit a vein at that depth which has produced good ore from the surface.

South Dakota

LAWRENCE COUNTY

Imperial Mining Company—The miners are engaged in sinking through the porphyry which blocked drifting in the quartzite level of the Dakota shaft. It was first supposed to be a dike, but turned out to be faulted porphyry capping. The shaft has gone down 80 ft., passed through the porphyry, and is now in shale, probably close to quartzite.

Nebraska—A strike of good milling ore is reported on the Connie-May-Morris ground, near Roubaix, which is being worked under lease by the Nebraska Mining Company.

PENNINGTON COUNTY

Forest City—This company, operating the Clara Belle mine, near Hill City, has begun the erection of a cyanide plant to treat the tailings from the amalgamation mill. The recovery by amalgamation is about 50 per cent.

Mariposa Mining Company—This company is about to begin the erection of a hoist on the property at the head of Burnt Fork creek. The shaft, which is down 200 ft., will be sunk another 100 ft. Later a 100-ton mill is projected on Slate creek southeast of Mystic.

Texas

MARION COUNTY

Jefferson Iron Company—This company has bought the property of the Lone Star Iron Company at Jefferson, and is negotiating for the purchase of several large tracts of land containing iron-ore deposits. The headquarters of the company are in St. Louis; the officers are A. P. DeCamp, president; N. P. Withington, secretary and treasurer.

TARRANT COUNTY

American Fullers' Earth Company—Preparations are being made to increase the plant from 20 tons to 50 tons daily capacity. The company has a lease covering 2500 acres of land near Fort Worth.

Utah

BEAVER COUNTY

Utah Gold and Copper—A force of men is now finishing the laying of a 2000-ft. line of 6-in. pipe for carrying water to the mouth of the tunnel. This will be used to develop power for blowers for ventilating the mines, and also for operating an electric-light plant. Lumber for bunk houses, office and blacksmith shop is being hauled from Modena. The buildings will be completed in about three weeks. Ore shipments will be increased in the near future.

Orphan Boy—W. J. Merritt and associates have taken control of the Orphan Boy property in the Star district consisting of 11 claims. At present there are about 1200 ft. of tunnel and 500 ft. of shaft. It is the intention of the new company to commence work on a double compartment shaft to be sunk to the 1000-ft. level.

Golden Reef—This company with properties at Beaver Lake recently listed its shares on the Salt Lake exchange. The company is capitalized for $100,000, represented by 500,000 shares of stock of par value of 20c. The property consists of 27 claims surveyed for patent, and the development consists of 500 ft. of shafts, 1900 ft. of tunnels and 60 ft. of winzes. The shaft is equipped with a 15-h.p. gasolene hoist and 10 men are employed at the present time.

JUAB COUNTY

Swansea Extension—In the north drift on the 200-ft. level below the tunnel disclosures have been made of fine lead ore. The ore body is about 300 ft. below the surface.

Tintic Mines Company—The officers have ordered the 135-ft. shaft on the Town View claim to be retimbered and deepened. The movements of this company have been watched with considerable interest since the purchase of several claims north of the Victoria and east of the Eagle & Blue Bell.

SALT LAKE COUNTY

Butler-Liberal—A new compressor is being installed and as soon as it is in working order the shaft will be deepened to get under the orebody opened up some months ago on the 227-ft. level. The company has at this level a breast of 14 ft. of good ore.

Columbus Consolidated—Two new 2½-ton electric motors have been placed in commission in the main operating tunnel. These motors run from power derived from storage batteries which are charged from the company's hydro-electric plant. Each motor is capable of handling 12 cars of ore. The foundations are ready to receive the new electric station pump, which is now *en route*. A new strike has been made on 300 level in the Garfield fissure.

SEVIER COUNTY

Sevier Consolidated—It was reported that the right vein that the former owners of the Sevier Consolidated had lost through faulting has been recovered. The vein was faulted to the west with its dip reversed. A crosscut to the west on the 85-ft. level has caught the vein.

TOOELE COUNTY

Consolidated Mercur—Owing to failure of the ground under part of the leaching department of the cyanide mill, eight large leaching tanks collapsed precipitating their contents on the floor of the mill. There was no loss of life the unloading crew being in another part of the mill at the time of the accident. Reserve tanks were put into use and the capacity of the mill will not be seriously curtailed.

Virginia

FLOYD COUNTY

Work has been resumed at the arsenic mines in this county, after a shutdown of several years.

Washington

JEFFERSON COUNTY

James A. Moore, of Seattle and associates are installing a steel plant at Irondale to be completed within six months. Mr. Moore has control of large deposits of hematite ore in Washington.

WHATCOM COUNTY

International Lime Company—The company has purchased 160 acres of land containing raw material for the manufacture of cement. It is reported that a plant will be built soon.

Wisconsin

IRON—GOGEBIC RANGE

A syndicate having its headquarters at Ironwood, Mich., has bought a 40-acre tract north of the Ottawa and Windsor mines, and has begun to test it by drilling.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt camp for the week ending May 8 were: Coniagas, 65,400 lb.; Crown Reserve, 102,816; Kerr Lake, 122,201; La Rose, 327,300; Nipissing, 337,090; Temiskaming, 150,060; Temiskaming & Hudson Bay, 60,000; total, 1,164,867 pounds.

Little Nipissing—A new hoist and boiler are being installed on the company's location J. B. 2, the shaft on which will soon be down to the 125-ft. level, where drifting will be carried on. A new vein 16 in. wide of vein matter carrying 2 in. of cobalt is reported to have been struck about 4 ft. from the main vein on the company's Peterson Lake lease.

Muggley Concentrators, Ltd.—From April 19 the name of this company has been changed to Northern Customs Concentrators, Ltd.

Ophir—A plant consisting of a 100-h.p. boiler and six-drill Sullivan compressor is being installed. No. 1 vein has been traced by stripping for 1300 ft., and on the surface shows native silver and nicolite. There are five other promising veins on the property.

Pan Silver—On this property, adjacent to the Temiskaming, six shafts have been sunk. The deepest is the main or No. 4 shaft, down 180 ft., from which 380 ft. of drifting has been done at the 100-ft. level, and a vein carrying native silver encountered. The shaft is being put down to 200 ft Shaft No. 5 is down 60 ft., and drifting was recently started at that level on a 7-in. cobalt-calcite vein showing native silver contents. Development work is at present confined to these shafts, and diamond drilling is being carried on at the south end of the property to pick up some of the Gifford Extension veins.

ONTARIO—MONTREAL RIVER DISTRICT

Elk Lake—This company, controlled by the Hawthorne syndicate, is installing a plant, comprising a five-drill compressor, two 60-h.p. boilers and a hoisting engine.

Otisse—Work is steadily progressing and a large quantity of ore has been sacked ready for shipment on the opening of navigation.

YUKON

An important strike of paying gravel was made recently on Miller creek, in the Glacier creek district. The strike is on ground that is open to entry, and a number of miners and prospectors have gone to the district.

Another strike, which has caused much excitement is on Hubbard creek in the Fortymile district. This is reported to be rich.

Mexico

SONORA

Black Mountain—Oil is to be used for fuel in place of coal. About 250 men are employed. Chief Engineer S. E. Powers was killed recently by falling into a concrete oil pit.

El Globo—Work is being pushed by means of a small air drill on the 1600-ft. prospect tunnel which is calculated to cut the vein at a depth of 1000 ft. C. A. Romadka, of Douglas, Ariz., is general manager.

El Van Mining Company—One thousand feet of development work have been done on the property near Nacozari. A large body of concentrating copper ore was encountered; also a body of 10 per cent. ore. Fritz Kohlmeyer is manager.

Pavo Rico—This mine, owned by N. S. Finch, is under option to O. L. Neer and Geo. B. Hosier, who have a small force of men at work, and have a shipment of ore ready for the smelter.

Promontorio—C. B. Dunster recently made an examination for Michigan parties. The mine is a short distance below Moctezuma.

Pura Plata—The mine about 15 miles west of Moctezuma, has been secured on a $30,000 bond and lease from Geo. F. Woodward and associates. W. P. Belding, of Los Angeles, the new owner, will start work on the property at once.

Silver Seal Exploration Company—Three cars of high-grade gold-silver-copper ore are being shipped to Douglas. The ore is maintaining its silver and copper value, with an increase in the gold contents. Dr. A. Sandberg, of Nacozari, is superintendent.

Lucky Tiger—The directors' report, March 17, 1909, states that for the year ending Dec. 31, 1908, the total prospecting and development work in drifts, raises and crosscuts was 10,230 ft. The mine produced 2014 tons of first-class ore, yielding $471,425, and 1426 tons of concentrates, worth $339,963 Net returns from smelters $713,297. Dividends paid during the year, $71,500.

Australia

NEW SOUTH WALES

Gold production in April is reported at 21,360 oz., an increase of 626 oz. over April, 1908. For the four months ended April 30 a total of 77,112 oz. is reported this year.

WESTERN AUSTRALIA

Gold production in April was 137,764 oz., being 10,770 oz. more than in March, but 7951 oz. less than April, 1907. For the four months ended April 30 the total production was 556,356 oz. in 1908, and 520,141 oz.—or $10,751,314—in 1909: a decrease of 36,215 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 19—The coal trade in the West, while still subject to fluctuations, seems to be approaching more solid ground. The steady, if slow, increase in the demand for steam coal is making itself felt and the trade is more active than at any time during the past 18 months. It has not yet approached anything like a boom stage, but has advanced considerably beyond its period of greatest depression. The Lake trade opens rather slowly.

In the East the bituminous trade remains more quiet than in the West, but the time is approaching when Seaboard consumers must lay in stocks, and sellers are rather encouraged; though trade is not yet active a better feeling is manifested.

The anthracite trade is quiet and will probably remain so until accumulated stocks are worked off. This will take some time and the larger companies are running many of their collieries on short time. It is probable that May will show a lighter production of anthracite than any month this year—certainly less than in March and April.

The report that the controlling interest in the Chesapeake & Ohio road had been sold to the Pennsylvania Railroad Company seems to have been premature, since it has been contradicted. The present owners of the road announce that they are negotiating for new connections and extensions, but it is quite possible that this is only intended to promote the sale which is evidently desired. Meantime it is to be noticed that the pushing of West Virginia coal in the Seaboard markets is less aggressive than it has been.

Tidewater Coal Demurrages—Charges have been filed with the Interstate Commerce commission by Peale, Peacock & Kerr, shippers of bituminous coal from central Pennsylvania, against several of the carrying roads. The complainants claim that demurrage and other charges are levied at tidewater points which, in effect, discriminate against the smaller independent shippers.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 8, short tons:

	1908.	1909.	Changes.
Anthracite	1,927,189	1,888,727	D. 38,462
Bituminous	11,416,858	12,361,856	I. 935,998
Coke	2,447,380	3,497,590	I. 1,050,210
Total	15,790,427	17,738,173	I. 1,947,746

Increase for the week, 157,788 tons. The total increase this year to date was 12.3 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, three months ended March 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	4,780,391	990,562	5,770,953
Buff., Roch. & Pitts.	1,402,009	109,839	1,511,848
Buff. & Susquch'na	397,719	81,738	479,457
Penn. lines, N. Y. C.	1,971,559	22,092	1,993,651
Pitts. & L. Erie	1,618,669	1,006,246	2,624,915
Norfolk & Western	2,830,534	644,599	3,475,133
Ches. & Ohio	2,860,329	116,288	2,976,617
Total	15,861,210	2,971,364	18,832,574
Total, 1908	15,502,068	1,951,291	17,453,359

Total increase, 1,397,215 tons, or 8 per cent. In addition the Baltimore & Ohio carried 212,109 tons anthracite in 1908 and 242,249 in 1909; increase, 30,140 tons.

Tonnage of Chesapeake & Ohio, nine months July 1-March 31, short tons:

	Coal.	Coke.	Total.
New River	4,841,857	192,349	5,034,206
Kanawha	3,801,186	21,886	3,823,072
Kentucky	264,634	.....	264,634
Connecting lines	189,056	61,442	250,497
Total	9,096,732	275,677	9,372,409
Total, 1907-08	8,358,000	274,049	8,632,049

Total increase, 740,369 tons, or 8.6 per cent. Deliveries this year to points west of mines, 4,701,558 tons coal and 158,268 coke; points east, 1,157,041 tons coal and 117,409 coke; tidewater, 3,231,896 tons coal; anthracite to line points, 6237 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, three months ended March 31, short tons:

	1908.	1909.	Changes.
Hocking Valley	718,188	696,681	D. 21,607
Toledo & Ohio Cent.	291,426	261,848	D. 29,578
Baltimore & Ohio	518,439	267,240	D. 251,199
Wheeling & L. Erie	738,313	665,852	D. 72,461
Cleve., Lorain & Wh.	700,582	446,978	D. 253,604
Zanesville & Western	363,072	285,300	D. 77,772
Toledo Div., Pen. Co.	525,367	451,278	D. 74,089
L. Erie, Alliance & Wh.	312,338	266,923	D. 45,416
Marietta, Col. & Clev.	21,887	14,321	D. 7,566
Total	4,189,612	3,356,421	D. 833,191

The total decrease in shipments this year was 19.9 per cent.

Coastwise shipments of coal from chief Atlantic ports, three months ended March 31, long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York	3,900,458	2,471,838	6,372,296	64.7
Philadelphia	472,888	1,043,303	1,516,191	15.4
Baltimore	39,567	852,595	892,162	9.1
Newp't News	.....	651,915	651,915	6.6
Norfolk	.....	416,889	416,889	4.2
Total	4,412,913	5,436,540	9,848,453	100.0
Total, 1908	3,909,051	5,386,406	9,295,557	.....

Total increase this year, 552,896 tons, or 5.9 per cent. New York includes all the harbor shipping ports.

Coal receipts at St. Louis three months ended March 31 were 2,251,497 short tons in 1908, and 1,774,835 in 1909; decrease, 476,662 tons.

Coal passing through Lock No. 3 on the Monongahela river three months ended March 31 was 2,246,240 short tons in 1908, and 2,371,240 in 1909; increase, 125,000 tons.

Coal passing through Davis Island dam on the Ohio river three months ended March 31 was 841,555 short tons in 1908, and 1,335,445 in 1909; increase, 493,890 tons.

Shipments of coal by water from Seattle and Tacoma, Wash., three months ended March 31 were 163,021 tons in 1908, and 63,662 in 1909; decrease, 99,359 tons. These shipments are chiefly to California and Alaska ports.

Coal passing through the Sault Ste. Marie canals for the season to April 30 short tons:

	1908.	1909.	Changes.
Anthracite	2,032	18,516	I. 16,483
Bituminous	12,648	108,969	I. 96,321
Total	14,680	127,484	I. 113,804

The United States canal at the Sault was opened April 20, and the Canadian canal April 21, about the same dates as last year.

Coal receipts at Boston, four months ended April 30, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	540,180	556,101	I. 15,921
Bituminous	1,038,936	1,067,693	I. 28,757
Total domestic	1,579,116	1,623,794	I. 44,678
Foreign	175,450	95,985	D. 79,465
Total	1,754,566	1,719,779	D. 34,787

The foreign coal is chiefly from the Nova Scotia mines.

New York

Anthracite

May 19—Trade is dull and the general anticipation is that it will remain so for a while until the present stocks are worked off.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor.

Bituminous

The Seaboard trade is said to be improving, but it is so slow that sharp eyes are required to see the change. If anything, more orders are coming from the far East, while business along the Sound continues regular though of small proportions. New York harbor shows no improvement. Prices are unchanged and their is no surplus coal to speak of, ship-

pers adhering to the plan of forwarding coal to tidewater only on orders. All-rail trade is the best. Transportation and car supply continue good. Some coal is still being taken for outside shipment.

The Coastwise trade continues rather dull and vessels are in good supply. Rates are unchanged. For large vessels from Philadelphia they are: To Boston, Salem and Portland, 55c.; Portsmouth, 70c.; Lynn, Newburyport and Bangor, 75c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

May 17—The coal trade in Alabama is still dull and the production is at low-water mark. In the Alabama coalfields the miners' union is now practically inactive, the few companies recognizing the union not giving employment to a sufficient number of men to warrant any boasting by the organization. There is a probability that no convention of the union will be held this year; in fact the officers of the union have no statement to make that is hopeful. There is considerable activity in coke in this State.

Chicago

May 17—Steam coals continue in steady, though not yet large demand, with lump becoming hard to sell and screenings in better demand. The interest of the trade now centers largely in contract making. prices in which are very low. The Illinois and Indiana supply is well regulated; except for occasional cargoes of lump coal there is practically no demurrage trouble. The domestic trade is fast settling into a state of summer dullness.

Lump and egg from Illinois and Indiana bring, $1.75@2.25; run-of-mine $1.65@1.75, and screenings, $1.35@1.65.

Hocking continues in large supply and has some sales at forced low prices to escape demurrage, quotations being $2.85@3. Smokeless continues in well-regulated supply, but has somewhat light sales, lump bringing $3.20@3.45 and run-of-mine $2.95@3.15.

Anthracite sales are somewhat light, but the general volume of business exceeds the record of previous spring seasons so far.

Cleveland

May 18—Lake trade is slow. There has been some chartering, but small vessels are scarce, and are asking a higher figure. Big boats will only go to the ore ports, where quick discharge can be had. The strike makes little trouble so far as the boats are concerned.

Steam trade does not improve as fast as expected. Ohio coal sells at $1.25 for lump, $1 for run of-mine and 75c. for slack, all at mine, Middle District. No. 8 District coal can be had at $1.10 for lump, 85c for run-of-mine and 60c. for slack, all at mine.

Indianapolis

May 17—Irregularity still characterizes the coal-mining industry of this State. The first week in May usually affords an index for the summer's work, and the record offers some encouragement. The operators say that the demand for coal is increasing gradually, but admit that when mine-run coal is down to 85c. a ton they can make little, if any, profit.

The United Fourth Vein Coal Company, in the Linton district, has landed sufficient orders to keep the mines fairly busy all summer. All the mines of the Vandalia Company are working now and the company is well fixed for the summer. The Shirley, the Little Giant and the Summit Mining companies report fairly good prospects of steady operation.

The operators are somewhat exercised over the apparent purpose of the Steel Trust to secure control in the Indiana coalfields. The Clinton field, where the Illinois Steel Company has secured a large interest, lies between the Deering property on the north and the Walsh mines on the south. It is considered very probable that Steel Corporation interests will secure control of one or both of these properties.

Pittsburg

May 18—Lake shipments are improving a little, but not to any great degree, though mines are getting ready for the trade. The local trade improves slowly. Prices are low, and in this respect the market does not gain. The outside price for mine-run is $1.10 for ordinary lots, and $1 has been done on large quantities. About 55@65c. may be quoted for slack.

Connellsville Coke—Negotiations for the proposed merger of independents continue quietly, and appraisals are being made of several of the plants.

Standard furnace coke is held at about $1.60 for spot, with $1.75@1.90 on second-half contracts. Foundry is $1.85 @1.90, with $2@2.75 asked on contracts. The *Courier* reports production in both Connellsville regions at 244,279 tons for the week, an increase of 14,572 tons over the previous week.

Foreign Coal Trade

German Coal Production—Coal production of the German Empire, three months ended March 31, metric tons:

	1908.	1909.	Changes.
Coal	37,697,874	36,477,870	D. 1,220,004
Brown coal	16,604,727	16,815,920	I. 211,193
Total mined	54,302,601	53,293,790	D. 1,008,811
Coke made	5,471,331	5,243,737	D. 227,594
Briquets made	4,419,351	4,506,769	I. 87,418

Of the briquets reported this year 3,575,083 tons were made from brown coal, or lignite.

German Coal Trade—Imports and exports of fuel in Germany, three months ended March 31, metric tons:

Imports:	1908.	1909.	Changes.
Coal	2,351,949	1,982,157	D. 369,792
Brown coal	2,201,737	1,801,163	D. 400,574
Coke	130,790	151,349	I. 20,559
Briquets	48,816	45,982	D. 2,834
Exports:			
Coal	4,929,200	5,241,817	I. 312,617
Brown coal	6,068	7,326	I. 1,258
Coke	926,791	835,076	D. 91,715
Briquets	350,401	330,533	D. 19,868

Coke exports this year included 7908 tons to the United States.

Nova Scotia coal shipments, three months ended March 31, long tons:

Companies:	1908.	1909.	Changes.
Dominion	368,713	598,961	I. 230,248
Nova Scotia Steel	81,247	117,737	I. 36,490
Cumberland	89,920	110,071	I. 20,151
Acadia	57,867	79,887	I. 22,020
Inverness	26,412	45,674	I. 19,262
Intercolonial	60,911	68,125	I. 7,214
Total	685,070	1,020,455	I. 335,385

All the companies showed gains this year, the total increase being 49 per cent.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 1: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.78; best Monmouthshire, $3.60; seconds, $3.42; best small steam, $2.76; seconds, $2.52. All f.o.b. shipping port. This is a farther advance on several kinds.

Iron Trade Review

New York, May 19—The iron and steel trades continue active and improvement can be noted in more than one quarter. Buyers seem to have been convinced that they are warranted in anticipating improvement and are, accordingly, more willing to contract for future deliveries.

In pig iron the buying of foundry material is steadily increasing in Eastern territory, and an improvement is also noted in the West. Basic iron is not quite as active, chiefly for the reason that the larger makers of open-hearth steel who buy their iron have provided for their requirements over the third quarter of the year.

In finished material structural steel continues the more active department, but there have been good transactions in bars, plates and sheets. Wire products have been advanced by the principal producer $2 a ton above the lowest figures made. This action, it is said, is chiefly for the purpose of stopping speculative buying and it has been concurred in by several of the larger independent mills. Rail orders continue rather slow, but a number of contracts for cars have been placed and orders sent to the locomotive works are increasing their activity. Bridge orders from the railroads are coming in quite freely.

That the iron manufacturers are satisfied, is manifested by the fact that a number of companies which reduced wages last April have announced that the former standard will be established again on July 1. These companies include nearly all the more important independent producers.

The Steel Corporation has not so far made any general reduction in wages.

Lake Iron Ore—Iron-ore stocks on Lake Erie docks May 1, as compared with those on Dec. 1 are reported by the Cleveland *Iron Trade Review* as follows, in long tons:

	1907-8.	1908-9.	Changes.
Stocks, Dec. 1.....	7,385,728	8,441,533	I. 1,055,805
Stocks, May 1.....	5,480,300	5,370,268	D. 110,032
Ship'd to furnaces	1,905,428	3,071,265	I. 1,165,837

Adding these winter shipments to 17,453,258 tons, the amount shipped to furnaces during the navigation season of 1908, gives 20,524,523 tons as the entire shipment of ore from Lake Erie ports during the year ended May 1, 1909, as compared with 31,692,446 tons in the preceding year; a decrease of 11,167,923 tons.

Shipments of iron ore from the upper Lake ports in April were 55,794 tons, which compares with 630,975 tons in April of last year.

Lake Iron Ore Prices—It has been practically decided to quote prices on Lake Superior ore the same as last season—Old Range bessemers, $4.50; Mesabi bessemers, $4.25; Old Range non-bessemers, $3.70; Mesabi non-bessemers, $3.50, all f.o.b. Lake Erie port. The guarantee is unchanged also, being 55 per cent. iron, base on bessemers, and 51.5 per cent. iron on non-bessemer ores.

Baltimore

May 18—Exports for the week included 3,363,800 lb. steel billets and 87,460 lb. zinc dross to Liverpool; 799,123 lb. tin scrap to Rotterdam. Imports included 518 tons ferromanganese from Liverpool; 5350 tons iron ore from Cuba.

Birmingham

May 17—Southern pig-iron manufacturers continue to sell iron, though not in big lots. The aggregate is satisfactory, equal to, if not more than, the make. The production is showing some improvement; two furnaces were started this month by the Tennessee Coal, Iron and Railroad Company. Williamson furnace, in Birmingham, which has a daily capacity of about 90 tons, will be closed down for repairs. Iron prices in Southern territory remain about the same they have been, No. 2 foundry selling at $11.50 per ton minimum, with several of the companies holding for $12 for delivery during the latter part of the year. The home consumption continues steady, with prospects of a better demand. Several of the smaller industries in the Birmingham district are beginning to take on renewed life. The Stockham Pipe and Fitting Company has business in hand or in sight to warrant an operation of its plant double turn. The cast-iron pipe concerns in this territory are still receiving business. The Central Foundry Company is in full operation again on soil pipe after a disastrous fire several weeks ago. Machine shops and foundries throughout this sections are getting in some orders of consequence. Rumors prevail, without positive verification, that the Tennessee will shortly resume operations at the steel plant at Ensley.

Chicago

May 17—Conditions in the iron market are little changed. The average buyer is taking supplies in small lots; the larger interests are in general supplied up to the fourth quarter and not anxious to contract farther ahead. It seems to be taken for granted that pig iron will not go lower in price.

Southern iron brings $11.50@12, Birmingham ($15.85@16.35, Chicago), for No. 2. Some sales probably continue as low as $11, Birmingham, with some as high as $12.25. Iron for delivery in the fourth quarter brings $12 as a rule, the lower quotations being for delivery sooner. Northern holds at $16.50@17 to the consumer, the price of $16 at the furnace being made in some cases. Southern iron furnishes most of the speculative trading, Northern being quiet and comparatively steady. Lots sold are, in general, small now, running up to 300 to 400 tons. The tone of the market is one of growing confidence, as far as opinions of furnace agents are expressed.

In finished products the market sees good buying, sales of railroad materials and structural steel being large and increasing.

Coke is in better demand, but still at $4.70 for the best Connellsville.

Cleveland

May 18—Last season's ore prices having been reaffirmed, a number of sales have been made, the total being about 2,500,000 tons, probably. The prices are: Old Range bessemer, $4.50; Mesabi bessemer, $4.25; Old Range non-bessemer, $3.70; Mesabi non-bessemer, $3.50; all f.o.b. Lake Erie ports.

Pig Iron—No large sales, but a number of small ones, making a considerable total. Prices are firmer, and no sales are made below $15.25 for No. 2 foundry.

Finished Material—Sales of structural steel and bars continue good, with some trade in plates also.

Philadelphia

May 19—Fair sales of pig iron are reported, making up a large total. Foundry, basic and malleable have all sold, but forge iron drags behind still. Cast-iron pipe makers are in the market for some large lots of low-grade pig. Southern iron is not being pressed, though some Virginia furnaces are making offers. For foundry the basis is about $16.25, delivered, for No. 2X, with 25 or 50c. more asked for fourth quarter.

Steel Billets—Current business is for small orders, prompt delivery, sellers being unwilling to take long contracts on present prices.

Bars—Sales have been moderate but prices are firmer, though refined iron is still irregular. Store trade is improving.

Plates—Demand is still irregular, but there are some large inquiries floating around.

Sheets—More business is showing up, and mills are not inclined to shade prices.

Structural Material—Several large contracts and a number of small ones are under negotiation and likely to go through. Makers are inclined to be stiffer as to price.

Scrap—The market is stronger and dealers are quite chipper. Some of them are inclined to hold back, believing they will get better prices than are now offered.

Pittsburg

May 18—The advance of $1 per ton last week in bars and shapes seems to have been well taken. It has not checked orders, which continue good, so far as consumers are concerned. Speculative buying is not so active, though this is a matter not always easy to determine. However, jobbers are more cautious, apparently, about loading up.

The American Steel and Wire Company has advanced prices of wire and wire products $2 per ton, and this has been done also by the leading independents. The advance does not seem to have checked orders so far, though some jobbers are holding off.

Pig Iron—Demand seems to be improving a little, but the market is still below the expectations. Prices, however, are a shade firmer. Sellers are holding out for $14.75 for bessemer; $14.25 for basic and No. 2 foundry and $13.50 for gray forge, all at Valley furnaces. On large orders 25c. less might be done for early shipments.

Steel—A little more new business is reported. Deliveries continue good on old contracts. In the local market billets are firm at $23 and sheet-bars at $25.50, as formerly.

Sheets—Demand is better. Prices remain on the basis of 2.25c. for black and 3.25c. for galvanized, 28 gage, ordinary carloads. There is less talk of shading than there has been.

Ferromanganese—The market is quoted at $41, Baltimore, or $42.95, Pittsburg, for ordinary lots. For future deliveries $1 more is asked.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports production

of pig iron in Germany in March at 1,073,116 tons, or 123,449 tons more than in February. The daily average increased from 33,917 tons in February to 34,617 in March. For the three months ended March 31 the total was, in metric tons:

	1908.	1909.	Changes
Foundry iron	583,421	560,882	D. 22,539
Forge iron.....	180,557	170,396	D. 10,161
Steel pig.....	271,260	277,416	I. 6,166
Bessemer pig....	112,180	110,405	D. 1,775
Thomas(basic)pig	1,955,105	1,925,405	D. 29,700
Total..... ...	3,102,513	3,044,504	D. 58,009

Total decrease this year, 1.9 per cent. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

Metal Markets

New York, May 19—The metal markets show signs of increasing demand for manufacture and consumption, and some higher prices are recorded in consequence.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver:			
April 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,467,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298,582	" 2,750,269

Exports from the port of New York, week ended May 15: Gold, $1,798,000, to Argentina and Paris; silver, $884,866, to London and Paris. Imports: Gold, $149,662, from Australia and South America; silver, $53,705, from the West Indies and Mexico.

Gold and silver movement in Great Britain, three months ended March 31:

	Imports.	Exports.	Excess.
Gold.....	£16,131,463	£10,184,832	Imp. £5,946,631
Gold, 1908...	11,167,244	8,024,886	Imp. 3,142,358
Silver.....	3,339,828	3,155,161	Imp. 184,667
Silver, 1908.	2,222,857	3,616,822	Exp. 1,393,965

Of the silver imported this year a total of £2,805,898 is credited to the United States.

Gold—There has been a demand for gold and the price on the open market in London has been 77s. 9¾d. per oz. for bars. Most of the gold offered was taken for Austria. In New York exports reached $7,000,000, about $6,000,000 going to France, the rest to Brazil and Argentina.

Platinum—Business is dull and prices a little lower. Dealers ask $23@23.50 for refined platinum, and $25.50@26 for hard metal. Scrap is quoted at $19@20.50. The market is depressed by the existence of some stocks in the hands of small holders, who are anxious to turn their metal into cash.

Silver—Silver has settled to a more steady level. China has not been so active a buyer lately, and prices have been sustained by buying from India less moderate than the China operations had been previously.

SILVER AND STERLING EXCHANGE

May.	13	14	15	17	18	19
New York....	52¾	52⅞	52⅞	53	52⅝	52⅝
London.....	24¼	24 9/16	24⅛	24⅜	24 7/16	24 7/16
Sterling Ex..	4.8775	4.8780	4.8780	4.8780	4.8780	4.8785

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to May 6:

	1908.	1909.	Changes.
India.... ...	£ 2,865,658	£1,519,300	D. £1,346,258
China.....	511,400	1,038,200	I. 526,800
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,467,158	£2,640,300	D. £ 826,858

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
13	13⅛ @13⅜	12⅞ @13	59	29¾	4.30 @4.32½	4.22½ @4.25	4.90 @4.92½
14	13⅛ @13⅜	12⅞ @13	59½	29¾	4.30 @4.32½	4.22½ @4.25	4.92½ @4.95
15	13⅛ @13⅜	12⅞ @13	....	29¾	4.30 @4.32½	4.22½ @4.25	4.92½ @4.95
17	13⅛ @13⅜	12⅞ @13	59 7/16	29	4.30 @4.32½	4.22½ @4.25	4.95 @4.97½
18	13⅛ @13⅜	12⅞ @13	59	28⅞	4.30 @4.32½	4.22½ @4.25	4.97½ @5.00
19	13⅛ @13⅜	12⅞ @13	59 3/16	28⅞	4.30 @4.32½	4.22½ @4.25	4.97½ @5.02½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—While the activity in this market has subsided somewhat, transactions continued during the week May 13-19 on a fair scale, and the tone remains very firm. Producers have greatly relieved themselves by the large sales effected within the last fortnight, and there is now a general appreciation that the deliveries have caught up with the production and may even surpass it. Consequently there is a great deal of confidence in the future of the market. This is manifested by the general disinclination to contract for delivery beyond July, and prices are stiffer for all future shipments than for prompt and near-by. The ideas of sellers in this respect are measured to a large extent by interest charges. None of the agencies is now aggressive in forcing sales, but for early delivery all offer electrolytic copper at 13⅛c., cash, delivered 30 days, or a little less than 13c., cash, New York. Some transactions were made during the week at less than 12⅞c. and some at a little more than 13c., but these were determined by special conditions. The case is similar with respect to certain transactions in Lake copper that were made at 13¼c. However, the latter is understood to be the price that is now asked by the Calumet & Hecla. The closing quotations are unchanged at 13⅛@13⅜c. for Lake copper; 12⅞@13c. for electrolytic in ingots, cakes and wirebars; 12¾@12⅞ for casting copper. The average for casting copper was 12¾@12⅞ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire is 14½c. base, carload lots at mill. Business has been steady.

The standard market in London has held its own throughout the week, and the fluctuations would indicate that there has been an evening-up process among the various factions. The close is steady at £59 3s. 9d. for spot and £60 for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.; best selected, £62 10s.@£63 10s.; strong sheets, £74 10s.@£76 10s.

It is reported that the selling of the product of the Utah Copper Company will soon pass from the United Metals Selling Company to the American Smelting and Refining Company.

Tin—The increased shipments from the East, which were reported for the first half of this month, created a depressing influence in the market. Transactions, however, were of small volume and changes in the quotations of small moment. The close is cabled at £131 2s. 6d. for spot, £132 5s. for three months.

The domestic market followed closely, as far as prices are concerned, that of London. Business is reported as satisfactory and consumption seems to keep up on a fairly good level. The market closes at about 28⅞ cents.

Lead—There is a good business doing, and quotations have again advanced somewhat, particularly in the West, the close in St. Louis being 4.22½@4.25c., while the metal is quoted at 4.30@4.32½c. New York.

The tone of the London market has also improved, and sales have been of a larger volume. The close is stronger at £13 6s. 3d. for Spanish and £13 8s. 9d. for English.

Spelter—Under the influence of a very heavy inquiry from the galvanizers, the market advanced from day to day and closes strong at 5.12½@5.17½c. New York, 4.97½@5.02½c. St. Louis.

Quotations for spelter in New York, May 13, were 5.05@5.07½c.; May 14 and 15, 5.07½@5.10c.; May 17, 5.10@5.12½c.; May 18, 5.12½@5.15c.; May 19, 5.12½@5.17½ cents.

The market in London is also higher, the closing quotations being cabled at £22 for good ordinaries, £22 5s. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Antimony—Business during the week has been quiet, with few sales. Prices are nominally unchanged at 8¼@8½c. for Cookson's; 7¾@8c. for U. S., and 7¼@7½c. for outside brands.

Aluminum—Quotations are 22@24c. per lb. base for No. 1 ingots in large lots; 31@32c. base for wire, and 33@34c. base for shorts. Business is steady, but not especially active.

Quicksilver—Business has been rather dull, but prices are steady. New York, $44.50 per flask of 75 lb. San Francisco, $44 for domestic and $42 for export orders. London quotation is £8 7s. 6d. per flask, with 3s. 9d. less quoted by jobbers.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Spanish Metal Exports

Exports of metals and minerals from Spain in January, reported by *Revista Minera*, in metric tons:

Metals.	1908.	1909.	Changes.
Pig and manuf. iron	892	3,226	I. 2,334
Copper	786	1,629	I. 843
Copper precipitate	1,822	1,463	D. 359
Lead	12,056	9,698	D. 2,358
Zinc	2	37	I. 35
Quicksilver	9	1	D. 8
Minerals.			
Iron ore	525,572	479,678	D. 45,894
Manganese ore	4,288	.....	D. 4,288
Copper ore	101,499	63,543	D. 37,956
Lead ore	215	86	D. 129
Zinc ore	8,375	7,250	D. 1,125
Pyrites	116,896	97,712	D. 19,184
Salt	39,685	45,905	I. 6,220

Zinc and Lead Ore Markets

Joplin, Mo., May 15—The highest price reported paid for zinc was $42 on a base price of $39 per ton of 60-per cent. zinc, the highest grade ores bringing only a $30 base against a $39.50 to $40 base price for 59 to 60 per cent. grades. The week was one of scattering prices; 300 tons of 60-per cent. ore sold on a $37 base, 200 tons of 59 to 60 per cent. on a $40 base, 150 tons sold on a $39.50 base. The bulk of ore sold, however, on a $38 to $39 base. Silicate ores sold from $17@20 per ton of 40-per cent. zinc. The average price, all grades, was $35.90. Lead prices were again stronger, as high as $57.50 being paid for this week's delivery, with $60 bid for delivery early next week. The average price on this week's settlements, all grades, was $55.84 per ton.

This spring has been one of exceptional outputting conditions, and the mines are generally being operated to the full capacity, except those mines that cannot be operated on the present level of prices.

SHIPMENTS, WEEK ENDED MAY 15.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,466,120	671,880	$ 82,935
Joplin	2,487,240	402,560	60,393
Galena	853,240	120,600	18,854
Prosperity	356,780	334,300	15,941
Miami	788,350	65,090	13,252
Duenweg	521,290	113,410	11,652
Carthage	379,010	.....	9,390
Alba-Neck	362,990	.....	6,895
Granby	483,430	23,410	6,044
Aurora	307,280	.....	6,366
Spurgeon	201,410	75,130	4,926
Badger	249,730	.....	4,868
Quapaw-Baxter	149,940	47,370	4,063
Zincite	155,270	.....	3,027
Sarcoxie	123,640	.....	2,284
Carl Junction	74,880	.....	1,497
Wentworth	83,880	.....	879
Totals	11,043,380	1,853,760	$250,205
20 weeks	225,032,690	36,648,270	$5,025,482

Zinc value, the week, $198,330; 20 weeks, $4,061,542
Lead value, the week, 51,875; 20 weeks, 963,940

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	Zinc Ore. Base Price. 1909.	Zinc Ore. All Ores. 1908.	Zinc Ore. All Ores. 1909.	Lead Ore. All Ores. 1908.	Lead Ore. All Ores. 1909.
January	$37.60	$41.25	$35.56	$38.46	$46 88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50 82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$31.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., May 15—The highest price paid this week for zinc ore was $40.50 per ton; the base price of 60 per cent. zinc declined from $40 to $39 per ton. For 80 per cent. lead ore $54 per ton was paid; one car, 82 per cent., brought $56 per ton. The week's shipment is the heaviest of the year; a large accumulated stock is beginning to move. Conditions are now ideal for outputting, after a backward spring, and a general resumption of activity is in evidence.

SHIPMENTS, WEEK ENDED MAY 15.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	961,320	.....	158,900
Benton	386,700	.....	.....
Highland	380,500	.....	.....
Strawbridge	352,000	68,600	.....
Hazel Green	345,500	65,000	.....
Cuba City	251,800	.....	.....
Galena	240,900	.....	.....
Livingston	160,000	.....	.....
Linden	121,430	.....	.....
Harker	58,010	.....	.....
Total	3,257,260	133,600	158,900
Year to May 15	39,583,754	1,397,660	3,123,700

In addition to the above there was shipped to the American Zinc Ore Separating Company 600,490 lb., and to the Joplin Separator Works 258,000 lb. zinc concentrates.

Petroleum

May 19—Exports of mineral oils from the United States, four months ended April 30, in gallons:

	1908.	1909.
Crude petroleum	29,987,851	44,959,602
Naphthas	10,176,163	23,407,046
Illuminating oils	344,121,231	335,556,561
Lubricating oils	53,515,097	48,862,589
Residuum	14,783,172	32,601,010
Total	452,583,504	485,386,808

Paraffin is included in lubricating oils. The total increase this year was 32,803,304 gal., or 7.2 per cent.

Chemicals

New York, May 19—The market shows no considerable change. Deliveries on contracts are somewhat more active but current business is only moderate.

Copper Sulphate—Sales continue steady but not especially active. Current quotations are unchanged at $4.22½ per 100 lb. for carload lots, and $4.47½ per 100 lb. for smaller parcels.

Arsenic—Current quotations are unchanged at 2⅞@3c. per lb. for white arsenic. The sales for the week approximate 50 tons.

Nitrate of Soda—The market continues quite active, a good business being done at unchanged quotations, 2.15c. for spot and 2.12½c. for futures.

Mining Stocks

New York, May 19—The general mining-stock market has been much less active than during the preceding week. There was more or less recession of prices from the high levels then attained. This was not altogether due to profit taking, but seems to indicate that the bull movement had advanced farther than was really warranted by conditions. Trading diminished in volume and the course of prices was rather irregular, a few stocks gaining while others lost. The close is quite uncertain, and it cannot be said that there is any decided tendency apparent.

Henry H. Rogers died this morning. The effect of his death on the market can hardly be gaged yet; but it must be remembered that he had not been specially active for two years past.

On the Curb trading was rather dull with some losses in quotations, especially in the copper stocks. These, however, were variable and for no apparent reason. Cobalt mining stocks continue in favor, and generally held their own pretty well. The Nevada gold stocks, however, were rather neglected.

Boston, May 18—The North Butte mining episode resulted in killing off an increasing interest in the market for min-

ing shares and net results for the past week are general declines with some few exceptions. It is believed, however, that the declaration of the usual quarterly dividend of $1 per share by this company will have a steadying influence and that there will be less cause for attacking the stock. In addition Quincy mining directors, as well as Calumet & Arizona and Old Dominion, have declared regular dividends so that these ought to serve as bullish factors.

Brokerage houses are in a good condition and money continues easy. Brokers report that their liabilities are smaller than they were a few weeks ago so that stocks are in strong hands. The exceptions, as far as advances are concerned, are Nevada Consolidated, which records a net gain of $1.87½ to $23.50, which is its record price. Osceola has made a gain of $4 to $13, and Parrott is fractionally higher than a week ago. U. S. Smelting has risen $1.62½, net, to $47.37½ and the preferred $1.50 to $48.25 per share.

East Butte ran off $1.50 to $12.87½; rights on the same varied from 55 to 70c., each share carrying four of them. North Butte did not get below $60 during the week, even though there was one or two incipient bear raids.

The Curb features have been in the higher grade of stocks. Helvetia made a high at $6.12½, assessment paid. Ohio Copper had good advance. Southwestern Development has been the most active feature, largely through newspaper advertising.

STOCK QUOTATIONS

NEW YORK	May 19	BOSTON	May 19
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.45	Adventure	9
Amalgamated	83⅛	Allouez	‡40
Anaconda	50¾	Am. Zinc	25
Balaklala	‡2 1/16	Arcadian	5
British Col. Cop.	6⅞	Arizona Com.	43⅞
Buffalo Mines	‡3½	Atlantic	9½
Butte Coalition	26¼	Boston Con.	13¾
Colonial Silver	..	Calumet & Ariz.	103
Cum. Ely Mining	8 1/16	Calumet & Hecla	645
Davis-Daly	6¼	Centennial	‡30½
Dominion Cop.	½	Copper Range	80⅜
Douglas Copper	2¼	Daly-West	9⅝
El Rayo	2½	East Butte	14⅞
Florence	27½	Franklin	15⅛
Foster Cobalt	.32	Greene—Can.	10⅜
Furnace Creek	.12	Hancock	‡10¾
Giroux	7⅞	Isle Royal	.28
Gold Hill	..	Keweenaw	3
Goldfield Con.	7 1/16	La Salle	14½
Granby	103	Mass.	14⅛
Greene-Gold	..	Michigan	12
Greene G. & S.	9	Mohawk	.65
Guanajuato	1⅛	Nevada	23⅛
Guggen. Exp.	195	North Butte	62
Hanapah	.15	Oilbway	11¾
Kerr Lake	8¼	Old Colony	2.60
McKinley Dar	.91	Old Dominion	‡54⅝
Miami Copper	15	Osceola	‡133
Mizmee	¾	Parrot	34⅝
Mines Co. of Am.	1/16	Quincy	‡90
Mitchell Mining	⅛	Rhode Island	11¾
Mont. Sho. C.	11⅞	Shannon	15⅞
Nev. Utah M. & S.	2¾	Superior	‡11¼
Newhouse M. & S.	2⅞	Superior & Bost*	14
Nipissing Mines	10⅛	Superior & Pitts.	14
Old Hundred	⅝	Tamarack	‡73
Silver Queen	.12	Trinity	13⅛
Stewart	¾	U. S. Smg. & Ref	47⅝
Tennessee Cop'r	42⅝	U. S. Sm. & Re., pd.	48⅝
Tri-Bullion	..	Utah Con.	41½
Tuloa Copper	1⅛	Victoria	‡5
Utah Apex	6¾	Winona	6¾
Utah Copper	51⅝	Wolverine	‡148
Yukon Gold	4⅞	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	39
Am. Smelt. & Ref.	93½
Am. Sm. & Ref., pf.	109¾
Colo. Fuel & Iron	41¾
Federal M. & S., pf.	79½
National Lead	58
National Lead, pf.	106¼
Pittsburg Coal	11
Republic I. & S.	27
Republic I. & S., pf.	87¾
Sloss-Sheffield	80¾
Standard Oil	677
U. S. Steel	58⅛
U. S. Steel, pf.	129⅛
Va. Car. Chem.	50

BOSTON CURB	Low.
Ahmeek	150
Black Mt.	.80
Chemung	16
Globe Con.	5¼
Helvetia	5⅞
North Lake	17½
Ray Central	3⅞
Ray Con.	15⅞
San Antonio	13¼

ST. LOUIS	May 15	
N. of Com.	High.	Low.
Adams	40	.30
Am. Nettie	.08	.05
Center Cr'k	2.00	1.50
Cent. C. & C.	80.00	79.00
C. C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	6.00
Con. Coal	20.00	19.00
Doe Run	115.00	115.00
Gra. Bimet.	.30	.22
St. Joe	14 00	12.50

LONDON	May 12
Name of Com.	Clg.
Dolores	£1 58 0d
Stratton's Ind.	0 3 1½
Camp Bird	1 2 9
Esperanza	3 0 0
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 11 9

Cabled through Wm. P. Boubright & Co., N. Y.

NEVADA STOCKS. May 19.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	18
Belcher	.48	St. Ives	.10
Best & Belcher	.35	Triangle	.01
Caledonia	.10	BULLFROG STOCKS	
Challar	.06	Gibraltar	.04
Comstock	.28	Homestake King.	.01
Con. Cal. & Va.	.65	Mont. Shoshone C.	1.87½
Crown Point	.47	Tramp Cons.	.06
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.09	Bonnie Clare	...
Hale & Norcross	.17	Lee Gold Grotto	...
Mexican	.76	Nevada Hills	1 25
Ophir	1.30	Nevada Smelting	87½
Overman	.15	Nevada Wonder	.60
Potosi	.14	Nevada-Utah	2.68
Savage	.19	Penn-Wyoming	.05
Sierra Nevada	.27	Pittsburgh S. Pk.	.52
Union	.33	Rawhide Cool't'n.	...
Utah	.04	Round Mt. Sphinx	.13
Yellow Jacket	.57		
TONOPAH STOCKS			
Belmont	.78		
Extension	.63		
Golden Anchor	...		
Jim Butler	.15		
MacNamara	.23		
Midway	.23		
Montana	.75		
North Star	.92		
Tono'h Mine of N.	7 12½		
West End Con.	.29		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.15		
Blue Bell	.04		
Booth	.18		
Columbia Mt.	.11		
Comb. Frac.	.83		
Con. Red Top	.03		
Cracker Jack	.03		
Dia'field B. B. C.	.05		
Goldfield Belmont	.04		
Goldfield Daisy	.28		
Great Bend	.09		
Jumbo Extension	.12		
Kendall	.05		
Lone Star	.05		
May Queen	.04		
Oro	.08		
Red Hill	.08		
Roanoke	..		
Sandstorm	.12		

COLO. SPRINGS	May 14
Name of Comp.	Clg.
Acacia	.06⅛
Black Bell	...
C. C. Con.	.03
Dante	.06
Doctor	.09
Elkton	.63⅛
El Paso	.48⅝
Findlay	.15
Gold Dollar	.11½
Gold Sovereign	‡.03
Isabella	.20⅛
Jack Pot	.07⅛
Jennie Sample	.06⅞
Jerry Johnson	‡.05⅜
Mary McKinney	.38
Pharmacist	‡.03
Portland	.91
Un. Gold Mines	.06¼
Vindicator	.60
Work	.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida	May 8	June 5	$0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Confidence, Nev	May 18	June 8	0.20
Con. Imperial, Nev	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 9	0.001
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Lochsper, Nev	May 5	May 26	0.05
Mabella, Ida	May 15	June 14	0.05
Imlay, Nev	Apr. 6	Apr. 28	0.03
Julia Con., Nev	May 24	June 17	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr 8	Apr 29	0 10
Nev Superior	Apr. 10	May 1	0 071
Palmyra G. & C., Utah	June 11	June 30	0.001
Reindeer & G., Ida	Apr 28	May 28	0.005
Savage, Nev	Apr 8	May 5	0.10
Sierra Nevada, Nev	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Utah, Nev	May 6	May 27	0.03
Yerington Gold, Nev	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23 834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23 708
May	52.795	.....	24.377	.....
June	53.063	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.993	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908	1909.	Lake. 1908.	1909.	LONDON. 1908	1909
January	13.726	13.893	13.901	14.280	62.386	57 688
February	12.905	12.949	13.098	13.295	58.786	61 198
March	12.703	12.387	12.875	12.826	58.761	56.231
April	12.743	12.565	12.928	12.993	58.331	57.363
May	12.598	.....	12.788	.....	57.387	....
June	12.675	.....	12.877	.....	57 842	....
July	12.702	.....	12.933	.....	57.989	....
August	13.462	.....	13.639	.....	60.500	....
September	13.388	.....	13.600	.....	60.338	....
October	13.354	.....	13.646	.....	60.139	....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14 411	.....	62.943	....
Year	13.208	.....	13 424	.....	59 902	

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28 060	July	29.207	.....
February	28.978	28 290	August	29 942	....
March	30.577	28.727	September	28.815	....
April	31.702	29.445	October	29 444	....
May	30.015	.....	November	30 348	....
June	28 024	...	December	29 154	....
			Av. Year	29.465	...

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	1909.	St. Louis 1909.	London. 1908.	1909.
January	3 691	4.175	4.025	14.469	13 113
February	3.725	4.018	3.868	14.250	13.313
March	3.898	3.986	3.835	13.975	13.438
April	3.993	4 168	4.051	13.469	13.297
May	4.293	.....	.....	12.938	...
June	4.466	.....	.....	12.600	...
July	4.744	.....	.....	13.000	...
August	4.580	.....	.....	13 375	...
September	4 515	.....	.....	13.125	...
October	4 351	.....	.....	13.375	...
November	4.330	.....	.....	13.538	...
December	4 213	.....	.....	13.156	...
Year	4 200	.....	.....	13.439	...

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York 1908.	1909.	St. Louis. 1908.	1909.	London. 1908.	1909.
January	4.514	5 141	4.433	4.991	20.563	21.425
February	4 788	4 889	4 638	4.789	20.875	21 563
March	4 665	4 707	4.527	4 607	21.075	21.438
April	4 645	4.965	4 495	4.815	21 344	21.531
May	4.608	.....	4 478	.....	19.938	...
June	4.540	.....	4 406	.....	19 000	...
July	4 485	.....	4.348	.....	19.031	...
August	4.502	.....	4.356	.....	19.350	...
September	4.569	.....	4 419	.....	19 563	...
October	4 801	.....	4 651	.....	19.750	...
November	5.003	.....	4 909	.....	20.875	...
December	5.157	.....	4 987	.....	20.625	...
Year	4 726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Alaska, Mexican, g.	Alas.	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas.	200,000	25	10,485,000	April '09	0.50
Alaska United, g.	Alas.	180,200	5	513,520	April '09	0.25
Amalgamated, c.	Mont.	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.	500,000	100	16,000,000	April '09	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	36,625,000	April '09	1.75
Am. Smelters, pf. A	U. S.	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf B	U. S.	300,000	100	6,000,000	June '09	1.25
Am. Zinc, Lead&Sm	Kan.	80,000	25	280,000	Nov. '07	0.50
Anaconda, c.	Mont.	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c.	Ariz.	3,682,520	....	6,182,520	April '06	0.50
Atlantic, c.	Mich.	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s.	Mont.	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D., pf., l.z.	Wis.	196,607	1	10,949	Nov. '08	0.01½
Boston & Montana.	Mont.	150,000	25	53,400,000	April '09	3.00
Bull,Beck. & Cham.g	Utah	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull.	Ida.	300,000	10	10,971,000	May '09	0.15
Butte Coalition, c. s.	Mont.	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizona c.	Ariz.	200,000	10	10,500,000	Mar. '09	1.00
Calumet & Hecla, c.	Mich.	*100,000	25	108,350,000	Mar. '09	5.00
Camp Bird, g., s.	Colo.	820,000	5	5,707,200	April '09	0.24
Carisa, c. g.	Utah	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s.	Utah	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c.	Utah	283,440	5	226,832	Oct. '07	0.20
Combi'tion Co. G'f'd.	Nev.	320,000	1	688,000	Sept. '06	0.15
Con. Mercur, g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo.	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich.	384,185	100	8,067,885	April '09	1.00
Creede United, g.	Colo.	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l.	Utah	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l.	Utah	180,000	20	5,731,000	April '09	0.30
De Lamar, g. s.	Ida.	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.	Mo.	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.	Colo.	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.	Colo.	2,450,000	1	1,315,545	Sept. '08	0.01
Fed. Sm., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.	Idaho	120,000	100	4,331,250	Mar. '09	1.75
Findley, g.	Colo.	250,000	1	337,500	Sept. '06	0.01
Florence, g.	Nev.	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Gemini-Keystone.	Utah	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.	Colo.	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g.	Nev.	3,532,371	10	1,770,428	April '09	0.30
Grand Central, g.	Utah	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g.	Cal.	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho.	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.	S. D.	218,400	100	24,372,440	May '09	0.50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.	Ariz.	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf.	N. Y.	89,126	100	1,871,646	May '09	1.50
Iron Blossom, s. l.	Utah	1,000,000	0.10	80,000	April '09	0.08
Iron Silver.	Colo.	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal.	390,000	10	347,100	April '09	0.02
Jerry Johnson.	Cal.	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.	Mont.	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s.	Colo.	130,551	5	130,440	Jan. '07	0.15
Lightner, g.	Cal.	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah	190,000	1	57,000	Sept. '07	0.07½
Mammoth, g. s. l.	Utah	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo.	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l.	Utah	800,000	1	108,000	Sept. '08	0.01½
Mohawk, W.	Mich.	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Punch.	Mont.	80,833	25	9,437,274	Jan. '07	15.00
Nevada Hills, s. g.	Nev.	746,000	5	373,000	Dec. '07	0.10
New Century, z. l.	Mo.	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c	Utah	600,000	10	300,000	Sept. '07	0.50
New Idria, q.	Cal.	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc.	U. S.	100,000	100	12,000,000	May '08	4.00
North Butte.	Mont.	400,000	15	7,200,000	June '09	1.00
North Star, g.	Cal.	250,000	10	1,911,988	Mar. '09	0.30
Old Dominion, c.	Ariz.	293,245	25	849,332	Mar. '09	0.50
Old Dominion,M&Sc	Ariz.	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.	Nev.	201,600	3	1,816,360	May '08	0.10
Osceola, c.	Mich.	96,150	25	7,420,250	Jan. '09	2.00
Parrott, c. s.	Mont.	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g.	Cal.	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co	U. S.	44,934,600	1	1,123,365	April '09	0.02½
Portland, g.	Colo.	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.	Nev.	100,000	10	375,000	July '07	0.20
Quincy, c.	Mich.	110,000	25	18,560,000	Mar. '08	1.00
Sacramento, g. q.	Utah	1,000,000	1	225,000	Nov. '06	0.00½
St. Joseph, l.	Mo.	1,000,000	10	6,308,357	Mar. '09	0.15
Shannon, c.	Ariz.	300,000	10	‖450,000	July '07	0.50
Silver Hill, g. s.	Nev.	108,000	1	‖81,000	June '07	0.05
Silver King, g. s. l.	Utah	150,000	20	11,187,500	July '07	0.33½
Silver King Co't'n.	Utah	1,224,425	5	1,105,402	April '09	0.15
Sioux Con.	Utah	746,380	1	335,595	April '09	0.07
Snowstorm, s. l.	Ida.	1,500,000	1	690,000	Feb. '09	0.03
Standard Con., g. s.	Cal.	178,394	10	‖5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo.	1,000,000	5	4,895,865	April '06	0.12½
Swansea, g. s. l.	Utah	100,000	5	‖329,500	Mar. '07	0.05
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.	Colo.	300,000	5	2,016,000	Dec. '08	0.48
Tonopah of Nev.	Nev.	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont	Nev.	1,500,000	1	600,000	April '07	0.10
Tonopah Ext'nsion	Nev.	928,433	1	283,030	April '06	0.15
Tonopah Midway.	Nev.	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l.	Utah	500,000	1	295,000	Dec. '08	0.02
United States, com.	Utah	350,933	50	2,148,099	May '09	0.15
United States, pfd.*	Utah	485,845	50	5,306,495	April '09	0.87½
United Cop, com	Mont.	450,000	100	5,962,500	Aug. '07	1.75
United, c. pf.	Mont.	50,000	100	1,500,000	May '07	3.00
United, z. l., pf.	Mo.-Kan.	19,556	25	312,782	Jan. '08	0.50
United Verde, c.	Ariz.	300,000	10	1,385,322	Mar. '09	0.75
U. S. Red. & Ref. Pf.	Colo.	39,458	100	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah	100,000	10	323,000	Feb. '09	0.02
Utah Con., c.	Utah	300,000	5	7,500,000	April '09	0.50
Utah Copper.	Utah	350,250	10	1,088,925	Mar. '09	0.50
Victoria, Utah.	Utah	250,000	1	177,000	Mar. '07	0.04
Vindicator Con., g.	Colo.	1,500,000	1	1,980,000	Jan. '09	0.03
Wolverine, c.	Mich.	60,000	25	5,400,000	April '09	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.01
Yankee Con.	Utah	1,000,000	1	182,500	Jan. '07	0.03
Yellow Aster, g.	Cal.	100,000	10	958,789	Aug. '07	0.20

*Previous to consolidation $1,436,250 were divided. †Amalgamaetd.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Allis-Chalmers, pf.	U. S.	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S.	181,530	100	1,747,620	April '09	3.00
American Cement.	Pa.	200,000	10	1,288,000	Jan. '09	0.30
American Coal	Md.	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa.	150,000	100	900,000	Nov. '06	0.75
Cambria Steel.	Pa.	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	W. Va.	51,250	100	2,613,750	April '09	1.50
Central C. & C., pf.	Mo.	18,750	100	1,476,562	April '09	1.25
Col.&Hock. C.&I., pf.	Ohio.	69,244	100	383,818	April '08	1.50
Consolidated Coal.	Ill.	50,000	100	350,000	July '04	1.00
Consolidation Coal.	Md.	102,500	100	‡10 431,650	Jan. '09	3.50
Crucible Steel, pf.	Pa.	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf.	N. J.	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va.	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem., com	U. S.	74,103	100	2,297,193	June '09	1.00
General Chem., pf.	U. S.	100,000	100	6,255,000	Jan. '09	1.50
International Salt.	Penn.	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., cm.	Pa.	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'f C. & I., pf.	Pa.	15,000	100	900,000	Feb. '09	2.50
Kern River Oil.	Cal.	20,000	100	84,000	July '09	0.10
Lehigh Coal & Nav.	Pa.	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf.	Md.	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf.	Pa.	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com.	U. S.	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf.	U. S.	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com.	N. Y.	149,054	100	3,279,189	April '09	1.25
National Lead, pf.	N. Y.	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel&Wire,pf.	N. Ye.	25,778	100	631,561	May '06	1.75
New Central Coal.	Md.	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf.	W. Va.	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax.	Cal.	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil.	Cal.	92,000	10	711,000	June '08	0.06
Penna. Salt.	Pa.	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.	Pa.	165,000	100	8,662,968	Nov. '08	3.50
Phila. Gas, com.	Pa.	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.	Pa.	120,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf.	Pa.	297,010	100	11,434,962	April '09	1.75
PocadontasC.C., pf.	W.&Va.	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.	W. Va.	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill.	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala.	100,000	100	2,133,000	June '09	1.25
Sloss-Sheffield, pf.	Ala.	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil.	U. S.	970,000	100	652,802,905	June '09	9.00
Tenn. C. & I., com.	Tenn.	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn.	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal.	Texas.	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling.	U. S.	50,000	100	5,875,000	Jan. '09	5.00
U. S. Steel Corp., cm.	U. S.	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S.	180,000	100	14,700,869	April '09	2.00
Warwick I. & S.	U. S.	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal	Pa.	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. ‖Stock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Amistad y Conc'rdia	Mex.	9,600	50	$417,070	April '08	$1.36
Batopilas.	Mex.	446,268	20	‡55,784	Dec. '07	0.12½
British Columbia, c.	B. C.	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.	Ont.	900,000	1	399,000	May '09	0.01
Butters' Salvador, g.	Salv.	150,000	5	600,000	April '09	0.25
Cobalt Central, s.	Ont.	4,761,500	1	92,230	Feb. '09	0.02
Coniagas, s	Ont.	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C.	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass.	B. C.	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont.	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. s.	Mex.	400,000	5	600,000	May '09	0.15
Dominion Coal, com.	N. S.	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf.	N. S.	30,000	100	‡630,000	Feb. '08	3.51
Dos Estrellas, g. s.	Mex.	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. s.	Mex.	1 080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.	Mex.	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s.	Ont.	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn.	B. C.	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper.	Mex.	864,000	10	6,137,800	Mar. '07	0.40
Guanajuato.	Mex.	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. s.	Mex.	10,000	100	30,000	July '08	3.00
Guggenheim Expl.	Mex.	105,000	100	5,272,500	April '09	2.50
Hinds Con., g. s. c. l.	Mex.	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.	Ont.	600,000	5	1,108,000	June '09	0.30
La Rose Con., s.	Ont.	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., g.	B. C.	200,000	25	425,000	Dec. '06	0.48
Le Roi No. 2, g.	B. C.	120,000	25	889,200	Mar. '09	0.48
Lucky Tiger-Com., g.	Mex.	65,000	10	71,500	Dec. '08	0.30
McKinley-Darragh, s	Ont.	2,000,000	1	480,000	Jan. '09	0.05
Mex. Con. M.&S. Co.	Mex.	240,000	10	660,000	Mar. '08	0.25
Mex. Mill.&Trans.pf.	Mex.	12,000	100	35,450	Jan. '08	3.00
Mines Co. of Am.	Mex.	2,000,000	1	3,545,000	April '09	0.02
N. Y. & Hond. Ros.	C. A.	150,000	10	2,467,000	Jan. '09	0.10
Nipissing, s.	Ont.	1,200,000	5	2,640,000	April '09	0.25
N. S. St.&Coal, com.	N S	9,876	100	1,087,856	April '08	1.50
N. S. St. & Coal, pf.	N. S.	10,300	100	479,130	April '09	2.00
Penoles*	Mex.	2,500	100	8,630,000	Dec. '07	3.50
Peregrina, pf. s.	Mex.	10,000	100	538,656	Mar. '08	3.50
Pinguico, pf. s.	Mex.	20,000	100	240,000	Oct. '08	3.00
Reco, g. s. l.	B. C.	985,000	1	527,082	April '06	0.02
Right of Way	Ont.	499,518	1 00	189,822	May '09	0.10
Securities Corp, pf.	Mex.	2,000	100	42,699	July '08	3.50
Silver Queen, s.	Ont.	1,500,000	1	345,000	Nov. '08	0.05
Temiskaming, s.	Ont.	2,500,000	1	525,000	April '09	0.06
Tezuitlan Copper	Mex.	10,000	100	....	Dec. '08	1.20
Tilt Cove, c.	N. F.	89,000	2	495,630	May '08	0.55
Tretbeway, s.	Ont.	945,450	1	311,998	May '09	0.10
Tyee, c.	B. C.	180,000	5	201,600	Aug. '07	0.03

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

John W. Freeman has been appointed manager of the Sprague Electric Company's Pittsburg office to succeed F. W. Barry, who recently resigned.

Traylor Engineering Company, Allentown, Penn., advises having closed a contract with the Leesburg Mining Company, of Columbus, Neb., for a 30-stamp mill.

Smooth-On Manufacturing Company, Jersey City, N. J., has issued the third edition of its Smooth-On instruction book No. 7 and will send a copy to any engineer on application.

The Wood Drill Works, of Paterson, N. J., has put in a stock of drills at Toronto, Ontario, Canada, at the showrooms of the A. R. Williams Machinery Company, which has branch offices in Winnipeg, Vancouver and Montreal.

The Carnegie Steel Company has added to the 1550-h.p. in Crocker-Wheeler form W motors in its Duquesne plant by the purchase of three more motors of the same type, especially designed for rolling-mill work, aggregating 225 h.p.

Tate, Jones & Co., Inc., Pittsburg, Penn., has just received an order through the Erie City Iron Works from the Union Pacific Railway, at Omaha, Neb., for a complete oil-burning equipment for use in connection with the Erie City "Economic" boilers.

The San Francisco branch office and warerooms of the Sullivan Machinery Company are now located at 461 Market street, in the Sheldon building, instead of at 26 Fremont street, as heretofore. Sullivan air compressors, diamond drills, rock drills and other mining machinery are carried in stock.

S. Morgan Smith Company, York, Penn., has opened an office at 644 American Trust building, Chicago. J. C. Temple, a well-known hydraulic engineer, who has been engaged in the water-wheel business for many years, has charge of this office and will be pleased to hear from people west of Pittsburg who are contemplating installing turbine wheels.

S. B. Stine, Osceola Mills, Penn., has recently purchased the Osceola Foundry and Machine Company, formerly known as the J. J. Pie Estate, which has been in operation for some thirty or forty years. Interested parties will be pleased to learn that this plant is again in operation and that they can secure duplicate parts of the various machines which have been installed during this long period.

The Wood Drill Works, of Paterson, N. J., is distributing through the home office and United States representatives, Booklet H-29, entitled, "A Word With Thee," explaining the drilling methods used in constructing the South Scranton tunnel, the great dam of the Hollingsworth & Whitney Company, at Madison, Maine, and cuts of some of the undertakings in which the "Wood" rock drill figured prominently.

Alberger Condenser Company, 95 Liberty street, New York City, has issued catalog No. 13 pertaining in particular to Wainwright water heaters. This covers the hot-water service heater as ordinarily used for domestic supply and swimming pools, also covers heaters for hot water heating system. The catalog will be found to be very interesting and contain information of value, and copies will be furnished upon application.

Frank Wells Hall has been appointed manager of the Philadelphia office of the Sprague Electric Company. Mr. Hall was formerly connected with the Sprague Electric Company, both in the New York and Chicago offices in engineering and sales capacities. His knowledge of the Sprague Electric products combined with his wide circle of acquaintances and his extensive business and engineering experience will undoubtedly win for him a large clientele in his new territory. Mr. Hall assumed his new duties April 15, 1909.

The Shannon Engineering and Contracting Company are consulting engineers, devoted to modern appliances for handling all kinds of material. The company has been recently organized to engage in the manufacturing of complete industrial railways, cars of every description, cable and automatic railways, and also deal with steam and electric locomotives, hoisting engines and other contractor's equipments. The organizers of this company are H. E. Mills and O. W. Scholz, having had over twenty years' experience in this particular class of work.

Fred M. Prescott Steam Pump Company, in order to facilitate the increasing demand for its product, has opened up another district sales office, at Atlanta, Ga. All business accruing in the southern and southeastern States will be handled directly from there. All inquirers will find the new office equipped with full engineering data, prices and information affecting any pumping machinery problem. The office is in charge of R. L. Radcliffe, who has been connected with the company's sales department for some time.

What might be called a pocket edition general catalog has just been gotten out by the Joseph Dixon Crucible Company, of Jersey City, N. J. This lists its principal products, such as crucibles, facings, lubricating graphite, greases, pencils, protective paint, etc., giving brief descriptions and prices. It is of value to the purchasing agent, engineer, contractor, superintendent, and anyone, in fact, who uses or specifies graphite in any form. The booklet is of commercial envelop size, and will conveniently go in the pocket or desk pigeonhole. It is substantially bound in tough cover stock, and attractively printed. A copy can be secured by writing direct to the company.

Elaterite roofing is not paper roofing, it is solid, reinforced, weather-resisting cement. It has been made for over ten years with a reinforced body of cement (the same principle is now being employed by modern builders, using reinforced concrete) this makes a strong and durable roofing. Elaterite roofing consists of a solid body of tough, pliable, non-drying elaterite cement, which retains its properties throughout the long life of the roofing. The body of cement is reinforced with a heavy fabric center and saturated wool-felt back. The regular grades are finished with a top layer of Mica and are as follows: 5X grade is reinforced with one layer of imported India burlap and weighs about 65 lb. per square. 4X grade is reinforced with one layer of imported India burlap and weighs about 55 lb. per square. 3X grade is reinforced with heavy muslin and weighs about 40 lb. per square. The Western Elaterite Roofing Company, Denver, Colo., will send full particulars on application.

Elmer & Amend have issued a new catalog entitled, "Calorimeters and Pyrometers." Under "Gas Calorimetry," full data of the Junker calorimeters for gas and liquid fuel testing is given, these being the standard instruments of their kind in general use. Under "Solid Fuel Calorimetry," which has become such an important subject, due to the general movement toward buying coal strictly on its true heating value is given a short treatise on the sampling of coal (which is a most important element in the process of the determination of the heating value of fuel), also a working description of the Emerson fuel calorimeter. This instrument, which embraces all the latest features in calorimetry, is meeting with much favor, on account of its ease of operation, extreme accuracy and low cost. A brief description of the standard Mahler and Atwater bombs is also given. Under "Pyrometry," special attention is directed to the Wanner optical pyrometers, which are the most accurately reading instruments for temperatures up to 7000 degrees. Also Fery radiation pyrometer and the new telephone resistance pyrometer, the latter instrument being low in price, simple of operation and very accurate.

The D'Olier Engineering Company has secured contract from the United States Government for a complete hydroelectric plant at Fort Yellowstone, Yellowstone National Park, including penstock and concrete power house. This installation will be used for furnishing light and power throughout Yellowstone Park and will consist of three 150-kw. alternating-current, 3-phase, 60-cycle generators, each direct connected to one 280-h.p. D'Olier Francis turbine water wheel operating under a head of, approximately, 275 ft. The water will be carried to the power house by a 26-in. steel penstock, which will be installed by the company and which will be provided with automatic-relief valves and large air chamber to aid in the regulation of the turbines, as the matter of regulation presents some difficulties, owing to the length of the penstock, which is, approximately, 2200 ft. A complete switchboard of the most modern type and transmission wiring are included in the contract. The turbines will be of the single-discharge type, with 22-in. runners mounted in cast-iron spiral flume on a horizontal shaft and discharging into the cast iron quarter-turn fittings resting on cast-iron base plate. The wheels will be of government bronze and the swivel gates will be of manganese bronze of the D'Olier Engineering Company's latest swinging type. A flywheel is provided on each wheel with an effective flywheel effect of 6000 lb. The entire installation is of the most modern type, and it is expected that high efficiency and low maintenance expense will be secured.

Trade Catalogs

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1436. Trommels or revolving screens. Illustrated, 24 pages, 8x10½ inches.

Wilbraham-Green Blower Company, Pottstown, Penn. Bulletin No. 4. Rotary positive pressure blower. Illustrated, 4 pages, 6x9 inches.

C. W. Hunt Company, West New Brighton, N. Y. Catalog No. 091. Coal and ore handling machinery. Illustrated, 86 pages, 6½x9 inches, paper.

Grönkvist Drill Chuck Company, 18 Morris street, Jersey City, N. J. Catalog. Johansson combination standard gages. Illustrated, 28 pages, 9x11 inches, paper.

B. F. Sturtevant Company, Hyde Park, Mass. Bulletin No. 105. Gas boosters. Illustrated, 3½x6 inches. Bulletin No. 106. Electric ventilating sets. Illustrated, 3½x6 inches.

Brown & Sharpe Mfg. Co., Providence, R. I. Catalog. Milling machines, grinding machines, automatic gear cutting machines, screw machines, cutters, machinists' tools, etc. Illustrated, 552 pages, 3½x6 inches, paper.

The Browning Engineering Company, Mansfield, Ohio. Bulletin No. 33. Revolving steam shovels. Bulletin No. 34. Automatic buckets. Bulletin No. 35. Locomotive cranes. Bulletin No. 36. Railroad ditcher. Bulletin No. 37. Scraper bucket excavators. Illustrated, 6x9 inches.

The Morigrieve Engineering Company, 44 Market street, Perth Amboy, N. J. Bulletin No. 1. Grieve safety device for jet condensers. Illustrated, 4 pages, 5½x8½ inches. Bulletin No. 2. A. M. C. elastic metallic packing. Illustrated, 4 pages, 5½x8½ inches. Circular. Angell steam trap. Illustrated.

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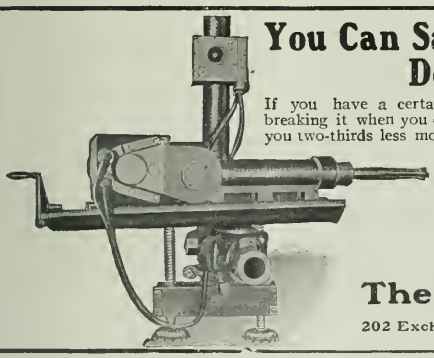

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The Engineering and Mining Journal

LXXXVII. NEW YORK, MAY 29, 1909. NO. 22.

Calumet and Hecla Drill-Sharpening Device

A Machine That Sharpens 3640 Drills Daily, Capacity of Which May Be Doubled. Electrical Counter Records Number of Drills Handled

BY C. L. C. FICHTEL*

The Calumet & Hecla Mining Company operates about 300 drilling machines, which necessitates the sharpening of approximately 4000 drills per day. The economical and efficient handling of these drills was the problem that confronted M. M. Morrison, who has direct charge of all forgings and castings for the company, and it was through his efforts that the present system was worked out in detail. This installation is the most extensive and complete of any in the country and its operation is entirely satisfactory; sharpened drills are turned out in a manner equal if not superior in every respect to the old method of hand sharpening.

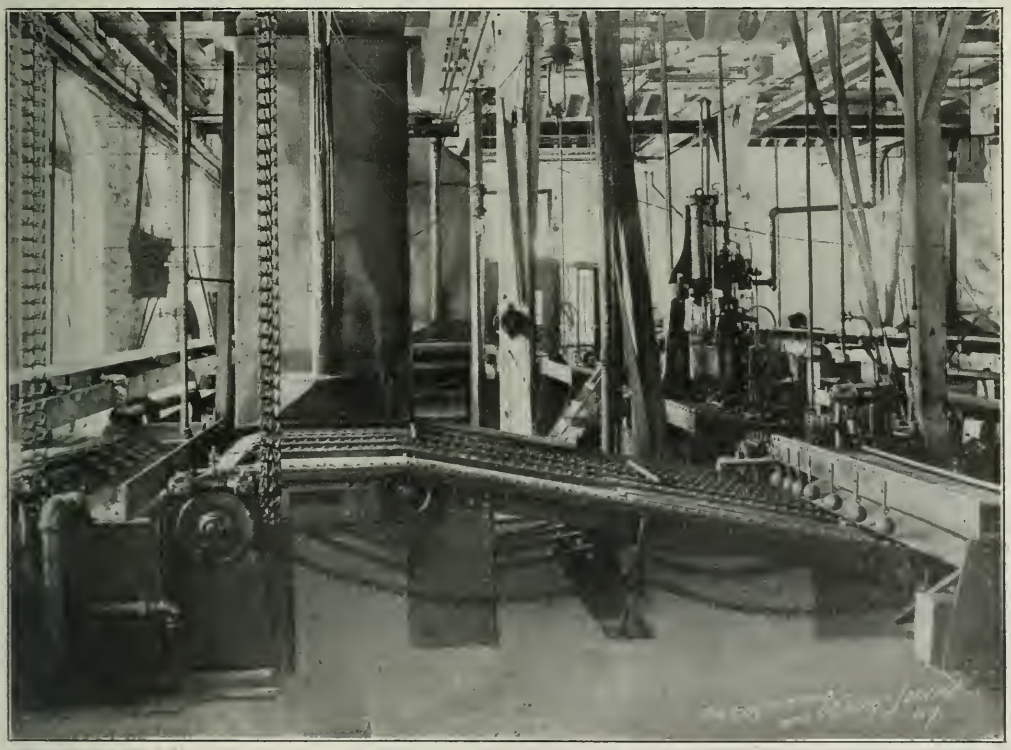
Method of Handling

Owing to the location of the plant it was found impossible to afford railway facilities into the building; consequently it is necessary to haul the drills by team from the various shafts. As the drills come from underground they are assorted according to lengths and placed in an iron box, or case, built especially for this purpose. Upon their arrival at the shop an electric crane lifts the case off the conveyance and places it in its allotted space beside the belt conveyer, shown in the accompanying plan.

Each party of miners is held accountable for a certain number of drills, or an equivalent weight of steel; therefore it is necessary that each drill be returned to its original place. To accomplish this, each shaft is taken separately and a record made of the number and sizes of the drills as they are taken from the carrying case; when this number has passed through the machine and been restored to its place the next shaft is taken up.

Method of Sharpening and Finishing

As the drills are taken from their various cases they are placed upon a belt conveyer, which runs the full length of the



THE DRILL SHARPENING PLANT

*Calumet, Mich.

building and travels at the rate of from 6 to 12 ft. per min., according to the rate of sharpening, the bit end of the drill facing the direction of motion. When the drill reaches the heating forge it is taken by hand from the belt and placed upon a chain conveyer, which carries it with a rotating motion through the heating forge, requiring about 3 min. to pass the heating portion. This forge is fed by crude oil under pressure and is heated to about 2000 deg. F. The drill leaving this conveyer falls onto a movable apron which, when lifted, allows the drill to slide into position in the sharpener.

Sharpener

The sharpening machine reduces the end of the bit to a cutting edge and shifts the surplus metal from the center to the edges. It is operated by compressed air at 65 lb. pressure, and consists primarily of a 5-lb. hammer in the form of a double die, striking 1600 blows per min. on a 4-in. stroke. When the drill falls into position from the heating forge it is clamped and held by the action of an air cylinder; this cylinder is operated by a foot lever, which also controls the throttle valve of the hammer.

The hammer mechanism is mounted on a sliding carriage controlled by a hand lever; this allows the device to work the metal from the heel of the bit to the edges and treats the opposite faces practically simultaneously. Upon the arrival of another drill from the forge the preceding one is released, and the lifting of the apron to allow the heated drill to come into the machine also causes the sharpened drill to fall upon a chain conveyer, which runs underneath this apron, and upon which it is carried to the next machine, the upsetter.

Upsetter

The functions of the upsetter are to restore the diameter of the drill and to back the cutting edges into a plane at right angles to the horizontal axis of the drill. This is accomplished by a few blows from an air cylinder, the piston of which carries the die. This cylinder strikes approximately 100 blows per min. on a 5-in. stroke, acting directly on the face of the drill. During this process the opposite end of the drill butts up against a rest and is securely held in position by a hand lever which grips it against stationary arms.

There are three of these rests, which necessarily must be adjustable to accommodate the various lengths of drill. They are staggered 120 deg. apart along an extended piston of a hydraulic cylinder; in this manner three different positions are obtained with an adjustment in each case of nearly 24 in., the length of the cylinder. This cylinder is operated by oil under about 65 lb pressure, the pressure in the oil tanks being maintained by a retaining pump.

Fluter

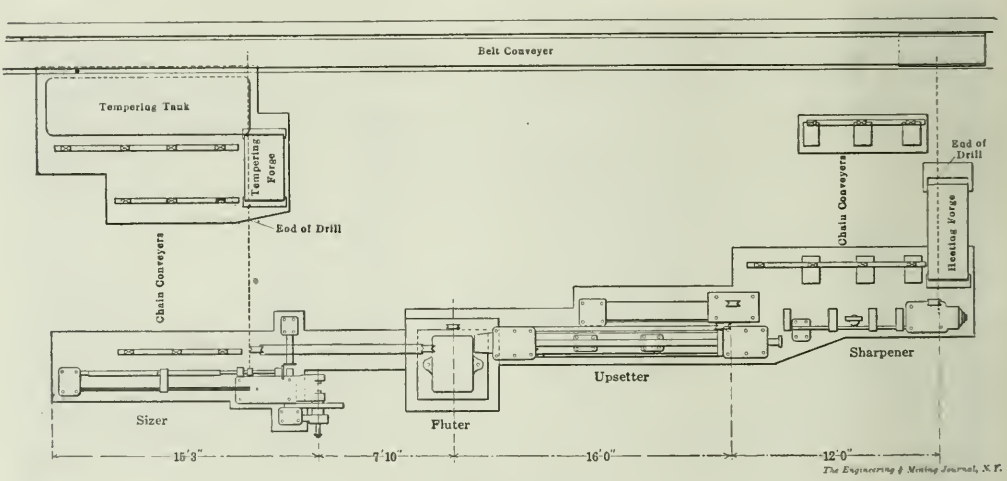
The drill next passes on to a fluter, which is an 800-lb. steam drop hammer, with a stationary die attached, acting upon a movable die. This straightens the vanes of the drill and reduces them to standard thicknesses. Two blows of the hammer are sufficient to accomplish this. The drill is then carried, in a manner similar to the connection between the sharpener and the upsetting machine, to the sizing machine.

Sizer

The sizing machine measures and reduces the drill to proper proportions, the diameter of a finished drill being commensurate to its length; that is, the greater the length the smaller the cross-section of the sharpened end. The drill entering this machine is forced into position by a movable rest, acting upon the machine end. The rest travels on a slide and is controlled by means of a screw; this is actuated by friction cones belted to the driving shaft. The action of this screw through a worm gear also controls the opening between the dies, a travel of 1 ft. on the screw changing the opening ⅛ in. When the drill has been placed in position, the clutch connecting the ram with the main shaft is thrown in and one complete revolution is made, forcing the dies together and reducing the ends of the drill accordingly. The drill is then turned half way and the two adjacent faces are treated in like manner.

The drill is now carried transversely on endless chains through the tempering forge. In passing from the sizer to the forge the heated end of the drill passes through a hood about 4 ft. long, through which an air jet from a Sturtevant fan blows, cooling the drill below 600 deg. F. before it enters the tempering forge. This reduction in temperature is made so that when the drill passes through the forge it will not be heated beyond the required depth from the sharpened edge. This forge is a duplicate of the heating forge, with the exception that it is narrower, the drill taking about 2 min. in passing through it. As the drills leave the forge they drop into a tank containing cold water; here they are hardened and then are elevated by a chain conveyer to the under side of the conveyer belt on which they are returned to their respective places.

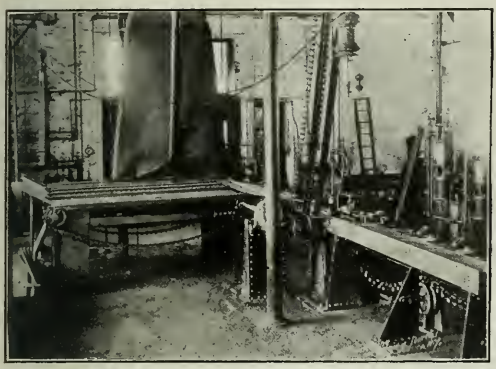
The number of drills passing through the machine are recorded by an electrically actuated counter, which operates as follows: When the drill passes a certain



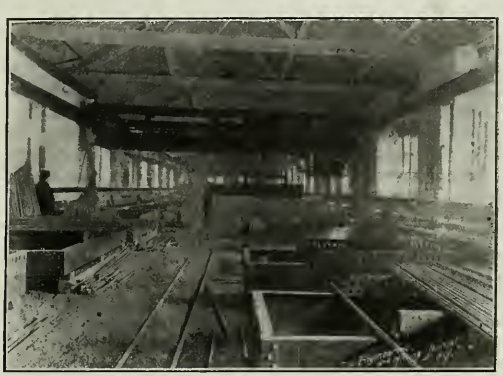
PLAN OF DRILL SHARPENING PLANT

point on its way to the heating forge it closes a contact, which operates a relay. The closing of this relay operates the alternating-current magnet coils, the armature of which is connected by a shaft to the arm of a reciprocating engine counter, and its pull lifts the arm against the tension of a spring. The alternating-current side of the apparatus consists of the reactive coil, a pair of magnet coils complete with armature and dashpot of a multiple-arc lamp, and is connected to the lighting circuit. The relay connection is made to avoid the grounding of the circuit on each stroke.

The compressed air used in the plant is furnished from the large central compressing plant. The shafting, conveyers, etc., are run by a 50-h.p. 2300-volt induction motor belted to the main drive. The installation includes two complete outfits as described and is treating at present 3640 drills daily, an average of three per minute per outfit. This can be increased to six per minute per machine if occasion demands. Considering 150 drills per day for a sharpener and helper as a good average by the hand method, it will be seen that a great saving is being effected.

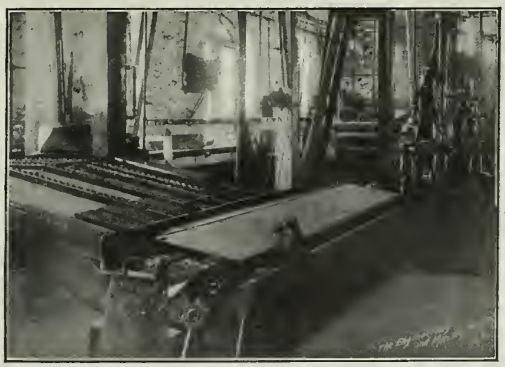


HEATING FORGE, SHARPENER, UPSETTER AND WESTINGHOUSE AIR PUMP



DRILL CASES AND ARRANGEMENT FOR HANDLING

UPSETTER, SHARPENER AND HEATING FORGE



TEMPERING FORGE, SIZER AND FLUTER

Magnesite in India

In a paper on the Indian magnesite industry, read before the Society of Chemical Industry, H. H. Dains describes the work carried on at the principal deposits lying in the Chalk hills, near Salem, in the Madras presidency. The magnesite covers a superficial area of about 2000 acres and occurs in numerous irregular veins which ramify an ultrabasic intrusion of eruptive rock called dunite, a mineral consisting essentially of magnesium orthosilicate. Generally the magnesite is nearly white; it has a specific gravity of 3, and a hardness of about 5. Shipments of the mineral recently made show from 96 to 97 per cent. magnesium carbonate, with an exceptionally low content of lime, silica, alumina and oxide of iron. A modern calcining plant for the production of caustic and "dead-burned" magnesia has been erected near the quarries. The material ultimately finds employment in the manufacture of refractory bricks for basic furnaces, artificial stone, flooring, fireproof partitions, and many other stoneware productions.

The town of Vallecas, Spain, according to *Stone*, May, 1909, is built almost entirely of meerschaum. Vallecas has on its outskirts great quarries of meerschaum too coarse for pipe making, and a meerschaum-built town is the result. In Morocco meerschaum is so plentiful that they use it, when soft and fresh, for soap. It gives a plentiful and cleansing lather. Ekdischehr, in Asia Minor, supplies the world's meerschaum. There are 2000 mines, large and small, and 8000 Kurd and Persian meerschaum miners work day and night in them. This meerschaum comes from the earth yellow and turns white after 10 days' bleaching in the sun.

Suction Gas and Its Application to Mining

Prejudice against This Type of Power Generator Is Being Overcome. Test of Plant Installed at Threlkeld Mines, Cumberland, England

BY GEORGE D. STEPHEN*

In no branch of applied science has the introduction of suction gas met with greater success than in modern mining practice. Mining men generally are somewhat prejudiced against power gas on account of its unreliability. In spite of this its popularity increases day by day, chiefly owing to its cheapness and efficiency. As regards reliability, there is no doubt that for small sizes, suction-gas engines and producers compare favorably with steam engines; for large sizes the balance of favor in this respect lies with the steam engine. This will be more apparent when the starting of large suction engines is discussed. For mining and quarrying purposes, suction-gas plants made by both English and Continental makers are to be found in almost every country in the world, performing different classes of work.

Installation in Cumberland, England

The gas plant at Threlkeld mines, Cumberland, England, was built by Crossley Brothers. It consists of two generators and engines. Gas pipes are 10-in. diameter, fitted with stop valves so that one or both engines may work off either generator and convey the gas a distance of 20 to 30 ft. to the engines.

The engines, 100 h.p., are each directly coupled by a flexible coupling to 60-kw. direct-current generating sets, running at 200 r.p.m. in parallel, and supplying the same mains. The starting arrangement consists of a small pump by which petrol vapor is pumped into the engine cylinder and subsequently ignited. Scotch anthracite in the form of peas ½ to 1 in., is used in the producer. The coal is fed into the producer by means of a storage hopper and feeder, from which it reaches the working level of the fire by gravitation; this arrangement causes the incandescent part of the fire to be constantly fed with warm dry fuel. The feeder and hopper are so designed that the fuel can be introduced into the furnace without at the same time introducing air.

The Producer

The producer, similar to the one shown in the accompanying illustration, consists of a cylindrical metal shell, with angle-iron stays and is lined on the inside with firebrick separated from the outside metal skin by a coating of sand. The firebrick lining rests on a metal ring supported on two cast-iron boxes, termed superheaters, placed at the hottest part of the fire and mounted on a flat plate carried right across the producer. The fire bars rest in a hole in the center of this plate. In this way a pit is formed immediately below the grate, and in this pit the steam and air used in gas making mix before passing together through the fire. The life of the firebrick lining depends upon the quality of the brick, but may be taken at about six or nine months. Around the cylindrical bell, defining the depth of the fuel in the producer, is the saturator or boiler *B*. In the bottom of the saturator, warm water is kept at a definite level by means of an overflow pipe *P*. The saturator takes the form of a flat dish extending to the outer shell of the generator, and has a series of baffle plates on its under surface which form passages, through which the hot gases pass, giving up heat to the water on their way to the scrubbers. This is the application of the principle of regeneration and accounts for the great economy effected, for it is clear that the requisite steam is raised in the saturator by extracting the heat from the gas as it passes from the fire to the coke scrubbers.

Course of the Air

The air is admitted through what are known as the primary and secondary supplies. The primary air, which consists of air only, is admitted direct to the closed space under the fire grate by way of the starting fan. The secondary air, drawn through the air regulator, passes over the surface of the water in the saturator, absorbs water vapor, passes by way of vertical pipes (marked steam pipe in figure) embedded in the packing of the furnace, thence passing through superheaters to the closed chamber under the fire grate, where it is mixed with the primary air from the fan inlet before entering the fire. The gas is led off by a pipe *E* to the scrubbers, where it is cooled and washed before being used in the engine. A dust collector is sometimes interposed between the producer and the scrubbers, a pipe from the bottom of the collector carrying dust from the gas pipe into the water of the seal box *F*. A blowoff cock is fitted through which the inferior gas passes when starting up the generator.

The seal box also acts as a safety device, for, if an explosion were to take place, the water seal would blow out.

Scrubbers

The scrubbers consist of cylindrical vessels of wrought iron filled with coke, each provided on the top with a water spray; the water trickles through the coke, cools the gas, and increases its density and capacity for doing work. Two scrubbers are attached to each generator, for if the gas is not sufficiently cooled, water vapor is carried over into the gas mains, which usually gives a damp sparking plug. A sawdust scrubber is sometimes provided to remove any trace of tar from the gas, tar being objectionable for the continuous running of gas engines, as it clogs the valves and causes undue stoppage for cleaning.

Working on Light Loads

One difficulty experienced when working on a light load is that the reduced number of strokes made with the gas valve open may not draw enough air to keep the fire in active condition so that full load may be thrown on at any time. To overcome this difficulty a bypass is fitted between the gas pipe and the mixing chamber so that during each suction stroke of the engine a small quantity of gas passes into the mixing chamber and a small quantity of air is drawn through the producer fire. This quantity of gas is not sufficient to form an explosive mixture and so the exhaust from the engine contains a small percentage of gas. This bypass is a very convenient arrangement, but for ordinary conditions prevailing at a mine, experience has shown that the coal consumption is considerably greater and in a few cases the device has been discarded. At the Threlkeld mine the suction-gas plant runs on a light load during the night, pumping water from a shaft and no difficulty is found in maintaining the quality of the gas when no bypass is fitted.

On a light load another difficulty must be overcome. When the governor cuts out a number of charges, steam continues to be generated which fills the steam space and causes the charge to be exceedingly inflammable. The fire is cooled by the production of this charge, and when the temporary richness has passed off, the gas produced at a lower temperature is of a poorer quality. In the Threlkeld plant this difficulty is surmounted by allowing

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the steam to escape at light loads through one or more cocks opening from the air-space in the saturator into the open air.

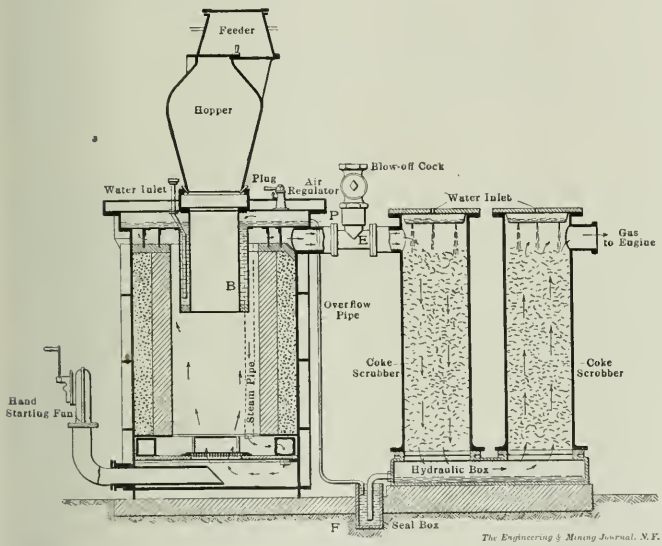
Starting the Plant

After the fire is lighted, air is forced underneath the grate by means of a fan, worked by hand or a small motor; this air escapes through the blowoff valve. Blowing is continued for 15 or 20 minutes when the blowoff valve is closed and the gas tested at the engine test cocks; if it maintains itself alight, giving a long blue flame, it is of good quality for use in the cylinders. With a small engine a turn or two at the flywheel is usually sufficient to start it, but with larger sizes some other means must be adopted, such as the use of compressed air, petrol, etc

At the Threlkeld mine some difficulty has been found in starting the engines As no compressed air is available, petrol vapor is pumped into the engine cylinder and ignited. This gives the engine a "kick off;" the gas is turned on at the engine and if the sparking arrangement is in good order, the engine invariably starts. Moisture in the gas pipes is a source of annoyance, as it destroys the regularity of the sparking, and it has been found advisable to adopt a high-tension pump spark for starting and, when well started, to use the magneto.

When working two engines off one generator the difficulty of starting the engine farther away from the producer is increased. The gas has to be shut off from one of the engines before the other can be started, and if the former is heavily loaded it soon slows down.

As far as can be seen, it appears that the engine to be started must attain a certain piston speed before it can draw gas from the generator and this speed cannot be obtained by petrol, but by compressed air only, which is costly to obtain unless already in use at the mine. The management has, however, adopted a rather novel method of starting, by converting one of the d.c. dynamos into a motor until the required speed is obtained when it is again converted into a generator. As the two compound-wound machines have to run in parallel and supply the same mains, a number of switches are required, which method introduces complications difficult to understand by unskilled labor and in this respect is disadvantageous. One point in favor of this method is that any defect in the sparking or in the working of the engine can be easily detected, while the engine is running without any gas.



PRODUCER PLANT SIMILAR TO THE ONE INSTALLED AT THRELKELD MINES, CUMBERLAND

Fuel Consumption

The guarantee made by most makers is, that under ordinary working conditions the full consumption, using anthracite coal, shall be under 1 lb. per b.h.p.-hour. Compared with a steam plant the cost of attending to a suction plant is small, as the generator is charged only every four hours; the time required to clear the fire and recharge occupies only five minutes. The "stand-by" loss for a suction plant is very much less than for a steam plant and for generation of electricity full load can be put on in a few minutes from a "stand-by" generator.

Perhaps the perfection of electrical winding will be a stepping stone to the extensive application of electricity and the general disuse of steam power. And it is by the introduction of suction gas or some form of power gas for the production of electricity that collieries and metal mines will benefit. Suction-gas plants seem to be well adapted for the development of metal mines in inaccessible districts, where water power is unavailable, and where the transport of a large supply of coal, such as is required by steam engines, is the determining factor between success and failure.

Test Plant at Threlkeld Mine

The object of the test was to determine the coal consumption under the varying working loads, due to winding and pumping by electricity. The installation had been in commission almost a year at the time of the test.

After the klinkers were removed, the producer was filled up to the level of the hopper and at the end of the trial the klinkers were again removed and coal filled in to the predetermined level, so that complete accuracy was insured in measuring the fuel. The coal was weighed by a spring balance which was previously checked by standard weights. The gas engine was directly coupled by a flexible coupling to a d.c. 6-pole compound-wound dynamo of 60 kw. capacity at 200 revolutions per minute.

Following is a summary of the test:

Duration of test, 4 hours; total quantity of coal consumed, 250 lb.; average consumption of coal per hour, 62.5 lb.; average dynamo load in kw.-hours, 40.1; average b.h.p. of engine, 63.26; fuel per kw.-hour, 1.56 lb.; fuel per B.h.p.-hour, 0.986 lb.; cost of Scotch anthracite, 22s. per ton; cost of fuel per kw.-hour, 0.184d.; cost of fuel per B.h.p.-hour, 0.116d.; total klinker and ash, 25.5 lb.; efficiency of dynamo at two-thirds load, 85 per cent.

Thermal efficiencies:

$$\frac{\textit{Electrical energy at terminals}}{\textit{B.t.u. in fuel}} = 16.25 \text{ per cent.}$$

$$\frac{\textit{B.h.p. energy}}{\textit{B.t.u. in fuel}} = 19.2 \text{ per cent.}$$

Following is an analysis of a sample of Scotch anthracite used: Ash, 4.23 per cent.; moisture, 2.11 per cent.; volatile matter, 9.59 per cent.; fixed carbon, 84.07 per cent. The calorific value of this coal was 13.556 B.t.u. per pound, and 7531 calories per kilogram.

Crushed steel is used as an abrasive. It is produced by one concern only in the United States.

Freighting Ore with Big String Teams

By George C. McFarlane*

In no other section of the country is the art of driving horses and mules in long teams as well developed as in the outlying camps of southern California. The California practice could be imitated to advantage in many mining sections, where a long wagon haul is necessary to get in supplies and haul out ore and concentrates to the railroad.

At first the practice of freighting with big teams was confined to the comparatively level valley and desert sections, where it was not difficult to herd a long string of stock along the straight level roads. Gradually, however, the little details of handling the stock and fitting out the ore wagons and rigging have been perfected, until now 12- and up to 20-horse teams are worked by one driver on mountain roads, where an inexpeienced driver might have difficulty in handling a team of fours.

Hauling Borax in Ventura County

The borax haul from the mines in Ventura county to the railroad station at Bakersfield is a good example of cheap wagon transportation over difficult roads and under rather unfavorable conditions. From the mines on the south slope of Mt. Pinos to the railroad station is 65 miles by road. Leaving the mines the road follows through the foot-hills for 10 miles, then climbs the divide and skirts along the range to the head of the Tejon cañon, follows down the cañon to the San Joaquin valley, thence across 35 miles of sand and adobe plain to Bakersfield.

The freight rates over this road vary from $10 to $12 per ton for outgoing borate, and from $6 to $10 for incoming machinery and supplies. The freight rates vary with the price of hay and barley. In favorable years a good deal of feed is raised in the little mountain valleys along the road; in dry years the ranchers have no surplus to sell and all the feed must be hauled from the railroad station and distributed at way stations on the inbound trip. In laying out a road for this class of traffic considerable attention should be paid to curves, particularly where they are on steep grades; on straight stretches or on moderate curves, grades are not so important, as on heavy grades the driver can drop the trail wagons and pull them separately.

On fairly level stretches curves of 30 ft. radius are permissible. On these sharp curves the grade should be widened to about 18 ft. so that the pointers of the team may have a chance to work. It is good policy to have most of the curves of over 200 ft. radius; then the driver can keep things moving without continually putting the pointers over the chain.

On the Ventura borax road few of the grades exceed 8 per cent., although there are two or three short stretches of 12 per cent. grade. The teams will handle the full load on grades up to 8 per cent.; when the grades are steeper than this the trails are dropped and the load pulled in two sections.

After heavy rains parts of the road get heavy; at times the big lead wagons will go down in an adobe mudhole and stick so hard that it takes 30 head of stock to pull it out. During three months of the rainy season proper no attempt is made to send out regular teams and most of the stock is turned out to pasture in the valley. Before the present depression in the borax trade about 500 head of stock were kept on the road hauling ore by the two mines in Ventura county. The teams ranged in size from 10 to 18 head; occasionally 20- and 22-horse teams were put over the road. Fourteen-animal teams seemed to have the best success on this road, larger teams requiring exceptionally skilful drivers to handle them on the sharp curves and heavy grades of the mountain section of the road. The stock used on this road is about equally divided between mules and horses; some of the teams are straight mule teams, others are all horses, while the greater number are mixed mule and horse teams. As a rule the mules are lighter than horses and will not pull as many pounds of ore as an equal number of horses; they require just as much feed in proportion to their size as a horse, but require less care and attention. Horses, on account of their size, make the best wheelers and generally make good line leaders; mules, however, work better as pointers, being very quick and nimble in skipping over the chain on curves.

A Freight Outfit

A 14-animal freight outfit will consist of three wagons and a two-wheel feed cart, and will haul from 12 to 14 tons of ore; about 6 tons in the lead wagon, 4 tons in the first trailer, and 3 tons in the second. The lead wagon will have 2⅝-in. square steel axles, 7-in. tires and will be fitted with strong double brakes; the ore-bed being 2-in. plank strongly ironed. The sides are usually flashed with sheet iron and the bottom covered with dump boards laid crosswise. Through bolts run under the dump boards the full length of the box, and before any ore is loaded these bolts are tightened up to hold the dump boards close together to prevent the fines from sifting through. The running gear of a wagon of this size will cost about $300 and the ore bed $75 to $100. The trailers are smaller editions of the lead wagon and are fitted with single brakes, the lead wagon brakes being set with a long lever. A strap runs from this lever and is snapped to the saddle of the wheel horse, the brake being controlled entirely by the pull of the driver on the strap. The first trail-brake handle sets in a quadrant with a patent dog, and a small line runs from the handle of this brake to the driver. By pulling up on this line and quickly slacking off, the brake is set and dogged, by pulling up and slacking off slowly the brake is released. The hind trail-wagon brake is used only on heavy grades and in these cases the driver goes back and sets it just before the grade is reached. For convenience in coupling together the trail wagons are fitted with a short sliding draw-head; a horn or tail piece projects out about 2 ft. from the hind axle of the lead wagon to receive the draw-head. In going around a sharp curve this tail piece swings out laterally with the short tongue of the trailer and causes it to track the lead wagon instead of cutting across on a chord of the curve.

The draw chain consists of a number of eye-bars connected by short links, with slip shackles at every third stretcher. It is fastened to the hind axle of the lead wagon, passes through a stirrup under the front axle and a loop under the tongue. All the animals except the wheelers are hitched to stretchers attached to the draw chain. With a 14-animal team it would be necessary to have two or possibly three sets of pointers; the pointers are hitched on in front of the wheelers and are free to swing from side to side or jump across the chain. All the other pairs up to the leaders are hitched to the stretcher immediately in front of them; with them it is simply a game of follow the leader, and the only way they can get tangled up is by the leader's slacking up.

Handling the Team

In handling the team the driver rides the left-hand wheeler, holding the brake strap over his left shoulder with the left hand and guiding the team with a jerk line held in the right hand. The two leaders are fastened together with a jockey stick and the line passes back from the bridle of the near leader through loops in the bridles of the swing animals to the driver, not being fastened to the pointers in any way. The line leader is guided more often by words than by the line; on gentle curves the outer pointers are called by name and they swing around sideways to the chain and single point. On sharp curves the pointers on the inside of the turn are put over the chain by flipping the jerk line over them, striking them on the side of the head

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opposite to the way they are wanted to jump; as soon as they are over the chain the pointers pull off at an angle—on very sharp turns almost at right angles.

With three pairs of pointers working in this way, I saw a 16-horse team with three ore wagons and a feed cart turn around in a road 60 ft. wide. In making up a big team it is necessary to have a trained line leader and at least one set of well-broken pointers; the rest of the stock need not be accustomed to working in big teams. For the first couple of trips a green team will have to be loaded light and one or two swampers must be in attendance. The swampers club the pointers over the chain on the turns and handle the brakes on the bad turns and heavy grades. In two or three weeks a good driver will have the team trained so he can handle it alone.

Unlike the freighters in Montana and Idaho, who can turn the stock out at night to rustle most of their feed on the range, the borax haulers have to buy all feed, and instead of timothy and oats, they have to be satisfied with wheat, hay and barley, and pay big prices for it besides. Even with this handicap, they are wagon freighting cheaper than in any place in the country and the teamsters are paid the highest wages, i.e., $100 a month and expenses and more. Even the big oil-burning traction engines have not been able as yet to freight as cheap as the long-line skinners.

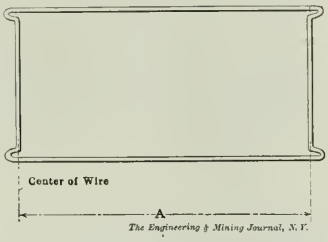
To get the best results, it is necessary to get the best wagons and equipment and keep them right up in shape all the time. As soon as the wagons and stock begin to run down, they must be replaced by new ones. In figuring out freighting costs, the companies consider that a freight outfit lasts four years, so that after an outfit was run two years it can be sold to ranchers for about half of its original cost. In general, all freighters figure on selling and trading their horses and wagons and getting new ones as often as possible, for it does not pay to keep a poor outfit on the road. For the same reason only the most careful and skilful teamsters are employed and once a man has established a reputation he can generally command his own price. The monthly expense of keeping a 14-horse team on the road averaged in 1907 about as follows: Wages of driver, $100; board and road expenses of driver, $35; shoeing the stock, $32; wagon repairs, tire-setting, etc., $25; feed (5 tons wheat hay at $12), $60; 4 tons of rolled barley at $32, $128; total, $380.

A complete 14-animal freight outfit costs in California from $3500 to $4000, and since it lasts only four years, the monthly depreciation would be about $80. This, added to the running expense, makes the total monthly cost $460. On an average the 14-animal teams hauled out 41.2 tons of borate ore and 6 tons of inbound freight, a total of 47.2 tons. This makes the actual cost of hauling a ton 65 miles, $9.75.

A Balloon Survey

By Walter S. Weeks*

The difficulty and inconvenience of measuring the hight of the back in high stopes by means of swaying rods led me to try the use of balloons for that purpose. During the summer of 1908 the method was given a trial at the Harvard summer school of mining at South Strafford, Vt. The scheme was successful. The idea was to let the balloon, to which a thread was fastened, rise to the back of the stope and then to measure the length of the thread between the bottom of the balloon and the floor. This length plus the diameter of the balloon gave the hight of the stope. The thread was measured by



SKETCH OF REEL. 2 × A + CIRCUMFERENCE OF WIRE = 2 FEET

winding it upon a reel of known size, and counting the number of turns.

The following is a description of the outfit necessary for the work: The balloons are the ordinary toy variety costing 5c. each. They are purchased uninflated and are filled with hydrogen gas when they are to be used. The hydrogen gas can be obtained from dealers in chemicals. It costs 5c. per cu.ft. It can be purchased in cylinders holding 50 cu.ft. The gas in the cylinder is at such a pressure that it will easily inflate the balloons. The choice of the thread which holds the balloon is very important. One balloon will lift but a small amount of ordinary cotton string. The proper thread to use is No. 100 glacé thread. This is light and very strong. A well inflated balloon will lift 70 ft. of this thread.

The measuring reel is made of heavy wire. A convenient size for the reel is such that one complete turn is equal to 2 ft. A sketch of the reel is seen in the accompanying illustration. A reel with a spindle was tried but was found to be inferior to the simple reel shown. It is necessary to follow the course of the balloon with a light of some sort. For this purpose a good acetylene bicycle lamp will answer. The round, shiny surface of the balloon catches and reflects the rays of the light so that the balloon can be seen when it is many feet in the air.

Preparing and Handling the Balloon

Stretch the neck of the balloon over the nozzle of the hydrogen cylinder. Hold the balloon securely while the gas is gently turned on. Inflate the balloon until it is about 10 in. in diameter. Tie a piece of soft cotton string about the neck of the balloon and remove it from the nozzle. Stretch the neck, double it back and tie again. Cut off all loose ends of the string to avoid weight. Fine thread cannot be used for securing the neck, as it cuts the rubber.

Attach the balloon to thread that is wound on the reel. Take the balloon beneath the back to be measured and allow it to ascend. When it has reached the back, unwind the thread until the reel can touch the floor directly beneath the balloon. Now hold the reel firmly in the left hand, and with the right pull down the balloon and wind up the thread, carefully counting the number of turns. The length of the thread plus the diameter of the balloon equals the hight of the stope.

If the stope is windy, let the balloon up to the back and it will soon catch in some irregularity. Then walk under the balloon and measure. If the stope is inclined it will be found that the balloon will work up along the hanging wall. The dip of the thread can be taken with a clinometer and the slope distance converted into the vertical distance. By stretching a tape between survey stations and taking balloon measurements every few feet, an accurate contour of the back can be obtained.

Powder smoke should be blown out of the stope before any high measurements are attempted as the balloon can be seen only a short distance through the smoke. Lighted candles should be kept away from the balloon as the hydrogen explodes with some violence when ignited. Keep balloons as dry as possible as drops of water add weight.

Balloons will remain inflated about two hours. It is not worth while trying to reinflate them. If one balloon will not carry the thread to the required hight, put on another one.

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A new development in the alloying of aluminum with other metals (*The Metal Industry*, May, 1909) has just been accomplished by the production of "silverite." This metal is something entirely new and is composed of a mixture of aluminum, copper, zinc and steel in varying proportions according to the requirements. The resulting metal has a specific gravity of 3.1, a tensile strength of from 40,000 to 45,000 lb. per sq.in., and a compression resistance of 100,000 pounds.

Pyrite Smelting by Knudsen Method in Norway

When Sulphide Ore Is Roasted, Using Heavy Air Current, It Partially Melts, and Pure Metallic Sulphide Gathers on the Hearth

BY E. KNUDSEN*

Much time and much money have been spent on the problem of pyrite smelting, and but slow progress has been made. This may partly have depended on the diversity of ore, necessitating different treatments; what is suitable for one ore may not be applicable for another. In the development of the Knudsen process at Sulitjelma, Norway, this was well observed, for experiments with very different ores were made during the course of the year and furnished a good guide.

Outline of Method

The Knudsen process depends on the fact that when sulphide ores are roasted under the influence of a powerful air current the ore melts partially, and the pure metallic sulphide flows out and gathers on the hearth of the furnace. The construction of the furnace is shown in Fig. 1. The idea is to accumulate a small bath of melted ore as soon as possible by means of the air blast; by the production of a strong oxidation in this bath a very high temperature is produced which then acts on the remainder of the charge.

The temperature attained in this process is so high that sulphide ore, even rich in silica, becomes entirely fluid. The tremendous heat, particularly in the last period of the concentration, renders it necessary to employ very thick linings of refractory material. The heat remaining in the furnace after the matte and the slag are removed is sufficient to kindle the new charge. The amount of coke or coal employed is very small, ranging from 0.5 to 1.5 per cent. of the weight of the ore, according to the nature of the latter. This quantity of coke is not particularly necessary for carrying out the process, but it serves to hinder the stiffening of the first, small, metal bath by the blast. The introduction of the air plays an important part in the process.

To charge the furnace, the estimated quantity of coke or coal is first introduced; this is then subjected to a strong air blast, whereby the fuel becomes red hot. The upper half of the furnace is connected with the hopper, which is then opened, and the charge falls into the furnace. The air blast is then maintained at a pressure of about 5 lb., the tuyere being well cleaned so that it does not form a nose. When the bath of melted iron sulphide reaches the tuyere, the air pressure is increased to 10, 15 and even 22 lb. in some cases. In from 1½ to 2 hours, the whole charge is ordinarily melted and concentration begins; in from 3½ to 4 hours a matte is ready, containing from 40 to 50 per cent. of copper. The furnace is then tipped horizontally and the contents poured out into the forehearth.

Experience at Sulitjelma

It is now six years since the first experiments on a large scale were made at Sulitjelma and progress is slowly but surely being attained. At first a furnace of about 7 tons capacity was erected; then one to treat 10 to 12 tons, and finally one that had a capacity of from 15 to 20 tons. When I say 10 to 12 and 15 to 20 tons, the reason for this is that the ores are not of the same bulk, on which account it would be more correct to state the furnace size in terms of its interior volume, e.g., 6 cu.m. and 10 cu. meters.

The durability of the furnace can be seen in the following statement: The small furnace, in the period from Feb. 18, 1907, to April 9, 1908, made nine runs which, while they treated different tonnages, still showed an increasing duration.

The larger furnace generally gave a longer run, apparently in proportion to its capacity, and it required less repair. The big furnace permitted 179 to 202, and even up to 459 charges per run. While the smaller furnace required for repairs approximately 1½ magnesite brick per ton of ore, the maintenance of the large furnace needed only one brick per ton. It is to be remarked that after removal the old brick were crushed and used for lining the hearth in the slag receptacle.

DURABILITY OF FURNACE.

Run.	Magnesite Brick Used in Repairing Furnace.	Number of. Charges.	Tonnage Smelted.
1	2,184	81	734.4
2	1,456	139	1,399.8
3	1,880	96	942.1
4	1,220	86	859.7
5	1,975	70	628.4
6	1,522	109	1,013.8
7	1,960	218	1,733.7
8	2,150	189	1,407.4
9	2,076	124	1,000.8

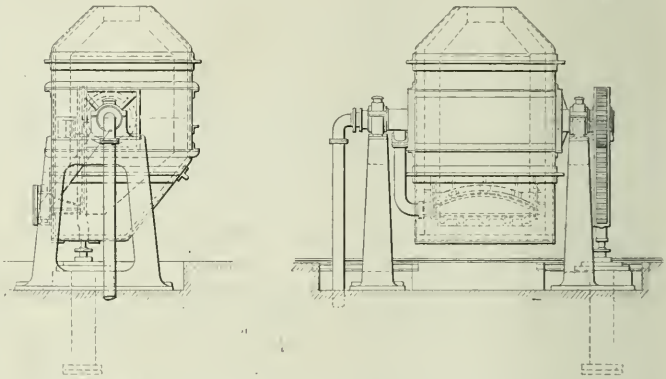

FIG. 1. KUNDSEN FURNACE OF 8 TO 10 TONS CAPACITY

This represents the furnace as first constructed by the author. At present larger furnaces are used of a modified form which have been found more satisfactory.

Nature of Ores Smelted

The ores of Sulitjelma may be divided in two classes: Pure silicious ore and ore that is partially chloritized. The average analyses of each class are given in the accompanying table.

ANALYSES OF SULITJELMA ORES.

	Silicious.		Chloritized.	
Copper	6 47%	6 45%	5 15%	5 11%
Iron	32 74	32 90	25 64	27.10
Sulphur	33 87	39 90	22 64	25.30
Silica	16 75	16 20	31.38	26.30
Alumina	10 17	8 50	12.21	12.20

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NOTE—From advance sheets of "The Mineral Industry, Vol. XVII.

Our experience has shown that when a silicious ore is smelted, an easily fusible slag results, which, on being retained for about 20 min. in the horizontally placed furnace, gives a slag containing only from 0.5 to 0.6 per cent. copper. When, however, a large quantity of the chloritized ore is treated, the slag becomes thick and must be held for a longer time in order to separate completely the particles of matte blown into it by the blast. For this purpose a forehearth is provided into which the charge is poured and allowed to remain for about 90 min., after which the slag is run off and granulated while the matte is tapped into a Manhés converter.

COPPER-BESSEMERIZING

Certain other ores had the disadvantage of decrepitating, which caused the charge to fall into a more or less powdery state, and then fuse together. If a considerable part of the charge should then fall into the molten bath at once, sharp explosions would occur, which, to the uninitiated, would seem dangerous; the only damage, however, was the freezing of the bath, if the falling mass of charge were too large. Whenever this accident occurred, we would tip the furnace to the horizontal and put a few kilograms of coke and 200 to 400 kg. of crude ore in range of the tuyeres; on replacing the furnace vertically and turning on the blast, the charge would again become normal. We have, in fact, smelted charges consisting of one-third lump ore, one-third fine ore and one-third dust, with success, but when so much fine material is introduced into the furnace the charge is bound to sinter somewhat.

We also experimented with slimes from the Elmore vacuum process, briquetted for smelting, with excellent results. The Elmore slimes were mixed with 4 per cent. of milk of lime, pressed with a primitive ramming apparatus, and placed for 12 hours in a drying chamber. The briquettes were thereby rendered so firm that they withstood the hardest knocks, and did not fall apart when introduced into the Knudsen furnace. In 2½ hours of smelting a matte was obtained with 38.5 per cent. copper. When much fine ore has to be treated, it is best to divide it, taking the smaller portion to make into briquettes, drying but not burning them, before putting them into the furnace. This insures a quiet operation without unpleasant disturbances.

THE KNUDSEN FURNACE (20 TONS) DURING THE SMELTING OF THE CHARGE

We have smelted ores high in silica and low in sulphur and iron, for example, with 20 to 21 per cent. of sulphur, 32 per cent. of iron and 40 per cent. of silica. These ores smelted satisfactorily and gave a clean slag, but they were hard to kindle on account of the small amount of sulphur in them; this fact required the addition of 2 per cent. of coal and coke, but as soon as the bath of iron sulphide came in front of the tuyeres the oxidation of the iron furnished the necessary heat.

Experimental Results

The composition of the matte during these experiments ranged from 45 to 56 per cent. copper, and the slags of a number of charges contained, respectively, amounts of copper and silica shown in the accompanying table. If the matte and slag be allowed to remain for a time on the hearth, and it has been indicated that a duration of 1 to 1½ hours is best, the matte particles can then be successfully separated. It is advantageous to place some pulverized, pure silicious ore on the hearth in order to render the slag cleaner. It also has a good effect on the matte, which is sometimes produced too profusely if it has formed a crust on the walls, and for this reason has had to be tapped more slowly. A matte with 65 to 70 per cent. of copper might be obtained, which, however, is not well adapted for the Manhés converter; by adding this raw ore, the copper contents can be brought down to 55 or 60 per cent., which can then be bessemerized very well.

Composition of the Slag

As previously stated, the fluidity of the slag is the deciding factor. With a well-

acting furnace and with ores giving an easily fusible slag, no forehearth was found to be necessary. But in metallurgical processes things so often take place unexpectedly, that I do not consider it advisable to work without the forehearth.

SLAG ANALYSES.

Copper.	Silica.	Copper.	Silica.	Copper.	Silica.	Copper.	Silica.
0.52%	34.46%	0.48%	34 47%	0.53%	34.97%	0.46%	32.00%
0.61	36 91	0.40	34.35	0.63	33.66	0 42	31.49
0.49	37 68	0.38	35.35	0.65	32.56	. .	. .

The slags at Sulitjelma are commonly monosilicates, with from 28 to 32 per cent. silica, 56 to 59 per cent. iron oxide, 10 to 12 per cent. of alumina, about 1.5 per cent. sulphur, and from 0.3 to 0.6 per cent. of copper.

Experiments were made by allowing the slag to flow into large iron pots, and fine results were obtained for a day at a time, until suddenly the slag would become thicker, and the separation of matte particles would be incomplete. Such surprises do not occur in a forehearth heated by generator gas. I have observed that slags with 32 to 36 per cent. silica carry the least amount of copper. We have had slags that, on being granulated, contained only 0.29 per cent., but ordinarily they varied from 0.4 to 0.6 per cent. in copper.

Composition of the Matte

The matte ordinarily produced at Sulitjelma has a copper content of 50 to 55 per cent. and contains 20 to 21 per cent. of sulphur. After tapping into the converter, the first hour's treatment produces a copper 99.25 to 99.5 per cent. pure The copper contains some silver.

The greatest difficulty of the process, when conducted in a small furnace, is to secure a matte which shall not vary too widely from the average. Wall accretions are more likely to occur, involving a longer blowing; and, thereby, a richer matte unsuited for the Manhés converter. With a large furnace, this last difficulty is less pronounced since the charge sinks regularly and permits the formation of a matte with any desired copper content. With charges low in iron, it is important not to blow too long, making a matte high in copper, since there is danger of freezing the charge.

When the charge has been sufficiently blown, the furnace is emptied at once, and after a few minutes the matte runs into the converter. We have often made a finished bessemer copper within 5 hours after charging the furnace, and sometimes within 4½ hours.

Lining of the Furnace

The durability of the lining depends altogether on its construction. The magnesite brick must be closely united, so that the joints are reduced to a minimum, and special mortar must be used. The fragments of the brick from the lower part of the furnace are used partly for repairing the upper part when necessary (which is not often), and some are broken up for lining the forehearth. Magnesite is especially necessary for the lower part of the furnace, up to 1.25 m. above the tuyere. It is the back of the furnace that suffers most. We have, for example, repaired the large furnace twice, above the tuyere, with 600 to 800 brick, and with these two small repairs have smelted 9000 tons of ore. The magnesite mortar is mixed with tar and applied very warm.

GRANULATING THE SLAG

Air Blast

The blast pressure is variable, ranging from ¼ to 1 atmosphere, and often to 1 1/3 to 1½ atmosphere. A good deal depends on this as to how the charge starts. When care is exercised in the beginning, and not too much air is given during the first hour, a charge will generally settle down in a regular manner, and will then work well with a pressure of one atmosphere When the charge hangs back and crusts are formed, it is necessary to use a higher pressure, whereby the melted bath is strongly agitated and the crusts go into solution.

The power necessary for blowing a Knudsen furnace, of about 12 cu.m. capacity, is as follows: In the first 1½ hours, not far from 40 h.p. is needed; in the next 1 to 1½ hours, 80 to 100 h.p., and in the last hour of the blast, 150 to 160 h.p., and in a few rare cases, 200 h.p. A furnace of 12 cu.m. capacity treats 20 to 25 tons of ore, and inasmuch as at least four charges in 24 hours can be reckoned, the power required is not large per ton of ore smelted, particularly as a pause of about 1 hour takes place between every two charges, for cleaning the furnace and burning the coke and coal, when practically no power is consumed. Having steam facilities, the feed water can profitably be warmed by gases given off from the furnace, as I have practically demonstrated.

Waste Gases

The gases given off in the beginning of the process are not very hot, but they soon increase in temperature; at a distance of 10 m. from the mouth of the furnace, we have measured, with a pyrometer, temperatures of 600 to 780 deg. C., toward the end of the process. The radiation from the lining of the furnace, after it has been emptied and again set upright, is so great that we have measured 180 deg. in the outlet channel distant 10 m. from the mouth of the furnace.

The percentage of sulphurous acid in the gas has often been determined. From the nature of the process, the percentage is somewhat variable, but the gases from a charge show an average between 6 and 7 per cent., by volume, of $SO_2 + SO_3$. The amount has been determined to be from 2½ to 11½ per cent. by volume, and was, in the last instance, 9 to 9½ per cent. dioxide and about 2 to 2½ per cent. trioxide.

Fuel

The coke and coal consumption depend on the cross-section of the lower part of the furnace, and not on the size of the charge. Thus if a 20-ton furnace be charged with only 12 or 14 tons, the same amount of coke must be used as though it were filled with 20 tons. As previously stated, with ores difficult to kindle the coke consumption rises to 2 per cent., while ordinarily it is less than 1 per cent.

For a charge of from 20 to 25 tons, there are required, per ton: 0.1 ton of coke; 0.1 ton of coal; 15 pieces of magnesite brick, to repair the furnace; and 20 pfennings (5c.) worth of tools, tar, etc. The heating of the forehearth also requires, per 24 hours, about 2¼ tons coal and ¼ ton wood. It is to be noted that one forehearth is sufficient for two or even for three Knudsen furnaces.

Labor Employed

The running of the Knudsen furnace requires two men per shift. These can attend to the charging, smelting, pouring out and also the cleaning. It is their duty to see that the charge is placed in the hopper over the furnace, ready for use, and that the coke and coal are on the grates. A foreman can easily look after two or three Knudsen furnaces. The generator and the forehearth can also be attended by two men per shift.

Cost of Operation

The cost of smelting with a plant of two furnaces of 20 tons each, and one forehearth, with a generator, at normal prices for labor and materials, is about three marks (74c.) per ton of ore smelted, for the Knudsen furnaces, and 0.70 mark (17c.) per ton for the management of the forehearth. Air compression is reckoned in, as are the chief repairs that are occasionally necessary to the hearth and the furnaces. In this statement, wages are reckoned at 5 and 4 marks per shift and the coke at 35 marks per 1000 kg., coal at 20 marks per 1000 kg., and magnesite bricks at 1 mark apiece.

It has been thoroughly proved that in the Knudsen process the loss of copper is less than in the former process of roasting and smelting of roasted ores in water jackets. This copper loss has been reduced by about 45 per cent. The smelter report, covering a run at Sulitjelma of over 115 charges, from Sept. 26 to Oct. 31, 1908, furnishes the following data: The ore charges varied from 8.3 to 15.4 tons, but were chiefly from 12 to 14 tons. The coke and coal used was 0.2 ton in practically every charge. The time required was from 2 hours, 35 min., to 6 hours, with an average in the neighborhood of 4 hours. In every case the charge stood for 1½ hours in the forehearth. In practically every case 0.5 ton of Elmore slimes was charged in the hearth. The copper in the slag from hearth ranged from 0.4 to 0.66 per cent. Copper in the matte ranged from 34.4 to 73.3 per cent. The majority ran from 40 to 60 per cent. The generators required from 2 to 2.5 tons of coal and from 0.25 to 0.35 tons of wood per charge.

During the last three years, all smelting ores in Sulitjelma have been treated in Knudsen furnaces. The rich slags, however, were smelted in a water jacket, but this practice will be discontinued. During 1907, at Sulitjelma, 10,141 tons of ore were smelted, and all of this in Knudsen furnaces. The cost was as follows, in Norwegian crowns ($0.27) per ton: Unloading, transportation and carrying of the ore, coke, etc., into the works, 0.73; lining the Knudsen furnaces, 1.69; smelting (including air compression), 1.48; repairs, etc., 0.48; total, 4.38. For 1908 the cost of smelting appeared to be less.

As previously explained, the small furnace is uneconomical, for it requires the same attendance as the large one, and the amount of combustible material is about the same. It is therefore advantageous to use the larger furnace and to connect two of them to one hearth, thus insuring a cheaper production per ton of smelted ore. Experiments on the smelting of pyrrhotite ores containing nickel are well under way; copper ores, also, containing zinc blende have been smelted to a matte without difficulty, and with good results.

THE MATTE IS TAPPED INTO MANHES CONVERTER

In selling iron and steel, says the Cleveland *Iron Trade Review*, the net ton—of 2000 lb.—is the most generally used, and where such is the case, basing quotations are on one or 100-lb. quantities, as for instance, 1.30c. Pittsburg per lb., or $1.30 per 100 lb. on plates, 1.15c. or $1.15 Pittsburg, on steel bars, etc. Most of the finished lines including plates, sheets, skelp, merchant bars, hoops, bands, shapes, tubular goods, wire, nails, etc., are sold at net tons. In tinplate the basing prices are on the 100-lb. box and in cotton ties, on the bundle. Fixed ton prices are the rule where products are sold on the 2240-lb. or gross-ton basis, which is the case with semi-finished steel, such as billets, sheetbars, slabs, wirerods, etc., muckbar and old material. Scrap, however, is sometimes sold by net tons and skelp is sometimes dealt in at gross tons. Rails are about the only finished product to which the gross ton applies.

The iron-ore deposits of the Briey basin in France were first opened in 1898. The first shipments were made in 1899, amounting to 102,131 metric tons. In 1905 the shipments reached 2,352,848 tons, and in 1908 they were 4,580,223 tons. The Briey ores are similar to the minette ores of Luxemburg. They average about 35 per cent. metallic iron and carry lime enough to make them self-fluxing. The percentage of phosphorus is too high for pig iron made from them to be used in the acid-steel process, but they make excellent basic pig.

Russian platinum exports in 1908 (*Chem. Trade Journ.*, April 17, 1909) amounted to 321 poods, valued at 9,658,000 rubles, as compared with 298 poods, valued at 6,930,000 rubles in 1907.

The Coal Dust Question in Great Britain

Reviewing Efforts of the Early Investigators, and Showing How Present Legislation Has Reduced the Number of Gas and Dust Explosions

BY HENRY HALL*

Notwithstanding the many practical demonstrations showing the explosive force of coal dust, the mining world has been very slow to acknowledge and accept the position as one that positively demands a radical change of existing methods of mining. For a period extending over 60 years, from about 1845 to the present time, many scientific experimenters have endeavored to convince practical miners that fine coal dust was as much to be dreaded and guarded against as firedamp itself, but it is only during the last 10 or 15 years that this view has become so generally accepted by those responsible for the safety of the workers in coal mines.

The earliest experimenters were content to point out that coal dust (dusty roads) augmented the force and intensity of firedamp explosions. Professor Faraday lecturing at the Royal Institution on the circumstance of an explosion at Haswell colliery in 1844, expressed his opinion of the disaster in the following words: "The ignition and explosion of the firedamp mixture would raise and then kindle the coal dust which is always pervading the passages, and these effects must in a moment have made that part of the mine which was the scene of the calamity, glow like a furnace."

In the same lecture, the following interesting paragraph appears, forecasting nearly the whole of the phenomena since proved to be actual and true: "In considering the extent of the fire from the moment of the explosion, it is not to be supposed that firedamp was its only fuel; the coal dust swept by the rush of wind and flame from the floor, roof and walls of the works would instantly take fire and burn if there were oxygen enough present in the air to support its combustion; we found the dust adhering to the faces of the pillars, props and walls, in the direction of and on the side toward the explosion, increasing gradually to a certain distance as we neared the place of ignition. This deposit was in some parts half an inch thick, in others almost an inch thick; it adhered together in a friable coked state. When examined chemically and compared with the powdered coal, it was found deprived of the greater proportion of the bitumen, and in some instances entirely destitute of it. There is every reason to believe that much coal gas was made from this dust, in the very air itself in the mine, by the flame of the firedamp which raised and swept it along, and much of the carbon of this dust remained unburned only from want of air."

Coal Dust Was Not Considered in Itself Explosive

This description of a coal-mine explosion in 1844 is quite consistent with the later knowledge gained on the subject, except that it takes no account of the fact, now established, that coal dust and air in certain proportions are capable of being exploded, and causing a disaster in the entire absence of firedamp. In 1844 and for several years afterward the part played by coal dust was held to be a simple aggravation of the firedamp explosion, merely adding fuel to the flame, an irresistible and natural conclusion, in the absence of knowledge of its explosive qualities.

During this period the coal mines were generally of no great depth, surface water percolating and keeping the stratifications wet, and any dust raised in the operation of coal-getting quickly became damp and innocuous. When deeper and dry seams had to be opened up, where in consequence of the greater depth the natural temperature of the strata was comparatively high, then the dust question became a serious one. In mines of this character, fine dry coal dust accumulated from day to day and was strewn by the traffic and ventilating currents throughout the whole of the galleries, adhering to, and remaining as a coating or covering on all projecting parts, and where no steps were taken for its removal, I have frequently seen it lying 6 or 8 in. thick along the sides of the main roads for considerable distances, while the lighter and finer particles were deposited in a substantial layer on both roof and sides. Passing along such roads, the sensation is that of walking on a velvet carpet. In an extended interval of time, there must be thousands of tons of this combustible material lying ready to be licked up by a passing firedamp explosion, or itself exploded in the absence of any firedamp by a blown out gunpowder shot.

This was the normal condition of the majority of British coal mines in 1872 and is still the condition of a large number in districts where the coal seams are soft and friable and the underground temperature high. It is remarkable that in the British act of Parliament for the

A COAL-DUST EXPLOSION IN THE EXPERIMENTAL SHAFT IN LANCASHIRE

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regulation of mines passed in 1872, no reference whatsoever is made to coal dust; indeed the word does not occur anywhere in the act. I mention this to show that the coal-dust question did not begin to assume any great importance until subsequent to that date, and no attempt had yet been made to alter or mitigate a condition of things which was generally prevalent in all the deeper mines in the Kingdom.

Explosions Killed 4098 Persons

Great colliery disasters attributed to the presence of firedamp continued to be of frequent occurrence. From the beginning of 1873 to the end of 1892, 4098 persons lost their lives in British coal mines by explosions, and the evidence given at the formal investigations of the circumstances of several of these accidents made it impossible to assign them to the agency of firedamp alone; their magnitude and extension throughout many miles of underground roadways could not be adequately explained on the firedamp theory alone. For some years it was the fashion to try to account for the immense development of force in colliery explosions, on the assumption that a sudden and unforeseen outburst of firedamp had occurred, inundating with explosive atmosphere more or less the whole area of the mine, or in other words that the occurrence was due to an "act of God." This theory failed to hold the field for long because there was an entire absence of any evidence of such a state of things existing, either immediately before, or after the event.

About the year 1875, William Galloway of Cardiff, who at that time held the position of a government inspector of mines, drew attention to the important part played by coal dust in so-called firedamp explosions. This gentleman pursued his inquiries and carried out many experiments and became an able and strenuous advocate of what has been termed "the coal-dust theory."

In a paper read before the Royal Society in 1876, Mr. Galloway stated: "A mixture of firedamp and air, in the proportion of one volume of the former to 112 of the latter, becomes inflammable at ordinary pressure and temperature, when charged with fine dry coal dust, such as that which is to be found on the roadways in dry coal mines."

This conclusion of Mr. Galloway's was confirmed by an elaborate series of experiments carried out under the direction of Sir Frederick Abel, assisted by Mr. Smethurst at a colliery near Wigan at the instance of a royal commission on mine accidents then sitting, and of which body Sir Frederick was a member. I witnessed many of these experiments and although they proved that an atmosphere contaminated with 2 per cent. of firedamp became explosive when it was mixed or carburetted with fine dry coal dust, the experiments were on so small a scale that the more important question, as to whether coal dust and air in the absence of firedamp was explosive was left untouched. The conclusion arrived at by Messrs. Abel and Smethurst is set forth in the following extract from their report:

"Some of these dusts when thickly suspended in air traveling at the velocity of 500 to 1000 ft. per min., and exposed to the action of a large flash of flame, as is produced by guncotton and blasting powder, exhibited a tendency not only to burn explosively in, or close around the flame, but also to propagate flame or cause it to travel along some distance; but the most decisive of the results were not of a nature to warrant the conclusion that flame could be carried along to a very great distance by coal dust in the complete absence of firedamp."

It is not to be wondered at, that a rapidly moving atmosphere made up of air containing 2 per cent. of methane, and intimately mixed with fine dry coal dust should be capable of being inflamed and burned with explosive violence by the intrusion of the flash and shock of a blown-out gunpowder shot, and it is clear that an atmosphere such as this, must frequently exist in parts of dry and dusty mines, where every freshly exposed coal face is constantly exuding firedamp.

Some of the Earlier Experiments

Every great disaster as it occurred gave rise to greater interest in the subject of coal dust and scientists renewed their endeavors to elucidate further the phenomena of colliery explosions. Experimental galleries were installed at considerable cost in Germany, France and England. The German experiments were carried out at Saarbrücken in 1884 by the Prussian Firedamp Commission. At the suggestion, and under the direction of Mr. Hill, one of its members, the gallery used was about 170 ft. long, with a sectional area of 22 ft. In one series of the experiments, dust and firedamp were used; in the second series, dust alone. Mr. Hill submitted certain conclusions as the result of these tests; among others of a less definite character, we find:

"1. The presence of coal dust in more or less abundance in the immediate vicinity of the working face, gives rise to more or less considerable elongation of the flame projected by a blown-out shot, whether small quantities of firedamp be present in the air or not.

"2a. In the complete absence of firedamp the elongation or propagation of flame is generally of a limited extent, however far the deposits of dust may extend in the mineways.

"b. There are, however, certain descriptions of coal dust, which if ignited by a blown-out shot, will not only continue to carry on the flame, even to distances extending considerably beyond the confines of the dust deposits, but will also give rise to explosive phenomena, in the *complete absence of any trace of firedamp*, which, in character and effects are similar to those produced with some other dusts in air containing 7 per cent. of firedamp."

In France in 1882, M. M. Mallard and Le Chatelier published the results of their inquiries into the part played by coal dust in mine accidents. Their researches seem to have led them to conclusions opposed in important respects to those of previous experimenters. They confidently maintained that no coal-mine accident of any importance could be attributed, even with some claim to probability, to the action of coal dust. They also maintained that all explosions of magnitude which have been solely attributed to coal dust have occurred *in mines in which firedamp occurs;* that the possibility of coal dust *per se* giving rise to an important explosion, could only be established by the occurrence of an explosion in a mine in which the total absence of firedamp could be absolutely demonstrated, and that the impossibility of dust alone giving rise to extensive explosions is demonstrated by the fact that lignite mines, which are generally very dusty, the dust being extremely inflammable, but which are at the same time almost free from firedamp, have never yet been visited by accidents of this class.

In England, a royal commission on accidents in mines (the late Sir Warrington Smythe was chairman) sat from 1876 to 1886, and in a report of the latter date, the commissioners stated: "The following facts relating to the part played by dust in coal-mine explosions may now be regarded as conclusively established.

"1. The occurrence of a blown-out shot in working places where highly inflammable coal dust exists in great abundance, may, even in the total absence of firedamp, possibly give rise to violent explosions, or may at any rate be followed by the propagation of flame through considerable areas, and even by the communication of flame to distant parts of the workings where explosive gas mixtures, or dust deposits in association with non-explosive gas mixtures, exist.

"2. The occurrence of a blown-out shot in localities where only small proportions of firedamp exist in the air, in the presence of even comparatively slightly inflammable, or actually non-inflammable but very fine, dry, and porous dusts, may give rise to explosions, the flame from which may reach to distant localities where either gas accumulations or deposits of inflammable coal dust may be inflamed, and may extend the disastrous results to other regions."

The commissioners made the following suggestions for guarding against the danger of blasting in dusty mines:

"1. The removal of dust as completely as possible from the working places.

"2. The provision and thoroughly efficient adoption of simple and effectual

measures for rendering dust innocuous in the presence of a blown-out shot.

"3. The discovery of means for preventing the possible occurrence of blown-out shots.

"4. The adoption of particular agents or of particular methods of using such agents, which deprive a blown-out shot of its danger by insuring the total absence of flame, or of highly heated solid matter when the shot is fired.

"5. The substitution for explosive agents, of similarly efficient methods of bringing down coal and stone which are quite free from the special dangers attending the use of those agents."

These extracts from the various reports, both British and foreign, exhibit only a half-hearted acceptance of the "coal-dust theory" and did not by any means press home the urgency of immediate action; however, the following British act of Parliament for the regulation of mines (1887) did enact certain precautionary measures to be observed in dusty mines as follows: "If the place where a shot is to be fired is dry and dusty, then the shot shall not be fired unless one of the following conditions is observed, that is to say:

"1. Unless the place of firing and all contiguous accessible places within a radius of 20 yd. are at the time of firing in a wet state from thorough watering or other treatment equivalent to watering, in all parts where dust is lodged whether roof, floor or sides, or

"2. In the case of places in which watering would injure the roof or floor, unless the explosive is so used with water or other contrivance as to prevent it from inflaming gas or dust, or is of such a nature that it cannot inflame gas or dust."

Interest in the subject did not cease with this official recognition of the danger to be apprehended from the presence of dry coal dust and great explosions continued to occur from time to time in spite of these new regulations. Messrs Galloway, W. N. Atkinson, J. B. Atkinson, and myself continued our efforts, in and out of season, to convince mine owners and managers of the great risk there was in using ordinary gunpowder for blasting in dry mines. About this time, explosive agents of an entirely different character from gunpowder notably roburite, bellite, etc., began to be introduced and used in some of the mines in Lancashire and elsewhere. I was impressed with the immense difference in the behavior of these new explosives as compared with that of gunpowder; this can be simply and easily demonstrated by placing a charge under a small heap of coal dust; in the case of gunpowder, there is an immense development of flame rising high in the air and consuming the dust, while flame is entirely absent when the charge is made up of the newer explosives.

It was plainly evident that salvation lay in this direction, not only because we now possessed an explosive agent, developing on ignition noncombustible gases, but also, what is equally important, of a nature so rapid in action that the occurrence of the dreaded blown-out shot was almost an impossibility. That much greater security against explosions of gas or dust would be secured by the substitution of the newer explosives for ordinary gunpowder was self-evident, but how to bring this home to those operating the mines was not so easy. Experimental galleries and scientific treatises failed to impress those with whom the power rested to change existing methods. At this time, I commenced a series of experiments in a disused colliery shaft 150 ft. deep, with quite simple accessories, believing that an object lesson on a large scale, the scene being an actual mine, would appeal more directly to practical miners than elaborate and more artificial experiments.

A Practical Object Lesson

The first step to be taken was to make this pit shaft represent as nearly as possible a dry, dusty underground road; with this object in view, ledges of timber were fixed at varying intervals in the shaft, to form resting places for dust, as would be the case in a timbered underground road. When these fittings had been completed and the shaft ready for use, about 2 cwt. of fine coal dust was thrown down the shaft the bulk of which fell to the bottom and went out of action; consequently, only a thin coating of dust was left adhering to the sides of the shaft and to the timbers, ready for action. An iron cannon charged with ¾ lb. of ordinary blasting powder was lowered to the bottom of the shaft and when all was ready the cannon was fired vertically upward by means of an electric battery. A series of six tests was made; at the second trial, the dust was exploded and in an official report dated October, 1890, the phenomenon is described as follows:

"Dust was ignited and a violent explosion took place in the shaft; a large body of flame rushed out of the mouth of the pit, setting the woodwork on fire on the surface and ascending into the air about 20 ft." A note is added: "The electric firing cable was burnt and destroyed and the experiments had to be discontinued." The series of tests were resumed a month later, the dust used being in a blend of highly bituminous coal (Arley seam) from two separate collieries. There were four trials, the dust being allowed to settle in the shaft over a period varying from 20 min. to 2 hours; an explosion of dust resulted in each of the three trials, where gunpowder was the explosive, but at the fourth test, the cannon being charged with 4 oz. of roburite, there was no explosion of the dust. After No. 1 test, the charge of gunpowder was increased to 1 lb., a weight of charge below those frequently used for blasting coal. The last experiment of the series caused the most violent explosion of all, probably due to the shaft which was naturally damp being warmed and dried by the previous explosion.

The scene of operations was now changed to a pit shaft in course of sinking, described as follows: "Depth of pit, 390 ft., diameter, 18 ft." This pit was in course of sinking and was connected with another sinking pit close by, by means of a cut-through in a coal seam at a depth of 300 ft. The cannon was fixed on a scaffold at this latter depth. The shaft sides were wet and dripping and the lower part of the pit, below the scaffold, was full of water. A coke fire was placed on the scaffold causing the experimental pit to act as an upcast, the current of air passing being only at the rate of 30 ft. per min. Weather fine, temperature at surface 68 deg. F. A series of six tests was completed, and although as they proceeded, heavier charges of explosive and more dust were used, in no case was there an ignition of the dust. The cause of this is by no means clear; probably the chief factors were the wet condition of the shaft and its large dimensions (18 ft. diameter.

It has been found that a contracted experimental tube, charged with an explosive atmosphere, is exploded more readily than one of larger dimensions (see official tests for flameless explosives in Germany and elsewhere). I believe that at least three conditions are necessary for the initiation of a coal-dust explosion, viz., a large hot flame in close contact with the dust; rapid vibration of the atmosphere from shock, and a brisk supply of ventilation to continue and develop the primary ignition.

A third series of tests was instituted in a still deeper shaft (630 ft. deep and 8 ft. diam.) and these proved to be the most important and conclusive of all. A scaffold was fixed at a depth of 540 ft. and two cannons, side by side, attached to it. The experimental shaft was upcast from a pumping shaft a little distance away, the ventilation traveled from one to the other through a gallery lined with brickwork, the air moving at the rate of 100 ft. per minute.

An analysis of the air proved firedamp to be entirely absent. Charges of 1½ lb. of gunpowder were used, and from 3 to 4 cwt. of dust were used in each experiment, the bulk of which, lodged on the scaffold or fell to the bottom of the shaft, the active portion adhering to the timbers above the position of the cannons. Two cannons were used with the intention of raising the dust with the first shot and thus getting it into suspension in the air, ready for the second shot, but as events proved, the most successful and violent explosion took place when only one cannon was fired. A preliminary trial shot without dust was fired so that a proper comparison of results might be made.

Results of Experiments

There were in all 16 trials in this deeper shaft; in 9 cases, so far as could be judged, the dust was not ignited, whereas explosions varying in violence instantly followed the firing of the shots in the other 7 instances; the last trial of all produced the most violent explosion, which, in the official report, is described in the following words: "Dust was ignited, followed by a continuous roar and a rush of flame completely filling the shaft mouth and ascending 60 ft. into the air. This was the most violent explosion since the commencement of the experiments. It is difficult for anyone who did not witness this experiment to realize the extent of the explosion. The flame continued to issue from the pit for 5 or 6 sec., followed by dense smoke. The violence carried away some of the woodwork 37 ft. above the pit mouth (only one cannon was fired)."

Professor Galloway was present and witnessed this experiment, and at once expressed the opinion that all previous experiments were dwarfed to absolute nothingness; he was highly pleased to have himself seen his views, so long and perseveringly affirmed, verified in such a striking manner. On four different occasions during the experiments, the flame traveled 600 ft. and ceased only when it reached the mouth of the pit; there was an undoubted increase of violence as it traveled on its course.

The details of these tests, which are "historic," were in due course submitted to the authorities, and Henry Matthews, (now Lord Llandaff), at that time His Majesty's principal secretary of state, in a brief dated December, 1890, the year in which the Llanerch and Morfa explosions happened, refers to these experiments as follows: "As I felt the great importance of arriving at further information and more certain conclusions on this subject, I sanctioned the proposal of Mr. Hall, Her Majesty's inspector of mines, to conduct experiments for the purpose of ascertaining whether an explosion can be caused by blasting operations when coal dust is present, and in the entire absence of gas or firedamp."

"Mr. Hall has the merit of having been one of the first to draw attention to this subject. He, as well as Mr. Galloway, whose opinions are well known and have been often published, brought the matter prominently before the royal commission appointed in 1876 to report on accidents in mines, before whom, however, these opinions met only with partial acceptance. The subject has also been specially investigated in the Durham district by J. B. Atkinson and W. N. Atkinson, Her Majesty's inspectors of mines.

"The result of Mr. Hall's experiments is reported by him in a paper which accompanies this circular, and to which I desire to call most serious attention. The conclusion deduced by Mr. Hall from his experiments is, that a blown-out shot may, in the presence of coal dust, and in the entire absence of firedamp, cause explosions of great violence, often accompanied by volumes of rushing flame, traveling considerable distances, and possibly as far as the supply of coal dust continues."

In 1891, a royal commission on explosions from coal dust in mines was appointed. The members of that commission were the Right Hon. Joseph Chamberlain, M.P. (chairman), Lord Rayleigh, Sir William T. Lewis, Harold B. Dixon, Emerson Bainbridge and Charles Fenwick. At the instance and by the directions of this commission, I undertook to carry out a long series of experiments to test representative dusts from the various mining districts in Great Britain. With this object, samples were procured from 45 separate collieries and from 36 distinct seams; these samples were subjected to similar tests to those already described. This work occupied 12 days, the weather throughout being fine and warm and on several days there was an unusual difference between the wet and dry thermometers showing the atmosphere to be very dry.

The experiments were commenced on each day by firing a 2-lb. charge of gunpowder without dust, so that the onlookers might be better able to judge of the part played by the dust in the subsequent experiments. The conditions of the test were kept as nearly alike as possible for each sample, and on the completion of each test, blank shots were fired to clear the shaft of dust, before another sample was proceeded with. One hundred and three shots of gunpowder were fired, the charge in each case being 1½ lb.; 10 shots of roburite and 3 shots of ammonite were also fired, the weight of charge being 8 oz. More than 50 per cent. of the gunpowder shots resulted in violent explosions of dust, and where there was not an actual explosion, there was always considerable charring of the electric cable except in one or two instances, showing that the dust had ignited but was of such a nature or so impure that it could not develop into a veritable explosion. Of the 10 shots fired with roburite, and those with ammonite, there was neither any sign of an explosion of dust nor any charring. The fact that the "high explosives" behaved so differently to ordinary gunpowder is most important, and at once suggests a means of mitigating the danger of blasting in coal mines.

In reporting these experiments to the royal commission, the conclusions were summarized as follows:

"1. That coal dust from several seams in different districts, notably those from Glamorgan, Monmouth, Durham, Lancashire, Yorkshire and Scotland, are almost as sensitive to explosion as gunpowder itself.

"2. That coal dust is, as a rule more sensitive to explosion in proportion to its high quality and freedom from impurities.

"3. That a ready supply of oxygen, such as is supplied by a brisk ventilation, has the effect of making coal-dust explosions more probable and more severe.

"4. Of the whole of the dust tested, that from the Albion colliery, Glamorgan, excelled all others in violence and sensitiveness to explosion."

Note. Within a year from the date of this report, there occurred at the Albion colliery one of the most sweeping and disastrous explosions which has ever been recorded; 290 people were killed.

"5. With regard to precautionary measures to be taken in the face of these facts, I have again to urge the total abolition of gunpowder from coal mines and the substitution of certain high explosives."

The commissioners examined every one whom it was thought could throw any light on this subject. Among the witnesses were the late Sir Godfrey Lushington, the late Sir Frederick Abel and the leading mining engineers of the Kingdom.

The evidence was conflicting, but anyone who studies it carefully and impartially can hardly fail to be convinced that where dry coal dust is allowed to accumulate and be carried forward by the ventilation and traffic throughout the main arteries of a mine, a disaster of great magnitude may be developed either by a gunpowder shot blowing out, or by the accidental ignition of a small and otherwise harmless quantity of firedamp.

The Commissioners' Conclusions

The commissioners give a summary of their conclusions as follows:

"1. The danger of explosion in a mine in which gas exists even in very small quantities, is greatly increased by the presence of coal dust.

"2. A gas explosion in a fiery mine may be intensified and carried on indefinitely, by coal dust raised by the explosion itself.

"3. Coal dust alone, without the presence of any gas at all, may cause a dangerous explosion if ignited by a blown-out shot or other violent inflammation. To produce such a result, however, the conditions must be exceptional, and are likely to be produced only on rare occasions."

The last sentence in paragraph 3, rather weakens their conclusions and is calculated to throw great difficulty in the way of remedial measures; however, the following precautions which the commissioners suggest, especially No. 1, are definite and much to the purpose:

"1. That the firing of shots should be carried out between the shifts and when the majority of the men are out of the mine.

"2. Where general watering is not prescribed by the inspector, that the roads on either side of the place where a shot

is fired should be thoroughly wetted for a space of at least 30 yards.

"3. That large accumulations of dust, whether on the roof or floor, should not be allowed to remain."

These are the final words of the commissioners and it is curious that they make no mention of the desirability of substituting "high explosives" for gunpowder, although several witnesses spoke highly of these newer explosives. The commissioners do not appear to have given proper weight to the fact that these flameless explosives were already being used with success in several well conducted mines, a fact which nullified the adverse criticism of those who had no previous personal experience of their use.

After having made a study of all the great explosives, and being firmly impressed that blasting with gunpowder was the initial cause of nearly all these disasters, I became a strong advocate for the abolition of gunpowder. In a paper read before the Institution of Mining Engineers, I submitted figures showing the number of fatalities from so-called fire-damp explosions, which were directly due to blasting with gunpowder. These figures were alarming, and were a serious indictment against the continued use of this explosive. The paper also gave statistics from actual practice showing the effect on cost of working and quality of production in collieries where "high explosives" had already taken the place of gunpowder.

By the opponents of the change, it was constantly argued that the use of the more rapid high explosives would entail a large increase in the amount of small coal or slack in consequence of its shattering effect. It was asserted that there would be as much as 10 per cent. more small coal produced, that the cost of each charge would be double that of gunpowder; there was also a constant repetition of the stock phrase, that legislation in the direction indicated, "would lead to many mines being closed." It would, of course, have been a serious matter if the new explosive were likely to damage the coal to the extent suggested, but from actual results obtained at different collieries, I was able to show that an increase of 2 per cent. of slack was nearer the actual figure than 10 per cent.

The paper here referred to was severely criticized, especially by north of England engineers and I was attacked by a section of the press in an unfriendly spirit; indeed there seemed to be an honest conviction that the abolition of gunpowder spelled almost ruin to the coal trade

In 1896 the Coal Mine Regulation Act of 1887, was amended, and Section 1 of the amended act reads: "(1) the power to propose, and modify special rules for a mine under the Coal Mines Regulation Act of 1887 (in this act referred to as the principal act) shall include powers with respect to any of the following matters:

"(a) The nature and description of the lights or lamps to be used in the mine and their custody and the mode of using and trimming them, and

"(b) The description of explosives to be used in the mine, the mode of using and of storing such explosives, and of making and stemming holes, and the times at which and the manner in which shots are to be fired in the mine, and,

"(c) The number or class of persons, if any, to be permitted to remain in the mine or any part thereof while shots are being fired, and,

"(d) The watering or efficient damping of the mine or any ways or places therein, and,

"(e) Generally the precautions to be adopted for the prevention of accidents from inflammable gas and coal dust."

This extension of the power of the secretary of state was proposed by Sir William Harcourt—himself an ex-home secretary—and in due course the power thus conferred was taken advantage of to make an order to be called the "Explosives in Coal Mines Order." The following is the text of that order:

"Whereas by Section 6 of the Coal Mines Regulation Act, 1896, it is enacted that a secretary of state, on being satisfied that any explosive is, or is likely to become, dangerous, may by order, prohibit the use thereof in any mine or in any class of mines either absolutely or subject to conditions: I hereby, in pursuance of the power conferred on me by the aforesaid section, make the following order:

"1.—(a) In all coal mines in which inflammable gas has been found within the previous three months in such quantity as to be indicative of danger, no explosive, other than a permitted explosive as hereinafter defined, shall be used in or taken for the purpose of use into the seam or seams in which the gas has been found, or any shaft or drift communicating therewith which is in process of being deepened or sunk or being driven, as the case may be.

"(b) In all coal mines which are not naturally wet throughout, no explosive, other than a permitted explosive as hereinafter defined, shall be used in or taken for the purpose of use into any road or any dry and dusty part of the mine, or any shaft or drift communicating therewith which is in process of being deepened or sunk or being driven, as the case may be.

"2. In all such coal mines or parts thereof as aforesaid, the use of permitted explosives is prohibited unless the following conditions are observed

"(a) Every charge shall be fired by a competent person (hereinafter called the shot-firer) appointed in writing for this duty by the owner, agent, or manager of the mine, and not being a person whose wages depend on the amount of mineral to be gotten.

"(b) Every charge of the explosive shall be placed in a properly drilled shot hole and shall have sufficient stemming, and each such charge shall consist of a cartridge or cartridges of not more than one description of explosive.

"(c) No cartridge shall be used unless it is marked in the manner set forth in the third schedule hereto, in addition to any marking required by the first schedule hereto.

"(d) No charge shall be fired except by means of an efficient electrical apparatus so inclosed as to afford reasonable security against the ignition of inflammable gas, or by a permitted igniter-fuze, as hereinafter defined.

"(e) Where the charge is fired by an electrical apparatus, the shot-firer shall not use a cable for the purpose, which is less than 20 yd. in length. He shall himself couple up the cable to the charge and shall do so before coupling the cable to the firing apparatus. He shall also himself couple the cable to the firing apparatus. Before doing so, he shall see that all persons in the vicinity have taken proper shelter. Should the charge miss fire, he shall immediately disconnect the cable from the firing apparatus.

"(f) Every electrical firing apparatus shall be provided with a removable handle or safety plug, or push button, which shall not be placed in position or operated until the shot is required to be fired and which shall be removed or released as soon as a shot has been fired. The removable handle or safety plug shall at all times remain in the personal custody of the shot-firer while on duty.

"(g) Each explosive shall be used in the manner and subject to the conditions prescribed in the schedules hereto.

"(h) Where two or more shots are being fired in the same place and such shots are not fired simultaneously, the shot firer shall make an examination for gas immediately before the firing of each shot, and shall not fire the shot unless he finds the place where the shot is to be fired and all contiguous accessible places within 20 yd. free from gas and safe for firing

"Provided that nothing in this order shall prohibit the use of a safety fuse in any mine in which inflammable gas has not been found within the previous three months in such quantity as to be indicative of danger

"3. In every coal mine the use of any explosive is prohibited in the main haulage roads and in the intakes unless all workmen have been removed from the seam in which the shot is to be fired, and from all seams communicating with the shaft on the same level, except the men engaged in firing the shot, and in addition such other persons not exceeding 10 in number as are necessarily employed in attending to the ventilating furnaces, steam

boilers, engines, machinery, winding apparatus, signals, or horses, or in inspecting the mine; or unless a permitted explosive is used under the conditions prescribed in Section 2 of this order, and every part of the roof, floor, and sides of the main haulage road or intake, within a distance of 20 yd. from the place where it is used, is, at the time of firing, thoroughly wet, either naturally or from the application of water thereto.

"This section shall not apply to such portions of the main haulage roads and intakes as are within 100 yd. of the coal face.

"This section shall not authorize the use of any explosive in any case where the use of such explosive is prohibited by Sections 1 or 2 of this order.

"4. Detonators shall not be used in or taken for the purpose of use into any mine unless the following conditions are observed:

"(a) Detonators shall be under the control of the owner, agent, or manager of the mine, or some person or persons specially appointed in writing by the owner, agent, or manager for the purpose, and shall be issued only to shot-firers or other persons specially authorized by the owner, agent, or manager, in writing.

"(b) Shot-firers and other authorized persons shall keep all detonators issued to them until about to be used, in a securely locked case or box, separate from any other explosive.

"In the case of a shaft being sunk from the surface, it shall not be deemed a contravention of this section if the primers for charges are fitted with detonators on the surface before being taken into the shaft, provided the primers are so fitted in a workshop established under Section 47 of the Explosives Act, 1875, and are only taken into the shaft immediately before use by the shot-firer or other authorized person, and in a thick felt bag or other receptacle sufficient to protect them from shock.

"5. Sections 1, 2 and 3 of this order shall not apply to mines of clay, or stratified or nodular ironstone, nor shall they apply to shafts in course of being sunk from the surface, or deepened, or to drifts and other outlets being driven from the surface, except as provided by Section 1 of the order.

"Where a mine contains several separate seams, this order shall apply to each seam as if it were a separate mine.

"6. In this order, the term "permitted explosives" means such explosives as are named and defined in the first schedule hereto, and the term "permitted igniter-fuse" means such igniter-fuses as are named and defined in the second schedule hereto; provided that where the composition, quality or character of any explosive or any igniter-fuse is defined in such schedule, any article alleged to be such explosive or such igniter-fuse which differs therefrom in composition, quality or character, whether by reason of deterioration or otherwise, shall not be deemed to be the explosive or igniter-fuse so defined; provided further that an owner, agent or manager shall not be responsible for the composition, quality or character of an explosive or igniter-fuse, if he shows that he has in good faith obtained a written certificate from the maker of the explosive or igniter-fuse that it complies with the terms of the schedule, and that he has taken all reasonable means to prevent deterioration of the explosive or igniter-fuse while stored."

This is the position as it is today. The order makes it illegal to use any explosive other than a "permitted explosive" in mines coming within the category of fiery, or dry and dusty. A permitted explosive is one which has passed the official test at Woolwich arsenal. The conditions of these official tests are similar to those laid down in a proposal which has recently been submitted to the American authorities. Gunpowder has entirely failed to pass the tests and hence it is no longer used in mines to which the Explosives in Mines order applies.

Legislation Has Proved Beneficial

This legislation has proved beneficial beyond all expectation. The order first came into force in 1897 and we find the average annual loss of life from explosions since that date to be 50 per cent. fewer than was the case in a similar period immediately preceding its operation. I believe that this great diminution in fatalities from explosions has been chiefly due to the fact that the use of gunpowder which always entailed a constant risk of blown-out shots, has been largely dispensed with.

The interference with the economic position has been trifling and the present users of the "high explosives" have now no cause to regret the change; in fact, for much of the work underground, experience has shown the newer explosives are more economical than the old.

In conclusion, it is perhaps well to remind the workers in mines that all the labors of scientific experts will prove of no avail to avoid disaster unless they themselves are willing to submit to strict discipline and cheerfully comply with the regulations made for their safety, and also to remind the higher authorities in whose hands the administration of the law rests, that without their sympathy and support, it is impossible for mine officials to adequately control large bodies of men.

Prospecting for antimony ores, among which stibnite, the sulphide of antimony, is most prominent, has been carried on (*Chem Trade Journ.*, April 24, 1909) in South Burma, and in Lahaul, where a large deposit occurs near the Shigri glacier. Stibnite seems to be widely distributed in the Tenasserin division of South Burma.

The Bottineau Gas Field

By John G. Barry*

During the last year and a half several discoveries of natural gas in Bottineau county and eastern Ward county have caused considerable excitement. The first discovery was made at the Parker farm about 9½ miles south of Westhope on July 3, 1907, when gas was struck at 178 ft., while drilling a well for water. Since that time many wells have been drilled for gas in the same region and a number of them have been successful. Accordingly a preliminary investigation of the region was made early in September, 1908. The time possible for this work was very limited, and only the main facts in regard to the field were obtained.

The wells drilled in the vicinity of the Parker farm pass through the glacial covering and cut a gas-bearing sand at depths ranging from 154 to 176 ft. Four wells at this place have shown good flows of gas, while three others drilled to the north toward Westhope have been unsuccessful. A pressure exceeding 100 lb. per sq.in. and a flow of 2,000,000 cu.ft. per day is reported for each of the successful wells. The Great Northern Oil, Gas and Pipe Line Company, which has been carrying on prospecting at the Parker farm, has drilled a deep well in hope of striking a deep-seated body of gas. At the time of the visit to this region this well had reached a depth of 1180 ft. On Sept. 11, 1908, this well showed the following section:

Soil, 2 ft.; yellow clay and gravel, 30; Blue clay, 122; gravel with sand below (no flow of gas), 16; white slate, 35; black sand (seam), 3; soft blue shale (caving), 242; black slate, 50; blue shale (caving), 205; yellow hard rock (limestone), 5 in.; blue shale, 145 ft.; sandy shale, 10; blue shale to bottom, 320; total, 1180 feet. Oil seepage is reported in the common wells of this vicinity, but this is probably due to decomposing organic matter in the drift.

At Mohall there are two wells which have yielded gas. They are about 7 miles west and north of the town, and about 26 miles west of the wells at Westhope. A generalized section of these wells was as follows: Yellow clay, 20 to 25 ft.; blue clay, 200; blue shale, 70 to 80 feet.

Since the visit to this region gas has been reported as having been struck at the following places: Maxbass, 16 miles southwest of Westhope; Lansford, 10 miles southeast of Mohall; and at the McCaslin farm, 14 miles southwest of Mohall, and five miles west of the Parker farm, at a depth of 200 ft. The sand in which the gas is found varies in thickness in most cases from 16 to 20 ft. It is med

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ium fine grained, rounded, and of a greenish-black color due to an admixture of decomposing carbonaceous matter.

An analysis of the gas made by Prof. E. J. Babcock, of the School of the Mines of the University of North Dakota, shows the following results: Hydrogen, 0.5 per cent.; methane, 82.7; ethylene and other illuminants, 0.2; carbon monoxide, 1.2; oxygen, 3; nitrogen, 12.4 per cent. B.t.u. (calculated), 886 per cubic foot. The oxygen and nitrogen were probably from air present.

It is impossible at present to definitely outline the posibilities of the area. The gas is now being used locally in farm houses and it is proposed to pipe it to Westhope for use there, and later to some of the other surrounding towns.

Most of the wells of this area which have been productive are situated within the area of Glacial Lake Souris, the gas occurring in a layer of sand immediately underlying the glacial drift. Upon the recession of the ice-sheet from the Coteau du Missouri a glacial lake known as Glacial Lake Souris was formed, lying between the coteau and the southern border of the ice sheet.[1] Considering Upham, McHenry county, the Coteau du Missouri lies about 50 miles to the southwest and runs in a northwest-southeasterly direction. The Turtle mountains lie about 25 miles to the northeast of Upham. Both the Coteau du Missouri and the Turtle mountains have a considerably greater altitude than the region under consideration. Undoubtedly the coteau and the mountains were at one time continuous, and their present relationship is due to erosion.

It is universally thought that the erosive action of the ice sheet was limited to wearing down the smaller elevations and partly filling the pre-existing valleys with its débris. Considering the course of the Coteau du Missouri, and the Souris and Sheyenne rivers, it is reasonable to suppose that previous to glacial time there lay to the north and east of the coteau a principal drainage area which had a northwest southeast course, and which probably drained to the south and east. It is certainly reasonable to suppose that there was deposited throughout the region a considerable amount of detrital material with an admixture of organic matter, probably of vegetable origin. Upon the decomposition of the organic matter the débris would act as an excellent gas reservoir. This theory as to the origin of the gas occurrence of this region is put forward with only a slight knowledge of the existing facts, and is only a preliminary one, conditioned by the gathering of additional data.

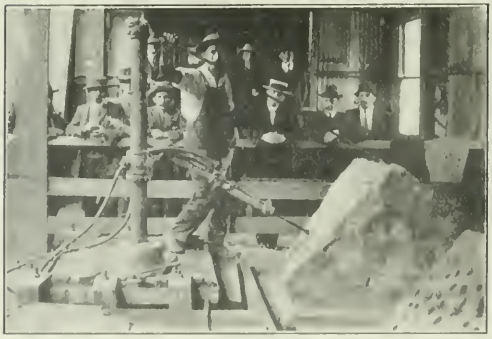
[1] Upham, Monograph XXV., U. S. Geological Survey, p. 267

Rand Stope Drill Competition

The photographs reproduced herewith show several of the drills entered in the Rand stope drill competition. These are of interest in connection with the article "Surface Trials in Rand Stope Drill Competition," by Eustace M. Weston, in the JOURNAL of May 15, 1909, p. 998.

SISKOL DRILL

CHERSEN DRILL



WAUGH DRILL

KONOMAX DRILL

According to the statistics collected for THE MINERAL INDUSTRY, the production of arsenious acid increased from 2,020,000 lb., valued at $101,000, in 1907, to 2,603,505 lb., valued at $93,103, in 1908.

Salt in Austria

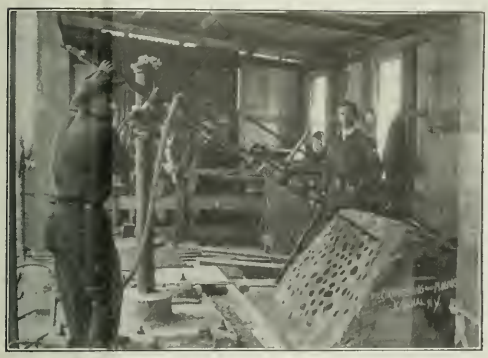
The salt deposits of Austria are extensive, says Consul-General W. A. Rublee, of Vienna. There are very large mines in Galicia near Cracow, at Wieliczka, and these furnish 36 per cent. of the salt Austria produces. Until a year ago the salt in Galicia was mined, but now the easier method of artificially producing brine by introducing water into the mines has been largely adopted. This brine is then evaporated in open pans, in vats and by the vacuum process.

The value of the salt at the source of production, whether mined or manufactured, ranges per 100 kg. (220 lb.) from 1.04 to 2.25 crowns (21 to 45c.), at which price it is sold by the government, salt being a government monopoly, to industrial concerns. This is exclusive of the cost of freight and packing. Other purchasers have to pay the tax levied on salt by the government, which varies in the different crown lands and ranges per 100 kg. from 14 to 20 crowns ($2.40 to $4). The average price, therefore, per 100 kg. is about 22.5 crowns ($4.50). The annual consumption of salt is estimated at 6½ kg. per capita (14.3 lb.). The salt from Galicia and Moravia is sent to Russia under contract.

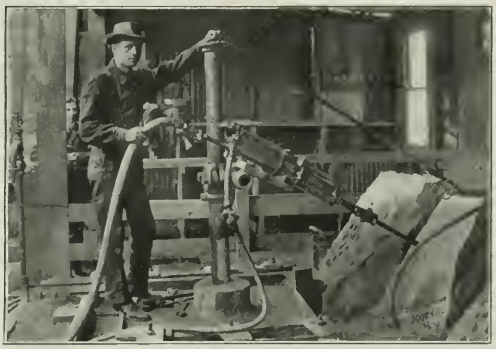
Amendment to Norwegian Mining Law

The text of the bill to be laid before the Norwegian Storthing for amending the law relating to mining and water-power concessions prescribes that all companies acquiring such concessions shall be domiciled in the country and governed by a majority of Norwegian citizens. Concessions are to be granted for terms of not less than 40 years, or more than 80 years, the property then being handed over to the state, together with any water-power plant that may be thereon. The purposes for which water-power concessions are to be used must be stipulated in the concession, and the right to prohibit the application of the water power to certain purposes is to be reserved. Work on the lands granted under concession must be commenced within a certain time, and preference is to be given to Norwegian labor and materials in carrying out the work.

The concessionaires may not, without special permission of the authorities, enter into any agreement or combination for raising the price of mining products or electrical energy to Norwegian consumers. A communal tax, equivalent to 5 per cent. of the water power, and a production tax of 1 to 3 per cent. of the value of ore at the mine, will be charged. Mines must be worked in a proper manner, and not to the detriment of the community. In the event of the fines for infractions of the terms of the concessions increasing to a certain extent, the concession shall be forfeited to the state.



MURPHY DRILL



ANDERSON DRILL

WESTFALIA DRILL

VLOTMANN DRILL

To prevent the formation of rust in boilers (*Petroleum Review*, April 24, 1909) experiments have been made at the Berlin Technical Institute, to use water deprived of the air it contains by means of charcoal. The decrease of rust in the boilers fed with water treated by the process has been about 25 per cent.

Tin Mining and Milling in North Queensland

The Tin-bearing Country Embraces 12,000 Square Miles; the Adoption of Modern Methods Will Render Available Much Low-grade Material

BY G. W. WILLIAMS*

The tinfields of North Queensland are found in the mountainous country that lies back of the coastal ranges from the port of Geraldton to Port Douglas. The hills composing the range vary in hight from 2000 to 4000 ft. and form the watershed from which the Tate, Walsh and Herbert rivers flow to the Gulf of Carpentaria. The tin-bearing country embraces an area of 12,000 square miles. The district is tapped by two railways, the Stannary Hill-Irvinebank line from Boonmoo (82 miles from Cairns on the Chillagoe line) and by the Mount Garnet tramway which branches off the Chillagoe line at Lappa and runs back to the Smiths Creek mines. The Koorboora field lies on the Chillagoe line and forms the most westerly portion of the fields.

Wolfram, molybdenite and scheelite occur throughout the district, often in intimate association with the tin. The underlying rock of the whole area is granite which has been exposed by denudation in many places and which occasionally sends dikes into the overlying sedimentary rocks. Generally speaking, the tin lodes are composed of holocrystalline chlorite occurring in lenses or irregular bunches in the metamorphosed sedimentary rocks. Topaz, tourmaline and fluorspar are normal accessory constituents of the lodes, together with iron pyrites, wolfram and occasionally copper and bismuth. In some cases there is distinct evidence of the secondary enrichment of the lodes at the surface, but in most cases the mines do not show any marked fall in grade with depth. In one mine, I obtained some interesting tin crystals where the cassiterite was obviously a pseudomorph on tourmaline. Hundreds of small lodes have been worked throughout the whole area but in nearly every case ore of less than 2 per cent. has not been taken. With the exception of the mines owned by the Stannary Hill Company, North Queensland tin mining is controlled by John Moffat of Irvinebank, who has erected tin-dressing plants throughout the district and who owns in part or in entirety almost every mine. It was due solely to Mr Moffat's enterprise that the Chillagoe, Mount Garnet and Mount Molloy mines were opened up.

The most important mine on the field is the Vulcan at Irvinebank. This mine is developed down to 1050 ft., at which depth the lode is 100 ft. in length and 24 ft. wide, the ore averaging 7 per cent. tin. As depth has been gained the ore has shown little change, but the orebody is distinctly smaller in depth. It is worked by large underhand stopes and not a stick of timber or a ton of filling is used. The great vaulted stopes are open from the top of the mine to the bottom.

About four miles distant is the Governor Norman, a large low-grade mine. Up to date the low-grade (1 per cent.) mines have not been seriously attacked, except by the Stannary Hill company, but wherever I went I saw evidences of the existence of large areas of 2-per cent. ore. Under the present system of mining the lodes are worked only in the richer portion. Mining methods are archaic and in the matter of transport of ore both in the mine and on the surface the methods in vogue are barbaric in their simplicity. Costs must be appallingly high, for mines I visited that had been producing good ore for 10 years were still handling their ore by horse-whims up narrow underlay shafts of irregular grade.

The tin-dressing plants erected by the Irvinebank Mining Company (Mr. Moffat's firm), are uptodate and do good work. At Irvinebank the plant comprises a 60-head battery with jigs, vanners and buddles. A tin smelter is attached and smelts concentrate and stream tin from the various dressing plants and river workings.

As will be seen when the work done by the Stannary Hills company is considered, the treatment of low-grade ore has met with some success. It is quite certain that with modern methods, modern plants and improved facilities for transport the 1.5 per cent.-lodes will prove highly payable.

The Stannary Hill Company

The leases owned by this company extend along the crest of a range of country the backbone of which appears to be composed of low-grade tin-bearing chlorite. There are several mines of which the most important are the Ivandoe, Kitchener and Extended. In the former mine the ore occurs in stringers and bunches in chlorite. These bunches make and cut out with little warning and are often of large extent. At 250 ft. depth the ore made into a bunch that measured 220 by 50 by 20 ft., and after cutting out entirely another bunch of ore, was again picked up at 350 ft., measuring 120 by 10 by 50 ft. These bunches are worked out without timber. In some cases, where the deposit is long and comparatively narrow, the stopes have been carried up to 159 ft. in hight without timber or filling. Throughout the whole district the country rock hangs perfectly and falls are almost unknown.

An adit level 2500 ft. in length has been driven under the line of leases. From this level it is proposed to prospect for ore with a diamond drill. The country is admirably suited for this kind of development work. The bunches follow a well marked shoot in the surrounding country. The ore shoot has been followed down to 700 ft. below datum and at present the shaft is being sunk with a view to opening up below that point. The ore averages 2 per cent. On the Kitchener mine a similar deposit has been worked, and the ore appears to be pitching into the ore shoot of the Ivandoe mine. On the Extended the crest of the hill is composed of low-grade ore (1 per cent tin stone). It is the intention of the management to build a battery close to the hill and to open up a large open cut. There is little doubt that the venture will be entirely successful. At the Arbouin mine, about four miles distant from the Stannary Hill station, ore containing 1 per cent. tin stone was successfully treated by open cutting. Breaking cost 48c and haulage and development 50c. (Transport involved crossing a valley by aërial tram and three miles of railway.) Crushing cost $1.60 per ton, making the total $2.58 per ton (2240 lb.)

The Arbouin Mill

The tin-dressing mill is situated on the side of the river about seven miles away from the mine, with which it is connected by the tramway. The trucks of ore are run down a slope in line and dumped into the bins from which the ore passes over a 2-in. Blake-Marsden ore breaker. A 1-in. grizzly receives the product and the oversize is returned by an elevator to a smaller breaker of the same type which reduces it to 1-in. cubes.

The product from the second breakers and the undersize from the grizzlies pass to the battery bins from which it is fed by means of Challenge feeders to 30 head of stamps. The latter weigh 1350 lb. and run at 104 drops per minute, with a 6-in drop. The screen is woven, 121 mesh. The mill pulp passes to hydraulic

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classifiers which separate the slimes and feed the sands to two 5-hutch jigs. The first heads, which contain about 25 per cent. of tin, go to the calciners. The product from the four other hutches in each jig passes to a conical classifier which delivers the overflow to two, and the underflow to three Wilfley tables. The middlings from all five tables pass over another table and the middlings from this table are returned to the same table. The concentrates from all the tables go to the calciners; the tailings are discharged to the river and the slimes pass to the settlers.

The concentrates from all sources are collected in settling pits and are removed from these to a drier heated by the waste furnace gases. The calciner is a three-hearth Merton furnace with extended forehearth. The roaster treats 120 long tons per week. The roasted concentrates are mixed with water and pumped up to three 4½-ft. grinding pans. The pulp from the pans is distributed over four double-belt Luhrig vanners. The clean concentrate contains 70 per cent. tin oxide. The rest of the product is pumped up to two grinding pans and from these is distributed by classifiers to two double-belt Krupp-Luhrig vanners. The concentrates are sent to the keiving tubs, the middlings are returned and the slimes and tails pass over three revolving buddles. These buddles also receive the slimes from the settlers. The concentrates from these buddles are returned to the calciners. The tails go out to the race. Gradings showing the nature of the battery pulp and the final tails, with the battery crushing through 225-mesh screen and no regrinding, are shown in an accompanying table. The ore consisted of 100 tons from the Kithener mine (3 per cent SnO_2), 984 tons from Ivanhoe (2.90), and 1941 tons from Abouin (1.4), a total of 3085 tons of 2.001 per cent. ore. Samples were screened dry; 15-mesh screens were used on the battery boxes. Stamp duty was 5.4 tons per 24 hours. Slimes in the product through 200 mesh carried a trace of SnO_2.

Since the installation of grinding pans, sizing tests have not been made, but the recovery is approximately 90 per cent. on 2-per cent. ore.

It is most probable that the battery will be rebuilt on the side of the big mill at the Extended mine. A saving of 55c. per ton in transport will be effected when the alteration is complete and a better arrangement of the concentration plant will also effect a slight reduction in costs.

The Koorboora Tinfield

Koorboora, 108 miles from Cairns on the Chillagoe railway, is the center of a small but valuable group of tin mines. The Irvinebank Mining Company has a 10-head tin-dressing plant here for the purpose of treating ore from its mines and from the mines worked by tributers and prospectors in the district. The battery was erected nine years ago, and since then it has treated 40,000 tons of ore, obtaining 2200 tons of concentrates. The mines are situated within a radius of 4½ miles of the mill. The most promising is the Shakespeare mine, situated about ¼ mile from the mill. The lode has been opened up in an open-cut to 50 ft. in depth and is exposed for 80 ft. in length and 25 ft. in width. The main shaft is down 200 ft. and a large tonnage of 1- to 1.5-per cent. ore has been opened up. Under present conditions it does not pay to treat ore containing less than 1.75 per cent. tin stone. This mine is a good example of a mine which, if systematically opened up and connected by aerial tram with the battery, could make 1.5 per cent. ore pay with tin at $650 per ton. The lode is massive chlorite somewhat irregular in outline but maintaining uniform metal content. The country rocks are greywackes and other altered sedimentary rocks.

The Southwick mine produces 10-per cent. ore from a narrow lode. The lode has been followed down to 200 ft. in depth by an underlay shaft which, like most North Queensland shafts, reproduces with faithful accuracy every variation in the dip of the lode. The ore is raised by horses. At the Tennyson group there is a large tin-bearing chlorite formation, but only the rich bunches in the lode are worked. At 120 ft. the ore averages 5 per cent. lead, 3 per cent. tin oxide, 8.5 per cent. zinc and 17 oz. of silver per ton. There is the making of another fair-sized mine in these leases.

Throughout the district, I visited many small mines where small lodes or bunches of rich ore in low-grade orebodies were being worked with horse-whims. The Neville mine is of interest in that it is, I think, the largest wolfram mine in the world. The leases are situated about 1½ miles from the battery. The lode is a large chlorite body the limits of which have not been clearly defined. At 200 ft. the pay ore measures 150 ft. in length and averages 20 ft. in width. To date 8100 tons have been crushed for a return of 6.6 per cent. wolfram (70 per cent.). The mine was under water at the time of my visit, but owing to an increase in the price of tungsten it was being unwatered with a view to the restarting of stoping. This mine has a good vertical shaft and has been well developed.

Near the Neville is the Telegraph lease where a lode 50 ft. in length and 8 ft. wide is worked. The ore carries 4 per cent. each of tin and wolfram. In almost all mines in the tin country the ore is hand-picked in the stopes, the richer portions only being sent to the surface. Miners receive from $2.16 to $2.40 per 8-hour shift. In development work the "leading hand," who receives an extra 25c. per day, crushes and pans off his own samples.

The Tate River Alluvial Workings

The Tate river rises in the coastal ranges and flows westward to the Gulf of Carpentaria. The river gravels have been worked since 1876. The present company, an offshoot of the Irvinebank company, acquired its property in 1890, and since then has sluiced 175,000 tons of dirt for a return of 430 tons stream tin. The tin from these workings is exceptionally pure and the average value of the dressed tin stone is 74 per cent. metallic tin.

During the winter months the gravel is piled up at the head of large sluiceways and when the summer rains commence water is brought in by a race 7½ miles in length and the accumulated dirt washed down to the races where the tin is collected. The gravels are about 600 yd. wide and vary in depth from 1 to 15 ft. The company owns 103 acres of alluvial ground. The gravels average 5½ lb. of dressed tin per ton.

Wolfram Camp

This camp is situated about 14 miles from Dimbulah, 73 miles from Cairns on the Chillagoe railway. The ground is held in miners' claims, leases not being allowed. The geology of the district is similar to that of the rest of the tin country, altered sedimentary rocks overlying the granites. The wolfram occurs

SIZING ANALYSES, MAY, 1906.

	Battery Pulp.			Final Tails.		
	Per Cent. Weight.	Per Cent. SnO_2.	Per Cent. of Total SnO_2.	Per Cent. Weight.	Per Cent. SnO_2.	Per Cent. of Total SnO_2.
On 20 mesh..	0.63	1 6	0.4	0 08	0 36	0.07
Through 20 on 30 mesh..	7 93	1 6	5.5	3.75	0 36	3 24
Through 30 on 40 mesh..	7 23	1 7	5.3	5.25	0.40	4 7
Through 40 on 60 mesh.	16.08	1 8	12.7	14 93	0.32	10.7
Through 60 on 80 mesh..	8 40	2 2	7.9	6.35	0.30	5.7
Through 80 on 100 mesh..	9 31	2 7	10.9	10.31	0 26	6 2
Through 100 mesh, coarse....	30.25	2 5	57 3	34 10	0 54	9 4
Through 100 mesh, slimes....	20.17		7 0	22.74		7 0
		2 4			0.43	

in small chlorite lodes which average 10 ft. in length and 2 ft. in width. Some larger shoots extend to 30 ft. in length and 5 ft. in width. The ore is mostly won by miners working their own ground, but in some cases claims have been amalgamated and are worked from one shaft. The deepest shaft is down 300 ft. and in depth the mineral contents appear to be practically unchanged. Generally speaking the lodes average 5 per cent. of wolfram and molybdenite. A dressing plant has been installed by the Irvinebank company. The plant comprises rolls, jigs, vanners and an oil flotation process for the recovery of molybdenite. The latter yields a 90-per cent. to 95-per cent. concentrate. The wolfram concentrate from the jigs and vanners contains 50 per cent. tungstic acid and 10 per cent. bismuth. With a good market for wolfram the district employs from 400 to 500 men, most of whom can make good money from their claims.

Conclusions

Reviewing these notes, made as a result of a fortnight spent in riding around the chief centers of the tinfields, I can only repeat the remark made frequently in connection with individual mines: the future of the field lies in the development and working of the low-grade lodes. It is a pity to see the rich portions of a lode stripped out while 1.5 per cent. ore is left in such a position that it can never be profitably recovered. The Stannary Hills company has demonstrated at its Arbouin mine that low-grade ore can be profitably treated even with high milling and transport costs. It remains now for the other tin mines to adopt modern methods and to realize that 1 per cent. tin ore is an extremely valuable asset and should not be thrown aside or buried in old stopes for want of better filling.

Of course there are mines that from their situation, can never hope to mine low-grade ore, but these mines are in the minority; the bulk of mines should be able to work on ore of far lower grade than that which is now considered unpayable.

The value of the mineral production of Queensland during 1908 (*Queensland Gov. Min. Journ.*, April 15, 1909) was £3,814,487, a decrease of £287,677, as compared with 1907. The deficiency was due to the lower value of minerals other than gold.

It is stated in the fourteenth annual report of the Rand Mines, that the ore reserves at the end of 1908 were: Main reef, 2,475,215 tons; Main reef leader, 3,666,556 tons, and South reef, 4,562,061 tons, making a total of 10,703,832 tons.

Mineral Production of French Colonies

Special Correspondence

The Minister of Colonies has just issued the statistics of the mineral production of the French Colonies (Algeria and Tunis excepted) for the year 1907. The colonies referred to in the statistics include French Guiana, West Africa, Madasgascar, Indo-China and New Caledonia. The values of the products for each of the principal colonies are as follows:

Guiana (gold)	$2,246,419
New Caledonia (nickel, cobalt, chrome ores)	936,294
Madagascar (gold and iron ore)	1,858,865
Indo-China (gold, tin, zinc, tungsten, coal)	897,731
West Africa (gold)	22,550
Total	$5,961,859

The quantities and values of the different mineral products are given in the following table, the weights being in metric tons with the exception of gold, which is given in kilograms:

Gold	7,201 kkg.	$4,065,878
Nickel ores	120,106 tons	600,532
Cobalt ores	3,800 tons	112,425
Tin and tungsten	128 tons	59,700
Zinc	6,020 tons	131,200
Chrome ore	29,818 tons	223,637
Coal	305,156 tons	637,528
Lignite	15,062 tons	29,371
Sundries	3,335 tons	22,033
Total	483,425 tons	$5,882,004

Gold is obtained from placer workings and dredgings in Guinana, Madagascar, West Africa and Indo-China. The production of Guiana was 4160 kg. against 3503 kg. in 1906, declared for a value of 11,232,097 fr.; of Madagascar, 2940 kg. against 2200 in 1906; the balance came from Indo-China and West Africa.

The nickel ore (garnierite), a product of New Caledonia, shows a small increase, but the export is lessening with 103,542 tons, as against 130,688 in 1906. It will be noticed that the quantity of garnierite shipped in the last four years for which figures are available is greater than the ore produced, 458,175 tons being exported against 432,666 produced. It seems that the stocks on hand and the general business depression has brought about unfortunate conditions for the mining industry in New Caledonia. Great hopes are, therefore, directed to the metallurgical plants that are contemplated and under construction (Tao works). The export of chrome in 1907 from New Caledonia, was made by Birch & Co., Ltd., of London, in acordance with their agreement with the Société le Chrôme. This has terminated, however, and the rich Tiebaghi mine has been closed.

Some new companies are now working for gold in Guiana and Madagascar, phosphate rocks in the Touamotou Islands in the Pacific, and copper in New Caledonia, but they are not yet producing. The mineral output of the French colonies in 1907 was produced from 950 concessions of 587,367 hectares, 9664 men being employed. It should be noted that the production of the most extensively mineralized and worked region of the French Empire, Algeria and Tunis, is not included in the above statistics.

Henry H. Rogers

Henry H. Rogers, whose death was briefly noted in the Journal last week, died suddenly in New York, May 19, aged 69 years. He was born in Fairhaven, Mass., and began life in rather a humble way, like most boys of his time and place. When about 20 years old he was attracted to Pennsylvania by the new oil discoveries and entered into business there. A few years later he came into contact with John D. Rockefeller and some others of the founders of the Standard Oil Company, and entered into close business relations with them, which ended only with his death. He soon became prominent in the direction of the Standard and was for many years its vice-president, being practically the chief manager after John D. Rockefeller retired from the more active management; in which, however, Mr. Rogers always had an active and prominent part.

As he accumulated money he gradually became, outside of the Standard, a prominent figure in the stock markets, and a large owner of railroads and other securities. To him it was generally believed, was due the direction of the speculations of the "Standard Oil Group" which had so great an effect on Wall Street and which gave the group such a wide-spread influence on the railroad systems of the country.

About 10 years ago his attention was turned to copper, and he organized the Amalgamated Copper Company. Probably, as was generally believed at the time, the purpose was to control and centralize the copper production and business of the country, as oil had been controlled—though this purpose was not avowed. The course of the Amalgamated is a matter of history. Under Mr. Rogers' leadership it has, at any rate, become one of the great industrial institutions of the country, with an organization and technical management which is a model for similar corporations.

Mr. Rogers' latest work was in connection with the development of bituminous coal interests. He built the Virginian Railway, intended to develop certain sections of West Virginia and to furnish the coal mines of that State with a new outlet to tidewater. He furnished almost all the money for this enterprise and had plans for its extensive development, and for giving it a leading place in the eastern bituminous trade.

Two years ago Mr. Rogers had an apoplectic stroke, and after that began to withdraw from his large speculative ventures, though he retained his active interest in the Virginian Railway. It was

due to this that his death caused so little sensation on the stock markets. It has been said that he felt keenly the bitter attacks on the Standard Oil monopoly and on other activities in which he was concerned; but he never gave any outward sign of such feeling.

Personally he was much esteemed by his intimates; and he gave generously to the town of Fairhaven, where he was born, and where he retained a residence all his life.

A Memorial to Bennett H. Brough

At the time of the death of Bennett H. Brough, last October, well and widely known as an instructor in the Royal School of Mines and in other technical institutions, and for many years as secretary of the Iron and Steel Institute, it was noted that he had left only a scanty provision for his family. When this was ascertained, the members of the Iron and Steel Institute raised a fund for the assistance of his widow and children. The response was a liberal one, and this fund is now practically closed. Aside and apart from this, many of Brough's friends, and particularly those who had no opportunity of subscribing to the above fund, have expressed a desire to establish a lasting memorial which, it is suggested, should take the form of a scholarship for boys from the City of London School, where he was educated, tenable at the Royal School of Mines, where, both as student and teacher, he did such excellent work.

A committee has been formed having as secretary George T. Holloway, and as treasurer R. E. Commans, Speer Road, Thames Ditton, Surrey, England, to whom contributions may be sent.

Mr. Brough occupied for a long time positions which brought him in contact with many people, who quickly learned to appreciate his many admirable qualities. Many of them, not only his English associates, but also American and foreign engineers, will be ready to contribute to what seems to be a fitting memorial.

A Proposed Powell Memorial

The 60th Congress appropriated $5000 for the erection of a suitable memorial to Maj. J. W. Powell, to be placed on the brink of the Grand Cañon of the Colorado. For the purpose of complying with the will of Congress the Secretary of the Interior asked W. H. Holmes, C. D. Walcott and H. C. Rizer to act as a committee to assist him in determining the character of the monument and in selecting the site.

At the earnest solicitation of numerous old-time associates of Major Powell, this committee has consented to initiate a movement among his friends for the erection of an appropriate monument over his grave at Arlington National Cemetery, which remains as yet unmarked. This project will undoubtedly appeal not only to the personal friends of Major Powell, but to large numbers of those who appreciate his achievements in the several branches of science to which he so largely contributed.

The various statues in Washington commemorating the deeds of military heroes were erected by many societies. It would seem equally appropriate that those interested in scientific progress should commemorate the life and services of a man who was a leader along lines making for constructive rather than destructive work.

The character of the monument will not be decided upon until the fund has been raised, but the committee will be glad to receive from contributors suggestions relating thereto. Subscriptions will be received by H. C. Rizer, United States Geological Survey, Washington.

We are informed that the sum of $600 has been collected in a short time, and with no special effort. We have no doubt that this sum will be largely increased by the many who appreciate the great services rendered by Major Powell to the cause of geology and geological exploration in this country.

Pig Iron Classification

The full report of the American Iron and Steel Association contains a carefully prepared statement of the different kinds of pig iron made, classified according to their quality and the purposes for which the iron was intended. This statement for two years past is given in the following table:

	1907		1908	
	Tons.	Per Ct.	Tons.	Per Ct.
Bessemer	13,027,083	50.5	7,086,360	44.5
Low-phosphorus	204,537	0.8	130,616	0.8
Basic	5,375,219	20.9	4,010,144	25.1
Forge pig	683,167	2.6	457,164	2.9
Foundry	5,066,311	19.7	3,573,210	22.4
Ferrosilicon	84,898	0.3	64,412	0.4
Malleable bessemer	920,290	3.6	414,957	2.6
Spiegeleisen	283,430	1.1	111,376	0.7
Ferromanganese	55,918	0.2	40,642	0.3
Miscellaneous	80,508	0.3	47,137	0.3
Total	25,781,361	100.0	15,936,018	100.0

Low phosphorus pig is iron running below 0.04 per cent. phosphorus. The basic pig does not include a very small quantity of basic iron made with charcoal as fuel. Miscellaneous includes white and mottled iron, castings made direct from the furnace and a few tons of ferrophosphorus. Spiegeleisen contains from 9 to 22 per cent. of manganese; ferromanganese, 45 to 82 per cent. The standard for spiegeleisen is 20 per cent.; for ferromanganese, 80 per cent. manganese.

The more interesting changes are the smaller proportion of bessemer and the larger use of basic iron. It is evident also that the demand for foundry iron did not decrease in quite so great a proportion as the iron trade

Production of Ores, Metals, Minerals and Chemicals in the United States in 1908

The accompanying tables show the production of some of the principal ores, minerals, metals and chemicals, in the United States during 1908, as collected for the forthcoming volume of THE MINERAL INDUSTRY:

PRODUCTION OF SECONDARY MINERALS AND CHEMICALS IN THE UNITED STATES.

Product.	Measure.	1908. Quantity.	1908. Value.
Alundum	lb.	3,160,000	$189,600
Ammonium sulphate	sh.t.	87,600	5,247,240
Arsenic	lb.	2,603,505	99,193
Bromine	lb.	1,149,000	103,410
Carborundum	lb.	4,907,170	294,430
Coke	sh.t.	23,496,666	55,595,792
Copper sulp. (c)	lb.	37,654,961	1,833,797
Copperas	sh.t.	35,334	388,674
Crushed steel	lb.	630,000	44,100
Graphite, artificial	lb.	7,385,511	502,667
Lead, white	sh.t.	116,628	10,515,315
Lead, sublimed, white	sh.t.	9,100	973,000
Lead, red	sh.t.	11,358	1,156,282
Lead, orange mineral	sh.t.	393	43,157
Litharge	sh.t.	12,254	1,231,206
Mineral wool	sh.t.	9,197	77,228
Zinc oxide (m)	sh.t.	65,100	5,816,040
PRODUCTION OF METALS IN THE UNITED STATES.			
Aluminum	lb.	13,000,000	4,095,000
Copper	lb.	948,196,490	127,285,897
Ferromanganese (q)	lg.t.	152,018	6,445,563
Gold, fine	Troy oz.	4,659,562	96,313,256
Iron, pig	lg.t.	15,784,000	267,538,800
Lead	sh.t.	314,067	26,381,628
Quicksilver	flsks. (o)	17,969	805,690
Silver, fine	Troy oz.	51,798,053	27,382,523
Sodium	sh.t.	2,000	1,000,000
Zinc	sh.t.	210,511	19,897,500
Platinum	Troy oz.	510	11,655
PRODUCTION OF THE RARE METALS IN THE UNITED STATES.			
Bismuth	lb.	5,200	6,600
Cadmium	lb.	10,000	9,300
Calcium	lb.	350	520
Magnesium	lb.	500	500
PRODUCTION OF ORES AND MINERALS IN THE UNITED STATES.			
Antimony ore	sh.t.	360	19,800
Asbestos	sh.t.	1,350	24,000
Chrome ore	lg.t.	280	5,600
Coal, anthracite	sh.t.	80,329,578	159,122,961
Coal, bituminous	sh.t.	334,124,486	382,569,166
Fluorspar	sh.t.	39,389	212,647
Garnet	sh.t.	2,530	78,090
Graphite, crystalline	lb.	3,433,039	149,763
Limestone flux	lg.t.	9,650,000	3,860,000
Magnesite	sh.t.	8,967	52,342
Petroleum, crude	bbl. (i)	184,711,413	136,347,831
Tin ore	sh.t.	50	12,500
Tungsten ore	sh.t.	497	126,281
Zinc ore	sh.t.	838,377	.....

(c) By product only. (i) Barrels of 42 gallons. (m) Includes a small quantity made from spelter. (o) Flasks of 75 lb. (q) Includes spiegeleisen, although the value is given as ferro-manganese.

The work on Feb. 1 in the New York State Barge Canal (*Engineering-Contracting*, April 7, 1909) was as follows: Work under contract, 194.1 miles; additional plans completed, 106.2 miles; plans over 75 per cent. completed, 71.9 miles; other plans in progress, 35 miles.

Colliery Notes

A careful miner will make it an invariable rule to use a copper scraper and clean the dust out of every shot-hole before inserting the charge.

At all coal shafts, where sinking operations are going on, the boiler should be set far enough away to make it impossible for a sudden flow of gas from the shaft to become ignited.

It is generally advisable when installing a power plant, to see that the ground at one end of a line of boilers is clear of buildings, so as to permit the addition of other units as required.

When special shot-firers are employed at a colliery, the miners should state the length of each shot-hole with chalk on a piece of board so that the shot-firer can properly proportion the charge required.

With reference to shaft accidents, the consensus of opinion seems to be that greater safety results from the use of detaching hooks rather than from safety catches. Many engineers fear these latter devices because they are liable to come into operation at a time when they are not wanted.

With the inauguration of the new laws regulating the valuation of Government coal lands, the possibility of purchasing cheap fuel beds, in the West, disappears. New River coal in West Virginia (with transportation convenient), can be purchased for $75 an acre, while inferior coal lands in Utah are now valued at more than $300 per acre.

In the mines of Great Britain, the continuous-current system has almost entirely been replaced by the alternating or polyphase-current system of electric supply. This latter is practically safe even in gaseous mines, for with the use of induction motors, the sparking troubles on commutators, which exist in continuous-current motors, are entirely dispensed with.

One authority states that a good feed-water heater will pay for itself in two months' operation. In actual practice, one such heater reduced the fuel consumption 16 per cent. An open heater is better than a closed heater and shows higher efficiency. This type of heater, however, must be used in connection with a good separator for removing the oil from the exhaust.

For use as a secondary-power producer in shaft sinking, the most satisfactory machine yet devised is the simple straight-line air compressor. This type of machine shows greater efficiency than the general run of small engines. A 10x16¼x18 in. compressor will be found sufficiently large to operate three or four drills and a pump in sinking a shaft of moderate depth. Compressed air has so far been found more satisfactory than electricity as a secondary power in shaft sinking.

Where main or main-and-tail haulage is used, the haulage gear of the system of haulage is worked at full power for only one-third of the time; it then stands for about one-third, and runs at a much smaller power for the other third. Consequently the amount of power necessary for dealing with a given output with these types of haulage is much greater than with endless-rope haulage.

More attention is now being directed to the proper utilization of our peat bogs. One authority states that Michigan contains about 8416 sq.m. of swamp land, largely covered by peat and muck. Assuming that one-tenth of the peat area is workable, and figuring on a depth of 10 ft. (60 to 70 ft. is not unusual), this represents an available peat supply of 1,153,000,000 tons, having a gross value of $3,459,000,000. The estimated cost of producing peat varies from $1 to $2 per ton.

Where main-rope haulage is used, it is impossible to fix any definite gradient upon which the cars will run back by gravity; the degree of slope upon which a train of cars will self-act, depends largely upon the weight of the cars, the size of the wheels, the condition of the road, and the weight of the rails. With heavy cars having large wheels, the train will run back on a gradient of less than 1 in 36; however, on an average kept road, with the car wheels of reasonable size, it will generally be found that a gradient of 2 in 26 is a fair allowance.

One authority on shot firing states that where there are high currents of air, the shot-holes should be placed with the direction of the air current, having the mouth of the shot-hole pointing away from the downcast shaft or intake air. This arrangement, it is said, will prevent the shot from blowing against the air. This same engineer believes that the air at many mines contains such a quantity of dust and occluded gas, that explosions have been caused by the concussion of shots against the mine air, which latter, in some cases, is more readily explosive than firedamp, and takes fire at a lower temperature.

The investigations recently carried on in mines after explosions have occurred, have shown that the most poisonous mixture of gases has been found along the track of the main explosion. The most insidious constituent present in these after gases is carbon monoxide. One point brought out by these examinations is that the average miner will generally make for the main roads in his efforts to escape from the mine. The comment is made that where miners have followed this plan, they have usually been overcome by the poisonous gases encountered. On the other hand, as was shown at the West Stanley disaster in Great Britain, those men who take the circuitous routes instead of the main roads, often get out safely.

An interesting point of difference in the coal mines of Europe and of America, is the shape of the shafts. In most European districts, the circular shaft is generally adopted, owing to the comparative ease with which it is sunk. Engineers who advocate the circular shaft advance the arguments that it is stronger, cheaper to sink and much more able to resist pressure than any other form; on the other hand, the chief disadvantage of the circular shaft is, there is a waste of space between the square formed by the cages, and the circumference of the shaft. However, this space at the present time is utilized as a medium for conveying power cables and pump mains to and from the surface; this space is also valuable as an opening for the free passage of air. In the various coalfields of Great Britain and on the Continent, the rectangular shaft, such as is used in America, has never grown largely in favor. Although the rectangular shaft can be better divided into compartments, and does not involve the waste of space that occurs with the circular form, the difficulty of sinking rectangular shafts, owing to the corners, which have to be kept square, combined with other disadvantages, are said to over-balance the favorable points of this form.

The engineer who attempts to master the problems of mine ventilation, should be familiar with the effects upon human respiration of an atmosphere containing more or less than the normal proportion of oxygen. A normal atmosphere may be regarded as consisting of two gases—oxygen and nitrogen—mixed together in the approximate proportion of 21 per cent. of the former to 79 per cent. of the latter. The proportion of oxygen in mine air may be reduced to as low as 15 per cent. before a person is likely to experience any difficulty in breathing, although lamps and candles will not burn in such an atmosphere. Any further reduction, however, is attended with serious consequences. When only 7 per cent. of oxygen is present in air, the face of the individual becomes gray, the lips blue, there occurs palpitation of the heart and a general dulling of the senses. Since a small deficiency of oxygen occasions such little actual discomfort, great care must be exercised in entering places where there may be a lack of this life sustaining ingredient, as there are no preliminary symptoms, and in an atmosphere entirely deficient in oxygen, a man would become unconscious in 30 or 40 seconds, with little or no preliminary warning. It is also true that in deep mines, where the atmospheric pressure is greater than that ordinarily prevailing at the surface, a man may safely breathe an atmosphere containing a slightly lower percentage of oxygen than might be considered sufficient at ordinary pressure.

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Illustrated.

The Eight-hour Law in California

The eight-hour law which was passed by the legislature of California at its last session took effect May 9, and is producing much trouble. The law is positive in its terms and forbids, under penalties, the employment of men underground for more than eight hours out of 24. Moreover, it extends to mills and smelting works, as well as to underground mines. A number of mine owners met in San Francisco recently and decided to take prompt legal action to test the constitutionality of the law, subscribing a fund for the purpose of meeting the expenses of a test case. Meantime they decided to obey the terms of the law, but to limit its action practically as far as possible. Thus they agreed to restrict work to eight hours, but resolved to count actual working time only at the face, excluding all time spent by the men in entering or leaving the mine. This, of course, would vary greatly at different mines, according to depth and other conditions.

The miners are not accepting these terms without active protest, and contend that the eight hours should run from the time they enter the shaft or tunnel until the return to daylight. Several strikes have already occurred. Thus, in the big mines at Jackson and Sutter Creek and thereabouts in Amador county on the Mother Lode, at Campo Seco and at Angels in Calaveras county, in mines at Sierra City, Sierra county, and at some places in Shasta county, the men have struck and refuse to comply with the rule adopted by the operators. The Austrian and Italian miners on the Mother Lode, of whom there are many, insist on working under the new law without any concessions to the operators. At the Shasta county smelting works and in Grass Valley and Nevada City the miners have been working under an eight-hour schedule for some time. The annual meeting of the State Miners' Union No. 2, Western Federation of Miners, occurs this week at Angels, and the question of fighting the operators in the California Miners' Association is to come up. If they decide to do so there will be many individual contests in different mines; but it is doubtful if the mine operators will stand together should this occur. There are many small mines in the State, owned by [illegible] small companies, who have not the means or disposition to enter into a long and doubtful contest.

It is contended on behalf of the mine owners that many California mines are operated on a narrow margin; and that in a number of these the small profit might be turned into a loss by shortening the day without a reduction in wages, or by the substitution of three shifts for two. This is probably true in a number of cases. The legislature, however, refused to consider protests against the law on this or other grounds. The probability, judging from precedents in other States, is that the law will stand. There will be much friction, however, before matters are finally adjusted to its operation.

Hand Sorting

Hand sorting as a treatment of ore delivered from the mines is a process that is too often neglected. If practiced in the laborious ways of Mexico and Europe, it is undoubtedly too costly to be applied generally with high priced labor, which is the condition in most parts of the United States. If applied, however, in an economically arranged sorting plant, the process is frequently very profitable, delivering immediately a high-grade concentrate, at comparatively low cost per ton, and without incurring any loss from sliming or otherwise. A concentrating mill, meaning a jig or table mill, is the fashionable accessory to a mine. But there are many mines that lie idle for years, awaiting the provision of a plant of machinery for crushing and washing, which could be made to pay their way and eventually obtain the necessary mill by the introduction of a good system of hand sorting.

Even after the concentrating mill has been provided, it is frequently the case that ore is run through it which would better be removed by hand sorting. This is the case, for example, with ore of low grade, considering the general average, which nevertheless contains a good deal of galena that by the first crushing is liberated in pieces of ¾ to 1 in. in diameter. To run such ore through the crushers and rolls of the ordinary concentrating mill is but little short of criminal.

The conditions that we have mentioned exist to a large extent in the Cœur d' Alene. The absence of hand sorting in that district was for a long time a fea-

ture that attracted the attention of visitors. However, during the last year or two there has been a general introduction of picking plants, all of the big mines having been thus equipped, except the Morning and the Hunter. In fairness we must say that this is no new thing, inasmuch as the excellently managed Bunker Hill & Sullivan has practiced hand sorting to a more or less extent for upward of five years and is continuing to do so.

In the present practice of the Cœur d' Alene, the ore is roughly sorted into shipping product, concentrating ore and waste, the shipping ore being sent to the smelters and the waste being returned to the mines for filling. Because of this sorting the shipments of crude ore from the Cœur d'Alene increased materially in 1908 as compared with 1907. Opinion is not unanimous, however, as to the result of the practice. According to some authorities the sorting has considerably increased the extraction of ore, by reducing the slime losses which formerly were large, owing to the unnecessary crushing of brittle mineral. An advantage in hand sorting is found also to be the throwing out of sticks and blocks of wood coming from the mine, thereby preventing chokes in the launders of the mill.

The drawbacks to hand sorting in the Cœur d'Alene are: (1) High cost of labor, $3 per nine-hour shift, and the impracticability of using boys or any form of cheaper labor. (2) The lower grade of the concentrate produced by hand sorting as compared with the mill concentrate. Against these drawbacks is undoubtedly a higher extraction of mineral, but the amount of the latter is difficult to determine. It is next to impossible to sample the product of the mines that goes to the sorting house, and in fact the matter of ore extraction is practically carried back to the stopes.

Some mines in the Cœur d'Alene do indeed practice ore sorting to a decided extent in the stopes. All the ore mined by them is moved by hand from the place where it was broken to the ore chute. During this transfer first class ore is picked out in large chunks, while freshly broken and clean, by the mine laborers (without otherwise interfering with their work) as an incident in the mucking of the ore. In certain mines, however, a limitation of this practice has been found in the insufficiency of chutes, or other facilities, by which the accumulated first-class ore in the stopes can be segregated and brought to the surface. It is safe to say that when sorting of this kind can be successfully practiced underground, it may be continued even more advantageously on the surface where suitable provisions may be made. The most reliable gage of the value of the practice is, of course, the ledger of the bookkeeper.

Pig Iron Production of the World

The total pig-iron production of the world in 1908 showed a decrease of 12,476,000 tons, or a little over one-fifth from that of 1907. The greater part of this loss—over five-sixths—was in the production of the United States. The depression extended to all European countries which report decreases of greater or less amount; but none of them compare at all with the sharp and extreme reduction in our own output. This was to be expected, since European fluctuations in manufacture are never so violent in either direction as those of the United States. The small production of last year offsets the great make of 1906 and 1907. Following the United States, the larger losses in 1908 are found in those countries where the iron trade is most active usually, as in Germany, Great Britain and Belgium; but the reductions were only 15.5 per cent. in Belgium, 9.4 in Germany and 6.4 in Great Britain, compared with 38.6 per cent. in the United States.

The accompany table, prepared for THE MINERAL INDUSTRY, gives the pig-iron production of the world in 1907 and 1908, reduced to metric tons; the third column showing the percentage of change last year:

PIG IRON PRODUCTION OF THE WORLD.
IN METRIC TONS

	1907.	1908.	Change. Per Cent.
United States	26,193,863	16,190,994 D.	38 6
Germany	13,015,760	11,813,511 D.	9 4
Great Britain	10,082,638	9,438,477 D.	6 4
Three leading producers	49,322,261	37,442,982 D.	24.1
Austria-Hungary	1,405,000	1,390,000 D	1 1
Belgium	1,427,940	1,206,440 D	15 5
Canada	590,414	572,183 D	3 1
France	3,588,949	3,391,150 D	5 5
Italy	32,000	32,500 I	1 6
Russia	2,768,220	2,748,000 D	0 6
Spain	385,000	375,000 D.	2 8
Sweden	603,100	563,300 D.	6 6
All other countries	625,000	550,000 D.	12 0
Total ..	60,747,914	48,271,555 D.	20 5

The extent of the change is illustrated by the fact that in 1907 the United States made 43.1 per cent. of the pig iron of the world; in 1908 only 33.6 per cent. The proportion made by the three chief producers was 81.2 per cent. in 1907 and 77.8 in 1908. Further, the make of the United States in 1907 was 3,065,465 tons more than the combined output of Germany and Great Britain; while in 1908 it was 5,060,994 tons below their united production.

Both of Chihuahua.

Gold Production in Australasia

The gold production of Australasia for the first quarter of 1909, as officially reported, shows a loss of 7.9 per cent., or very nearly $1,400,000, as compared with the first quarter of 1908. In the six States of the Commonwealth of Australia the loss was 7.2 per cent.; while in New Zealand there was a decrease—hardly anticipated—of 11.7 per cent. In every case there was a decline from last year, though some of the changes were small.

The total Australasian production for the three months was as follows, in ounces of fine gold, South Australia and Tasmania being estimated:

	1908.	1909.	Changes.
New South Wales	62,562	47,403 D.	15,159
Queensland.....	93,145	92,722 D.	423
South Australia..	2,400	2,350 D.	50
Tasmania.....	15,625	14,500 D.	1,125
Victoria.....	149,933	141,805 D.	8,128
West'n Australia	410,631	382,395 D.	28,236
Commonwe'lth	734,296	681,175 D.	53,121
New Zealand....	124,318	109,761 D.	14,557
Total, oz.....	858,614	790,936 D.	67,678
Total value....	$17,747,551	$16,348,647 D.	$1,398,904

The greatest actual decline was in Western Australia, and was due to a decrease in the values of ores in the principal mines, rather than to diminished activity. The largest proportional loss was in New South Wales, and resulted for the most part from the diversion of men from mining to other industries. In Victoria there were fair increases in January and February, but for some unexplained reasons a heavy decrease in March brought the total for the quarter down to a lower point than last year. The New Zealand loss was chiefly from the dredging industry, which has been falling off for some time.

If the first quarter is to be taken as an index, the prospect for Australasia is that the gold production for 1909 will show a continuation of the decline which has been going on for several years. It is quite possible, however, that increases may be shown in the latter part of the year, as is frequently the case there. The attention given to the mining of other metals, especially copper, has not been without its effect on the gold mining industry.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

The Cost of Mining Coal

The contribution to the literature of this subject in the JOURNAL of May 8, 1909, is both unique and instructive, and may be regarded as a classic which may be profitably studied by engineers and managers who desire to master the subject in its broadest conceptions. Mr. Finlay has rendered an invaluable service in showing how conclusions, both useful and specific, may be deduced from entirely general and non-specific data. Many business men who are not engineers, as well as engineers who have the business instinct, have the faculty of "sizing up" matters of cost and profit, from data such as Mr. Finlay uses, by a process possibly identical with the methods elaborated by Mr. Finlay. That article and the similar contribution on the "Cost of Pig Iron Made from Lake Superior Ore," furnish the material for a treatise defining the methods of which costs may be computed with a close approach to accuracy. When the engineer is confronted by difficulties which may seem insurmountable because of the impossibility of obtaining actual figures of cost, or of securing access to cost sheets, he has merely to adopt Mr. Finlay's methods to reach conclusions which will furnish close approximations to the truth.

Expressing this method mathematically we may write:

$$C = \frac{4\,W}{3\,O} + d + i + a;$$

in which

C = Cost per ton,
W = Average rate of wages per day of all employees,
O = Daily output in tons per employee,
d = Depreciation of plant per ton of output,
i = Interest on capital per ton of output,
a = Amortization charge per ton of output.

While there may be material differences in judgment as to what constitute proper depreciation, interest and amortization charges, if these be fixed by adopting current rates of interest and valuations determined by property appraisals in harmony with prices at which similar property is salable, these differences will not be large enough to make a material difference in the final result. In some cases a nearer approximation to actual costs will be obtained by changing the numerical factor $\frac{4}{3}$ to $\frac{3}{2}$, making the formula read:

$$C = \frac{3\,W}{2\,O} + d + i + a.$$

In the absence of actual cost sheets or other data, the investigator has therefore to learn the average rate of wages of all employees, the average output in tons per employee, the approximate investment in plant and improvements, and in lands, etc., to enable him to make a close estimate of the cost per ton. The numerical factors $\frac{4}{3}$ and $\frac{3}{2}$ introduce an empyrical method of approximating the cost of materials, supplies and incidental expenses, which in practice is generally from one-fourth to one-third of the gross cost. In other words, if the gross cost of mining be $1 per ton, the labor cost is usually from ⅔ to ¾ (66 to 75c.) of this amount, and the balance, 1/3 to ¼ (33 to 25c.), represents these other items.

It may be thought that the experienced mine manager or engineer should be able to make such estimates from his special knowledge of the conditions in any district, and this is true if the engineer be personally familiar with the district or if he has had experience under practically like conditions, but even those of the widest experience will find the method useful in examining propositions located in districts with which they are not familiar, especially in checking up general conclusions based upon data furnished by parties in interest and which may be more or less unreliable.

Mr. Finlay makes a remarkable statement concerning the rate of wages when he says, "I do not believe that this is a factor at all." In its broadest sense this statement is possibly true, and the arguments which Mr. Finlay advances to support it are plausible and convincing, but the statement is one likely to be misunderstood and perhaps misapplied. I do not imagine that Mr. Finlay intends to convey the idea that an increase in the wage scale will not increase the cost of mining coal, but on the contrary as I understand the argument, he means that local differences in the wage scale result from differences in the cost of living in the climate, social environment, etc., and that such differences are apparent but not real differences, that the wage scale is the measure of the value of work done, being the compensation received for such work and that the law of supply and demand keeps this practically uniform throughout the country. The same argument can with equal force be applied to all countries. While the question is one of academic interest, it has some practical bearing upon the issue and should be carefully considered, and Mr. Finlay has rendered a distinct service in directing attention to it.

A correct determination of the cost of mining is the most important function of the engineer when acting in an advisory capacity, for upon it must be based the appraisals of money values and advice as to whether the property can profitably be worked. If the cost be too high to permit profitable operation, its present money value must be small, its purchase may be undesirable, or if purchase has already been effected, its immediate sale may be advisable. The practical problem which the advisory engineer must solve is specific. It rarely relates to average cost in a given district (although for purposes of comparison this must be known), but on the contrary, is usually the determination of mining cost at a given property under existing physical and economic conditions, and the value of the service rendered must always depend upon the accuracy with which this is determined. The engineer has rarely to speculate upon questions affecting the wage scale, as this scale is usually known and fixed; farther, as any change in the scale will affect the cost of all competitive properties in nearly the same ratio, such possible changes may be disregarded. The pertinent question as to whether the property can be made to produce coal at a cost not exceeding the average cost in the district; if not, then the venture has a doubtful future; otherwise it may be favorably considered—assuming of course that the quality of the coal is equal to the average quality produced in that district.

THICKNESS OF COAL IS PRINCIPAL FACTOR

In addition to what Mr. Finlay has said, it may be useful to emphasize the fact that the principal factor affecting the cost of mining is the thickness of the coal. To graphically illustrate this, I submit a diagram showing cost curves which have been constructed to show how the thickness affects the cost of mining anthracite coal in Pennsylvania. These curves have been plotted from a large

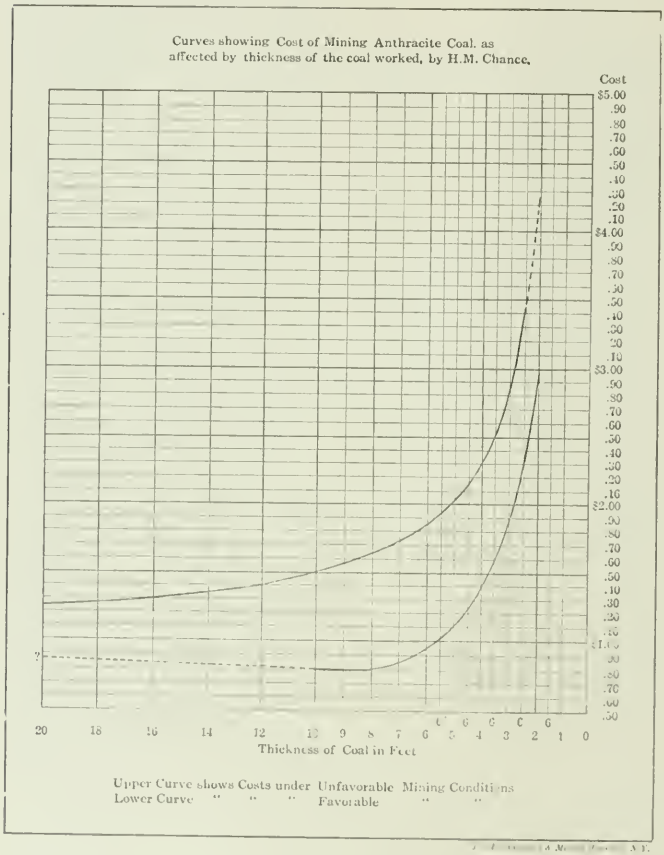
collection of data, including actual costs under widely varying conditions.

The costs shown by these curves include all items properly chargeable to mining, but do not include the cost of preparing coal for market. These costs are not "run-of-mine" costs because they are computed by dividing the total cost of production by the number of tons of merchantable coal produced, excluding the waste and coal burned under the boilers of the mining plant. The items thus included embrace labor of every description, skilled, unskilled, clerical, etc., all materials used in repairs, maintenance and construction, all supplies consumed, general office expenses, etc. and new equipment bought in ordinary course of operation and development, as well as the cost of exploratory and other work incidental to consistent maintenance of property and increase of output. The items not included are the cost of preparing coal for market, cost of selling output, taxes, interest on investment, depreciation (cost of plant having been charged to operation) and amortization of value of lands.

The costs as computed for these curves do not include any operations where the coal is mined by stripping in open-cut work, or where the coal is above water-level and is opened by drifts or tunnels, and are applicable only to coal opened for mining below water-level by shafts or slopes.

From an examination of the upper curve it will be seen that under favorable mining conditions (small output, poor management, depth and roof, faults, rolls, gas, crushed coal, water, slate and rock partings) the coast ranges from $1.25 to $1.30 for beds containing from 15 to 20 ft. of coal, up to about $3.40 for beds 2 ft. 6 in. thick. The curve beyond the 2½ ft. line is hypothetically prolonged to the 2 ft. line, there being no actual figures available, for in the presence of unfavorable conditions coal less than 2 ft. 6 in. thick is rarely worked.

From an inspection of the lower curve it will be seen that when the conditions are favorable, the cost ranges from $0.80 or $0.85 for thick coals, up to from $2.30 to $2.90 for beds containing from 2½ to 2 ft. of coal. It will be noted that the cost increases rapidly in the case of coals less than 4 ft. in thickness and that at the 3-ft. line the curve becomes very steep.



The average hight of man limits the possibility of cheap mining to beds of coal 4 ft. or more in thickness; if man had a stature of 20 ft. he could mine coal 6, 8 or 10 ft. thick only by removing much rock or slate to gain room in which to work; if he stood but 2 ft. high, he could work beds 18 in. thick without removing any of the roof or floor to gain headroom. Hence for this and other reasons, we cannot hope to work thin coals at anything like an approach to the low costs which may be reached in mining thicker beds.

In addition to this limitation fixed by the hight and size of the miner, the following conditions tend to increase the cost of mining thin coal seams:

1. The yield per acre is less, therefore the cost per ton for headwork, gangways, airways, shafts, cross-cuts, is correspondingly increased.

2. The yield per acre being less, more acres are required for a given output, the average underground haul is correspondingly longer and the haulage cost per ton is increased.

3. For the same reason the quantity of water to be pumped per ton of coal developed is larger, and the cost for pumping per ton of coal produced is correspondingly increased.

4. For the same reason the cost of ventilation per ton of coal is larger, often many times larger than in working thick coals.

5. The interest charge (account plant and equipment) is larger per ton of coal produced.

6. The cost of superintendence per ton of coal produced is larger.

A merely cursory investigation of these factors is sufficient to show that the thickness of workable coal is of predominating importance in determing the cost of mining.

By reference to the cost curves it is seen that the average difference in the cost of mining due to the presence of favorable or unfavorable mining conditions, in mining the thicker beds is from $0.50 to $1 per ton, and in mining the thinner beds is from $1 to $1.10 per ton.

It will of course be understood that in many cases where quite exceptional conditions are present, the costs may differ materially from those indicated by these curves, for example, a coal bed may contain 10 or 12 ft. of coal, but may be so crushed and faulted and contain so much waste that the mining cost may exceed $2 per ton. These curves have not been constructed to include exceptions of this kind, being intended to show how, under fairly normal conditions the average costs vary with the thickness of the coal worked. The two curves shown, one to represent costs under conditions adverse to cheap mining, and the other under

conditions favorable to cheap mining, illustrate the ordinary extremes under what may be termed normal conditions.

These curves represent the experience at no particular operation, nor of any particular operating company. Owing to the varying conditions at different operations and in different localities, curves showing costs at single operations, or of the combined operation of several collieries under one management, would in many cases show little similarity to those shown by the diagram illustrating this article. A similar curve to show mining costs as affected by thickness of coal worked under present *average* mining conditions in the anthracite districts, might be used to show the actual cost of mining anthracite coal—but that is a matter entirely foreign to the purpose of this article.

At some future time I hope to construct similar curves to illustrate the effect of variations in thickness on the cost of mining bituminous coal. To make such illustrations effective and useful they should each represent the conditions and costs in a single field or district. In a general way the same principles apply to bituminous as to anthracite mining. In both, the thickness of workable coal is the factor of greatest importance in determining costs. Assuming that the wage scales in two districts, or at two mines, are equal, or practically equal, and that neither mine nor district has any overwhelming natural advantage over the other, the factor ranking next in importance is that of daily output. Large output should mean low cost. Next in importance, and often of greater importance than the output, is the character and ability of the management. Mr. Finlay has sufficiently emphasized the importance of the personal ability of the operator or manager in reducing costs. Good management implies efficient equipment, regularity of output and intensive operation. Unless hopelessly handicapped by natural obstacles (faults, thin coal, poor roof, deficient equipment or lack of a market), good management should insure the profitable operation of any coal property.

H. M. CHANCE.

Philadelphia, Penn., May 11, 1909.

The "Consulting Engineer" and a Question of Ethics

The writer, who is a layman, has always had a vague respect for what are known as the ethics of the learned professions. Yet the following incident, which recently happened in New York, leads me to inquire if engineering societies prescribe any code of ethics for their members: Mr. B, a member of the American Institute of Mining Engineers, while acting as consulting engineer and stock-transfer agent for a gold-mining concern, having an office in New York, receives reports of new ore discoveries in the mine. B thereupon makes an agreement with H, one of the company's directors, and with G, a stockbroker, to turn over to these two such stock as he can buy at a low figure from stockholders of his acquaintance on condition that B have an option on one-third of stock so purchased, at cost plus 6 per cent. interest. It is agreed that H and G are to provide the money for purchase of stock. In some instances B buys stock directly from owners by withholding all good news and by posing as a disinterested broker for the seller. Afterward the stock rises to a price on the New York Curb equal to five times the purchase price. After the three parties, B, H and G, have divided their stock holdings among themselves B (as the company's transfer agent) refuses to return to G stock certificates which the latter has sent in for transfer. B's only excuse is that a syndicate of directors interested in the stock, do not want B to return the stock. Presumably the syndicate did not want this stock to appear on the Curb where they might have to purchase it. Other parties' stock was held up in a similar manner.

Does the JOURNAL consider that B has been faithful to his profession of consulting engineer, to the stockholders of the corporation employing him, or to those whom he, in the guise of a broker, induced to become his clients?

SUBSCRIBER.

Philadelphia, Penn., May 17, 1909.

[The term "consulting engineer" is being employed in ways that are so meaningless that we expect to see it entirely given up by the leaders of the profession. Inasmuch as any bootblack or chiropodist may be a "professor," why should not anyone be a "consulting engineer?" The new graduate who opens an office immediately becomes a "consulting engineer." The superintendent or manager out of a job and waiting for another one to turn up subscribes himself in the meanwhile as "consulting engineer," because he thinks that the adjective implies that he is doing something, which simple "mining engineer" might not. Some eminent engineers are officially entitled by the large companies that exclusively employ their services as "consulting engineer" for such and such company, which title is supposed to be higher than that of general manager. It has even been explained before a court of law that a consulting engineer is one who manages managers.

Now the very title of consulting engineer implies action in an advisory capacity. The engineer may often act strictly and solely in that capacity, just as the medical and legal men do, but often it is unsatisfactory to the engineer to give advice without assurance that his recommendations will be properly carried out, and the execution may be left entirely to him. He then becomes a managing engineer, or a managing director. The continued use of the title of consulting engineer manifests a poverty of invention in the matter of titles. The superintendent is under the general superintendent. The general superintendent is under the general manager. If the organization requires that someone shall be over the general manager, why not call the next rank the "managing director," or "director general?"

For example, Pope Yeatman is in reality the director-general of the Nevada Consolidated, Cumberland-Ely and Steptoe Valley companies. If any one of those companies should go to Dr. Peters for advice, they would go to him as a consulting engineer. This matter of title is not, like some others, a quibbling over dignity, and consequently of no importance, but on the contrary is one upon which some live questions of ethics depend. It is indeed the keystone of the question that is being discussed by the Mining and Metallurgical Society of America, with respect to the conditions under which an engineer is justified in accepting a contingent fee. In the course of this discussion Dr. H. M. Chance put the question very well in the following words:

"When an architect becomes the superintendent of construction for a firm of contractors, for the time being he ceases to be recognized as a professional architect; when a civil engineer becomes division superintendent of a railroad, he is no longer a civil engineer; and even when a lawyer becomes president of a corporation the public no longer regards him as a professional man; yet many mining engineers continue to be known as mining engineer for many years after they may have ceased entirely to do any professional work. This breeds confusion in the public mind, and a vague idea that the mining engineer is properly manager, inventor, promoter, or adviser at the same time, and consequently may be expected to act as his interests and those of his principals may require."

In the specific case cited by "Subscriber," the combination of consulting engineer and stock transfer agent suggests the incongruous. We shall make no comment upon this discord, but simply shall ask "Subscriber" to try to imagine J. Parke Channing, or John Hays Hammond filling those dual positions.

As to the ethics of the action of Mr. B as a stock-transfer agent, his relation to his company, his duty to his stockholders, etc., we do not think it necessary to express any opinion. We think, however, that the "gold-mining concern" in question might advisably follow the example of many large companies and entrust its stock transferring, etc., to some regularly organized and fully responsible institution. —EDITOR.]

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM OXIDE—A Process for the Electrolytic Production of Aluminum Oxide. Frank W. Morris, Victoria, B. C. (Brit. No. 6449 of 1908.)

ELECTROLYTIC EXTRACTION—Art of Extracting Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. (U. S. No. 920,893; May 4, 1909.)

ANTIMONY

ORE TREATMENT—An Improved Process of and Apparatus for Treating Antimony and Other Ores. Henri L. Herrenschmidt, Paris. (Brit. No. 7429 of 1908.)

ASPHALT

BY-PRODUCTS—A New or Improved Process for the Production of By-products from Asphaltum, and the Like. Smith Everett, London. (Brit. No. 27,335 of 1907.)

SEPARATION PROCESS—Means for Separating Bitumen from Bitumen Bearing Ore. George M. Willis, Chicago, Ill. (U. S. No. 918,628 and 918,629; April 20, 1909.)

COAL AND COKE

BRIQUETS—Method of Producing Anthracite Briquets. John F. Lovejoy, New York, N. Y., assignor of one-half to Abe Stein, New York, N. Y. (U. S. No. 921,550; May 11, 1909.)

BRIQUETTING—Fuel-Briquet Machinery. Robert Devillers, New York, N. Y. (U. S. No. 920,838; May 4, 1909.)

COKE—Improvements in Apparatus for Quenching, Screening and Loading Coke. Albert Goodall, Spennymoor, Eng. (Brit. No. 9226 of 1908.)

COKE—Regenerator System for By Product Coke-Ovens. Hugh Prentice, Bellevue, Penn. (U. S. No. 920,647; May 4, 1909.)

COKE OVEN. Carl Schroeter, Chicago, Ill., assignor of one-third to James F. Hill, Chicago, Ill. (U. S. No. 922,201; May 18, 1909.)

COKE OVENS—Improvements in, or Connected with Coke-Ovens. The Coke Ovens and By Products Company, Ltd., and Stephen N. Wellington, London. (Brit No. 6223 of 1908.)

COKE OVENS—Improvements in, or Relating to Regenerative Coke Ovens. Joseph Mueller, Berne, Germany. (Brit. No. 11,688 of 1908.)

MINING METHODS—An Improved Method of Mining Coal, or the Like. Harry A. Kuhn, Pittsburg, Penn. (Brit No. 9074 of 1908.)

SEPARATOR—Coal and Slate Separator. Herbert Mathewson, Shenandoah, Penn. (U. S. No. 920,972; May 11, 1909.)

COPPER

EXTRACTION FROM ORES—Process of Extracting Copper from Ores. Caleb G. Collins, Woodmere, N. Y., assignor to Calvin Amory Stevens, New York, N. Y. (U. S. No. 919,120; Apr. 20, 1909.)

MATTES—Improvements in the Treatment of Copper Mattes. James T. Carrick and Basil S. Pattison, Johannesburg, Transvaal. (Brit N. 12,750 of 1908.)

RECOVERY OF COPPER—An Improved Process for Eliminating Lead and Other Impurities such as Arsenic and Antimony, from a Plumbiferous Copper Matte, Ore or Alloy, and Simultaneously Recovering the Copper as Metal. Société Anonyme Usine de Destrugentation Hoboken lez Anvers, Belgium. (Brit No. 19,587 of 1908.)

GOLD AND SILVER

AMALGAMATOR. George H. Louks, Chicago, Ill. (U. S. No. 920,880; May 4, 1909.)

CYANIDE PROCESS—Process of Extracting Precious Metals from their Ores. William L. Imlay, Conestoga, Penn., assignor to William L. Imlay Rapid Cyanide Process Company, a Corporation of South Dakota. (U. S. No. 919,434; April 27, 1909.)

EXTRACTION OF GOLD—Improvements in Extracting Gold from Its Ores and Apparatus Therefor. Amédée M. G. Sébillott and Louis Maucaitre, Paris. (Brit. No. 5481 of 1908.)

EXTRACTION OF SILVER—Process of Extracting Silver from Its Ores. James C. Pryor, North Bay, Ontario, Canada. (U. S. No. 918,908; April 20, 1909.)

GOLD SEPARATOR. Levan L. L. Swenson, Longmont, Colo. (U. S. No. 917,906; April 13, 1909.)

PLACER-GOLD SEPARATOR. Thomas G. Leavell, Spokane, Wash., assignor of one-fifth to William J. Parks, one-fifth to Henry L. Herkelrath, one-fifth to Edmund E. Brandt, and one fifth to Merton J. Hills, Spokane, Wash. (U. S. No. 919,894; April 27, 1909.)

REFRACTORY ORE TREATMENT—Process of Removing Sulphur, Arsenic, and Other Like Impurities from Refractory Ores. Frank Cotton, Hornsby, New South Wales, Australia. (U. S. No. 922,088; May 18, 1909.)

IRON AND STEEL

BASIC BESSEMER PROCESS—Manufacture of Iron or Steel by the Basic Bessemer Process. Josy Flohr, Rodange, Luxemburg, assignor to Société Anonyme des Hauts-Fourneaux et Forges de Dudelange, Dudelange, Luxemburg. (U. S. No. 920,560; May 4, 1909.)

CINDER CARS—Tilting Device for Cinder-Cars. Mary B. Veitch, Bessemer, Ala., administratrix of Richard C. Veitch, deceased. (U. S. No. 916,636; Mar. 30, 1909.)

ELECTRIC REFINING OF STEEL—Improvements in and Relating to the Refining of Steel in Electric Furnaces. Communicated from the Company Bismarckhütte, Bismarckhütte, Germany. (Brit. No. 14,926 of 1908.)

FERRO-ALLOYS — Process of Making Ferro-Nickel and Nickel-Steel. Franklin R. Carpenter, Denver, Colo. (U. S. No. 922,388; May 18, 1909.)

FLUE DUST—Method of Utilizing Furnace-Flue Dust. Thomas M. Phillips, Youngstown, Ohio, assignor of one third to the Youngstown Steel Company, Youngstown, Ohio, a Corporation of Ohio, and one-third to Edward L. Ford, Youngstown, Ohio. (U. S. No. 919,073; Apr. 20, 1909.)

FURNACE OPERATION—Means for Cooling Furnace Walls. Luther L. Knox, Pittsburg, Penn., assignor to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania (U. S. No. 919,190; April 20, 1909.)

GAS PRODUCERS—Improvements in, or Relating to Gas Producers for Use in Melting, Heating and the Like in the Manufacture of Steel. George E. Scoby Smith, Bolton, Eng. (Brit. No. 12,856 of 1908.)

METALLURGY OF STEEL. William S. Simpson and Howard Oviatt, London, England. (U. S. No. 918,382; April 13, 1909.)

OPEN HEARTH FURNACE. Luther L. Knox, Ben Avon, and Montgomery Murray, Wilkinsburg, Penn., assignors to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,184; April 20, 1909.)

OPEN HEARTH FURNACES—Air and Gas Port for Open Hearth Furnaces. Frank D. Carney and Thomas T. McKntee, Steelton, Penn., assignors, by mesne assignments, to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,125; April 20, 1909.)

ORE TREATMENT. Improved Method of and Apparatus for Treating Ores. John T. Jones, Iron Mountain, Mich. (Brit. No. 5515 of 1908.)

ORE TREATMENT—Method of Treating Iron Ore. Communicated from John T. Jones, Iron Mountain, Mich. (Brit. No. 12,322 of 1908.)

PRODUCTION FROM FINELY-DIVIDED ORES—Improvements in, and Apparatus for, the Production of Iron from Finely Divided Ores. Philip M. Pritchard and the United Alkali Company, Ltd., Liverpool, Eng. (Brit. No. 6561 of 1908.)

REGENERATIVE REVERSING FURNACE. Luther L. Knox, Ben Avon, Penn., assignor to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,185; April 20, 1909.)

LEAD

ELECTROLYTIC REFINING — Treating Anode Slime from the Electrolytic Refining of Lead. Anson G. Betts, Troy, N. Y. (U. S. No. 918,647; April 20, 1909.)

FURNACE. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,333; May 4, 1909.)

LITHARGE—Method of Manufacturing Litharge. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,335; May 4, 1909.)

METALLURGICAL FURNACE. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,334; May 4, 1909.)

ORE TREATMENT—Method of Treating Argentiferous Lead Ores. Oliver H. Picher, Joplin, Mo. (U. S. No. 920,388; May 4, 1909.)

SUBLIMED WHITE LEAD—Method of Manufacturing Sublimed White Lead. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,332; May 4, 1909.)

NICKEL

RECOVERY FROM SILICIOUS ORES—Process of Recovering Nickel from Silicious Ores. Adolphe Chains, Philadelphia, Penn. (Brit. No. 18,596 of 1908.)

PETROLEUM

OIL-WELLS—Device for Pulling Oil-Wells. Lawrence J. McKinney, Prairie Depot, Ohio. (U. S. No. 920,615; May 4, 1909.)

PUMPING—Apparatus for Pumping Oil from Petroleum Wells. Karel E. Ehrmann, Bajoeng Lentjir, Sumatra. (U. S. No. 919,142; April 20, 1909.)

SULPHUR AND PYRITES

FURNACE—Improvements in Furnaces for the Combustion of Mineral Sulphur. Giuseppe Oddo, Pavia, Italy. (Brit No. 21,255 of 1908.)

TREATMENT OF PYRITES LIQUOR for Winning Metals Therefrom. John H. Thwaites, Peterborough, England. (U. S. No. 921,312; May 11, 1909.)

TIN

DETINNING—Process of Removing and Recovering Tin. Julius Elkes, Mount Pleasant, Penn. (U. S. No. 919,839; April 27, 1909.)

RECOVERY FROM WASTE — Improved Process and Apparatus for the Recovery of Metallic Tin from Waste Tinned Metal, Mixtures and Alloys of Tin and Lead, and Similar Metal Waste. Albert Nodon, Bordeaux, France. (Brit No. 7584 of 1908.)

ZINC

DISTILLATION FURNACE. Woolsey M. Johnson, Hartford, Conn., assignor to the Continuous Zinc Furnace Company, Hartford, Conn., a Corporation of Connecticut. (U. S. No. 920,473; May 4, 1909.)

EXTRACTION FROM ORES AND RESIDUES—Improvements in, or Relating to, the Extraction of Zinc from Ores and Zinc Residues. Weldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 27,020 of 1907.)

EXTRACTION PROCESS—Methods of Extracting in the Shape of Oxides, Sulphites and Sulphates Zinc and Other Metals from

Ores and Products Containing Them. Wilhelm Troeller, Frankfort-on-Main, Germany. (Brit. No. 6888 of 1908.)

FURNACE—Revolving Furnace for Volatilizing Zinc Ores. Harry H. Hughes, Springfield, Mo. (U. S. No. 920,143; May 4, 1909.)

FURNACE OPERATION — Improvements Relating to the Exhaustion or Extraction of Dust and Fumes Produced by Zinc Furnaces and the Like. Emile Der-Delattre, Dorpleln, Holland. (Brit. No. 13,146 of 1908.)

PROTECTION OF WORKMEN—Means for Protecting Operatives of Zinc and Analogous Furnaces from Heat, Fumes and Dust. Emile Der-Delattre, Liege, Belgium. (U. S. No. 921,375; May 11, 1909.)

RECOVERY OF ZINC COMPOUNDS—Method of Recovering Zinc Compounds and Ammonia, from By-Products of Galvanizing. Elias G. Pearlman and Martin M. Pearlman, Philadelphia, Penn. (U. S. No. 919,375, and 919,376; April 27, 1909.)

SMELTING—Process of Smelting Zinc Ores. Anson G. Betts, Troy, N. Y. (U. S. No. 918,648; April 20, 1909.)

ZINC OXIDE—Method of Manufacturing Zinc Oxide. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,336; May 4, 1909.)

ZINC OXIDE—Method of Making Zinc Oxide. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,337; May 4, 1909.)

MINING—GENERAL

BLASTING—Means for Detonating Dynamite and Other Explosives. Frank Wells, Philadelphia, and George E. Potts, Pottsville, Penn., assignors to the Potts Powder Company, a Corporation of Pennsylvania. (U. S. No. 918,907; April 20, 1909.)

HOISTING—Improvements in, or Connected with the Prevention of Overwindings in Mines. Harry B. Daglish and William S. Beck, St. Helens, Eng. (Brit. No. 6389 of 1908.)

VENTILATION—Improvements in the Ventilation of Mines. Albert G. Ford, Exeter, Eng. (Brit. No. 12,348 of 1908.)

ORE DRESSING

BALL MILL with Feed of Fresh Material at the One End, Removal of the Material at the Other End, and Return of the Coarse Ground Material on the Circumference of the Grinding Drum. Richard Beneke, Bromberg, Germany. (Brit. No. 15,453 of 1908.)

CONCENTRATING TABLES — Improvements in Concentrating Tables for Treating Fine Mineral Matters. Armelin Bernard and Luigi Sanna, Paris. (Brit. No. 19,314 of 1908.)

CONCENTRATORS—Improvements in and Relating to Ore Concentrators. Seth R. Swain, Denver, Colo. (Brit. No. 13,747 of 1908.)

CONCENTRATION—Method and Apparatus for Saving Slimes in Ore Concentration. James N. Flood, Denver, Colo. (U. S. No. 919,709; April 27, 1909.)

ELECTROMAGNETIC SEPARATION—Apparatus for Electro-magnetic Separation. Ferdinand Steinert and Heinrich Stein, Cologne, Germany. (Brit. No. 6323 of 1908.)

MAGNETIC SEPARATORS—Improvements in, or Relating to Magnetic Separators. Harold Alcock, Doseley and Henry C. Simpson, Horsehay, Eng. (Brit. No. 18,855 of 1908.)

ORE-CONCENTRATOR. Emil Deister, Fort Wayne, Ind., assignor to the Deister Concentrator Company, a Corporation of Indiana. (U. S. No. 921,089 and 921,090; May 11, 1909.)

ORE-CONCENTRATING JIG AND COAL-WASHER. George C. Hackstaff, Denver, Colo. (U. S. No. 922,419; May 18, 1909.)

ORE SEPARATION—Process of Separation of Metals. Richard D. Divine, Chicago, Ill. (U. S. No. 921,372; May 11, 1909.)

SEPARATION PROCESS—Apparatus for Separating Solids from Liquids. Francis E. Elmore and Alexander S. Elmore, London, England. (U. S. No. 919,144; April 20, 1909.)

SEPARATOR—Improvements in, or Relating to the Separation of the Liquid and Solid Components of Wet Slimes or Ore Pulp. Horace G. Nichols, Ymir, B. C. (Brit. No. 2479 of 1908.)

TAILINGS DISPOSAL—Process of Disposing of Tailing-Sand and the Like. John F. Jackson, Houghton, Mich. (U. S. No. 918,054; April 13, 1909.)

METALLURGY—GENERAL

AGGLOMERATION PROCESS—Process for the Agglomeration of Small Finely Divided Ores. Antonin P. Fenlakoff, St. Petersburg, Russia. (Brit. No. 4142 of 1908.)

BLAST-FURNACE OPERATION—Means for Running Off Slag from Blast Furnaces. Joseph Marsden and Edward Pearson, South Bank, England. (U. S. No. 922,304; May 18, 1909.)

ELECTROLYTIC REDUCTION—Process of Reducing Ores. Frank J. Tone, Niagara Falls, N. Y. (U. S. No. 921,183; May 11, 1909.)

EXTRACTION — Process of Extracting Metal from Ore. Caleb G. Collins, Woodmere, N. Y., assignor to C. Amory Stevens, New York, N. Y. (U. S. No. 919,129; April 20, 1909.)

REDUCTION PROCESS—Process for Treating or Reducing Ores. Edwin P. Welch, Denver, Colo. (U. S. No. 919,663; April 27, 1909.)

ROASTING PROCESS—Process of Subjecting Materials to the Action of Air or Other Gases. John E. Greenawalt, Denver, Colo. (U. S. No. 921,645; May 11, 1909.)

SEPARATION—Process of Separating Metals from Ores. Pierre Germain, Paris, France. (U. S. No. 921,227; May 11, 1909.)

SULPHIDE-ORE TREATMENT—Improvements in, or Relating to the Treatment of Sulphide Ores or Products. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 6511 of 1908.)

MINING MACHINERY AND APPARATUS

BLASTING CARTRIDGES — Means for Waterproofing Blasting Cartridges. Axel Larsen, London. (Brit. No. 13,890 of 1908.)

BLASTING DEVICE. Charles P. McGregor, Pittsburg, Penn. (U. S. No. 921,144; May 11, 1909.)

BLASTING FUSES — Improvements in Waterproof Caps for Blasting and Mining Fuses. Thomas M. Daniels, Valdez, Alaska. (Brit. No. 7585 of 1908.)

CAGES—Improvements in or Applicable to Pit Cages and Hoists. John Stoney and Joseph Hindley, Tyldesley, Eng. (Brit. No. 26,776 of 1907.)

COAL OR STONE DRILLING MACHINE. Albert Ball, Claremont, N. H., assignor to Sullivan Machinery Company, Claremont, N. H., a Corporation of Maine. (U. S. No. 920,007; April 27, 1909.)

CONVEYING APPARATUS—Improvements in Apparatus for Conveying Material in Mines and Other Restricted Places. Archibald Robertson, Blairhill, Scotland. (Brit. No. 14,713 of 1908.)

CONVEYERS—Improved Mechanical Feed for Bucket Conveyers. John West, Southport, Eng. (Brit. No. 10,798 of 1908.)

DRILLS—Improvements in Mining Drills. Aaron E. Jennings and James W. Jennings, Central City, Ky. (Brit. No. 6234 of 1908.)

DRILLS — Improvements in Percussive Drills for Use in Machine or Hand Rock Drilling. James Harrington, Natal and Robert Parry, Johannesburg, Transvaal. (Brit. No. 5778 of 1908.)

MINING-CAR. Clayton M. Dibler, Jeannette, Penn., assignor of one-third to William Ruwcio and Joseph Torco, West Newton, Penn. (U. S. No. 920,033; April 27, 1909.)

MINER'S LAMP. Charles B. Rimmel, Carnegie, Penn., assignor of one-half to Peter J. Scheib, Carnegie, Penn. (U. S. No. 920,882; May 4, 1909.)

PROSPECTOR'S TOOL—Individual Intrenching or Prospector's Tool. Edgar T. Conley, U. S. Army. (U. S. No. 919,132; April 20, 1909.)

PUMP—Hydraulic Rotary Pump. Ira H. Spencer, Hartford, Conn., assignor to Organ Power Company, Hartford, Conn., a Corporation of Connecticut. (U. S. No. 917,971; April 13, 1909.)

ROCK DRILLS—Improvements in or Connected with Percussive Rock Drills. William C. Stephens, Carn Brea, Eng. (Brit. No. 7630 of 1908.)

ROCK DRILLS—Improvements Relating to Pneumatic Rock Drills. Charles Christiansen, Geisenkirchen, Germany. (Brit. No. 7911 of 1908.)

ROCK DRILLS—Improvements in Percussive Rock-Drills. Holman Brothers, Camborne, Eng. (Brit. No. 6756 of 1908.)

ROCK DRILLS—Improvements in, or Relating to Rock Drills or Other Percussion Tools. Thomas Warson, Nottingham, Eng. (Brit. No. 6094 of 1908.)

ROCK DRILL SHARPENING MACHINE. Clark J. Smith, Ottumwa, Iowa, assignor to Hardsocg Wonder Drill Company, Incorporated, Ottumwa, Iowa. (U. S. No. 920,093; April 27, 1909.)

ROCK-DRILL SHARPENING AND SHAPING MACHINE. Clark J. Smith, Ottumwa, Iowa, assignor to Hardsocg Wonder Drill Company, Inc., Ottumwa, Iowa. (U. S. No. 919,969; April 27, 1909.)

SAFETY CATCH—Automatic Catch for Mining-Buckets, etc. Thomas C. Wright, Goldfield, Nev. (U. S. No. 922,375; May 18, 1909.)

SAFETY DEVICES — Improvements in Safety Devices for Lifts, Mine Cages and the Like. Albert Hodson, Lincoln, Ill. (Brit. No. 28,257 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps Especially Suitable for Use in Underground Workings and in Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 839 of 1909.)

SAFETY LAMPS—Improvements in or Connected with Locking Bolts of Miners' Safety Lamps. Harry B. Buckley, Batley, Eng. (Brit. No. 10,370 of 1908.)

SAFETY LAMP—Miner's Safety Lamp. Lewis W. Cogswell, James D. Abel and William A. Miller, Taylorville, Ill. (Brit. No. 9235 of 1908.)

TRANSPORTING APPARATUS for Mines. Alfred E. Davis, Johannesburg, Transvaal, assignor of three-fifths to Richard Meyer, Johannesburg, Transvaal, Francis Hastings Medhurst, London, England, and John Edgar Ferrar, Johannesburg, Transvaal. (U. S. No. 918,661; April 20, 1909.)

TUNNELING APPARATUS. Henry Japp, New York, N. Y., assignor to S. Pearson & Son, Inc., Long Island City, N. Y., a Corporation of New York. (U. S. No. 922,431; May 18, 1909.)

TUNNELING-MACHINE. Edward F. Terry, New York, N. Y., assignor to the Terry, Tench & Proctor Tunnel Machine Company, a Corporation of New York. (U. S. No. 917,974; April 13, 1909.)

VENTILATING-FAN for Mines. William D. Scott, Bridgeport, Ohio. (U. S. No. 921,744; May 18, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

CRUCIBLE FURNACES—Improvement in Crucible Furnaces. William J. Holzapfel, Scottdale, Penn. (Brit. No. 12,342 of 1908.)

DISCHARGING FURNACES — Pneumatic Apparatus for Discharging Furnaces. Samuel E. Hitt, Pittsburg, Penn. (U. S. No. 916,314; Mar. 23, 1909.)

ELECTRIC FURNACE. Charles W. F. Gorrell, Ottawa, Ontario, Canada, assignor to Marcus Ruthenburg, Lockport, N. Y. (U. S. No. 916,548; March 30, 1909.)

ELECTRIC FURNACE. Hans Nathusius, Friedenshütte, near Morgenroth, Germany. (U. S. No. 920,078; April 27, 1909.)

ELECTROLYTIC REFINING—Acid-Proof Tank for the Electrolytic Refining of Metals. Anson G. Betts, Troy, N. Y. (U. S. No. 918,649; April 20, 1909.)

ELECTRIC SMELTING-FURNACE. Herbert C. Harrison, Exton, Penn. (U. S. No. 919,165; April 20, 1909.)

ELECTRIC SMELTING-FURNACE. Charles E. Wilson, Hood River, Ore. (U. S. No. 921,325; May 11, 1909.)

FURNACE for the Treatment of Metals. Wilhelm Schemmann and Jegor Bronn, Rombach, Germany. (U. S. No. 915,488; March 16, 1909.)

FURNACES FOR VOLATILE METALS — Improvements in, or Relating to Furnaces for Volatile Metals. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 27,018 of 1907.)

MATTE CAR. Revolving Matte Car. Jas. C. Kilker, East Helena, Mont. (U. S. No. 921,998; May 18, 1909.)

MELTING-FURNACE. James E. Hewitt, Newark, N. J., assignor of one fourth to Christian Franz, Newark, N. J. (U. S. No. 918,150; April 13, 1909.)

METALLURGICAL FURNACE — Door-Frame and Roof-Skewback for Furnaces. Jacob B. McKennan, Frank E. Parks and Samuel W. Gillin, Pueblo, Colo. (U. S. No. 918,356; April 13, 1909.)

METALLURGICAL FURNACES—Improvements in and Relating to Furnaces for Metallurgical Purposes. Peter Schmelzer, Metz, Germany. (Brit. No. 18,523 of 1908.)

NODULIZING—Improvements in Machinery for Making Blocks from Fine Ores, Blast Furnace Flue Dust and the Like. George P. Wallis, Horsforth, Eng. (Brit. No. 10,541 of 1908.)

ORE ROASTING PLANT — Improvements in Coolers for Use in Connection with Ore-Roasting Plant. Thomas H. Webb, Poulton-le-Flyde, Eng. (Brit. No. 11,270 of 1908.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. A. Rickard is in New York and sails for England on May 29, where he will reside in future.

W. M. Brewer, of Victoria, B. C., is convalescent after a serious illness of several weeks' duration.

Major R. G. Edwards Leckie, of Sudbury, Ont., has been visiting the British Columbia coast cities.

J. P. Varian is engaged in examining properties in the Cobalt district, Ontario, for a New York syndicate.

George L. Fraser, manager of the Royal Collieries, Ltd., of Lethbridge, Alberta, is spending a vacation in eastern Canada.

E. G. Spilsbury, consulting engineer, will return to New York about June 1, after an absence of four weeks in Mexico.

Frank Jenkins, assistant manager of El Oro Mining and Railway Company, El Oro, Mexico, has gone to England to pass several months.

W. Rowland Cox, of Spurr & Cox (Inc.) is examining mines in northern Mexico for the American Smelting and Refining Company and other interests.

J. Parke Channing and J. A. Lewisohn were at Phœnix, B. C., recently, looking over the Dominion Copper Company's properties. They went thence to Vancouver.

Kezdick Smith has been appointed manager of the coal mines of the Vinton Colliery Company at Vintondale, Penn. He succeeds Charles L. Hower, who has resigned.

Charles M. Porcher has withdrawn from the firm of Pierson & Co., and will have charge of the eastern business of the Pittsburg Steel Company, with office in the Singer building, New York.

Pope Yeatman and Charles K. Lipman have been elected directors of the Guggenheimer Exploration Company to fill vacancies caused by the resignation of Robert Guggenheim and A. Chester Beatty.

John Hopp, the largest hydraulic placer gold operator in the Cariboo district of British Columbia, has gone to Barkerville to prepare for the ensuing season's mining after having spent the winter in Coast cities.

W. H. Trewartha-James, general manager, W. J. Watson, smelter manager, and J. W. Bryant, mining engineer, all of the Tyee Copper Company, recently paid a short visit to the Queen Charlotte Islands, British Columbia.

Oscar A. Knox, lately general manager of the Octave Mining Company, Octave, Arizona, has sailed from San Francisco for Sydney, N. S. W., on his way to Western Australia, where he has a professional engagement.

Rex Taylor, recently assistant superintendent of the Kerr Lake mine, Cobalt, Ont., has been appointed manager of the Right-of-Way mine in place of Joseph Houston, who recently resigned to take charge of the Bonsall.

E. Knudsen, inventor of the well known copper-smelting process, who has been general manager at the mines at Sulitjelma, Sweden, has resigned that position to accept the general management for the Mitterberger Kupfer Aktiengesellschaft, at Ausserfeldten, Salzburg, Austria.

Prof. Henry Mace Payne, of West Virginia University, will sail from New York on the "Minneapolis" July 17, and will return in September. He intends to visit as many representative mines as possible in England, Wales, Belgium, Germany and France to study conditions there.

A personal item that appeared in the JOURNAL of May 8 to the effect that M. K. Rodgers, of Seattle, is about to enter upon the management of the Nickel Plate mine at Hedley, B. C., was incorrect. As the item came from an accredited and generally reliable correspondent, we had no reason to doubt it.

W. A. C. Pape has resigned his position as resident manager with the Metallic Alloys Company, to take effect June 1, after having designed, built and put into successful operation a dry grinding mill for the treatment of manganese ores, as well as a small smelter for the manufacture of manganese copper. His address will be Elkton, Va., until June.

Obituary

Jacob E. Ridgway died in Philadelphia, May 12, aged 84 years. He was a coal operator in the western part of Pennsylvania for many years, and opened mines in Cecil township, Washington county, which were the first in that district. Some years ago he sold his mines to the Pittsburg Coal Company, and retired from business.

Societies and Technical Schools

Colorado School of Mines—The Legislature of Colorado has appropriated $75,000 for an experimental ore dressing and metallurgical plant for this institution. Frank E. Shepard, president of the Denver Engineering Works Company, has been selected as consulting engineer for the installation of this plant.

American Chemical Society—The summer meeting of the American Chemical Society will, as already announced, be held in Detroit, Mich., June 29, to July 2, inclusive. The meetings of the sections and divisions will be held on June 29 and 30, and on July 2. On July 1 the members will visit the University of Michigan at Ann Arbor, where they will be the guests of the university for the day, returning to Detroit in the evening for the usual banquet.

Engineers' Society of Pennsylvania—A convention has been called, to be held at Harrisburg, June 9-11, for the purpose of completing the organization of a State society, to include all classes of engineers. Several hundred members of the engineering profession in its several branches, residing in various parts of Pennsylvania outside of Harrisburg, are already interested in forming an association for the purpose of holding annual conventions in the State. This association operates within the charter of the Engineers' Society of Pennsylvania, which now has a club house in Harrisburg.

American Institute of Chemical Engineers—A preliminary program has been issued for the semi-annual meeting, to be held at Brooklyn, N. Y., June 24-26. Among the papers promised for this meeting are the following: "The Utilization of Low Grade Fuels in the United States," O. K. Zwingenberger; "Creosote Oil from Coal Gas Tar," Dr. J. P. Sadtler; "Automatic Acid Egg," Richard K. Meade; "Some Experiments on Case-hardening of Steel with Gases," Dr. J. C. Olsen; "New York Metropolitan District as a Center for Great Industries," Dr. C. F. McKenna; "Methods of Clay Control," J. G. Dean.

Appalachian Engineering Association—At the meeting of this association, at Roanoke, Va., May 8, Mayor Cutchin made the address of welcome, to which Dr. I. C. White responded in behalf of the association. The balance of the morning session was devoted to the transaction of business. At the afternoon session Prof. L. S. Randolph read a paper on the "Water Power Possibilities of the South." The paper was discussed by Dr. White and others, and was followed by Capt. Baird Halberstadt upon "Recent Research in the Origin of Coal." The address was profusely illustrated with micro slides and an extended discussion of the coal origin problem ensued. F. H. La Baume then addressed the meeting. At the evening session Dr. Frank A. Wilder read a paper on "Properties and Uses of Mineral Gypsum," which was discussed.

Major William N. Page sent a paper on "The Organization and Engineering Difficulties of the Virginian Railway." The last paper was by M. M. Caldwell on the "Lead and Zinc Ores of Southwestern Virginia."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Goldfield and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 22—While there is trouble at the Mother Lode properties at Jackson and other points in Amador county, over the new eight-hour law, several mines having quit work for the present, and there are similar difficulties in Tuolumne and Calaveras counties, yet the advent of the law has not produced the difficulty expected. The California branch of the Western Federation of Miners has been in session and the California Miners' Association has had a meeting in this city, yet there has been no very positive action by either of these bodies. The mine operators continue firm in the stand they took at the meeting two weeks since, which has been reported in these columns, and will insist that the eight hours means work "at the face" not from the time the men come to the shaft or tunnel. When this proposition has been rejected the mine has quit work notwithstanding the protest of the local miner's union. As a result, several important mines are for the present idle. A test suit will shortly be brought. The mine operators consider the new law to be unconstitutional and on the advice of the attorneys will contest it. There is, however, considerable unrest in the mining districts of the State and a great deal of uncertainty as to the outcome. If the law is finally enforced a number of low-grade properties on the Mother Lode and elsewhere must close down.

The Lassen Mining Company, of Hayden Hill, Lassen county, is about to resume operations after a shut-down of two years. After purchase of the properties it seems that one claim, into which the valuable vein was pitching, had a cloud on its title owing to defective probate proceedings. The company thought it was being "held up" and sooner than pay the price asked, quit work. As this is about the only productive mine in the county it will be good news to hear that it will soon be in operation again. There is quite an extensive plant on the property.

The Sixteen-to-One mine at Alleghany, Sierra county, still continues to hold the attention of mining men, owing to its phenomenal production in such short time and the fact that, thus far, there has been no end found to the productive ore shoot in the tunnel. Exceptionally high-grade ore continues to be taken out. The mine is owned by one man, E. H. Wilson, who has nothing to sell, and who is an experienced miner. He is not given to secrecy, but is willing that the information he has may be made public for the benefit of others in the same locality. He believes in legitimate mining and is carrying it on as he may well afford to. It is a noteworthy fact that notwithstanding the discoveries in this mine, the Tightner and others near Alleghany and Forest, in Sierra county, so far not one stock-selling company has been organized, though many hundreds of men have been attracted to the locality and are at work there. One man who was grubstaked in that section, while hunting for quartz, found unlocated placer ground from which he took $6000 worth of nuggets in a few weeks. In fact that region was formerly best known for its gravel deposits, most of them deep, and requiring drifting, though some surface gravels exist also. The county is one without railroads and has been neglected for some years. Its neighbor, Plumas county, is in the same fix as regards inaccessibility but now that such rich mines have been disclosed, access of population will mean much more vigorous prospecting of the mountain ranges.

The old Kenosha mine at Grass Valley is being reopened and unwatered. Some time since operations were commenced and then stopped but Geo. W. Root, the manager, has seen the stockholders in Kenosha, Wis., who are now willing to advance the funds. The plant is in good condition and retimbering the mouth of the shaft is being done.

Work has been started on the Banner Ridge Drift Mining Company's property near Banner Mountain, Nevada county. Machinery has been placed on the ground ready for future work. In past years many large nuggets have been taken out in this locality.

The Ocean Star mine in Washington district, Nevada county, owned by W. D. Cooley, has been bonded by E. C. Reed, of San Francisco, and the first payment made. There are two crosscut tunnels and a shaft on the property but more systematic developments are now to be made and hoisting works, mill, etc., will be put up. At the end of the 285-ft. tunnel a drift has been run in the face of which is a 6-ft ledge carrying free gold.

The old Gold Bank mine at Forbes town, Butte county, which for many years was a large producer but which was closed down a few years since, has been bonded to responsible men who are to reopen it. Some other mines in the same district are also to be reopened this summer.

The Chamber of Commerce of Sacramento, is about to arrange rather a novel exhibition of the resources of the county for tourists and visitors from the Eastern States. Gold bearing soil is found near Folsom, and a few acres are to be laid off with a miner's cabin and miners in charge, so that visitors may have a chance to pan out some gold for themselves.

Skidoo, one of the new camps in Inyo county, had rather a hard time of it at first, but is now coming to its own. The big Skidoo company has its mill working now not only on its ore but that of leasers as well. No renewals of leases are being given. A number of "outside" mines with from two to four men at work are also producing. The Cashier is installing a 5-stamp mill. The leases on the Cocopah ground are turning out well. Some new mills are to be built and a number of 12-mule teams are hauling freight.

Butte

May 19—A number of stockholders of the Davis-Daly Copper Company have recently protested against the refusal of the company to receive delinquent payment of assessments on the stock. The directors are firm in their stand that failure to meet the last assessment means forfeiture of the stock to the underwriters. It is possible that some legal action may be taken by the dissatisfied stockholders. The annual meeting of stockholders of the East Butte company will be held on June 7, at Phœnix, Ariz.

With the recent strike of copper ore in the Black Rock mine of the Butte & Superior company, interest in other of the smaller companies in the camp is reviving. Several of these continued to operate throughout the hard times, among them being the Tuolumne, East Butte Extension and Butte & Balaklava. A number of those that were unable to keep going during the financial depression are now making preparations for resuming. At the Ophir mine the Butte Central Copper Company, successor to the Butte Central & Boston Copper Corporation, is making ready to start sinking within a few weeks. The shaft is now down 500 ft. Upon the results shown by the Butte & Superior properties will depend the future of many of the smaller concerns, among them being the Butte-Milwaukee, Butte & London and Raven companies.

Denver

May 21—Of the many rotary rock-boring machines for driving tunnels without the use of explosives now under consideration and construction, four which have made working tests have so far proved total failures. What is most regrettable is that the projectors of some of these unproved machines are advertising them widely and selling stock in them; in fact, they are exploiting the credulous public at the same time as the inventions. As regards the merits of them all, it would seem on general principles that it is folly trying to make a steel cutting head stand all the stress and do all the work of chipping out a 6- or 8-ft. diameter heading of solid rock for, say, 4 ft. in length at a time, when a round of small holes drilled and a charge of powder will blow it out at one shot. So far, however, the contentions in an article published in the issue of the JOURNAL of Nov. 23, 1907, have been fully sustained.

Much speculation is rife here as to the object of the late visit of John D. Ryan, president of the International Smelting and Refining Company, and his conference in Denver with the vice-president of the company, Dennis Sheedy. It is stated in the daily press here that they will establish a smelter in this State, but thus far there is no definite assurance that such is their intention.

Incidental with the withdrawal of lands in the Gore range by the reclamation service for irrigation purposes, is a long stretch of rugged, mountainous country, extending for 10 miles from Gore to Radium, on the Moffat road, that cannot possibly be reclaimed, irrigated, nor cultivated, but which is valuable for deposits of mica, limestone, lithographic stone and lodes of metalliferous ores. This action is in line with that of placing lands in the forest reserves which are devoid of trees, and is retarding the development of the mining industry and working a hardship on the State.

There is much satisfaction among the tungsten miners of Boulder county over Senator Guggenheim's amendment to the tariff bill, providing for a 15 per cent. duty on tungsten ore, and the statement that it will be accepted by the committee. It is stated that in 1907, Boulder county produced about 1,200 tons of tungsten ore of an estimated gross value of half a million dollars. Last year, however, the panic and the falling off in the steel trade, knocked the bottom out of the tungsten mining industry in this State. It bids fair now to be revived again. The producers here state that there is hardly any profit in mining tungsten ore at less than $6 a unit. Boulder county tungsten is always in special demand by the manufacturers of steel, on account of being freer than any other from the heavy sulphides and oxides of iron, lead, zinc, arsenic and other impurities.

In Grand county, a discovery of very rich gold ore is reported from the foothills of the Gore range, 14 miles north of Kremmling, on the Moffat road. The country has been staked for miles.

In the deep drainage tunnel at Cripple Creek, on May 17, one man was instantly killed, and five seriously injured by an explosion of dynamite, caused by drilling into a missed shot. This is the first serious accident of the kind on this work.

At Stratton's Independence, over 80 men are engaged in surface leases. The whole of the ground on the outcrop of the various veins is completely covered, and much of the ore obtained is simply yellow clay, with gold contents varying from $10 to $50 per ton. In some places the lessees are down to the solid rock of the veins, and are finding bunches of very rich ore. It is currently reported that the monthly shipments from this extraordinary development of surface deposits varies from $15,000 to $20,000. In addition to this discovery, pay ore has recently been struck in the Washington vein, 300 ft. south of the main shaft, at a depth of 700 ft. from the surface. This is entirely in the granite. The ore shows calaverite and is in an altered granite matrix along and on each side of a shear zone, and is the first pay found in granite in Stratton's Independence. It is regarded as an important discovery and may lead to the development of a new mine.

Indianapolis

May 24—The Hungarian and Polish coal miners in the Jasonville district of Greene county have appealed to James Epperson, State mine inspector, for relief from what they declare to be the failure of the peace officers to protect them against riot, and the failure of the prosecuting attorney to bring proceedings against the rioters in the district who drove the foreigners from their homes. Mr. Epperson has taken the matter up with the attorney general and the governor; the latter has instructed the prosecutor to bring the matter to the attention of the grand jury. Complaint has also been made to the French Consul who likewise has demanded of the governor that the wrongs be redressed.

The trouble at the mine at which the ejected men were employed arose from charges made by the American miners that favors were being shown the foreigners, and that more work was being given them than could be procured by the native miners. A concerted movement was started which resulted in an attack upon the homes and camps of the foreigners and they were driven from the district, many leaving their household effects. They were fired into and they returned the fire, a number being injured on each side. The last legislature attempted to pass a law to prevent the invasion of the foreign miner but the bill failed.

Salt Lake City

May 21—The Bingham Construction Company, the company organized to operate the Mascotte tunnel enterprise at Bingham, has placed an order for 40 steel ore cars, weighing approximately 160,000 lb., to be used in transporting the ores of the Ohio Copper Company from its mines to the concentrating plant at the mouth of the Mascotte tunnel. The cars will have a capacity of 105 cu.ft., each, and the present order is only one fourth of the number that are to be placed in commission.

The annual meeting of the Silver King Coalition Mines Company was held in Salt Lake last week. The old board of directors and officers were reëlected without opposition. In his report, Engineer Charles P. Brooks estimated the developed ore reserves at approximately 130,000 tons. The shipments of crude ore and concentrates during the year amounted to 31,952 tons. This product sold for $1,345,000. Dividends amounting to $744,300 were paid and the rest of the money goes to operating expenses and additional surplus.

Section 41 of a circular issued by the commissioner of the general land office at Washington, and approved March 9, 1909, contains a ruling on the interpretation of the general mining laws that will vitally interest claims owners seeking to obtain patents. The Silver Shield company at Bingham, recently made application for patent on several claims and has had this new ruling brought to its attention. According to the new ruling, after a mining claim has been located, and before the owner can obtain a patent he will be required not only to prove that a lode has been discovered in the claim, but he must trace it out by actual work clear through the claim or claims sought to be patented. That done, he may concentrate his $500 worth of work for each claim, or remaining portion of it, at one point if he so desires. A strict enforcement of the new rule will mean that not many groups of mining claims, as such, will ever be patented again. It is not often that a ledge can be readily traced through a mining claim after its discovery on the surface and to expose it over the length of a group of claims would entail work that few men or companies would be capable of performing without loss of much time, and in some instances tremendous and unnecessary expenditures of money. In cases where companies and individuals locate on a lode and then take up additional claims to avoid encroachments from possible neighbors, the ruling will be a decided blow. It is not uncommon, after a vein has been located, or a discovery has been made, to locate a number of blanking claims without regard to whether they contain veins or not, but to head off possible litigation that arises so readily under our present mining laws.

The concentrating mill run in connection with the United States Smelting

Company's smelter at Bingham Junction will undergo a number of important changes to adapt it better to the concentration of Bingham ores. New features will be a regrinding plant and provision for electrostatic concentration of the zinc. The latter product will be shipped to zinc smelters in Kansas, except such portion as will be required by the company's process of making zinc oxide for neutralizing the acid in the smelter gases.

A deposit of a peculiar clay called "wonderite" that exists near Modena in Iron county is being mined for commercial purposes. The clay is soft and plastic but when it sets it becomes hard and will take a high polish exhibiting varied colors. The raw material is being bought by Salt Lake jewelers.

The new Utah Stock and Mining exchange was launched on May 18. Speeches were made by a number of prominent mining men in which they told of the field for a new exchange in Salt Lake. At the first formal call quotations were made on a large number of stocks nearly all of which are listed on the old exchange. During the opening day and the few succeeding days the trading has been good.

During the week ending May 14, the output of the Tintic mines comprised a total of 194 carloads as follows: In 50-ton cars, Ajax, 1; Bullion-Beck (leasers), 2; Centennial Eureka, 44; Eagle & Blue Bell (leasers), 1; Grand Central, 4; Mammoth, 14; Sioux Consolidated, 14; Victoria, 2; Yankee Consolidated, 2; in 20-ton cars, Brooklyn, 6; Black Jack, 3; Beck Tunnel, 4; Dragon Iron, 31; Colorado, 19; Iron Blossom, 37.

Goldfield, Nevada

May 20—The deal for the change in control of the Rawhide Coalition and the Rawhide Queen Mines Company, with a view to securing for the Rawhide camp a $300,000 railroad and a million-dollar mill at Walker lake has failed to go through.

From a willingness expressed by Charles W. Reed, president of the unfinished Rawhide Western Railway, to dispose of all the roadbeds which he put down between Walker lake and Rawhide, at an expense of about $75,000, it appears that the crucial reason why the deal did not go through was that there was no excuse nor necessity for the construction of the Rawhide Western railway. When the railroad was projected, it was the opinion of mine and mill operators that the only economical solution of the mill problem at Rawhide was to erect a large mill at Walker lake, 25 miles away, and transport the ores there for reduction. Recently, three experimental mills were erected in Rawhide, and all of these have been operated with success.

An unlimited supply of water has been struck on the flat, five miles south of Rawhide, and an underground lake discovered. Water is now being supplied faster than it can be utilized. The water question has been entirely solved in this way, and the water at Walker lake is not needed for milling.

The only question for the mills now to solve is that of fuel. The experimental mills at Rawhide are now using gasolene for power, all of which has to be transported across the desert by mule teams from the railroad station at Schurz, 25 miles away. Electric power companies, which are now supplying Nevada cities, have been examining into the Rawhide situation and offer practically unlimited electric power at $25 per horsepower. This eliminates the railroad proposition entirely.

London

May 15—At this season of the year there is a flood of annual reports coming from South Africa, the majority of the companies making up their accounts to the close of the year. The last year has been one of progress and most of the companies are able to show increased profits and to promise still further improvement in the future. Owing to the fall in working costs the ore reserves show in most cases a substantial increase, large tonnages formerly treated as unpayable now being classified as assets. The companies as a rule are liberal as regards the information given about the mine and the finances, but in one respect this is hardly the case and that is regarding the life of the mine. The numerous amalgamations that have been carried through in the last 12 months have made in many cases the life a subject of small importance. But there are still existent a fair number of mines that are nearing exhaustion, and in such cases more information as regards the date of exhaustion than is usually given appears wanted. Shareholders in the old established mines up to the present have had the satisfaction of being informed from time to time that the lives of their mines have been underestimated in the past. The reduction in working costs has completely altered the situation, and new reefs considered unpayable in the past are found to be workable, although, of course, the profits to be won in the future cannot be expected to compare with those in the past.

As examples of these extensions of life arising out of the altered conditions may be mentioned such companies as the Salisbury and the New Primose. The Salisbury mine was one that was a short time ago considered near the end of its tether, but owing to a recent valuation has suddenly been given a further six-years' lease of life. There are no doubt difficulties in estimating how long a mine may last and the experience of the past perhaps accounts for the skepticism of directors and engineers in regard to estimates of life for fear that they may again make a bad shot. This is hardly, however, a valid excuse for leaving the subject alone, and it is due to the shareholders to have the best information available as to the remaining time that they may expect dividends.

The report of the Ferreira contains a paragraph that calls for special attention, as it indicates the adoption of a policy that appears certain to receive criticism. The paragraph referred to states that the directors have retained a large cash balance in view of the comparatively short life of the mine and the possibility of entering into fresh business for the prolongation of the company where immediate cash might be required. This points to an amalgamation with another neighboring mine, or to the investment of part of the profits of the company in a new mine. Whether the shareholders will agree to the directors speculating with the profits earned remains to be seen. It is a new departure and one to which the shareholders might reasonably take exception. Their capital is invested in a particular mine and by right the profits earned should be distributed and not a portion only on a standard fixed by past results as is the case now. Most shareholders would prefer to have the control of the profits in their own hands and select their own investments. The Rand Mines, Ltd., have also announced that some of the funds of the company are to be devoted to taking up fresh business should a favorable occasion arise. But the case of this company is somewhat different to the Ferreira mine, as the business of the company is largely that of a finance company, and it, therefore, stands on a different footing. There seems to be a desire on the part of those who control the Rand to prevent the extinction of companies or rather the extinction of shareholders, and this is to be effected either by the process of amalgamation, or by investing the profits in a new undertaking. Of these two processes the former seems the more legitimate. Indeed, it is questionable whether the second process is legitimate at all.

An exhibition of a new form of tube mill was given recently to a party of engineers by Fraser & Chalmers at their works at Erith. The tube itself is similar to the tubes now in use and the novelty consists in the alteration of the motion given to the tube which is attached to the trunnions not at the central axis, but off the center, so that the tube itself has an eccentric motion. By this means greater motion is given to the pebbles, and pulp within the tube. It is claimed that this arrangement increases considerably the efficiency of the machine. Tests are being conducted to determine the most advantageous degree of eccentricity, and it is proposed later to send out the machine to South Africa where its capability can be tested alongside a tube mill of the ordinary type.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

SEWARD

The Alaska Central railway is rushing construction work to the coalfields of the Matanuska and Chickadoon, which are among the most important coal measures ever discovered in Alaska, there being wide seams of coal of a high-grade character. The government will maintain a naval coaling station on Resurrection bay within easy reach of the Alaska Central road. The site has already been approved by the Navy Department.

Arizona

COCHISE COUNTY

Arizona Gold Mines and Milling Company—The annual report shows that 600 ft. of tunnel work were done during seven months' operation last year. As soon as the power plant is equipped for oil-burning, operations will be continued.

Hilltop—A recent shipment of 15 tons of ore to the El Paso smelter gave returns of $40 per ton, net.

GRAHAM COUNTY

Shannon-Arizona Railway—Articles of incorporation were recently filed. The company expects to begin work on the proposed line from Clifton to Metcalf and bids for grading, blasting and tunnel work have been asked. Surveys have been completed. The line is 10 miles long, but will require excavations as follows: 100,000 cu.yd. solid rock; 7000 loose rock; 40,000 earth, and a 900-ft. tunnel.

Shannon Copper—Regular shipments are being made from this company's Copper Belle property at Gleason, Cochise county. Development work is being carried on at the Greenlee group near Clifton.

Detroit Copper—Judge Campbell, of the District Court, has set aside the $4000 verdict which was returned in the case of Hoefeld vs. The Detroit Copper Mining Company. This is one of 38 actions brought against the company by residents of Clifton, who claimed that the bursting of the company's dam caused them damage aggregating $250,000.

Missabe-Morenci Development Company—Articles of incorporation were recently filed by Dick Lakenau and associates. The company is organized to develop mining claims in Gold gulch between Morenci and Eagle pump.

Morenci Water Company—A new power house has been erected at the Eagle creek pump station.

Bonita—A short time ago a Mexican found three nuggets which he sold for $175. The gold was found near the mouth of Bonita creek. Development work shows the property to be of some worth, and a small plant is being operated with fair results.

California

AMADOR COUNTY

Defender—A new cyanide plant is being installed to work the tailings.

BUTTE COUNTY

Kentucky Ranch—The first clean-up of the new dredge has been made with satisfactory results.

Durgin—This old mine was recently incorporated by Los Angeles men. Preparations for working the property on an extensive scale are being made.

Gold Channel Dredging Company—This company was organized at Oroville by Los Angeles and Redlands people with the intention of working dredging lands near Oroville.

CALAVERAS COUNTY

Lloyd—The mine at Central Hill was sold at sheriff's sale to Arthur Jackson for $27,000. Mr. Jackson had obtained a judgment against the former owners, the Ophir Mining Company, for injuries received at the mine.

Reiner Mining Company—Electricity will be used for power in place of steam, as originally planned.

EL DORADO COUNTY

Mount Pleasant—A loan of $20,000 has been made with which to reopen the property, which has been idle for a year.

Morey—This mine, owned by Mrs. E. F. Morey at Grizzly Flat, is now producing. It has a three-stamp mill and power hoist. The ore is high grade.

Grainger—Numerous valuable nuggets are being taken out. They are found in a surface layer of decomposed granite which only covers the bedrock to 18 in. depth.

Lucero—At this property, S. W. Collins, superintendent, the showing on the 400 level of the Alpine is encouraging.

INYO COUNTY

Custer Consolidated—This company has been organized at Turlock to operate mines in the new district of Custer now being opened by N. O. Hultberg, of Turlock.

Pine Mountain—This group, owned by Heiskell, Wyat, Davies and others has been placed under bond to Salt Lake City men. These are gold-silver-lead claims.

KERN COUNTY

Amalie District—The Amalie mine is being operated by Rogers Brothers. A new company is about to take hold of the Zenda mine and reopen it. The Gold Peak company has not been operating lately.

MARIPOSA COUNTY

Ruth Pierce—This mine, near Hornitos, has been started up again, and the stamps are dropping on good ore.

Washington—This mine, in Hornitos district, one of the deepest in the county, is about to be sold to New York men. One shaft is 1600 ft. down.

MONO COUNTY

Snow Drift—McCarthy & Barnett have taken a lease on this mine, formerly the Booker, and will immediately commence work.

NEVADA COUNTY

American Mining and Development Company—An electric-light plant, compressor and drills have been purchased. The ditch was rebuilt. It is expected to upraise from the tunnel to the gravel channel in a few weeks.

Central Consolidated—Another strike of rich ore was made at Banner Mountain. It is supposed to be a continuation of the orebody found last month, only further south.

Norambagua—The heirs of the late Mr. Gilbert have decided to continue work and it will not be closed down as announced.

Oustomah—Frank M. Evans, manager, has started the 10-stamp mill on $40 ore.

PLUMAS COUNTY

Old Harry—In this mine, one of the Crown Point group near Quincy, Geo. McCall has found a small rich vein.

Colorado

LAKE COUNTY

Cleveland—This property is shipping 120 tons daily, the ore coming from the fourth and sixth levels. The crosscuts driven at the bottom of the shaft, 825 ft., to open the fissure vein north and south, are now passing through the parting quartzite.

Ibex—Lessees on No. 4 shaft of the Little Jonny, have encountered high grade gold ore at the 1200 ft. level, the body as

far as developed, shows six feet of ore at the breast. The mine is shipping in the neighborhood of 7000 tons of different classes of ore per month.

Garbutt—A body of lead sulphide ore has been opened close to the Little Jonny. Daily shipments of 35 tons are being sent to the smelter.

Castle View—Arrangements are being made for the resumption of work. The same interests will also operate the Big Chief and Evelyn and all will be worked through the Castle View shaft. The properties contain lead and iron ore.

Chrysolite—Lessees are shipping 30 tons daily from a body of iron-silver ore, recently opened in the lower levels of this old Freyer hill property.

Yak Tunnel—Fifty feet from the breast of the bore, a crosscut has been started toward the Fortune grounds. Three shifts are working with machine drill and it is expected that within six weeks connection will be made. The breast of the tunnel is now approaching the New Monarch territory.

Hibschle—Bennet & Harris, who have a lease on the Coronado, have taken hold of the Hibschle property and will work it from the Coronado.

Dinero Tunnel—Connections have been made with the old shaft from the tunnel level, and within a short time all of the old workings will be drained of water, permitting the company to work the ore that was left there by the former owners.

Pyrenees—New pumps have been installed and are now raising water from the lower levels of this property on Iron hill.

Star of the West—Operations have continued on this property on Iron hill during the winter, though shipments have not been so heavy owing to the fact that much attention was devoted to development work.

Iron Silver—Work of installing the aërial tramway on Iron hill has been started.

Lackawanna Gulch—With the opening of spring, interest has been renewed in the Lackawanna gulch and many miners and prospectors are directing their attention thither. The ore of this section is gold bearing.

Georgia

Walker County

Pigeon Mountain Iron Company—This company, recently organized, has bought from E. M. Jones, of Chattanooga, Tenn., a tract of 3500 acres on Pigeon mountain, just south of the Tennessee line. The land contains three workable seams of iron ore, and the company intends to begin work at once on development; also on a spur to connect with the Chattanooga Southern and the Central Railroad of Georgia. The officers are: President, Joseph C. Haas, Montgomery, Ala.; vice-president, R. E. Watson, Atlanta, Ga.; secretary and treasurer, Edwin Haas.

Idaho

Shoshone County

Snowstorm—Ore shipments during April were made at the rate of 200 tons per day. This has been increased to 300 tons daily. The third dividend for the year was paid this month amounting to 3c. per share, or $45,000.

Orofino—It is reported that a 5-ft. vein of galena was recently encountered. The ore carries some silver.

Cuba—The main adit is in a distance of 630 ft., and has gained a depth of 350 ft Lead ore has been encountered at this point.

Hecla—The annual report for 1908 was recently issued and states that during the year 76,586 tons of ore were extracted. Gross value, $569,805; cost of extraction, $233,136; cost of transportation and reduction, $193,146; cost of repairs, $34,723; net profits for the year, $108,799.

Coeur d'Alene Powder—An injunction has been issued by the District Court preventing the rebuilding of the plant which was recently destroyed by an explosion.

Indiana

Pike County

The Pure Oil Company is piping large quantities of oil from the Muran field and has begun the work of sinking additional wells nine miles south, where a new field has been discovered.

Sullivan County

The government experts sent from Pittsburg equipped with protective apparatus have, after a week's work extinguished the fire in the Keystone mine and the mine is now banked. They were able to live in the thick fumes and do effective work. There is little doubt that this experience will hasten the establishment of such a life-saving station in the Indiana coalfield.

Vanderburg County

The coal mines near Blackburn in this county—three in number—began operation this week after a suspension since the middle of January. These mines will give employment to several hundred men.

Michigan

Copper

Oneca—At the annual meeting of this company held recently the following directors were elected: John D. Cudahy, of Calumet, president; John Brooks, of Boston, secretary and treasurer; William F. Fitzgerald, George W. Towne and John C. Watson. Extensive exploratory work will be carried on during the summer under the direct supervision of John L. Harris.

Ojibway—Sinking has been resumed at No. 2 shaft 90 ft. below the 800-ft. level. The crosscut is approaching the lode No. 1 shaft, where sinking is suspended while the station at the 800-ft. level is being cut. The lode at this point lies in close proximity to the shaft. This company is gradually opening up good ground and will soon be in a position to maintain regular shipments.

Lake—This company has reached the fourth level in its shaft, a distance of 600 ft. from surface and a station is being cut preparatory to starting the level. At the third level the drift north is in about 75 ft. and is in ground carrying small mass and good stamp copper. The width of this lode has not yet been definitely determined, and it is planned to rig up a drill underground to ascertain its width instead of crosscutting through it.

Winona—It has been definitely decided to erect the stamp mill, which is to be owned jointly by this and the King Phillip Company, and actual work will be started in a day or so. This mill is to contain two heads and will be capable of handling about 1500 tons daily.

Superior—This company has reached the eleventh level at its No. 1 shaft and a crosscut started to cut the lode. Openings are being extended from the level above and good ground is being blocked out. Rock shipments of about 100 tons daily are made to the Atlantic mill. No. 2 shaft is being equipped with the hoisting and compressor plant that did service at No. 1 shaft.

Isle Royale—The shaft on the Baltic lode is temporarily bottomed at a depth of 400 ft. There is a gradual change in the character of the rock-formation as depth is obtained, the rock now resembling that opened at the Superior property.

Hancock—Sinking continues at this company's vertical shaft at a depth of 1600 ft. At the fifteenth level the large working crosscut that is to handle the rock tributary to No. 1 shaft, is approching the point where it will be intersected by the winze that is being sunk from the thirteenth level of No. 1 shaft. It is planned to establish levels at intervals of 100 ft. and work the ground down to this crosscut, which will be handled and hoisted at No. 2 shaft.

Mohawk—This company will begin the sinking of its new, or No. 6 shaft at once. A diamond drill hole was put down to test the overburden, encountering the Kearsarge lode at a depth of 200 ft. and showed the lode to be about 15 ft. wide and with the average copper content.

Minnesota

Iron—Vermilion Range

Section 30—No. 2 shaft at Ely, which was started 460 ft. from the old Shagawa shaft, has struck an orebody which ap-

pears to be of large size. Drifting and crosscutting have not yet reached the boundaries.

Missouri

Joplin Zinc-lead District

Conqueror—A new tailings mill has been built to run the large pile of rich tailings that have been accumulating for a number of years.

Cock Robin—Operations have been resumed. A new mill has been built and good ore is being hoisted.

Jack Pot—This mine in Chitwood has started work on the John Jackson land.

Continental—This company is subleasing some of the lots on its Prosperity 40 acres. The sublessees will work the upper runs.

Lucky Budge—Labor troubles caused a shut down at the mine.

Lincoln—This mill has begun production at its mine north of Duenweg.

Kitty Mack—This company is operating on the Schifferdecker land west of Joplin and has 18 ft. of disseminated ore in 10 drill holes at 175 ft. depth. A 200-ton mill will be erected when development is further advanced. Z. J. Sheridan, of Joplin, is manager.

Lincoln—This company, near Duenweg, is installing Richards pulsator jigs in its new mill.

Louisville—This company has purchased the Big Fly mill and is moving it to its mine near Belville. Ed. Mallet is manager.

Sawyer—A new mill is being built on the lease on the Rex land, east of Joplin.

Wayne County

St. Francis Iron and Land Company—As a result of a number of test pits and borings development work is to be begun on a large tract of iron-ore land. A contract has been let for a washing plant. The company's office is at Greenville, Mo. James W. Van Dolan is president; C. P. Scrogin, secretary and treasurer.

Montana

Butte District

Butte & Superior—The management states that the recent strike was made on the 1400-ft. level at a point about 100 ft west of the shaft. Drifting has been done for 50 ft., and the indications are that the vein is over 10 ft. in width. A recent assay shows 14½ per cent copper, 30 oz. silver and $2 gold per ton. The oreshoot dips to the east, thus indicating that its continuation will be found east of the shaft at a greater depth.

Broadwater County

Ohio-Keating Gold Mining Company—This company has recently been organized by George M. Bourquin, W. R. Kirk and F. G. Goggin, of Butte. The company will have a capital stock of $500,000, divided into shares of the par value of $1 each. It is proposed to operate the Ohio group of claims, situated in the Radersburg district, near the Keating Gold Mining Company's property.

Jefferson County

Boston & Corbin—Raises are being run at two places in the three-compartment shaft. An air compressor and also a new hoist have been ordered, both of which will be electrically operated.

Corbin-Wicks Copper Company—At a special meeting of stockholders held in Butte last week, a plan to turn over all the property of the company to the newly organized Montana-Corbin Copper Company, was favorably voted upon. The exchange is made on the basis of 15 shares of Corbin-Wicks stock for one of the Montana-Corbin Copper Company. The properties to be transferred are the Hidden Treasure and Copper King patented quartz claims. The new company is a Maine corporation with a capital of $750,000, divided into 150,000 shares of the par value of $5.

Nevada

Lincoln County

Pioche King—At a depth of 185 ft. a rich body of silver-lead ore has been encountered. The property adjoins the Prince Consolidated mine. John A. Kirby is general manager.

Nye County—Bullfrog

Montgomery-Shoshone—The monthly profits are approximately $20,000. New machinery is being added, which will increase the capacity of the mill about 20 per cent.

Mayflower—The total returns for April operations were $10,000 in bullion. The extraction was approximately 90 per cent.

Nye County—Round Mountain

Sphinx—Two separate and distinct veins of good milling ore have been encountered. M. J. Kiely is superintendent.

Jefferson—A tramway connecting the mine and mill is being built. Work on the mill is progressing rapidly.

Daisy—C. E. Johnson and associates have secured controlling interest. The company has been reorganized with C. E. Johnson, president and treasurer, and A. E. Johnson, vice-president.

Nye County—Tonopah

Tonopah Mining—The net earnings for April, available for dividends, were $150,000.

McNamara—An ore contract has been closed with the Balaklala Copper Company, Shasta county, Cal. Shipments amount to 200 to 250 tons per week.

Ore Shipments—The weekly shipments are approximately: Tonopah company, 3350 tons, Belmont, 1000, Montana Tonopah, 900, Midway, 100; McNamara, 250, West End Consolidated, 85 tons.

White Pine County

Cumberland - Ely—Daily shipments amount to about 1500 tons. Drilling has been resumed on the Puritan claim.

Nevada Consolidated—The daily ore output is approximately 3500 tons. The larger part of this ore is from the Copper Flat property.

North Carolina

Catawba County

Catawba Gold Mining Company—This company, operating the old Shuford mine, is striking rich ore, several thousand dollars worth of gold bullion having been shipped from the mine in the months of April and May.

Davidson County

Silver Hill—This old mine, famous for its production of silver nuggets and lead ore, has been acquired by New England capitalists and who are preparing to resume operations.

Franklin County

Portis—Two Overton gold placer washing machines are in operation with good results. A. J. Overton, of Salisbury, is manager.

Montgomery County

Carter Mine—A cyanide plant is being erected by Claude Hafer, formerly connected with the Iola mine.

Dark Spring—This property, recently discovered, shows a belt of low-grade ore 30 ft. wide, with brown streaks that run high in gold. Ohio parties are erecting chilean mills on the property.

Iola—This old mine, purchased by W. Fleming, of New York, is now being operated under the management of M. B. Spaulding, formerly of Guanajuato, Mexico.

Oklahoma

Craig County

A lead and zinc deposit has been opened up near Bluejacket, fifteen miles north of Vinita. Recently a strike of lead and zinc was made near Wagoner. The Bluejacket strike has created great excitement and there is activity in leasing lands and preparations for extensive development are under way.

Tennessee

White County

Clifty Consolidated Coal and Coke Company—This new company, owned by Massachusetts people, has bought 12,000 acres of land in the Caney Forks district heretofore owned by the Clifty Coal and the Caney Fork Gulf companies. The latter is still undeveloped, on the Clifty tract there is a coal mine. The Consolidated company will enlarge the mine, put in electric haulage and other improve-

ments, increasing the capacity to 1200 tons of coal daily. E. M. Jones, Chattanooga, Tenn., is consulting engineer.

Utah

BEAVER COUNTY

Beaver Carbonate—A third shoot of lead-silver ore has been encountered at a point 415 ft. from the shaft on the 700-ft. level. The crosscut has been driven 34 ft. in ore and the hanging-wall has not been reached.

Horn Silver—A second shift has been put on at this property and in a few days the present force of 25 men will be doubled.

JUAB COUNTY

May Day—The shaft has now attained a depth of 1000 ft. and crosscuts will be run from this level to tap a large body of ore which is supposed to exist near the Godiva line.

Tintic Central—The electric hoist has been put in operation and the sinking of the shaft is now being rushed. Three shifts are employed on the work.

East Tintic District—The operators of the East Tintic district are building a wagon road from that district to Eureka. The new road will take a direct route, cutting off five miles from the present course, and will mean a great saving to the shippers in that section. The road will be completed in about one month.

SALT LAKE COUNTY

Columbus Consolidated—This mine at Alta made last week the record day for shipments since the present campaign was started. During that day 125 tons of ore were hauled to the sampler from the loading station on Tanner Flat.

Washington

The native coal will undergo a severe test by the government vessels of the Bering Sea and Arctic patrol this year, in an effort to substantiate the claim that the domestic product is equal to the British Columbia coal which has been used for many years. The Green River Coal Company is rushing work on its new coal bunkers with the view of early production for the market. New machinery is being installed.

KITTITAS COUNTY

Cle Elum-Roslyn Electric Railway and Power Company—The county commissioners granted a franchise to this company, which proposes to furnish transportation and power for the mines in the district.

LEWIS COUNTY

McCoy Creek—The company is installing a reduction plant and expects to have it in operation within three weeks.

SNOHOMISH COUNTY

Bonanza—Two miners were seriously injured by a premature blast. A short time ago George Pecola, manager, was overcome by bad air and lost his life.

Wayside—The mine is producing ore from the 850-ft. level at the rate of about one carload per week. A big flow of water has been encountered in the lower workings subsequent to the opening of the new orebodies.

Sauk District—Smith & Hanson have encountered the paystreak in their new working tunnel.

Wisconsin

ZINC-LEAD DISTRICT

Benton—The Calvert is obtaining the 100-ton mill equipment of the Hazel Green Mining Company. W. N. Smith, of Platteville, has charge of the Calvert. The Corr will replace the mill destroyed by fire last fall. A new shaft has opened up a rich vein of jack below the blanket vein of lead. A. L. Deerhammer, of Beloit, Wis., is president. The Lucky Twelve Company has purchased the Monarch mill and will remove this plant to its property on the Murphy land, five miles southeast of Benton. The Lake Superior is pumping out and will resume operations; only two cars of concentrates were turned out by the new mill when the property was closed down by the panic. The Wisconsin Zinc Company is drilling on the Alfred Grey farm, one mile west of Benton.

Platteville—The Big Four Mining Company has obtained a lease option on the Trego mine, formerly operated by the Platte Lead and Zinc Company. The 150-ton mill was purchased two months ago from the Platte company, which had forfeited its mining rights. The Wisconsin Zinc Company is moving the Royal mill to the Mitchell Hollow land. The Jarrett Lead and Zinc Company is building a 100-ton mill at St. Rose, nine miles south of Platteville. George Jarrett, of Platteville, is in charge. The Klar-Piquette Company, on May 25, pays its first dividend of 10 per cent. on $20,000 capital. The mine is turning out 10 to 17 tons of concentrates per day, which average 50 per cent. metallic zinc; an accumulated stock of 300 tons is in bins. The St. Rose company pays a dividend of 3 per cent., May 25, on $75,000 capital.

Canada

BRITISH COLUMBIA—BOUNDARY DISTRICT

British Columbia Copper Company—Engineers are surveying a line for a spur from the Columbia & Western railway between Eholt and Phœnix to this company's Jackpot mine, in Wellington camp, and thence to the No. 7, in Central camp, and the Lone Star and Washington, near the International boundary line, the ground being also largely interested in both these mines. There is a considerable tonnage of ore at all three mines and the provision of transportation facilities will allow its being shipped to the company's smelting works at Greenwood.

Granby Consolidated—The Gold Drop, one of this company's group of mines in Phœnix camp, is being prepared for resuming shipment of ore by about the middle of May.

Jewel—The West Kootenay Power and Light Company is extending its electric-power transmission system to the Jewel mine, Long Lake camp, where a gold-stamp mill is being erected, and in connection with which the Nichols' slimes-saving process is to be used.

BRITISH COLUMBIA—CARIBOO

E. I. West, of Horsefly, has returned from Oakland, Cal., to prepare for the ensuing season's hydraulic placer mining for gold. His hydraulicking plant, including a concentration appliance for saving the fine gold from the black sands characteristic of the district, will be installed on the south bank of Horsefly river about 30 miles from Harper's camp, where he has leased areas of gold-bearing gravels.

BRITISH COLUMBIA—CROW'S NEST PASS

The Canadian Western Mine Operators' Association has remained firm in its decision to decline consideration of any new proposals from District No. 18, United Mine Workers of America; insisting upon execution of the agreement arrived at about the end of March and afterward ratified by a majority of the miners directly concerned, but which District President Frank Sherman afterward refused to sign. After having been idle a month the men have become dissatisfied, having meanwhile learned that International President T. L. Lewis and other officials have intimated that no financial assistance may be expected from the international organization, because the local men having struck work after ratifying the agreement submitted to their vote. Now local officials have applied for a Board of Conciliation and Investigation under the "Industrial Disputes Investigation Act, 1907," known as the Lemieux Act; so there is prospect of a settlement.

BRITISH COLUMBIA—EAST KOOTENAY

Aurora—Six feet of ore, averaging about 36 oz. silver per ton and 30 per cent. lead, is showing in the face of the tunnel. The mine, which is situated across Moyie lake from the St Eugene, is equipped with a small air compressor, steam driven.

BRITISH COLUMBIA—KASLO

Lucky Jim—Zinc ore is being shipped to the Mineral Point Zinc Company, Depue, Ill. The mine is leased to Hemenway & Loper, and G. W. Loper is in charge.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 15 were:

Buffalo, 42,990 lb.; Crown Reserve, 108,100; City of Cobalt, 59,000; La Rose, 131,200; McKinley-Darragh, 65,370; Nipissing, 62,060; O'Brien, 63,850; Temiskaming, 60,000; Temiskaming & Hudson Bay, 64,200; total, 656,770 pounds.

Beaver—An important strike was recently made at the 200-ft. level. The crosscut in which the strike was made commences 50 ft. east of the shaft. The vein is 10 to 12 in. wide and is said to carry over 3000 oz. silver to the ton. The significance of this find lies in the fact that in spite of extensive development work nothing of value has been found in the mine on the 100- or 150-ft. levels. Diamond drilling to strike the Temiskaming vein is being continued, the drill being put down at an angle of 45 deg. It is now 125 ft. below the surface.

Hargrave—The Jacobs or No. 3 Kerr Lake vein has been uncovered on the East Hargrave property, where it is 6 in. wide. About 400 ft. of the same vein have been stripped on the South Hargrave, on which the main workings are 235 ft. down.

La Rose—A new vein found on the surface of the Lawson property running at right angles to the main vein has been stripped for 28 ft. and shows solid ore 6 in. wide carrying much native silver.

Nipissing—During April ore of an estimated value of $149,739 was mined. Of a total of 291,629 oz. silver produced during the month 108,689 oz., or 37 per cent., came from the Kendall vein.

Chambers-Ferland—This company has purchased the Welsh claims in the Gowganda district, comprising 70 acres immediately adjoining the Bartlett property, on which some good discoveries have been made.

Dreadnought Mining Company—At a recent meeting of the shareholders of the Rothschild Mining Company, at New Liskeard, it was decided to transfer the holdings to the Dreadnought Mining Company, which is in process of organization in Montreal, with a capitalization of $1,000,000. A force of men will be set to work at once on the property under the direction of E. C. Kingswell.

Kerr Lake—Nearly all of the 84 tons of ore produced in April, which yielded about 200,000 oz. silver, came from No. 7 workings, including the new find known as the McDonald veins. On this vein a winze has been sunk 32 ft. from the 150-ft. level.

Mexico

Chihuahua

Zinc Smeltery—A State concession for the erection and operation of a zinc smeltery in the district of Iturbide, presumably at or near Chihuahua, has been granted to Donald B. Best and Luis F. Robinson.

Conchas Power Plant—It is reported that the newly perfected Mexican Northern Electric Company, of Canada, of which G. B. Greenwood, of Montreal, is president, is to shortly ecquire the Ginther-Creel-Cortazar power concession on the Conchos river, about 20 miles from Santa Rosalia, and erect a hydroelectric power plant. Mr. Greenwood was in Chihuahua recently.

Batopilas—The 1908 silver production of these mines totaled 839,865 oz., an increase of 8,328 oz. over 1907. The profits for 1908 were $57,445 as compared with $143,111 for 1907. The yield for the first four months of this year was over 750,000 fine ounces.

Iberri—A considerable body of shipping grade lead-silver ore has been opened at this Santa Eulalia mine. The owner is Juan F. Treviño and James Gasson is superintendent.

American Smelting and Refining Company—The monthly output of this company's Santa Eulalia mines is approximately 7000 tons. Upon the completion of the two aërial tramways the tonnage will be greatly increased. The ore is sent to the Chihuahua and El Paso plants.

Globe Mining Company—This New Orleans company represented by Joseph Meyer is developing properties in the Naica camp. It is likely that machinery will be installed soon.

Santa Maria—Recently 6 cars of high-grade copper-silver-lead ore were shipped to the Copper Queen smelter at Douglas, Ariz. This property is 25 miles from Sabinal, Chih., and is under the management of Wm. G. Gruber.

Rio Plata—Operations which were suspended for several weeks in April and May on account of the water shortage were resumed recently. The cyanide plant is scheduled for its initial regular run.

Guanajuato Consolidated—The general manager reports for the month of April, 1909, as follows: The mill ran 28½ days and crushed 6984 tons of dry ore; concentrates shipped to smelter 148 tons; estimated value of bullion produced $56,600; estimated value of concentrates $46,600; total gross value in products $103,200; less working expenses, including marketing of bullion and freight and treatment charges on concentrates shipped to smelter $69,500; estimated profit 33,700 pesos. Of this 11,000 pesos have been expended on development account. Amount of development work done, 406 feet.

Oaxaca

Taviche District—Recently a New York syndicate, headed by George W. Young and W. H. Ellis, purchased eight of the largest properties, comprising the Anita Grande, Las Pitallas, Hidden Treasure, La Buena, Admiral Dewey, Ampliacion, de Admiral Dewey, Gertrudis, and La Vereda. It is reported that 150-stamp mill will be installed. It will be operated by electricity and contain the latest improved machinery.

Two new mining companies were organized recently, one the Eliseo Gold-Silver Mining Company, with a capital of $5,000,000, and the other known as the Two Brothers Gold and Silver Mining Company, with a capital of $250,000. It is supposed that these companies are organized to operate the above-named properties.

Africa

Transvaal

The gold production of the Transvaal has already been reported at 607,101 oz. fine in April, and 2,395,433 oz. for the four months ended April 30. According to the report of the Chamber of Mines, the April output was from 1,676,000 tons of ore treated, giving an average of $7.14 per ton. For the four months the total tonnage was 6,588,856, the average per ton being $7.18. The labor report shows that on April 30 there were 162,901 negroes and 7734 Chinamen employed; an increase of 858 negroes during the month, but a decrease of 2263 Chinese. Since January, 1907, a total of 46,094 Chinese have been sent out of the Transvaal.

Asia

India—Mysore

Kolar Goldfield—Gold production in April is reported at 46,374 oz. bullion, an increase of 90 oz. over March, and of 767 oz. over April, 1908. For the four months ended April 30 the total was 181,476 oz. bullion in 1908, and 182,179 oz. in 1909; an increase of 703 oz. The bullion reported this year was equal to $2,489,074 or 163,961 oz. fine gold.

Australia

Queensland

Gold output in April is reported at 37,100 oz. from 52,700 tons of ore worked, and 300 oz. placer gold; a total of 37,400 oz., or $773,058 in value

Europe

Austria—Galicia

Advices from Vienna report that the representatives of the Standard Oil Company have concluded an agreement with the Galician oil producers. The Standard, it is said, agrees to build a number of large reservoirs for the storage of oil, at a cost of about $1,400,000. The annual storage charges agreed upon will be 17.5 hellers, or about 3.5c. per 100 kg. for the first four years, which will be sufficient to defray the whole cost of the reservoirs. After the expiration of the first four years the storage charges will be reduced to 6 hellers, or 1.2c., per year. The Standard further binds itself to buy from the Austrian oil combination its whole output of benzine and crude oil at an agreed minimum price of 12 kroner (about $2.40) for benzine and 5 kroner (about $1) for oil.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 25—In the West the increase or improvement in the coal trade has not been checked, but continues slow. Little betterment is apparent from week to week, but if comparison is made with the corresponding period last year it is found that there has been a considerable advance. Steam coal is in better demand, but domestic trade is naturally slow at this period of the year. Car supply is good on almost all roads, and there is little or no complaint from shippers.

The Eastern bituminous trade is rather more quiet than that in the West. On the Seaboard the flurry over West Virginia coal as a disturbing element has subsided, although it may come up again at any time. The Norfolk & Western and the Chesapeake & Ohio seem to have made up their minds to keep the peace for the present. There is some speculation as to the future of the Virginian railway now that H. H. Rogers is dead, but it seems probable that a man of his business methods and habits of thought must have made some provision for carrying out his plans with this road.

In the anthracite trade there is nothing new. Accumulated stocks are being quietly worked off and many collieries are still running short time.

It is said that the Lackawanna directors are considering some plan for bringing their business into conformity with the recent decision on the commodities clause. It is not certain, however, whether a subsidiary company will be formed to operate the coal mines or whether some arrangement will be made for transferring the selling point of coal from tidewater and Lake Erie to the mines.

The cutting of rates at Springfield and other Massachusetts points on anthracite coal has, it is understood, been stopped, but the method or nature of the agreement does not seem to be generally known.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 15, short tons:

	1908.	1909.	Changes.
Anthracite	2,058,900	2,011,893	D. 47,007
Bituminous	12,016,199	13,034,442	I. 1,018,243
Coke	2,569,441	3,689,546	I. 1,120,105
Total	16,644,540	18,735,881	I. 2,091,341

Increase for the week was 143,595 tons. Total increase this year to date was 12.6 per cent.

New York

Anthracite

May 26—Trade continues quiet, with about the usual demand for consumption. There is a moderate putting in of stocks on the May discount which increases toward the end of the month when another 10c. will be taken off the discount. All sizes are in good supply.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor.

Bituminous

The Seaboard bituminous trade, although still quiet, is showing some signs of improvement. A little more coal is being taken under contracts. The Far East is sending in a few orders. Business along the Sound remains steady, but not large. All-rail trade is about the same as it has been.

New York harbor continues to be rather a weak spot. Buyers are hunting for bargains, but not finding many. Prices are unchanged and there is little surplus coal, shippers still forwarding chiefly on orders.

Coastwise trade is a little better, but there are still plenty of boats and rates are unchanged. For large vessels from Philadelphia they are: To Boston, Salem and Portland, 55c.; Portsmouth, 70c.; Lynn, Newburyport and Bangor, 75c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

May 24—The coal trade in Alabama continues quiet. Very little coal is selling right now and the commercial producers are just as much down as the iron companies. But few companies in this State at present are operating their mines on full time. The coke demand is fairly good with prices holding up. Labor at the mines is complaining of the short work.

Chicago

May 24—The coal market shows increasing consumption of steam coals, with a lessening demand for lump to the advantage of fine coals. Screenings from Illinois and Indiana mines are the favorite fuel of many steam producers as summer comes on. Shipments of lump are too large just now.

Lump from Illinois and Indiana mines brings $1.75@2.25; run-of-mine, $1.65@1.75, and screenings $1.35@1.65.

Eastern coals find a steady market, but smokeless run-of-mine shows something of its old tendency to have bunched shipments at the railroad terminals, causing sales at low prices to escape demurrage. Pocahontas and New River smokeless sells at $3.20 for lump and $2.95 for run-of mine in general with run-of-mine occasionally bringing 10@20c. less. Hocking is still 25c. under the circular price of $3.15 on most sales, and sometimes sells for 30 or 40c. less. Gas coals are in light, steady demand, Youghiogheny ¾-in. bringing $3.15.

Domestic coals find light sales, bituminous being dull and anthracite inactive generally.

Cleveland

May 25—Selling of coal has been slow; buyers seem to be holding back, in the hope of getting coal cheap from sales made to avoid demurrage. The market is kept down by heavy shipments, and slack especially is in over-supply. Lake trade is slow, owing to trouble about vessels. The strike affects the smaller boats most wanted in the coal trade, much more than it does the larger vessels. Middle district run-of-mine can be had at $1 at mine. No. 8 run-of-mine 80@90c. at mine. Slack is purchasable at 50@60c. at mine.

Indianapolis

May 25—On the whole the coal trade for the past week has not been as satisfactory as expected. Shipments have been fairly good, but nothing has occurred to stiffen prices. The heaviest movement of Indiana coal is being directed over the Lake routes, although the Ohio river has moved a large tonnage. The factories and railroads are gradually increasing their buying. Orders for August and September delivery are expected to come in rapidly in the first two weeks of June. Retailers are holding off longer than usual, and the operators say the low prices have not appealed to them as expected. Most mines worked a little more than half time during the past week.

Pittsburg

May 25—No regular Lake shipments of coal will be made until after July 4. The movement thus far has been confined to

coal for the Canadian trade and some on railroad account. The Lake strike is not over, but the employers have the situation well in hand and believe they can man as many boats as required whenever they desire to do so. The regular market prices remain at $1.10 to manufacturers and other large buyers and $1.20 to retail dealers, for mine-run coal, but occasional sales are made at about $1 a ton, as formerly. The chief activity is in slack, which has firmed up to 60@65c. in price.

Connellsville Coke—The coke merger is expected to be put through, but there is still some question, as some of the prices asked are very high, from $3500 to $5500 an acre. It is computed on the outside that at 8000 tons of coke realized per acre, to carry out the operation and exhaust the coal in 15 years it would require about 90c. per ton of coke to be set aside to meet interest and refunding charges, computed at 6 per cent. and this is regarded as rather a heavy burden. Just what the options average on the whole, however, has not been ascertained.

The coke trade continues rather quiet, with prices unchanged at $1.40@1.60 for prompt furnace and $1.80@2 for contract furnace; $1.80@2 for prompt foundry and $1.90@2.25 for contract foundry coke, according to grade.

The *Courier* states the production in the Connellsville and lower Connellsville regions in the week ending May 15 at 252,485 tons, a gain of 8000 tons over the previous week, and reports shipments at 9179 cars; 3418 cars to the Pittsburg district, 4973 to points west of Pittsburg and 788 cars to points east of Connellsville. This is a gain of nearly 500 cars.

Coke Rates—The American Smelting and Refining Company has filed with the Interstate Commerce Commission a number of complaints of alleged overcharges on coke from the Connellsville region to Omaha and other western points.

Foreign Coal Trade

Austrian Coal—Coal production in Austria for the quarter ending March 31 was: Coal, 3,550,916; brown coal, 6,341,839; total, 9,892,755 metric tons. Coke made was 453,631 tons. Briquets made were 94,367 tons, of which 48,877 tons were made from brown coal, or lignite.

British Coal Exports—Exports of fuel from Great Britain, with coal sent abroad for the use of steamships in foreign trade, four months ended April 30, long tons:

	1908.	1909.	Changes.	
Coal	19,181,860	19,066,314	D.	115,546
Coke	362,223	353,624	D.	8,599
Briquets	130,552	170,957	D.	19,595
Total exports	20,014,635	19,890,895	D.	143,740
Bunker coal	6,244,036	6,085,543	D.	158,493
Total	26,278,671	25,976,438	D.	302,233

The largest export this year were 3,040,302 tons to France, 3,001,067 tons to Italy and 2,[illegible]87 tons to Germany.

French Coal Trade—Exports and imports of fuel in France, quarter ended March 31, metric tons:

	1908.	1909.	Changes.	
Exports:				
Coal	268,810	230,549	D.	38,261
Coke	35,010	38,942	I.	3,932
Briquets	24,750	45,195	I.	20,445
Imports:				
Coal	3,687,270	3,878,227	I.	190,957
Coke	463,810	491,962	I.	28,152
Briquets	213,340	252,700	I.	39,360

The chief imports are from Great Britain and Belgium. Exports include fuel furnished to steamships in foreign trade.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 15: Best Welsh steam, $3.90; seconds, $3.78; thirds, $3.54; dry coals, $3.06; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port. This is a decline of 6 to 12c. per ton.

Iron Trade Review

New York, May 26—A fair degree of activity continues in the iron and steel trades, although buying has fallen off somewhat from the recent high level. In part this is probably due to the fact that most manufacturers and immediate consumers have satisfied their needs for the present and have an abundance of material on hand; in part it is because the recent advances, though not great in themselves, have been sufficient to check some speculative business.

In finished material wire has had the greatest sale during the present month. This has resulted from the fact that the reduction in prices was held back much longer than in other branches, and when it was made there was consequently a rush to buy it. It is said that the American Steel and Wire Company took contracts during the first half of May for over 250,000 tons of wire and wire products. Structural steel sales for the same period are variously estimated from 175,000 up to 200,000 tons. The structural business is still coming in but the wire trade is pretty well over the rush.

Pig iron is in better demand than it has been. Both foundry and basic iron have sold well and from Pittsburg a good demand for bessemer pig is reported. Eastern furnaces are so far encouraged that their ideas of price are stiffer, from 25@50c. more is being asked in many cases for third-quarter delivery with an additional 25c. for fourth quarter.

A feature of the market has been some large sales of heavy steel melting scrap. This would naturally go with the demand for basic pig.

Finished Iron and Steel Production—The American Iron and Steel Association reports the total make of rolled iron and steel in all forms in 1908 at 11,828,781 long tons, a decrease of 8,030,033 tons, or 40.4 per cent., from 2007. The production of nails was 10,662,972 kegs of 100 lb. each, a decrease of 1,008,072 kegs, or 10 per cent. The output of tinplates in 1908 was 1,203,075,000 lb., an increase of 49,978,000 lb., or 4.1 per cent.

Baltimore

May 24—Exports for the week included 3,418,700 lb. steel billets to Liverpool. Imports included 1105 tons spiegeleisen and 1691 tons ferromanganese from Great Britain; 5400 tons iron ore from Cuba.

Birmingham

May 24—There is some pig iron being sold in the Birmingham district at present but the activity is not as pronounced as it was last month. Quotations are not as strong as they have been, some sales being made here now at $11 for No. 2 foundry. Two or three companies in this district, however, are holding their product for $11.50 immediate delivery and not under $12 for delivery during the last quarter of the year. There is to be a curtailment in the production in the next few days, mostly through the necessity for repairs at furnaces. The Tennessee company has no furnaces in blast at Ensley at all but four are going at Bessemer. The Woodward Iron Company has two out of three furnaces at Woodward in blast. The Sloss Sheffield company has five out of seven furnaces going. Williamson furnace needs repairs and will shut down this week. The Central Foundry Company furnace at Holt is reported as needing some repairs as well as that of the Woodstock Iron Company at Anniston. Inquiries are being received here but the business is far from being as active as last month. There is much hope expressed for a better condition in the future.

The foundries and machine shops could stand an improvement. The cast-iron pipe makers are busy and are running their plants on full time. A shipment of 31 cars of pipe by the Central Foundry Company at Bessemer, to Arizona, was made last week.

Chicago

May 24—The pig-iron market continues quiet, the market for iron and steel products is active. This condition would seem to point to increased sales of pig iron soon, but the selling element is not hopeful in this respect, though holding firmly to present prices. Small lots, for delivery in one to four months hence, are the order of the day. The average consumer of iron does not wish to go into the future to any great extent.

Southern iron sells for $11.50@12 for delivery up to the end of the third quarter or $15.85@16.35 Chicago. Northern holds at $16.50@17, with both Northern and Southern doubtless selling on some contracts at 50c. less than the minimum quo-

tation given. It is difficult to say at what price a large order could be placed, but it probably would not be much if at all below $11 Birmingham for Southern, or $16 for Northern.

Sales of iron and steel products are brisk, notably in railroad supplies and structural material. Coke is somewhat better for deliveries in the last half of the year, the best Connellsville bringing $4.70, as heretofore.

Cleveland

March 25—Quite a number of sales of iron ore are reported. Ore is coming down from Lake Superior rather slowly. Notwithstanding the strike, there are boats enough in commission to handle all the shipments; about 200 are in operation.

Pig Iron—The market is quiet, but many small sales are being made of foundry, with some good lots of basic pig. Prices are about on a basis of $15.25 for No. 2, Cleveland delivery.

Finished Material—Quite a number of small contracts for structural material and bars have been closed. Specifications on contracts are coming in more freely.

Philadelphia

May 26—The pig-iron market is stronger in tone, though prices have not advanced since last week. The chief activity is in basic, in which large contracts were placed, with more in negotiation. There is also more activity in several special brands which are selling at full asking prices. New inquiries are just to hand for pipe iron to cover the needs of pipe foundries. Forge iron is stronger in tone because of more inquiries but there have been no sales of consequence. The undertone of the entire market is stronger in view of enlarging demand from all quarters. No. 2X is quoted at $16; gray forge, $15, and basic, $15.25, asking price.

Steel Billets—Further ordering of billets in good sized lots is to be noted. Prices are firmer but not higher.

Bars—Best refined bars, at 1.35c., are selling better than for a month. A number of consumers have covered early summer requirements this week with orders calling for delivery in June.

Sheets—The change this week consists in the placing of orders by a few large consumers who have been buying piecemeal for months.

Pipes and Tubes—While the tone of the market is said to be stronger it is not because of large or numerous orders in this territory. Merchant pipe has been practically advanced. Tubes are quiet

Plates—The greater activity in ship yards, car shops and lesser industries is helping to strengthen the plate industry. A large amount of business has been sent to the mills of this State.

Structural Material The upward tendency is more apparent every day. All the structural mills are getting good business. Prices are stronger, the advance being genuine. Heavy orders for bridge, railroad and general building work are in sight. Manufacturers are at last holding their heads up.

Scrap—Heavy steel and heavy cast scrap are beginning to move after a long dullness, but at prices which do not lead holders to want to unload. They look for an advance on heavy steel and railroad. Other grades are weak and dull Yard men are looking up supplies but are cautious as to what they pay.

Pittsburg

May 25—The advanced prices for bars, plates, shapes and wire products made in the past two or three weeks have not stopped buying, which is still of fair volume, although not as heavy as it was at the minimum. It is recognized that the mills made the advances largely because they feared buyers were placing orders too freely, and were contracting for larger tonnages than they could conveniently dispose of.

The demand for wire products has been fairly heavy since the advance of $2 per ton May 15, and some sellers are refusing to book as large tonnages as are offered. Present prices are $1.70 on nails, 1.50c. on plain wire, 1.70c. on painted barb wire and 2c. on galvanized barb wire. The mills are running practically full.

The prospect is for a somewhat quieter steel market in the next two or three months, as the buying has been heavy and has probably exceeded the current rate of consumption.

Pig Iron—The market has scored a sharp advance, prices of all grades being 25 to 50c. higher than a week ago. Sales of between 20,000 and 30,000 tons of prompt bessemer have been made in the past week, the first lot being one of 10,000 tons, taken by a prominent steel interest at $14.50, Valley Other sales were of 4000- and 5000-ton lots, to ingot-mold foundries and steel works, and the price has advanced sharply to $15, Valley, as a minimum for prompt or third quarter, some sellers asking $15.25 and $15.50. Basic pig has firmed up after the large sales in the past few weeks, as low as $13.90, Valley, having been done, and the market is generally quoted at $14.50, although this price might be shaded 15 or 25c. per ton Sales of foundry iron have been made at all the way from $14.50@14.75, Valley, according to brand, and the market is quoted at this range, while forge is $13.50@13.75, Valley There has been a sharp advance in 50 per cent ferrosilicon, due to a temporary scarcity, and prompt material has sold at as high as $75, [illegible] forward deliveries being [illegible] sales of several carloads [illegible]

Steel—The market continues uneventful as to sales, as consumers are well covered by term contracts, on which deliveries continue to increase. Billets are firm at $23, Pittsburg, and sheet-bars at $25.50, delivered Pittsburg, Wheeling, Youngstown, etc.

Sheets—The market is unchanged, demand being fairly good, but prices shaded, on attractive business, about $1 per ton on flat sheets and $2 per ton on corrugated material. The regularly quoted market, on ordinary carloads, is 2.25c. on black and 3.25c. on galvanized, 28 gage.

Ferromanganese—The market is a trifle firmer, it being difficult to do $40, Baltimore, even on attractive business, it being regularly quotable at about $41, Baltimore, or $42.95, Pittsburg.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports pig-iron production in April at 1,047,197 tons, being 25,919 tons less than in March. The average daily production increased, however, from 34,617 tons in March to 34,906 in April. For the four months ended April 30 the total make was, in metric tons:

	1908.	1909.	Changes.	
Foundry iron	774,913	744,765	D.	30,148
Forge iron.....	239,384	232,838	D.	6,546
Steel pig.....	351,671	359,572	I.	7,901
Bessemer pig.....	146,956	143,575	D.	3,381
Thomas(basic)pig	2,569,455	2,610,851	I.	41,396
Total..... ...	4,082,379	4,091,601	I.	9,222

Steel pig includes spiegeleisen, ferromanganese, ferrosilicon, and all similar alloys. The total output shows a slight gain for the first time this year.

Metal Markets

New York, May 26—The indications in most of the markets are of increasing demand, and in consequence there is a general upward tendency toward higher prices, though increases so far are moderate.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver			
April 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,167,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298,582	" 2,750,269

Exports from the port of New York, week ended May 22: Gold, $6,589,739, to Paris, Berlin and Buenos Aires; silver, $850,633, chiefly to London. Imports: Gold, $139,552, from Australia and South America; silver, $67,834, from Central America and Mexico.

Foreign trade of the United States, four months ended April 30, as valued by the

Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 648,817,855	$ 547,257,162
Imports	346,301,599	477,825,021
Excess, exports	$ 302,516,256	$ 69,932,141
Add excess of exports, silver		4,899,459
Add excess of exports, gold		28,809,244
Total export balance		$ 103,640,844

The gold and silver movement will be found in the table at the head of this column.

The Treasury Department's estimate of money in the United States on May 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 193,501,336	$ 609,289,337
Gold certificates	42,089,580	804,609,289
Silver dollars	10,153,994	71,229,818
Silver certificates	5,965,203	476,581,797
Subsidiary silver	26,899,136	127,709,264
Treasury notes of 1890	8,481	4,320,519
U. S. notes	5,902,751	340,778,265
Nat. bank notes	25,263,392	662,144,83
Total	$309,783,872	$3,096,663,124

Population of the United States May 1, 1909, estimated at 88,687,000; circulation per capita, $34.92. Government deposits in national banks, not included in Treasury stocks, $59,381,047. Total circulation was $10,369,023 more than on May 1 last year.

Gold—There was a less active demand for gold and prices on the open market in London declined a little, bars being quoted at 77s. 9d. per oz. with American coin 76s. 4d. per oz. In New York the outward movement of gold still continues, both to Paris and to South America.

Platinum—Trade is reported as improving and sales are larger. Prices show little change, current quotations being $23@23.50 for refined platinum, $25.50 for hard metal, and $18.50@20.50 per oz. for scrap.

Our St. Petersburg correspondent writes under date of May 13: The government conference at St. Petersburg has not satisfied the smaller producers. It recommends that the export of crude platinum from Russia be prohibited, all refining to be done in the country. The proposition for a platinum trust has failed. The circulation of crude metal will be limited.

Quotations are unchanged. At Ekaterinburg the price is 4.50@5 rubles per zolotnik for crude metal, 83 per cent.; at St. Petersburg, 18,000@19,000 rubles per pood. These prices are equivalent to $16.02 and $18.13 per oz., average.

SILVER AND STERLING EXCHANGE

May.	20	21	22	24	25	26
New York	52⅞	52¾	52½	52⅝	52⅝	52⅝
London	24⅞	24¾	24⅝	24⅝	24¾	24⅝
Sterling Ex.	4.8780	4.8780	4.8780	4.8775	4.8780	4.8780

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—The market during the past week has been very steady, with very small fluctuations. Purchases on China account occasionally have helped to sustain the price.

Exports of silver from London to the East, reported by Messrs Pixley & Abell, year to May 13:

	1908.	1909.	Changes.
India	£ 2,889,358	£1,553,400	D. £1,335,958
China	516,400	1,075,100	I. 658,700
Straits	90,200	82,800	D. 7,400
Total	£ 3,495,958	£2,711,300	D. £ 784,658

Imports for the week £3500 from Mexico and £200,500 from New York; total, £204,000.

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
20	13½ @13⅝	12⅞ @13	59 5/16	29¾	4.30 @4.32½	4.25 @4.27½	5.00 @5.05
21	13⅛ @13⅜	12⅞ @13	59⅞	29¾	4.30 @4.32½	4.25 @4.27½	5.00 @5.05
22	13⅛ @13⅜	12⅞ @13	....	29¾	4.30 @4.32½	4.25 @4.27½	5.02½ @5.07½
24	13⅛ @13⅜	12⅞ @13⅜	59¾	29¾	4.30 @4.32½	4.25 @4.30	5.05 @5.10
25	13⅛ @13⅜	13 @13¾	60	29¾	4.30 @4.32½	4.25 @4.30	5.05 @5.10
26	13⅛ @13⅜	13 @13¼	61⅛	29¾	4.30 @4.32½	4.25 @4.30	5.05 @5.10

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—A large business has been done during the past week, for home trade as well as for export. The consumption is steadily improving, and if looks as if the deliveries for May would exceed the production, thus reducing the stock. There has been a good demand, not only for early delivery, but also for shipment over the remainder of the year, but producers have been unwilling to sell ahead at present figures. Prices have advanced, the closing quotations being 13⅜@13½c. for Lake copper; 13@13¼c. for electrolytic in ingots, cakes and wirebars; 12⅞@13c. for casting copper. The average for casting copper has been 12⅞@13 cents.

On Thursday and Friday of last week the standard market was firm at £50 7s. 6d. for spot, and £60 for three months. This week it became very active. Large orders came to hand from all sides and prices quickly advanced, closing at £61 2s. 6d. for spot and £61 16s. 3d. for three months, an advance of almost £2 since the close of last Wednesday.

Copper sheets have been advanced ½c. to 17c base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire is 14½c base, carload lots at mill. Business has been good.

For refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@77.

Tin—There has been a better tone in the London market, where the selling pressure, which was noticeable for some time past, seems to have been removed. Quotations have, however, not shown much change, but close firm at £132 12s. 6d. for spot and £133 12s. 6d. for three months.

Sellers in the domestic market have also been a good deal firmer, and especially spot material seems again to be concentrated in a few strong hands. The market closes steady at about 29⅜ cents.

Lead—There is a good demand for this article, particularly in the West, where prices have advanced, the close at St. Louis being quoted at 4.25@4.30, while at New York it remains unchanged at 4.30@4.32½ cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of May 26, that lead is strong and fairly active. Missouri brands are salable at 4.27½c. for both prompt and June delivery.

The London market has been quiet and somewhat lower, Spanish lead closing at £13 3s. 9d. and English lead at £13 7s. 6d.

Spelter—The galvanizing trade is constantly improving, and in consequence the consumption of spelter is steadily increasing. There has been a good demand during the week; prices are still advancing, St. Louis being quoted at 5.05@5.10c., and New York 5.20@5.25c. Sales for future delivery have been made at as high as 5.12½c., St. Louis.

Quotations for spelter in New York May 20 and 21 were 5.15@5.20c.; May 22 they were 5.17½@5.22½c.; May 24-26, inclusive, 5.20@5.25 cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of May 26, that spelter continues to advance. The latest sales are on a basis of 5.12½ cents.

The market in London is firm, closing quotations being unchanged at £22 for good ordinaries, £22 5s. for specials.

Base price of sheet zinc is 6¾c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—The market has been dull, and prices in the absence of sales are rather nominal at 8⅜c. for Cookson's; 7⅞c. for U. S., and 7⅜@7⅝c. for outside brands.

Aluminum—Business is increasing a little. Prices are unchanged at 22@24c. base for No. 1 ingots; 31@32c. base for wire and 33@34c. base for sheets.

Quicksilver—Business is rather better, but prices are unchanged. New York quotation is $44.50 per flask of 75 lb. San Francisco, $44 for domestic and $42 for export orders. London quotation is £8 7s. 6d. per flask, with £8 2s. 6d. quoted by jobbers.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, four months ended April 30, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	39,126	23,802	Imp. 15,324
Copper, 1908....	50,704	21,394	Imp. 29,310
Tin, long tons....	13,018	13,289	Exp. 271
Tin, 1908.....	16,200	13,430	Imp. 2,770
Lead, short tons.	73,461	14,712	Imp. 58,749
Lead, 1908.....	81,241	18,322	Imp. 62,919
Spelter, sh. tons.	36,492	2,082	Imp. 34,410
Spelter, 1908....	35,137	2,438	Imp. 32,699
Quicksilver, lb...	1,282,063	356,226	Imp. 925,837
Quicksilver, '08	1,691,733	633,255	Imp. 1,058,478
Ores:			
Tin ore and con.	7,445	.....	Imp. 7,445
Tin ore, 1908...	9,421	.....	Imp. 9,421
Pyrites.....	275,084	.....	Imp. 275,084
Pyrites, 1908...	301,777	.....	Imp. 301,777

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 128 tons copper matte, 7881 tons fine copper and 11,946 tons lead.

British Iron Trade—Exports and imports of iron and steel in Great Britain four months ended April 30 were valued as follows:

	Exports.	Imports.	Excess.
Iron and steel	£12,087,320	£ 2,503,331	Ex. £ 9,583,989
Machinery...	9,180,589	1,544,038	Ex. 7,636,551
New ships....	2,380,848	.....	Ex. 2,380,848
Total.....	£23,648,757	£ 4,047,369	Ex. £19,601,388
Total, 1908..	26,392,140	4,311,580	Ex. 22,080,560

Total decrease in exports, £2,743,383, or 11.6 per cent.; decrease in imports, £264,211, or 6.1 per cent. The quantities of iron and steel were, in long tons:

	1908.	1909.	Changes.
Exports.....	1,357,512	1,292,661	D. 64,851
Imports.....	342,136	374,595	I. 32,459

The increased tonnage of imports was mainly in blooms, billets and other half-finished material.

Zinc and Lead Ore Markets

Joplin, Mo., May 22—Zinc sulphide ore sold as high as $43 per ton, and the base price was advanced to $41.50 for 60 per cent. zinc, with an unconfirmed rumor of a $42 base. Offerings ranged down to a $38 base for heads and some slimes sold as low as $36@37 base. Zinc silicate ore sold at $14@24 per ton, the base offerings having about the same wide range, with a stronger demand for these ores the latter part of the week. The average price, all grades, was $37.44. Lead ore sold as high as $58 with small lots selling under $57. The average price, all grades, was $57.38 per ton.

Zinc prices began advancing Wednesday and the market continued feverish to the end of the week, when the offerings of $41.50 base were made for delivery next week, with larger demand from several smelters.

SHIPMENTS, WEEK ENDED MAY 22.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,877,150	1,380,580	$117,233
Joplin.....	2,595,640	208,080	57,478
Miami.....	861,790	151,410	17,288
Duenweg.....	685,390	108,460	15,184
Galena.....	659,300	64,060	14,416
Prosperity.....	656,130	38,530	14,229
Badger.....	622,250	35,070	13,448
Alba-Neck.....	544,020	.....	10,880
Aurora	580,240	.....	8,984
Carthage.....	374,540	.....	7,490
Spurgeon.....	247,790	82,440	6,504
Granby	428,720	18,400	5,509
Oronogo...	345,280	6,760	4,878
Quapaw.....	232,390	.....	4,416
Zincite.....	39,030	46,350	2,100
Carl Junction.....	87,630	.....	1,752
Sarcoxie.....	46,310	.....	926
Totals	12,883,600	2,140,140	$302,714
21 weeks.....	237,916,190	38,788,410	$5,328,196
Zinc value, the week, $241,292; 21 weeks,			$4,302,834
Lead value, the week, 61,422; 21 weeks,			1,025,362

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	.....	33.39	.....	56.05	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September .	37.63	.....	34.44	.....	54.59	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November...	39.13	.....	35.02	.....	54.53	.....
December...	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., May 22—The highest price paid this week for zinc ore was $43; the base price advanced from $39 to $40.50 per ton at the week end. For 80 per cent. lead ore $55 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 22.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	596,235	.....	242,300
Strawbridge.....	480,000	.....	.....
Cuba City	387,335	88,775	143,000
Benton.	328,490	..... .	.....
Hazel Green	302,400	.....	.....
Galena.....	264,000	.....	.....
Livingston	160,000	.....	.....
Rewey	61,000	.....	.....
Total..... ...	2,579,460	88,775	385,300
Year to May 22	42,163,214	1,486,435	3,509,000

On account of the condition of the mines, Highland, Linden and Harker are not reported. In addition to the above there was shipped to the American Zinc Ore Separating Company 410,770 lb., and to the Joplin Separator Works 214,000 lb. zinc concentrates.

Chemicals

New York, May 26—A slight improvement begins to show itself in the market, rather more on contract than on current business.

Copper Sulphate—Sales are about the same and business is done at last week's prices—4.22½ per 100 lb. for carload lots, and 4.47½ per 100 lb. for smaller parcels.

Arsenic—Sales have been fair with quotations a trifle lower, at 2¾@2⅞c. per lb. for white arsenic.

Nitrate of Soda—The market for this article continues good and prices have advanced a little, 2.25c. being asked for spot nitrate and 2.15c. for future positions.

Potassium Salts—Exports of potassium salts from Germany for the quarter ended March 31 were, in metric tons:

	1908.	1909.	Changes.
Kainit, kieserit, etc...	147,129	173,988	I. 26,859
Potassium chloride.....	27,744	41,841	I. 14,097
Potassium sulphate....	9,560	13,895	I. 4,335
Pot.-magnesium sul....	38,557	30,580	D. 7,977
Total.....	222,990	260,304	I. 37,314

Of the exports this year in all 84,080 tons went to the United States.

Fertilizers—It is reported that the combination of independent fertilizer manufacturers may fail, J. P. Morgan & Co. having withdrawn the financial support expected from them.

Mining Stocks

New York, May 26—The general stock market has been less active than for some time and inclined to be irregular. It has been a traders' market, with comparatively little outside influence and few disturbing factors. Consequently, it has moved up and down in a rather irregular way and has shown no very definite tendency. At best there has been rather a cessation in the bull movement, but without any general break. The most marked feature has been the great strength of Steel Corporation stocks, which have continued to rise, the common stock advancing to record quotations. It is to be noted that J. P. Morgan, Jr., has been chosen a director of the Steel Corporation to succeed H. H. Rogers—not a Standard Oil man, as was expected.

There was one sale during the week of Homestake, of South Dakota, 100 shares changing hands at $92 per share.

On the Curb the copper stocks have shown small fluctuations, but no important changes. The movement was divided, some stocks losing a little, while others gained. Sales were only moderate. The Nevada gold stocks are improving in

price and demand, while Cobalt stocks did a moderate business.

Boston, May 25. North Butte has again been the market feature; continued liquidation and bear manipulation have resulted in putting a quietus on the general mining share market. It broke from $62 to $55.50, recovered to above $59, and fell back again to under $57. The public is in the dark as to the actual condition of the company, but the best belief is that the property has fallen behind. The declaration of a $6 dividend by Calumet & Hecla lends encouragement to the situation, as it is a small increase over recent payments. Calumet dividends have always been in multiples of $5, so that this rate is an unusual one.

Amalgamated has fluctuated between $82 and $84.50, but closes about the same as a week ago. There is no pressure to sell mining stocks and the odds are that prices will work higher. United States Smelting has had a $3 advance to $50.50, while the preferred is also up to $1.75 to $50. There is pool work in this stock and these movements are facilitated by reason of the fact that all discords in the management are ended. United States Coal and Oil, the management being the same as United States Mining, has advanced from $31.50 to $34. Butte Coalition and Parrot have been strong spots.

Prices on the Curb have been firm for the higher-priced issues. Yukon has risen $1 to $5.25. Helvetia had a good advance also.

STOCK QUOTATIONS

NEW YORK	May 26	BOSTON	May 26
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.62	Adventure	9¼
Amalgamated	84⅛	Allouez	‡39⅞
Anaconda	50⅞	Am. Zinc	‡25
Balaklala	12¼	Arcadian	5
British Col. Cop.	7⅛	Arizona Com.	44⅞
Buffalo Mines	‡3½	Atlantic	9¾
Butte Coalition	26⅝	Boston Con.	15¾
Colonial Silver	¼	Calumet & Ariz.	104
Cum. Ely Mining	8⅞	Calumet & Hecla	635
Davis-Daly	5⅞	Centennial	31¼
Dominion Cop.	.07	Copper Range	81
Douglas Copper	2⅞	Daly-West	8⅞
El Rayo	2	East Butte	13⅛
Florence	3 1/16	Franklin	15
Foster Cobalt	‡.32	Greene—Can.	10⅝
Furnace Creek	.10	Hancock	10¼
Giroux	7⅛	Isle Royal	‡27
Gold Hill	‡⅛	Keweenaw	3¼
Goldfield Con.	7⅞	La Salle	14⅛
Granby	104	Mass.	14
Greene Gold.	⅛	Michigan	10⅛
Greene G. & S.	9	Mohawk	.06
Guanajuato	‡1⅛	Nevada	22⅛
Guggen. Exp.	195	North Butte	57⅛
Hanapah	‡.16	Ojibway	11
Kerr Lake	8	Old Colony	‡.60
McKinley Dar.	.90	Old Dominion	55
Miami Copper	14⅛	Osceola	135
Mexican	⅝	Parrot	35¼
Mines Co. of Am.	½	Quincy	90
Mitchell Mining	2⅞	Rhode Island	14⅞
Mont. Shoe C.	‡1½	Shannon	16¼
Nev. Utah M. & S.	2 1/16	Superior	49
Newhouse M. & S.	2	Superior & Bost	16⅝
Nipissing Mines	10⅞	Superior & Pitts.	14⅞
Old Hundred	⅛	Tamarack	‡70
Silver Queen	.37	Trinity	14¼
Stewart	‡4	U. S. Smg. & Ref	50
Tennessee Cop'r	41¼	U.S. Sm. & Ref. pd.	49¾
Tri-Bullion	⅛	Utah Con.	40⅝
Union Copper	1¼	Victoria	‡6⅞
Utah Apex	6¼	Winona	5¼
Utah Copper	51	Wolverine	‡115
Yukon Gold	5 1/16	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	39⅝
Am. Smelt. & Ref	93½
Am.Sm. & Ref., pf	109¾
Colo. Fuel & Iron	41½
Federal M. & S., pf.	‡92
National Lead	87
National Lead, pf.	105
Pittsburg Coal	12⅛
Republic I. & S.	29⅞
Republic I.& S.,pf.	91
Sloss-Sheffield	83
Standard Oil	673
U. S. Steel	60⅞
U. S. Steel, pf.	119⅝
Va. Car. Chem.	50¼

BOSTON CURB	Low.
Ahmeek	‡150
Black Mt.	‡.85
Chemung	16¼
Globe Con.	‡4½
Helvetia	5½
North Lake	‡7½
Ray Central	3¼
Ray Con.	17⅛
San Antonio	11¼

ST. LOUIS	May 22	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	2.00	1.50
Cent.C.& C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.25	.20
St. Joe	12.50	11.00

LONDON	May 26		
Name of Com.	Clg.		
Dolores	£1	58	0d
Stratton's ind.	0	3	1½
Camp Bird	1	2	9
Esperanza	2	18	9
Tomboy	1	2	6
El Oro	1	6	3
Oroville	0	13	9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS.

May 26.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp	Clg.
COMSTOCK STOCKS		Silver Pick	18
Belcher	50	St. Ives	.10
Best & Belcher	35	Triangle	.01½
Caledonia	09	BULLFROG STOCKS	
Challenge	09	Gibraltar	04
Comstock	31	Homestake King.	.01
Con. Cal. & Va	.66	Mont. Shoshone C.	1 93¾
Crown Point	50	Tramp Cons.	06
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.08	Bonnie Clare	...
Hale & Norcross	.20	Lee Gold Grotto	...
Mexican	.79	Nevada Hills	1 31½
Ophir	1.20	Nevada Smelting	.87½
Overman	.14	Nevada Wonder	60
Potosi	13	Nevada-Utah	2 25
Savage	.19	Penn-Wyoming	.05
Sierra Nevada	.28	Pittsburgh S. Pk.	.52
Union	.31	Rawhide Cao'l't'n.	...
Utah	.04	Round Mt. Sphinx	.09
Yellow Jacket	.56		
TONOPAH STOCKS			
Belmont	.78		
Extension	.49		
Golden Anchor	...		
Jim Butler	.15		
MacNamara	24		
Midway	24		
Montana	70		
North Star	92		
Tonopah Mine of N.	7 18¾		
West End Con.	29		
GOLDFIELD STOCKS			
Adams	02		
Atlanta	16		
Blue Bell	04		
Booth	16		
Columbia Mt.	10		
Comb. Frac.	74		
Con. Red Top	03		
Cracker Jack	03		
Dia'dfield B. B. C.	05		
Goldfield Belmont	04		
Goldfield Daisy	31¼		
Great Bend	09		
Jumbo Extension	14		
Kendall	.05		
Lone Star	04		
May Queen	04		
Oro	08		
Red Hill	.08		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS	May 21
Name of Comp.	Clg.
Acacia	.06¾
Black Bell	....
C. C. Con.	‡ .03
Dante	.06
Doctor	‡ .09
Elkton	63¼
El Paso	47⅞
Findlay	15
Gold Dollar	.11¾
Gold Sovereign	.03
Isabella	20½
Jack Pot	‡ .07½
Jennie Sample	.07
Jerry Johnson	‡ .05¾
Mary McKinney	39
Pharmacist	‡.03
Portland	87⅝
Un. Gold Mines	.06
Vindicator	.57½
Work	‡.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida.	May 8	June 5	$0.006
Carney Copper, Ida.	Mar. 25	May 1	0.003
Confidence, Nev.	May 18	June 8	0.20
Con. Imperial, Nev.	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 9	0.00
Echo, Ida.	May 1	June 1	0.002
Elk M. & M., Ida.	Apr. 20	May 20	0.001
Exchequer, Nev.	May 5	May 26	0.05
Hecla M. & M., Utah	May 15	June 14	0.05
Imlay, Nev.	Apr. 6	Apr. 28	0.03
Julia Con., Nev.	May 24	June 17	0.03
Laclede, Ida.	Apr. 7	May 1	0.003
Mexican, Nev.	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
Palmyra G. & C., Utah	June 11	June 30	0.001
Reindeer C. & G., Ida.	Apr. 28	May 28	0.005
Savage, Nev.	Apr. 8	May 5	0.10
Sierra Nevada, Nev.	May 4	May 28	0.10
Uintah Trens. Hill, Utah	May 20	June 9	0.01
Utah, Nev.	May 6	May 27	0.03
Yerington Gold, Nev.	Apr. 8	May 12	0.006

Monthly Average Prices of Metals

SILVER

Month.	New York		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.466	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	.....	24.377	.....
June	54.663	.....	24.760	.....
July	54.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.875	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.756	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.591	14.284	62.386	57.688
February	12.905	12.949	13.408	13.295	58.786	61.198
March	12.704	12.987	12.875	12.826	58.761	56.231
April	12.743	12.562	12.928	12.93	58.331	57.363
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.993	.....	57.989	.....
August	13.462	.....	13.639	.....	61.500	.....
September	13.488	.....	13.610	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.557	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908	1909.	1909.	1908.	1909.
January	3.631	4.175	4.025	14.469	13.713
February	3.725	4.018	3.866	14.250	13.313
March	3.888	3.866	3.835	13.975	13.438
April	3.923	4.168	4.031	13.469	13.297
May	4.253	.....	4.188	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.744	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.298	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.740	20.875	21.563
March	4.66	4.757	4.727	4.602	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	.....	4.458	.....	19.906	.....
June	4.54	.....	4.38	.....	19.600	.....
July	4.485	.....	4.48	.....	19.641	.....
August	4.707	.....	4.566	.....	19.350	.....
September	4.788	.....	4.64	.....	19.563	.....
October	4.801	.....	4.654	.....	19.750	.....
November	5.039	.....	4.889	.....	20.875	.....
December	5.147	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Alaska, Mexican, g.	Alas	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas	200,000	23	10,485,000	April '09	0.50
Alaska United, g.	Alas	180,200	5	513,520	April '09	0.25
Amalgamated, c.	Mont	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.	500,000	100	16,000,000	April '09	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	30,625,000	April '09	1.75
Am. Smelters, pf. A	U. S.	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf B	U. S.	300,000	100	6,000,000	June '09	1.25
Am. Zinc, Lead&Sm.	Kan	80,000	25	280,000	Nov. '07	0.50
Anaconda, c.	Mont	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c.	Ariz	3,682,520	5	6,182,520	April '06	0.50
Atlantic, c.	Mich	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s.	Mont	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D.,pf.,lz.	Wis	196,607	1	10,949	Nov. '08	0.01½
Boston & Montana.	Mont	150,000	25	53,400,000	April '09	3.00
Bull.Beck. & Cham.g	Utah	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull	Ida	300,000	10	10,921,000	May '09	0.15
Butte Coalition, c. s.	Mont	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizona,c.	Ariz	200,000	10	10,500,000	May '09	1.00
Calumet & Hecla, c.	Mich	100,000	25	108,950,000	June '09	6.00
Camp Bird, g., s.	Colo	820,000	5	5,904,000	May '09	0.24
Carisa, c. g.	Utah	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s.	Utah	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c.	Utah	283,440	5	226,832	Oct. '07	0.20
Comb'tion Co. G'f'd.	Nev	320,000	1	688,000	Sept. '06	0.15
Con. Mercur, g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich	384,185	100	8,067,885	April '09	1.00
Creede United, g.	Colo	1,625,000	1	214,053	July '06	0.02½
Daly Judge, g. s. l.	Utah	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l.	Utah	180,000	20	5,731,000	April '09	0.30
De Lamar, g.s.	Idaho	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.	Mo	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.	Colo	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.	Colo	2,450,000	1	1,315,545	Sept. '08	0.01
Fed Sm., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.	Idaho	120,000	100	4,751,250	June '09	1.75
Findley, g.	Colo	250,000	1	337,500	Sept. '06	0.01
Florence, g.	Nev	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev	912,000	1	546,000	Jan. '08	0.05
Gemini-Keystone.	Utah	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.	Colo	3,750,370	1	1,407,504	May '07	0.01
Goldfield Con., g.	Nev	3,532,371	10	1,770,425	April '09	0.30
Grand Central, g.	Utah	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g.	Cal	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.	S. D.	218,400	100	24,372,440	May '09	0.50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.50
Imperial, c.	Ariz	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf.	N. Y.	89,126	100	1,871,646	May '09	1.50
Iron Blossom, s. l.	Utah	1,000,000	0.10	80,000	April '09	0.08
Iron Silver	Colo	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal	390,000	10	347,100	April '09	0.02
Jerry Johnson	Cal	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.	Mont	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s.	Colo	130,551	5	130,440	Jan. '07	0.15
Lightner, g.	Cal	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah	190,000	1	57,000	Sept. '07	0.07½
Mammoth, g. s. l.	Utah	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l.	Utah	500,000	1	108,000	Sept. '08	0.01½
Mohawk, W.	Mich	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Purch.	Mont	80,833	25	9,437,274	Jan. '07	15.00
Nevada Hills, s g.	Nev	746,000	5	373,000	Dec. '07	0.10
New Century, z. l.	Mo	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah	600,000	10	300,000	Sept. '07	0.50
New Idria, q.	Cal	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc	U. S	100,000	100	12,000,000	May '08	4.00
North Butte	Mont	400,000	15	7,200,000	June '09	1.00
North Star, g.	Cal	250,000	10	1,911,988	May '09	0.30
Old Dominion, c.	Ariz	293,245	25	849,332	Mar. '09	0.50
Old Dominion,M&Sc	Ariz	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.	Nev	201,600	3	1,816,360	May '08	0.10
Osceola, c.	Mich	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. s.	Mont	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g.	Cal	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co	U. S.	44,934,600	1	1,123,365	April '09	0.02½
Portland, g.	Colo	3,000,000	10	8,227,080	Jan. '09	0.40
Quartette, g. s.	Nev	100,000	1	375,000	July '07	0.20
Quincy, c.	Mich	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q.	Utah	1,000,000	1	225,000	Nov. '06	0.01
St. Joseph, l.	Mo	1,000,000	10	6,308,357	Mar. '07	0.15
Shannon, c.	Ariz	300,000	10	450,000	July '07	0.50
Silver Hill, g. s.	Nev	105,000	1	81,000	June '07	0.05
Silver King, g. s. l.	Utah	150,000	20	11,187,500	July '07	0.33⅓
Silver King Co't'n.	Utah	1,224,425	5	1,105,402	April '09	0.15
Sioux Con	Utah	746,389	1	335,595	April '09	0.07
Snowstorm, s. l.	Ida	1,500,000	1	735,000	May '09	0.03
Standard Con., g. s.	Cal	178,394	10	5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo	1,000,000	5	4,895,865	April '06	0.12½
Swansea, g. s. l.	Utah	100,000	5	329,500	Mar. '07	0.05
Tamarack, c.	Mich	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.	Colo	300,000	5	2,016,000	Dec. '08	0.48
Tonopah of Nev.	Nev	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont	Nev	1,500,000	1	600,000	April '07	0.10
Tonopah Ext'nsion	Nev	1,500,000	1	283,030	April '06	0.15
Tonopah Midway	Nev	928,433	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l.	Utah	1,000,000	1	295,000	Dec. '08	0.02
United States, com.	Utah	500,000	50	2,148,099	April '09	0.50
United States, pfd.*	Utah	350,933	50	5,306,495	April '09	0.87½
United Cop. com.	Mont	485,845	100	5,962,500	Aug. '07	1.75
United, c. pf.	Mont	450,000	10	1,500,000	May '07	3.00
United, Z. l., pf.	Mo.-Kan.	50,000	25	312,782	Jan. '08	0.50
United Verde, c.	Ariz	19,556	100	1,385,322	Mar. '09	0.75
U. S. Red. & Ref. Pf.	Colo	300,000	10	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah	39,458	100	323,000	Feb. '09	0.02
Utah Con., c.	Utah	100,000	10	7,500,000	April '09	0.50
Utah Copper	Utah	300,000	5	1,471,000	June '09	0.50
Victoria, Utah	Utah	725,950	10	177,000	Mar. '07	0.04
Vindicator Con., g.	Colo	250,000	1	1,980,000	Jan. '09	0.02
Wolverine, c.	Mich	1,500,000	1	5,400,000	April '09	5.00
Work, g.	Colo	60,000	25	172,500	July '08	0.03
Yankee Con	Utah	1,500,000	1	182,500	Jan. '07	0.02
Yellow Aster, g.	Cal	1,000,000	1	558,780	Aug. '07	0.20
		100,000	10			

*Previous to consolidation $1,436,250 were divided †Amalgamated

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Allis-Chalmers, pf.	U. S	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S	181,530	100	1,747,620	April '09	3.00
American Cement	Pa	200,000	10	1,288,000	Jan. '09	0.30
American Coal	Md	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa	150,000	100	900,000	Nov. '06	0.75
Cambria Steel	Pa	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo	51,250	100	2,613,750	April '09	1.50
Central C. & C., pf.	Mo	18,750	100	1,476,562	April '09	1.25
Col.&Hock. C.&I.,pf.	Ohio	69,244	100	383,818	April '08	1.50
Consolidated Coal	Ill	50,000	100	900,000	July '04	1.00
Consolidation Coal	Md	102,500	100	x10 431,650	Jan. '09	3.50
Crucible Steel, pf.	Pa	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf.	N. J	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem., com	U. S	74,103	100	2,297,193	June '09	1.00
General Chem., pf.	U. S	100,000	100	6,255,000	Jan. '09	1.50
International Salt	Penn	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., com.	Pa	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'f C. & I., pf.	Pa	15,000	100	900,000	Feb. '09	2.50
Kern River Oil	Cal	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav.	Pa	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf.	Md	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf.	Pa	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com.	U. S	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf.	U. S	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com	N. Y	149,054	100	3,456,497	July '09	1.25
National Lead, pf.	N. Y	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel&Wire,pf.	N. Ye	25,778	100	631,561	May '06	1.75
New Central Coal	Md	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf.	W. Va	37,017	100	451,405	Nov. '08	1.50
Pacific Coast Borax	Cal	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil	Cal	92,000	10	711,000	June '08	0.06
Penna. Salt	Pa	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.	Pa	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com	Pa	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.	Pa	129,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf.	Pa	297,010	100	11,434,962	April '09	1.75
PocadontasC.C., pf.†	W.aVa	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.†	W. Va	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala	100,000	100	2,100,000	April '08	1.25
Sloss-Sheffield, pf.	Ala	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil	U. S	970,000	100	652,802,905	June '09	9.00
Tenn. C. & I., com.	Tenn	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal	Texas	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling	U. S	50,000	100	5,875,000	Jan. '09	1.50
U.S. Steel Corp., cm.	U. S	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S	180,000	100	14,700,869	April '09	2.00
Warwick I. & S.	U. S	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal	Pa	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. xStock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Shares. Par Val.	Dividends. Total to Date.	Dividends. Latest. Date.	Dividends. Latest. Amt.
Amistad y Conc'rdia	Mex	9,600	50	$417,070	April '08	$1 36
Batopilas	Mex	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.	Ont	900,000	1	390,000	May '09	0.01
Butters' Salvador, g.	Salv	150,000	5	600,000	April '05	0.25
Cobalt Central, s.	Ont	4,761,500	1	92,230	Feb. '09	0.02
Coniagas, s.	Ont	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass	B. C	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. s.	Mex	400,000	1	660,000	Aug. '09	0.15
Dominion Coal, com.	N. S	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf.	N. S	30,000	100	‡630,000	Feb. '08	3.51
Dos Estrellas, g. s.	Mex	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. s.	Mex	1,080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.	Mex	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s.	Ont	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn.	B. C	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper	Mex	864,000	10	6,137,800	Mar. '07	0.40
Guanajuato	Mex	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. s.	Mex	10,000	100	30,000	July '08	3.00
Guggenheim Expl.	Mex	105,000	100	5,735,000	July '09	2.50
Hinds Con., g. s. c. l	Mex	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.	Ont	600,000	5	1,108,000	June '09	0.30
La Rose Con., s.	Ont	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., s.	B. C	200,000	25	425,000	Dec. '06	0.48
Le Roi No. 2, g.	B. C	120,000	25	889,200	Mar. '09	0.48
Luck y Tiger-Com., g.	Mex	65,000	10	71,500	Dec. '08	0.30
McKinley-Darragh, s	Ont	2,000,000	1	480,000	Jan. '09	0.05
Mex. Con. M.&S. Co	Mex	240,000	10	660,000	Mar. '08	0.25
Mex. Mill.&Trans.pf.	Mex	12,000	100	35,450	Jan. '08	3.00
N. Y. & Hond. Ros.	C. A	2,000,000	1	3,605,000	Aug. '09	0.03
Nipissing, s	Ont	150,000	10	2,497,000	May '09	0.10
N. S. St.&Coal, com.	N S	1,200,000	5	2,640,000	April '09	0.25
N. S. St. & Coal, pf.	N. S	9,876	100	1,087,536	April '08	1.50
Penoles*	Mex	10,300	100	479,130	April '09	2.00
Peregrina, pf. s.	Mex	2,500	100	8,630,000	Dec. '07	20.00
Porcupine, pf. s.	Mex	10,000	100	538,656	Mar. '09	3.50
Reco, g. s. l.	B. C	20,000	100	240,000	Oct. '08	3.00
Right of Way	Ont	985,000	1	527,082	April '06	0.02
Securities Corp., pf.	Mex	499,518	1.00	264,701	May '09	0.10
Silver Queen, s.	Ont	2,000	100	42,639	July '08	3.50
Temiskaming, s.	Ont	1,500,000	1	345,000	Nov. '08	0.05
Tezuitlan Copper	Mex	2,500,000	1	525,000	April '09	0.06
Tines Co. of Am.	N. F	10,000	100	.....	Dec. '08	1.20
Tretheway, s.	Ont	89,000	2	495,630	May '08	0.55
Tyee, c.	B. C	945,450	1	311,998	May '09	0.10
		180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

W. L. Imlay Rapid Cyanide Process Company, Philadelphia, Penn., reports having closed its first 100-ton daily plant with the Gold Ridge Mining Company of Alabama.

The Wood Drill Works, of Paterson, N. J., has a number of copies of an enlarged sectional cut of the "Wood" rock drill which they are distributing gratuitously among mining schools desirous of securing a copy.

Buckeye Engine Company, Salem, Ohio, announces the appointment of Louis Bendit, as Kansas City sales manager, with offices at 504 N. Y. Life building, and J. R. Detweiler, as district manager, 505 Barnes building, Wichita, Kan.

Among the recent orders received by Tate, Jones & Co., Inc., Pittsburg, Penn., is an extensive one from the Erie Forge Company, Erie, Penn., for fuel-oil burning equipment for use in open-hearth furnaces. Uniformity, low cost and a steady supply are given as the reasons for the installation of oil over other fuels.

The Wagner Electric Manufacturing Company has opened an office in Denver, Colo., located in the Ideal building. This new office is in charge of O. H. Davidson, of the Electric Manufacturers' Sales Company. Mr. Davidson will have charge of the Wagner Company's business in Colorado, New Mexico, Utah, Montana and eastern Idaho.

The Independent Pneumatic Tool Company, of Chicago, Ill., has recently appointed the Burnite Machinery Company, 1710 Glenarm street, Denver, Colo., exclusive Colorado agents for their well known line of Thor pneumatic tools. A full line will be carried in stock, including piston air drills (reversible and non-reversible); pneumatic reaming, tapping and flue rolling machines; pneumatic wood-boring machines, pneumatic riveting, chipping, calking and beading hammers; pneumatic grinding machines, saws and flue expanders, repair parts for all machines. All orders for Colorado and vicinity should be sent to the Denver office.

John L. Wagner, vice-president of the Pneumelectric Machine Company, Syracuse, N. Y., spoke before the mining engineers' department of the State College of Pennsylvania on Wednesday, March 24, on "Mining Coal with the Electric Puncher." His paper, which was illustrated by numerous lantern slides, presented briefly the history of the application of electricity to coal-mining machines and showed in detail the latest designs of the Pneumelectric coal puncher, which represents the only machine of the reciprocating percussive type directly operated by a motor forming a part of the machine, and the only type in which the air is both compressed and utilized within the same cylinder.

S. B. Stine reports having recently closed contracts for the following complete ventilating equipment: The Maderia Hill Coal Mining Company, one 10-ft. fan, with engine; Cabin Creek Consolidated Coal Company, Kayford, W. Va., one 4-ft. direct connected fan, with Westinghouse motor; one 8-ft. belted fan and one 6-ft. belted fan; the Turkey Gap Coal Company, Ennis, W. Va., one 6-ft. fan and engine; the Price Coal Company, Ethel, W. Va., one 7-ft. fan and engine; the Rex Coal Company, Ethel, W. Va., one 8-ft. fan; Leahey Coal Mining Company, Lilly, Penn., one 5-ft. fan and engine; the Lambert Run Coal Mining Company, Fairmont, W. Va., one 5-ft. fan and engine; the La Belle Coal Company, Wellsburg, W. Va., one 5-ft. fan. J. T. Beard, the Scranton expert, has taken charge of the fan department of S. B. Stine and will act as his consulting engineer.

The Jeffrey "Lock-Jaw" wrench is the simple practical, common-sense development of the demand for a wrench whose jaws would not spread. Every man familiar with the severe service of track work realizes clearly enough the constant drain of expense in taking care of this troublesome complaint. The expense of wrench repairs has grown up through the years close and tight to the great body of maintenance costs. It requires, therefore, the closest investigation from a new standpoint—with the aid of the Jeffrey "Lock-Jaw" as a prod and wedge—to show up clearly how this clinging growth can be wrenched loose. Once rid of such expense, the Jeffrey "Lock-Jaw" wrench will be constantly in service as a safeguard against all future expense for track wrench repairs. Any wrench which fails through spreading of its jaws will be replaced free of charge.

The Curtis rotary pump is a positive rotary pump, that is to say, it can be used on high heads as well as low heads. This pump was designed more especially for mine service, although it is adapted for any service where piston pumps can be used. They are usually made iron bronze-lined, but for acid-mine water are constructed of solid acid resisting bronze. The blades or buckets in revolving rotor are made of wood or an anti-friction composition. The bearings in the heads are made exceptionally long and are either high-grade babbitt or lignum vitae and are supplied with exceptionally large grease cups where grease can be forced down by application of wrench with heavy plungers. The pumps are made in all sizes from 50 g.p.m. to 2000 g.p.m. capacity. The machine work on them is especially high grade. They are peculiarly adapted for mine service and take up very little room and are easily handled. The pumps are manufactured by the Pittsburg Machine Tool Company, N. S., Pittsburg, Penn.

Wm. Ainsworth & Sons, Denver, Colo., have just placed on the market a new theodolite for mountain and mining work. By the use of the hardest bronze alloys the weight of this instrument has been reduced to a minimum without sacrificing rigidity, and the U or theodolite standard, the merits of which are now well recognized, is so designed as to admit of placing a 2½-in. compass in the center, which is sufficient for checking. It has 4½-in. limb and vertical circle with edge graduation, 8-in. 20-power main telescope, 7-in. 18-power auxiliary telescope with counterweight that may be used either as a top or side telescope, 4-in. 30-sec. telescope level, stadia, gradienter, magnetic variation circle, 4-screw leveling head and extension tripod. The instrument weighs only 9 lb. complete with all attachments. The limb verniers are placed at 30 deg. with the line of sight, which together with the edge graduation on the vertical circle, enables an operator to read both vertical and horizontal angles from the one position. The telescope tubes are finished in an improved manner, insuring perfect collimation for all distances. Only the highest grade lenses ground according to the latest formulas are used. The telescope axis has the usual grooved bearings common to all this firm's instruments, the merits of which are now well recognized. The leveling head is of improved design and accurately constructed so that it cannot be cramped in any position, which greatly reduces the wear on the leveling screws and renders it unnecessary to loosen all of the screws when leveling up. The shifting center has a movement of ½ in. to permit locating plumb bob over point. The graduations, with the exception of the compass circle, are on solid silver and produced on their new 30-in. automatic dividing engine, which machine it is claimed is capable of producing automatically circles accurate to within one second of arc. The instrument is fully described in their catalog "BX."

The Bunker Hill screen, introduced by the Hendrie & Bolthoff Manufacturing Company, Denver, Colo., consists of an inverted truncated cone formed by stretching the screen cloth over a suitable wrought iron frame. This cone is attached to a hollow shaft set at an angle of 45 deg. and driven by bevel gearing and tight and loose belt pulleys. The hopper, also cone shaped, is fastened to the frame. It has near its bottom a discharge opening for the undersize, and carries a bracket which supports the feed box. The feed box is of sheet iron and contains a regulating shutter valve. The whole screen is mounted on a cast iron frame and is entirely self-contained. The screen is supplied with two spray pipes; one on the inside, adjustable by means of a universal joint and located on the side opposite to the feed box, and the other outside passing down nearly vertically between the screen and the hopper. The feed is deposited on the screen a little below the meridian line and falls in the same direction as the travel of the screen. The ore current may be thickened or thinned as occasions may require, by means of the shutter valve above referred to. The oversize is discharged through the hollow shaft and the undersize through the pipe tapped into the hopper surrounding the screen. The inner spray pipe washes through the screen any small particles that may not have passed through its meshes, while the outer spray pipe serves to keep the meshes open and prevents blinding. From the foregoing description it is readily seen that, on account of the conical shape of the screen, its peripheral speed is constantly varying in direct proportion to its different diameters at different sections. For this reason and also on account of the slight centrifugal force to which the particles to be screened are subject, they are forced to undergo a twisting motion, presenting all different faces to the wash water and the screening surface. The capacity of the Bunker Hill screen ranges from 25 to 50 tons per day and even more on certain ores. This is rather surprising, but not to those who have had occasion to know the screen from its inception, and have familiarized themselves with its working. Since the oversize is speedily washed away and discharged as soon as formed it does not occupy useful screening surface and block the way of the small grains. It is almost necessary to see the screen at work before one can realize its extraordinary capacity.

New Catalogs

Eastern Mfg. Co., Elmira, N. Y. Catalog. Elmira wood pipe. Illustrated, 68 pages, 6x9 inches, paper.

Eimer & Amend, 205 Third avenue. Catalog. Calorimeters and pyrometers. Illustrated. 44 pages, 6½x10 inches, paper.

Foote Mineral Company, 107 N. 19th street, Philadelphia, Penn. Catalog. Minerals. Illustrated, 320 pages, 6x9 inches. Leather and cloth bound.

Baldwin Locomotive Works, Philadelphia, Penn. Record No. 66. Smoke box superheater, feed water heater. Illustrated, 32 pages, 6x9 inches.

Western Electric Company, 463 West street, New York. Bulletin, "First Rateau Regenerator Installed in America," by F. G. Gaeschke. 8x10½ inches.

Dean Bros. Steam Pump Works, Indianapolis, Ind. Catalog No. 77. Lists of parts of pumps, directions for operating pumps, etc. Illustrated, 76 pages, 6x7 inches, paper.

J. Geo. Leyner Engineering Works Company, Littleton, Colo. Bulletin No. 1002. No. 5 Leyner stoper. Illustrated, 8 pages, 6x9 inches. Bulletin No. 1004. Efficient tunnel work. Illustrated, 8 pages, 6x9 inches.

International Steam Pump Company, 115 Broadway, New York. Bulletin W. 165. Worthington volute centrifugal pumps. Illustrated, 16 pages, 6x9 inches. Bulletin W. 166. Triplex house tank pumps. Illustrated, 4 pages, 6x9 inches. Bulletin W. 169. Boiler feed pumps. Illustrated, 4 pages, 6x9 inches.

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An Ore-transporting Railway in the Pyrenees

The Line Is Divided into Three Sections, Consisting of a Loading and Terminal Wire Rope Tramway, Connected by a Local Railway

BY A. GRADENWITZ*

In the most beautiful part of the eastern Pyrenees, at the famous winter resort of Amélie-les-Bains, terminates one of the most interesting wire-rope railways ever constructed for the opening up of inaccessible mining districts Though the level differences and other difficulties to be dealt with were not such as in connection with the well-known Cordilleras railway (35 km. in length and rising to 4500 m. in hight) still its design, characterized by enormous spans traversing the most savage and cloven mountain landscapes, renders this plant of unusual interest.

Valentine Brothers, of Paris, are the owners of an extensive iron deposit below Mount Canigou, a peak 2800 m. in hight, covered with everlasting snow. The average iron content of the ores is 50 per cent. The ore is taken either to Port Vendre on the Mediterranean, in order to be loaded on ships and conveyed to English metallurgical works, or transported direct by rail to the Schneider works of Creusot.

Mining and Loading the Ore

The process of working the ore is fairly simple: Galleries driven at different hights are connected by vertical shafts through which the ore is dumped toward the lowermost gallery; there it is loaded into trucks and taken to the bunker of the wire-rope railway (Fig. 1). The mines are at present being equipped with electrical drills and locomotives. The whole of the transporting plant, from the La Pinouse mines, situated at 1350 m. hight, down to Amélie, was divided into three sections corresponding to the special nature of the mountains, viz., two wire-rope railways and a local railway connecting the two. While not great, the level difference negotiated by the upper wire-rope railway, 1.3 km. in length, is sufficient for the railway to work independ-

FIG. 1. SURFACE PLANT AT THE MINE SHOWING LOADING STATION OF THE AERIAL TRAMWAY

*Berlin W. 50, Regensburgerstrasse 3.

ently, with a surplus of 10 h.p. which is used up by hand-regulated bands. The wire-rope trucks are loaded from a bunker erected on the mountain slope and are despatched at regular intervals.

The most interesting part of the upper wire-rope railway is the huge span (Fig. 2) traversing a deep valley 450 m. in width, immediately before the discharg-

FIG. 2. SPAN OF 450 METERS AT UNLOADING STATION, RAPALOUN

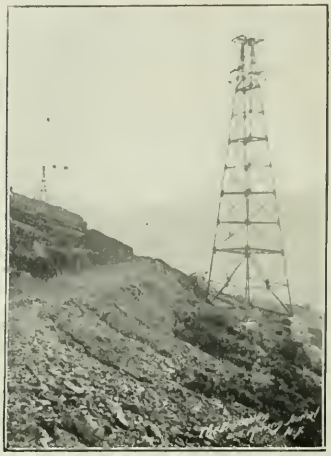

FIG. 3. TOWER 35 METERS HIGH

FIG. 4. UNLOADING STATION AT RAPALOUN

FIG. 5. ORE BINS ABOVE LA REDOUTE LOADING STATION

FIG. 6. UNLOADING BINS AT RAILROAD STATION AT AMÉLIE-LES-BAINS

ing station. Down in the valley are situated the water-power plants built by the mining company for supplying the mines with power and light.

The Railroad Section

The station of Rapaloun (Fig. 4) is erected on a steep rocky wall towering from the valley where the transfer is effected into the cars of the local railway. The ore is then transported in trains by tender locomotives to the station of La Redoute, 14 m. distant (Figs. 5 and 8). The entire tonnage is handled by three locomotives, carrying in each train 50 tons of ore. Having a level difference of only 200 m. the railway is situated throughout its length on mountain summits, the steep descent down to Amélie only beginning behind La Redoute. The station forms the center of operation for the local and wire-rope railways and with its extensive plants, repair shops and dwellings for machinists, guards and locksmiths, resembles a small village.

Transfer to the Terminal Section

The transfer of the ore is effected in the usual manner by means of a bunker into which the tilting cars are dumped. In front of the ore bunker extension, within the substantial lining wall, the wire-rope trucks are shoved along and filled, after which they are coupled in the station to the rope for transfer to the terminal section, 4½ km. in length leading down to Amélie. The difference in level is here nearly 900 m. and with a load of nearly 50 tons a surplus of nearly 100 h.p. is developed. On account of the enormous level difference, the railway has been subdivided into two sections of equal length with an intermediary station at the village of Can Kirk. At that intermediary station, as well as at La Redoute, are installed hydraulic braking regulators, designed as vane pumps, driving water through a narrow slot. The resistance varies according to the number of descending trucks, which obviously cannot be kept constant, as well as to atmospheric conditions, so that the braking effort must be altered by narrowing or widening the slot so as to keep the speed constant. This is effected by a centrifugal regulator connected to the traction rope, which with any alteration in speed, adjusts the width of the slot.

The railway on its way to Amélie-les-Bains traverses several wide valleys

Fig. 3 represents one of the lofty supports which on either side of these valleys form the last abutment of the rope At the station of Can Kirk, the trucks are loosened from the rope and, owing to their live force, they go on over the slightly sloping suspended rail, deviating laterally, and are again coupled, at the station, to the track rope of the lowermost section. The railway gradually descends, penetrating into the vineyard district of Amélie (Fig. 7) and, terminating at the railway station of Amélie-les-Bains, where another large bunker for receiving the ore has been erected (Fig. 6). By means of folding chutes, the ore is drawn off into the cars of the Southern Railway Company and taken to its final destination.

Construction

As regards the construction of the railway, it may be said that the whole of the runway consists of closed ropes offering a smooth surface to the rollers so as to be subject to less wear and tear and to put the rollers to less strain than would a spiral rope consisting of round wires. A clutch of standard Bleichert design is used for connecting the trucks with the traction rope. This clutch, which in the present case acts on the lower rope, is constructed in one with the driving gear, insuring the vertical suspension of the car independently of any inclination of the supporting rope. A special advantage of this design is that ropes of fairly different diameters are seized with the same security which in this special case is especially welcome, as the traction ropes on the two sections of the lower wire-rope railway are never stretched with absolute uniformity and accordingly are bound in the long run to assume different dimensions. The traveling speed on the upper wire-rope railway is 2 m. and on the lower 2.5 m. per second. The plant was constructed by Adolf Bleichert & Co.

FIG. 7. TOWER ON LOWER TRAMWAY NEAR AMELIE-LES-BAINS

FIG. 8. LA REDOUTE STATION, SHOWING BEGINNING OF LOWER TRAMWAY

Prospecting for Ores of the Goldfield Type

By J. Volney Lewis*

"In the Goldfield district alunite is so abundant and so generally associated with the intense alteration accompanying ore deposition that it must be looked upon as one of the most characteristic minerals of the gold deposits."[1] With this announcement Ransome not only added a new type to the geology of ore deposits, but pointed out a most promising new field for exploitation. The prospector, however, has not rushed in to possess the new land. He has rather roamed about blindly over vast areas of desert and mountain in the hope that somewhere, somehow, he would stumble upon the coveted treasure; but no practical means has been put into his hand for recognizing the ore he seeks.

There is gratifying evidence that the scientific prospector, the mining geologist,[2] is availing himself of the new knowledge to more purpose; but the vast area that may possibly bear this type of ore is too much for the few scientific men who are in the field. If the present generation or the next is to realize in any large degree the possibilities that have been opened up, we must enlist the larger army of practical mining men.

The Prospector's Dilemma

The prospector who knows his porphyry, his limestone, and the honeycombed rusty gossan that bespeaks the deeper-lying sulphurets has been taught by long experience to disregard all manner of whitish or grayish or clean-looking rock. The big mines that he knows have been opened on very different looking ledges, and only a tenderfoot would pause for a second look at the unstained outcrop. To the prospector in the desert all this has now been changed. If he has learned the lesson of Goldfield he knows that amazing values have been developed there in a beautifully white porcelain-like material for all the world like the most barren porphyry; and now others are duplicating this Goldfield experience in far-away corners of the desert, while vast inviting fields still lie unexplored.

I do not mean to say, of course, that iron-stained material is not found at Goldfield, both on the outcrops and in the mines, but merely that this is not a necessary or characteristic feature of deposits that carry high values.

Under such conditions what is the prospector to do? He cannot sink pits on every ledge, whether rusty or white, and have assays made all over the face of the earth. Besides, the assayer may miss the main point altogether. There may not be enough gold in the cropping or in the shallow pit to excite the mildest interest, but if alunite is there the prospector wants to know it, whatever the values, for it is worth while to follow it down a bit and try the assayer again on the deeper levels. Of course, alunite does not everywhere and under all conditions indicate the presence of gold; neither does rusty quartz nor any of the various "indications" by which the prospector is guided; but the abundance of the mineral and the constancy of its association with the ores at Goldfield, followed now by a similar occurrence in a new locality, are extremely suggestive; and there are large areas in the Southwest where geological conditions are closely similar.

Mineral Characters and Occurrence of Alunite

Alunite occurs in hard, white, porcelain-like masses, or in fine-grained condition like loaf sugar. In the latter case it is

*Mining geologist, Washington & Lewis, Singer building, New York.

[1] F. L. Ransome. "The Association of Alunite with Gold in the Goldfield District, Nevada." *Economic Geology*, Vol. 11, 1907, p. 669.

[2] R. T. Hill. Engineering and Mining Journal, Dec. 5 and Dec. 12, 1908.

either firm like marble, or it may be easily crumbled into a snow-white mass resembling pure kaolin and difficult to distinguish from it in the mines. At Goldfield it often has a pale pinkish color, while the kaolin is white. Sometimes it is found in little square-looking crystals (rhombohedrons) which form nests in the small openings of the rock, but these are rare and have never been seen as large as ¼ in. in diameter. The mineral is easily scratched with a knife (H. = 3.5 — 4), which would serve to distinguish it from similar masses of quartz and feldspar (H. = 6 and 7, respectively); but feldspar that is changing to kaolin would be soft also, and alunite is often so intermingled with both quartz and feldspar that its true characters are entirely masked. The fact that a substance does not readily yield to the point of the knife, therefore, is no proof that alunite is absent. The character of alunite and its frequent association with sulphides also prevents the use of any simple blowpipe test for its recognition.

Alunite has been found with gold in a number of closely related types of volcanic rocks (rhyolite, latite, andesite, etc.), all of which are generally gray or greenish or some lighter color, unless stained by iron from decomposing sulphides, and are generally known to the miner and prospector as "porphyry." It does not occur in these rocks in their unchanged natural condition, but has been formed along planes of fracture and crushing produced by faulting. But the rock that was crushed by the grinding of moving masses upon one another has been in many cases firmly cemented together again by the quartz that has been deposited through it. Hence it may be as hard as any of the country rock; but its color is usually changed in the process, and it is often much whiter, except where stained by iron from rusting sulphides. Pyrite often accompanies the alunite in these altered rocks, and gypsum is frequently found in very soft, white films along the cracks and seams.

Use of the Microscope

If a rock specialist from some college or university should turn prospector he might utilize his knowledge that a thin section of the rock under the petrographic microscope usually affords an easy method of recognizing the elusive alunite; but, like the prospector who must have everything assayed, he would work at a great disadvantage because his method cannot be carried into the field. He must grope in the dark, collecting materials from faulted and altered rocks for innumerable thin sections, and must await their preparation and examination before he knows whether he has found a promising locality or not. Besides, even the petrographer must sometimes halt between two opinions when the microscope fails to distinguish alunite from extremely minute particles of quartz and feldspar. In such cases the chemist must be called in to make the final decision.

The Appeal to Chemistry

The chemist, then, is the man to whom we naturally turn for the practical key to the situation. A short, reliable chemical method is what the prospector most needs, requiring only materials that can be carried into the desert with him without hampering his movements or restricting his grub supply. It is just this need that Mr. Gage has undertaken to meet in the second part of the accompanying paper.

In the microscopic study of alunite-bearing rocks I have often found that the results required chemical confirmation. Fortunately, Mr. Gage, who did this work for me, brought to the task not only a full understanding of the difficulties to be overcome, but also the ability to devise effective methods. In the absence of established methods for analyzing such complex mixtures of sulphates, sulphides and silicates, he has worked out the procedure which he describes in the first part of the accompanying paper, and the results have been highly satisfactory. With a view to making the method immediately available to the prospector or engineer in the field, he has further devised a qualitative modification which should not prove difficult for the nontechnical man. It is earnestly hoped that it may serve the prospector's purpose in searching for the Goldfield type of ores, which until now he has had no means whatever of recognizing.

Determination of Alunite

By R. B. Gage*

The importance which the mineral alunite has attained in the last year and a half on account of its association with and relation to the gold ores of Goldfield, Nevada, makes a method for its determination very desirable, not alone for its quantitative estimation in the laboratory, but one that can be applied in the field qualitatively in order that the presence or absence of alunite may be determined at once. This would be a comparatively easy matter if the mineral did not occur associated with other sulphates and often also with sulphides.

Alunite is a basic sulphate of potassium and aluminum whose composition may be expressed by the formula,

$$K\ (AlOH)_3\ (SO_4)_2.$$

Sodium may replace a portion of the potassium. Since the deposits of this mineral with gold seem to have been formed by the action of sulphuric vapors on feldspars, more or less gypsum is naturally to be expected if the original rock contains any of the lime-bearing, or plagioclase feldspars. Microscopic examination, by J. Volney Lewis, shows that both orthoclase and plagioclase feldspars are always present, and in nearly all specimens of the altered rock examined by me more or less gypsum has been found. Sometimes it is present in much smaller amounts than alunite, but often just the reverse is true.

Although alunite is affected but little by either strong or dilute hydrochloric acid, it is slowly soluble in strong sulphuric acid and is also readily decomposed by hydrofluoric acid. When the mineral is heated alone to a dull red it is decomposed with the formation of alum and the loss of water and more or less sulphur trioxide. At a higher temperature the latter is given off freely.

Quantitative Determination

I. In the Absence of Sulphides—For the quantitative estimation of alunite an indirect method must be employed in order to separate it from the other sulphates. When no sulphides are present a total sulphur determination is made as follows: One gram of the powdered material is mixed with five grams of sodium carbonate, to which is added a small crystal of potassium nitrate, in a platinum crucible of 30 c.c. capacity. The crucible should be heated first over a Bunsen burner and then over the blast until the material is completely decomposed. When the fusion no longer continues to give off bubbles of gas this point has been reached. The crucible should rest in an opening cut to fit accurately in a piece of asbestos cardboard in order to guard against the absorption of sulphur from the gas. The flame from the blast should heat that part of the crucible beneath the asbestos board to a uniform temperature; that is, a broad flame should be used rather than a pointed one.

The melt is digested in about 200 c.c. of hot water until completely dissolved, and then filtered. The filtrate contains all the SO_3 in the sample, together with more or less silica and alumina. The volume of the filtrate should not be less than 250 c.c., and it must be neutralized very carefully (with strong hydrochloric acid) or silica will separate out. If the acid is added slowly while the solution is stirred silica is sure to precipitate. When this happens the silica will have to be dehydrated by evaporating to dryness or another fusion must be made, as it is impossible to filter the gelatinous silica. A blank should be run, using the same weight of chemicals and the exact amount of strong hydrochloric acid added that will be required to decompose the carbonate used. The end point can be easily determined by adding a drop of methyl orange, which is not affected by the CO_2 given off.

To the filtrate from the fusion of the mineral the required amount of acid and

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about 1 c.c. in excess is added by allowing it to flow slowly down the side of the covered beaker. The solution should be set to one side until the acid has worked its way nearly to the bottom of the liquid, which it will soon do as the escaping gas keeps the liquid in motion. When the carbonates have nearly all been decomposed the solution should be stirred up vigorously for a moment and then heated to boiling. It should remain perfectly clear. If a slight precipitate appears, it should be filtered off. In either case 25 c.c. of hot barium chloride solution are added to the boiling solution and the mixture kept near the boiling point until the precipitate has settled, leaving the solution quite clear. Since the precipitate has a tendency to pass through an ordinary filter paper, a very thick one should be used. The clear liquid is gently decanted through the filter without disturbing the precipitate any more than necessary. After discarding the filtrate the precipitate is transferred to the filter and washed free from chlorides with hot water. The paper and precipitate are then transferred at once to a weighed platinum crucible and gently ignited over a Bunsen burner, cooled and weighed.

If there is any reason to suspect that the precipitate of barium sulphate is contaminated with silica or has been reduced on ignition of the filter paper, it should be moistened with water containing a few drops of hydrofluoric acid and a drop of sulphuric acid added. After evaporating to dryness a few drops of ammonia should be added and then expelled by heating. A second treatment with ammonia may be necessary in order to remove the last trace of sulphuric acid added. The crucible should be heated to a dull red after each treatment. It is finally heated to a bright red over a Bunsen burner, cooled and weighed. From the total SO_3 thus secured deduct the amount found to be present in sulphates other than alunite. The remainder thus determined, when multiplied by 2.5906, will give the alunite content of the sample.

The Separation of Gypsum—The method for the separation of alunite from gypsum is based on the insolubility of the former and the solubility of the latter in distilled water. Since it requires about 425 c.c. of water at 90 deg. C. to dissolve one gram of gypsum, the volume of the solution should never be less than 300 c.c. This amount will usually insure a large excess of the solvent, since the sample will seldom contain as much as 50 per cent. of gypsum. It is always advisable, as a check, to determine both the CaO and the SO_3 in the solution of gypsum, for often the sample will contain small amounts of soluble sulphates other than gypsum.

A test was made on a sample of nearly pure alunite and 0.34 per cent. of SO_3 was found to be soluble in hot water, although no CaO nor Al_2O_3 was dissolved. It is possible that this SO_3 may have come, in part at least, from the alunite, but since the specimen was not entirely pure and the amount of SO_3 taken into solution was less than one-hundredth of 1 per cent. of that present in the mineral, it is assumed in the method of procedure here described that the alunite is entirely insoluble in water. Therefore, any excess of SO_3 in the water solution over what is required by the lime to form gypsum may be assumed to come from soluble sulphates other than gypsum and is to be deducted, along with that in the gypsum, from the total SO_3 in the rock in order to determine the amount present in alunite. Sometimes the CaO in the water solution is in excess of the amount required to combine with the SO_3 to form gypsum. In this case it is impossible to tell whether or not any other soluble sulphates are present.

The actual operation is carried out as follows: One gram of finely powdered material is digested with 300 c.c. of distilled water for about one hour. The aqueous extract is filtered through a very thick filter paper (or two papers), as some of the undissolved sample will usually pass through an ordinary paper. The filtrate is made slightly ammoniacal and heated for some time. Should a slight precipitate appear it is filtered off. In either case the CaO is precipitated in the hot filtrate as the oxalate. The solution should be kept near the boiling point for at least 30 min. before filtering. A re-solution and reprecipitation of the lime is not necessary, since little or no magnesia is present.

A prolonged washing of the precipitate should be avoided, since calcium oxalate is not totally insoluble in hot water. Paper and precipitate are transferred without drying to a platinum crucible and the paper slowly incinerated. After the precipitate has been heated over the blast lamp for a few minutes it should be cooled and then moistened with a few drops of water and the same slowly evaporated off, when it is again heated until it no longer loses weight. It should always be cooled in a desiccator and the weighing done as rapidly as possible, as it absorbs moisture quite repidly from the air.

The filtrate is then made slightly acid with HCl and the SO_3 determined in the manner described above. The presence of oxalic acid will doubtless cause a slight error by keeping a small amount of barium sulphate in solution, but it is probably no greater than that which would be caused by the contamination of barium sulphate with calcium salts if the SO_3 was determined without first removing the lime

From the amount of CaO and SO_3 found the gypsum content is calculated. The SO_3 of the gypsum, plus that of other soluble sulphates present, is deducted from the total amount of SO_3 found in the rock in order to determine the SO_3 contained in the alunite. Should the material contain other insoluble sulphates than alunite, which is possible but not very probable, the results thus secured will be correspondingly high.

Owing to the nature of alunite and the substances that are usually associated with it, the results obtained by the methods described above do not possess the high degree of accuracy attained in the better analyses of ordinary rocks. In most cases, however, the errors will be so small that they may be neglected.

II. When Sulphides are Present—When pyrite is present the total SO_3 cannot be determined by the method given above. In this case a gram of the powdered material is transferred to a 300-c.c. platinum dish and decomposed with hydrofluoric acid. The residue after evaporation is moistened with strong hydrochloric acid and again evaporated to dryness, in order to expel as much of the hydrofluoric acid as possible. After moistening the residue again with a few drops of hydrochloric acid, it is digested with about 250 c.c. of hot water until all the soluble salts have gone into solution. It is then filtered and well washed with hot water. The SO_3 is determined in the filtrate in the manner described above.

Pyrite is attacked but slightly, if at all, by hydrofluoric acid. The solution should contain a little free hydrochloric acid in order to prevent the precipitation of barium fluoride with the sulphate, but too much acid will also prevent the complete precipitation of the barium sulphate. The hydrochloric acid used to moisten the residue may be sufficient if the final volume of the filtrate is not much over 300 c.c. If the precipitate is thought to be contaminated with barium fluoride, which is generally the case, the supernatant liquid is gently decanted, 2 c.c. of strong hydrochloric acid added, and the contents of the beaker gently warmed for a few minutes, when it is again diluted to about 300 c.c. and allowed to stand the usual length of time before filtering. Barium fluoride is a white flaky precipitate that will not settle to the bottom of the beaker like barium sulphate, hence anyone familiar with the appearance of the latter will have little difficulty in distinguishing it from the former, unless the amount of the barium fluoride precipitated is quite small compared to that of the barium sulphate. In this case it is impossible to distinguish them.

Qualitative Determination in the Field

A chemical test for the presence of alunite is a very simple matter and can easily be made in the field where water that is free from sulphates can be obtained. The necessary apparatus includes two or three pint tin cups (or tin cans may be used), a small mortar, and a spoon, cartridge, or other measure that will hold about a gram (15 grains) of the

powdered rock. (A 0.44 caliber cartridge one inch long will hold about half a gram of powdered rock.) A few ounces of barium chloride will also be needed.

When a test is to be made for the presence of alunite a small piece of the rock is first pounded up with a hammer and then ground to a fine powder in the mortar. About a gram of the powder is measured out into a tin cup which is nearly filled with water. The water is then boiled for 15 or 20 min. and allowed to stand until all the powder has settled. The clear water, which contains in solution whatever gypsum was present, is then gently poured into another cup or can *A* without removing any more of the powder than absolutely necessary. The undissolved powder is then dried in the cup and heated to a dull red, after which it is allowed to cool and again boiled with water as before, in order to dissolve the decomposed alunite. After the remaining powder has settled the clear water is then gently poured off into another cup *B*.

A small portion of the barium chloride is now dissolved in a little water, which should give a clear solution or be only very slightly clouded. The water in both the cups *A* and *B* is heated nearly to boiling and some of the barium chloride solution added to each. If either solution becomes cloudy it is proof of the presence of sulphates. If *A* is clouded and *B* remains clear, the rock contains gypsum but no alunite, while if *B* is clouded and *A* remains clear, alunite is present without gypsum.

In the arid regions of the West and Southwest the waters frequently contain sulphates, and this, it is feared, may prove the chief source of trouble in the application of the method. In any case it is always well to test the water before going to the trouble of preparing the rock powder. Take a little of the water in a cup and add a few grains of the barium chloride; if more than a very slight milkiness is produced this water cannot be used in the determination, since the sulphates in it would prevent the detection of those in the rock.

When suitable water can be procured any prospector can easily and quickly apply these tests after a little practice. Thus he may know positively whether or not alunite is present, and if it is he may prepare to sink deeper with a reasonable expectation of finding gold also. A rough estimate of the amount of alunite present may be made from the quantity of precipitate that clouds the water in *B* when the barium chloride solution is added. In making these tests it should be remembered that alunite is insoluble in either hot or cold water, and that it is decomposed and made soluble only when it is distinctly heated to a dull red. Care must be taken, however, not to heat the powder to a bright red, as this would drive off some of the sulphur trioxide which is easily recognized by its pungent odor. When this happens a fresh sample should be taken and another test made.

A Triangulation Station

By Lee Fraser*

For purposes of triangulation the chief requirements of stations consist in permanency and proper location, so as to be at all times visible. After considerable experience in surveying where the underbrush and forest growth is dense, a triangulation point, properly located, and constructed in the following manner was found to give satisfactory results:

The bill of material for one station consists of the following: 48 in. of 2¼-in. galvanized iron pipe; 8 in. of 1-in. brass or copper tubing; 72 in. of ½-in. round iron; 14 ft. of 1¼-in. galvanized iron pipe; 1 reducer, 2¼x1¼ in.; 40-ft. wire; 1 target; 100 lb. portland cement; 1000 lb. crushed stone, and three 2-ft. wooden stakes. The total time required by two men, for the construction of one station was two hours, all the material being on the ground with the exception of the stone, which was gathered from the hillside, and water, which was procured from a nearby stream.

After excavating a hole of proper dimensions, the 4-ft. length of 2¼-in. pipe reinforced by six 12-in. lengths of ½-in. round iron, is placed upright in the hole, and concrete (1-10) tamped firmly around it. Especial care must be taken in securing the pipe in a truly vertical position, for upon this condition, is dependent the verticality of the flag. After placing the base pipe (Fig. 2) in position, the interior is filled with concrete to within 10 in. of the top, and thoroughly tamped. The pipe is next filled with mortar to within 3 or 4 in. of the top, when the 8-in. brass or copper center, open at the bottom, but brazed at the upper end, is inserted in the mortar and thoroughly worked up and down to cause the mortar to pack firmly in the tube. It is then set with the upper end 1 in. below the end of the large pipe, insuring ample protection to the surface upon which the center mark is inscribed. Upon careful centering of the copper center tube the horizontal difference from coincidence between the axis of the flag and the center mark must be slight, and of so little importance as to be sufficiently accurate for the great majority of purposes. When the main pipe is thoroughly set, the attaching of the flag is a simple matter.

The flag being gray is readily distinguished against almost any background and especially against forest growth. When there is probability of confusion of the stations with one another, an excellent mark, and possessing the advantage of being distinguishable from any paint, is some geometrical figure, such as a sphere, a cone or cylinder made of wood and placed upon the top of the signal. When the pole is liable to incline, due to

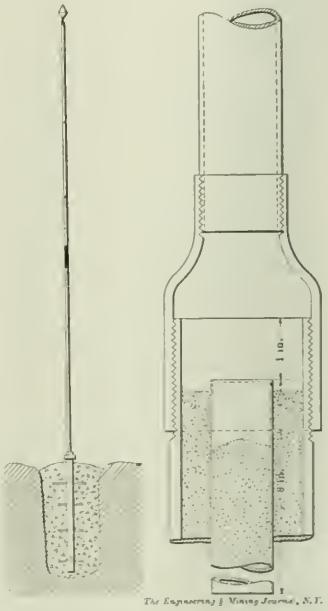

FIG. 1. TRIANGULATION STATION AND METHOD OF CONNECTION

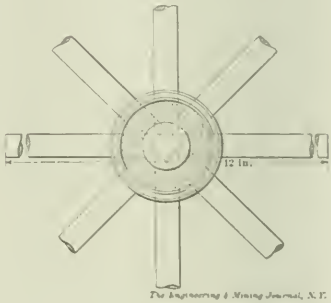

FIG. 2. BASE PIPE OF TRIANGULATION STATION

heavy winds, it is well to attach guy wires to insure rigidity, but it is exceptional when this measure must be used. To fafacilitate observations for elevation, a red and white band is painted about the pole, the junction of the two colors being a certain known distance above the station

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Copper Mines in Chillagoe District, Queensland

Some Isolated Properties in Northeastern Australia where Small Scale Smelting Operations Have Been Successfully Conducted

BY GERARD W. WILLIAMS*

In addition to the copper mines of Chillagoe already described in my previous article on "The Mining Industry in Queensland," in the JOURNAL of March 20, 1909, there may be cited some other copper properties of this northern section that are examples of small scale smelting operations successfully carried on at mines that are some distance from the railroad. The O. K. mine and smeltery have already been described. In addition, the Mount Molloy mine may be instanced and a brief description of its operation will be given, but before proceeding with this account, attention will be directed to the accompanying illustrations of the lead and copper smelting plant of the Chillagoe Railways and Mines, Ltd. The complex ores contained in this company's properties and the reduction works were described in the previous article.

GENERAL VIEW OF LEAD AND COPPER SMELTING PLANT AT CHILLAGOE, QUEENSLAND

HUNTINGTON-HEBERLEIN ROASTING PLANT OF THE CHILLAGOE COMPANY

THE MOUNT MOLLOY MINES

The Mount Molloy copper mine is situated [illegible] miles north of Biboorha on the Cairns-Chillagoe railway line. The country consists of slates and sandstone with intrusions of acidic rocks. The lode channel itself follows the course of a dike of felsophyre which can be traced for a considerable distance across the surface of the country. The ore is comparatively low grade and is sorted in the stopes. The mining practice presents no particular points of interest. The smelting plant comprises a water-jacket furnace, 90x36 in. at the tuyeres and 10 ft. 6 in. to the feed floor. The matte gravitates to a reverberatory where it is

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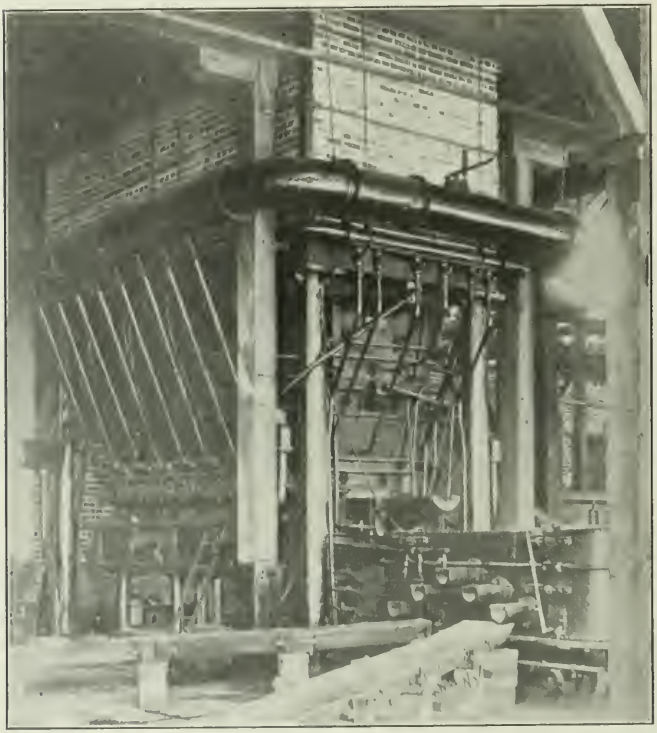
kept warm till such time as it is wanted by the converter. The output is insufficient to keep the converter continually in action so the converter plant only runs two shifts and the night shift matte is stored in the reverberatory furnace. This method appears to be more expensive than the O. K. mine practice where mattes produced on night shift are returned to the furnace in the morning.

The analyses in the accompanying table indicate the nature of the ores treated.



COPPER MATTING FURNACE OF THE CHILLAGOE COMPANY

ANALYSES OF MOUNT MOLLOY ORES.

	Chalcopyrite Ore.	Semi-sulphide Ore.	Carbonate Ore.	Pyrite Flux.	Iron Flux.
SiO_2	33%	58%	64%	28%	12%
FeO	20	10	4	28	70
Al_2O_3	3	7	8	3	.
CaO	1			1	2
MgO	6	..		6	.. .
ZnO	7	3		8	...
S	19	3 5	.....	45	
Cu	7	14	11	2	0 5

The charge is made up approximately as follows: Chalcopyrite ore, 10 cwt.; pyrite flux, 4; semi-sulphide, 1; iron flux, 3; limestone, 2; flue dust, 2; converter slag. 1; coke, 2. The furnace treats about 130 tons of charge per day exclusive of coke. The slags average: SiO_2, 39.9 per cent.; FeO, 30.4; CaO, 9.9; ZnO, 6.5; Al_2O_3, 8.0; MgO, 3.2; S, 0.7; Cu, 0.43. The mattes produced average 50 per cent. copper.

The presence of zinc in the ore is by no means a favorable indication, for thus far mines in North Queensland which contain zinc have failed signally to develop well in depth. This mine has attained a depth of 430 ft. but the ore body is smaller at that depth and appearances generally are not very favorable. The Mt. Garnet copper mine in the Koorboora district started off well but shortly after smelting operations started and about the time that the railway was extended 35 miles to the mine, the copper ore passed into zinc ore and the mine closed down. In depth the zinc seems to entirely replace the copper or it may be that the copper is really only a secondary replacement of the zinc blende.

Unlike most mining camps this mine is situated in the midst of beautiful country. The great tropical forests of the coastal range come down to within a few miles of the camp and the immediate neighborhood of the mine is well-grassed, park-like country. The company owns large timber concessions and is opening up a large export trade in timber. With the gradual depletion of the more available timber supplies the Queensland timber must come into considerable demand. One of timbers obtained here, the crowsfoot elm is equal if not superior to the best hickory or ash for the making of pick or ax handles, and for mining purposes the spotted gum is largely used. Cedar, pine and Morton Bay ash are shipped to the southern states.

Einasleigh Copper Mine

This promising mine is situated about 110 miles south of Chillagoe. The lode occurs in black mica schists lying on the contact of granites. The mine has been opened up to 300ft. in depth and developments are satisfcatory. Some time ago, the company attempted blast-furnace smelting with charcoal but the attempt was not successful. The advent of the new Ethridge railway, however, will enable coke to be obtained at a reasonable price. Unfortunately the mine promises to be highly silicious and concentration methods will have to be adopted as there is no iron flux obtainable locally. The outcrop is almost entirely covered by a flow of basalt of Tertiary age. The only portion visible is in the bed of the river where the waters have cut through the basalt sheet and have exposed the older rocks beneath.

Around the Einasleigh the country is covered with this basalt flow, but about 35 miles away a large copper outcrop has recently been discovered. It is of considerable extent and richness. Other small prospects have recently been opened, the new railway from Chillagoe to the Ethridge having given a great impetus to prospecting of all descriptions. The great need of northern Queensland is railways and it is to be regretted that there is such strong opposition to the building of private lines. The labor-democratic party opposes all lines owned privately and the state is not in a position to construct purely experimental lines from the public funds. If private enterprises were given a free hand the whole northern country would be speedily opened up, to the ultimate advantage of the state. But Queensland like the rest of Australia suffers from over-legislation and largely at the cost of the mining industry, which appears to be especially selected for experimental legislation.

Sheffield University, England, is installing an electric-steel furnace of the Kjellin type, to be used for experimental purposes.

The Gem Bearing Pegmatites of Western Maine

Deposits, Operated by Open Cut, Produce Tourmaline, Beryl, Feldspar and Mica. The Gems Occur Principally in Pockets in the Narrower Dikes

BY W. ROGERS WADE*

The discovery of tourmaline in Maine is credited to two students, Hamlin and Holmes, who were gathering specimens near the town of Paris in western Maine, in the autumn of 1820. Some crystals of green tourmaline were found, with which they were not familiar, and the specimens were sent to Professor Stillman of Yale for identification. In those days tourmaline was not used as a gem stone and the deposit was regarded as a mineralogical storehouse only. It was not till 1880, about 60 years after its discovery, that this deposit, now widely known to mineralogists as the Mount Mica mine, was opened as a mining property. So far as I can learn, this was the first gem deposit of value discovered in the United States.

The Pegmatite Area

The area of granite pegmatites extends in a general northwest direction from the Kennebec river in Maine to New Hampshire. They compose a broad band of country 25 to 30 miles wide and occur as parallel dikes and sills between the bedding of older schists, gneisses and limestones. But few of these pegmatites are gem bearing and it is the purpose of this paper to treat only of those that are. The section in which the gem-bearing pegmatites occur extends from Auburn to Newry, Me., an area about 70 miles long by 15 miles wide, and near the center of the larger zone. Their general strike is northwest and the average dip between 10 and 20 degrees to the northeast. They occur in connection with large granite areas.

The southwestern side of the belt is flat or slightly rolling country, and the valleys are filled with glacial sands. On the northeastern side the country is hilly with many rock outcrops. The pegmatites themselves, while they are easily disintegrated, do not weather away as fast as the mica schists above them. As a result their outcrops often form long low bluffs as at the Pulsifer and the Maine Tourmaline Company's mines in Auburn. They are more apt to outcrop on the hillside than on its very top. The Mount Mica mine is an exception to this.

Characteristic Coarse Structure

The most pronounced feature of the pegmatites is their coarse structure. Quartz crystals 2 to 3 feet in diameter are encountered, while feldspar crystals weighing a ton or more are met with. Some of the pegmatites not carrying enough tourmaline to be of economic value are often so rich in bands and masses of feldspar that they are mined for that mineral, which is ground and used in the manufacture of pottery. Large beryl crystals are apt to occur in these feldspar mines. One beryl crystal, encountered at the Berry mine in Poland, Me., was reported as being 6 ft. in diameter. At Buckfield in a tourmaline mine, quartz crystals are found so large that two men cannot lift them.

Another absolutely essential characteristic of gem pegmatites is that they shall be rich in lithia minerals. This is due to the fact that gem tourmaline must have at least one half per cent. lithia among its bases. The lithia minerals, especially lepidolite, concentrate around the pockets or gas cavities in which the gems occur, and are used by the miners as indicators that they are nearing a pocket.

These dikes all show a banded structure. Next the hanging-wall is a medium-grained band about as coarse as ordinary building granite, called graphic granite. This consists of a feldspar groundmass with lens-shaped quartz crystals, distorted by flowage while cooling, and a small amount of biotite mica. Below this occurs the zone of huge crystalization. In it are great mica plates, quartz masses and crystals, and masses of soda feldspar or albite. In the lower part of this zone, and often at the juncture with the one below, occur the gem pockets, lepidolite and practically all the rare minerals. It is locally called the "mineral sheet." Below this comes a band of nearly pure potash feldspar. On the underside of this feldspar, where it joins the next zone, is a narrow band of garnets from one to two inches thick. This is called the garnet streak and marks the lower edge of the vein commercially. The next zone below this is another biotite graphic granite, under which is the footwall.

Associated Minerals

A complete list of all the minerals found in these pegmatites counting those of rare occurrence would run into the hundreds. The most common besides the quartz, feldspar, and mica which compose the bulk of the dikes, are cleavelandite, lepidolite, black tourmaline, lithia or gem tourmaline, beryl, apatite, spodumene, caesium beryl, compounds of tin, manganite, triphylite, lithiophilite, beryllonite, cookeite bertrandite, montmorillonite, topaz, garnet, zinc spinel, herderite, and a host of the rarer minerals occur sparingly.

The only gems suitable for cutting in these deposits are tourmaline and beryl. The tourmalines are red, blue, green, white or pink, the red and green shades being the most desirable. Often several colors are found in the same crystal, varying from tip to tip or from the center outward. The beryls are either white, blue or yellow in color. The white beryls are brilliant when properly cut, but having no distinctive color are not much used in jewelry. The same is true of the white tourmaline. The blue beryl, called aquamarine, is, however, extensively used, also the yellow or golden beryl to a lesser extent. The large beryl crystals are generally opaque and of the characteristic pale apple green color. The tourmalines are found in pockets, but the beryls are usually embedded in the "mineral sheet."

Origin of the Deposits

These pegmatites have been intruded between older metamorphosed rocks. The larger fissures and stocks have been filled with the original granite magma, while in the smaller fissures the magma has become more acid, due to the greater ease with which vapors and superheated steam traversed these narrow openings. These vapors consisted of fluorides and borides of silicon, volatile compounds of iron, manganese, and the alkalies, with superheated steam. By this differentiation, the magma in the smaller openings came to have a greater percentage of gases, vapors, and steam than the original granite magma. Also the larger bodies, cooling more slowly than the small dikes, continued to give off acid vapors which passed, through cooling cracks and open channels in the center, into the smaller dikes as these became partly solidified.

In the smaller of pegmatite masses, the material next the walls was cooled and solidified rapidly as graphic granite. This caused a concentration of the vapors in the center of the dike. These vapors and steam reacting, finally changed borides and fluorides of silicon partly to quartz, which deposited as a secondary coating in the pockets, the hydroboric and hydrofluoric acids combining with the alumina of the feldspar and with lithia to make the gem tourmalines. Later solutions caused the alteration of the tourmalines in some of the cavities to cookeite.

It is seen that this hypothesis, if true, explains why the larger dikes make feld-

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spar mines and the smaller ones gem mines, because in the former there was not sufficient acid vapors concentrated to produce much tourmaline.

Mining Tourmalines at Auburn

The Maine Tourmaline Company's mine at Auburn is situated three miles from the railroad, on the southwestern side of Mount Apatite. An electric car line from Lewiston to Mechanics Falls passes within one-half mile of the workings. The pegmatite outcrops in a meadow and a gentle hill slopes back from the vein to the northeast. The outcrop is a low bluff 5 to 10 ft. high. The dip is 7 deg. to the northeast and the strike is north 50 deg. west (magnetic). Both foot- and hanging-wall are brown mica schists. Two trap dikes, from 4 to 6 ft. wide, standing vertically and striking northeast, cut the vein but have had no effect on the deposit. The upper graphic granite is 4 to 6 ft. thick, the "mineral sheet" is from 2 to 5 ft. thick and the feldspar zone below it is about 2 ft. thick on the average. The lower biotite graphic granite is about 8 ft. thick. All mining, however, stops at the upper edge of this zone at the garnet streak.

The mine is worked by three open cuts, the largest of which is 30x50 ft., with a depth of 14 ft. The rock is broken as follows: a row of 10 to 14 holes from 6 to 10 ft. deep is drilled with a steam drill in the mica schist and graphic granite, and fired by electricity, using 40 per cent. dynamite. This exposes the "mineral sheet" which is taken out carefully with 2- to 4-foot holes loaded very lightly and fired singly by fuses. In case a pocket is approached great care is taken not to place a hole too near where it is supposed to be. The rock next the pocket is removed with a pick or moil.

Approaching a Gem Pocket

The miner knows when he is nearing a pocket by the following changes in the "mineral sheet." First, the albite changes to cleavelandite. Next, a very curious rock composed of quartz and black tourmaline having the structure of graphic granite is encountered. The tourmaline crystals are all parallel plates or lenses and seem to have been stretched while cooling if they were formed from a fluid magma. They are so close to the pocket, however, and the quartz appears so very much as if it were water deposited, that it is likely that both the quartz and tourmaline crystalized from hot acid aqueous vapor and that the surrounding crystallographic relations were such that the tourmaline was forced to crystalize in one plane.

After the black tourmaline and quartz, lepidolite makes its appearance and runs to the pocket. There is often standing over the pocket large plates of muscovite with radial opaque pink or green tourmaline crystals intergrown between the mica plates. The muscovite often changes on its lower edge to lepidolite when the plates extend into the top of the pocket. Sometimes this lepidolite border will go all around the moscovite plate. I observed one diamond-shaped muscovite plate a foot across with a 4-in. rim of lepidolite around it.

Quartz of a smoky hue is generally associated with the large mica plates. The upper half of the cavity itself is generally quartz, mica and cleavelandite, the lower half being a porous decayed potash feldspar. The quartz, mica and cleavelandite growing into the top of the pocket are all beautifully crystalized. Pink and green tourmaline crystals are often grown into these quartz points. Most of the gems, however, lie in the mud or clay which partly fills the lower half of the pocket. Though many crystals are broken or badly flawed, others are perfect.

Many of the pockets contain no gems or apatite and are locally called "dead pockets." When an excessive amount of lepidolite occurs around a pocket it will be found to contain apatite with little or no gem tourmalines. It seems as if all the lithia was consumed by the mica and none left for the gems. In fact black tourmaline in small crystals is sometimes found in these pockets, which would beyond doubt have become gem or lithia tourmaline could they have secured the lithia.

Barren Pockets

The quartz crystals in the gem or apatite pockets are always coated by a thin secondary growth of minute quartz crystals. The quartz crystals of the "dead pockets" have no such coating. This would seem to indicate that the quartz crystals formed first. Then vapors of silicon fluorides, as perhaps the tetrafluoride, and similar vapors and compounds of boron, entered the pocket and meeting superheated steam, were oxidized to silicon oxide, freeing hydrofluoric and boric acids. These acids attacked the feldspar at the lower part of the pocket and with the lithia, which was present or came with the vapors, formed the complex boro-silicate of aluminia and lithia which is gem tourmaline. The latter contains 1.59 per cent. lithia and 0.29 per cent. fluorine, while the black tourmaline contains but a trace of lithia and no fluorine. Also the black tourmaline contains much less alumina and makes up this deficiency by increasing the ferrous oxide from 0.26 per cent. to 14.28 per cent.

In the "dead pockets" the fluoride and boride vapors of silicon never entered and tourmaline was not formed. They are apparently nothing but dead steam cavities, with only bright white or smoky quartz crystals projecting into them from the "mineral sheet" above, and have no secondary coating. The feldspar at the bottom of these pockets does not show the porous structure and decay of that of the gem pockets.

There is another kind of pocket in which the quartz crystals are coated with the secondary growth, but the tourmalines will be mostly altered to cookeite mica, only small portions of large crystals remaining. These cookeite pockets are generally dry or bony, that is, little if any wet mud or clay is present, dry hard cookeite mica taking its place.

A curious thing has been noted at this mine in connection with the gem beryls. A beryl crystal having a black tourmaline crystal next to it or growing into it, is always clearer and of a deep aqua-marine blue and cuts better gems than a beryl crystal not so accompanied. The feldspar from the third zone and all mica whether scrap or plate mica, are saved for market at this mine.

The Maine Tourmaline Company's mine yields principally pink and green tourmaline, the deep red shades not being abundant. Some very beautiful deep green stones of good size have been recovered. In 1904 a series of pockets yielding handsome dark blue tourmalines of nearly an oriental sapphire shade, were opened in pit No. 2. The green tourmalines from the Maine deposits are superior in color and brilliancy, especially at night, to those found in Brazil or California, and when properly cut are exceedingly beautiful gems.

The cost of mining per ton of rock removed for the years 1904 and 1905 was as follows:

Labor, 28.3c.; fuel, 2.3; explosives, 5.9; repairs, renewals, oil, etc., 0.4; total, 36.9. This does not include superintendence or office expenses.

Other Mines

The Pulsifer mine is on the same vein as the Maine Tourmaline Company's property at Mount Apatite. It was opened in 1901 or 1902 and has only been worked in a small way by an open cut about 15 ft. long and 10 ft. wide. This property produced a notable pocket of clear, transparent, purple apatite crystals, of which there were nearly 3000 in the pocket counting all sizes, the largest of which were about 2 in. in length. A large part of this find was purchased by Harvard University and is now in their museum. The occurrence of the tourmaline is the same in this mine as in the mine previously described. The predominating shades are pink and green, and many fine crystals have been taken from this small excavation.

For the last two years the John S. Towne lease has been sublet to the Maine Feldspar Company which did the mining, using a steam drill and derrick to handle the waste, paying a royalty on the feldspar and leaving the gems to Mr. Towne. Green tourmaline of a value of about $1500 was recovered during the

summer of 1907. The deposit is a continuation of the Maine Tourmaline Company's vein, but the dike is much thicker here and contains a greater amount of feldspar. The property is in the class between the straight feldspar mines and the straight gem mines.

The Hatch mine was opened in 1882, near the top of Mount Apatite, on the southeastern slope. The property has been worked spasmodically since. The principal product has been feldspar, the only tourmaline coming from a small open cut where the mine was first opened. The general character of the ledge is similar to those already described except that the dike is very thick. The hanging-wall has been eroded away and the footwall is not exposed to view.

The Berry Mine

The Berry mine, strictly speaking, is not a gem mine, its main product being feldspar. It is situated about two miles south from Mount Apatite. Here cleavelandite is not common, the feldspar being mostly orthoclase. The pegmatite is of immense size and glacial drift hides the wall rocks. It is not possible to tell the shape, dip or strike of the deposit. Both pink and green tourmalines of gem quality are occasionally found. Some good gems have come from the mine, but gem material is not abundant enough to warrant working it as a gem property. Both apatite and herderite are found here. Gem pockets occur in the orthoclase with only a small amount of mica and quartz around them. Lepidolite is always present. The mine has been opened as a large quarry and hand drilling is used entirely.

In the township of Hebron, about 16 miles northwest of Mount Apatite is the Merrill mine. The vein is 12 to 14 ft. wide with mica schist walls. Very little work has been done here. The occurrence is similar to that at Mount Apatite. The deposit has produced some of the deepest red tourmalines I have seen.

The Mount Mica deposit was discovered in 1820 as already mentioned, and the locality is famous for the gems and minerals it has produced. Active mining began in 1880 and has been carried on ever since. Mount Mica is a low hill in the township of Paris, Me., and is 26 miles from Mount Apatite. The pegmatite here is about 20 ft. thick, lying nearly flat between brown mica schist walls. Graphic granite exists next both walls, with the "minerals sheet" and feldspar zone between as at Mount Apatite. The mine is on the top of a gentle hill and is worked as a large open quarry about 200 ft. long by 100 ft. wide by 20 ft. deep at the deepest point. Drilling is done by hand and the waste rock piled behind by a derrick as the quarry advances. One pocket in this mine was of unusually large size, being 6 ft. high, about 12 ft. wide and 20 ft. in length. As is generally the case with very large pockets it contained few gems. The medium sized pockets, 2 to 3 ft. in diameter are the best producers.

The Newry District

The National Paper Company owns a piece of land in Newry, near North Andover, Me., on which tourmalines were found in 1902. The property seems to be fairly rich but due to the peculiar occurrence of the gems, they are difficult to recover. The pegmatite seems to be more or less uniform throughout and lithia minerals, especially triphylite, are abundant. The lepidolite does not segregate around pockets here, but comes sprinkled through the vein in small quantities. The gems occur in the solid rock just as a horablende crystal would in granite, only of course not so abundantly. There are certain spots where the texture of the ledge is coarser and the better gems are found there.

The gem crystals are peculiar in themselves, for they nearly all consist of two crystals crossed obliquely. They are generally opaque and of a faint apple green color on the outside with a beautiful, clear, red or green center. What the form of the deposit is I am unable to say as I obtained my description of the mine from Loren B. Merrill, manager of the Mt. Mica mine. This Newry deposit is about 70 miles from Mount Apatite, in a northwesterly direction and is on the end of the belt, as far as has been proved.

Metallic Chromium

Although chromium has long been known, it was not until the advent of the electric furnace that it was produced in a solid mass. Previous to that time it was obtained only in powder or fine crystals. According to the *Brass World*, May, 1909, solid, massive chromium is now obtained commercially in two ways: (1) By the so-called aluminothermic method; (2) by means of the electric furnace.

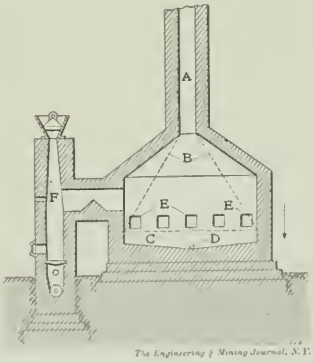
The aluminothermic process consists in reducing the oxide of chromium by means of aluminum. The reaction which takes place supplies heat enough to melt the chromium. By adjusting the proportion of oxide of chromium and aluminum it is possible to obtain fused, metallic chromium of high purity by this process. It is free from carbon.

In the electric furnace process, oxide of chromium is heated with carbon by means of the electric arc and the chromium is then reduced to the metallic state. When thus made it is combined with a large percentage of carbon, and requires purification. To remove the carbon, the crude chromium is melted with lime in an electric furnace. The carbon combines with the calcium to form calcium carbide, and the pure chromium is obtained as a fused [illegible]

By either of these processes, it is possible to obtain fused, massive chromium of a purity of from 97 to 98 per cent. metallic chromium. It does, therefore, compare favorably in purity with ordinary commercial metals.

Jones Iron Furnace

In U. S. Pat. 12,928, March 16, 1909, assigned to the Jones Step-Process Company, John T. Jones, of Iron Mountain, Mich., illustrates an improved furnace similar to that previously patented by him (U. S. Pat. 866,280, Sept. 17, 1907). The furnace is designed for smelting iron ore containing slag-making constituents which become fluid at a temperature not exceeding 2300 deg. F., a lower temperature than is necessary to melt the reduced iron of the ore. A vertical sectional elevation of the furnace is shown in the accompanying illustration in which the upper portion of the ore stack is broken away. The furnace consists essentially of a separate fuel-burning furnace *F* and an ore stack *A* with a chamber beneath the latter for the separation of the unmelted material and the molten slag.



JONES IRON FURNACE

The stack *A* is charged with ore in a finely pulverized condition mixed with a refractory material such as coke. The charge spreads out at the base of the stack as indicated by the dotted lines *B*. The reducing gases from the furnace pass around and through the ore column reducing the iron oxide to metal, the molten slag accumulating as a bath in the bottom of the chamber. When it has reached a depth indicated by the horizontal dotted line *C*, it is tapped off through the slag hole *D*. At *E* are horizontally operated rams which force the unmelted material through discharge openings on the opposite side. The metal is then separated by crushing and concentrating, or otherwise.

Features of a Vein Formation in Nicaragua

The Vein-System and Orebodies Appear to Be the Result of the Fracture and Decomposition of Effusive Rocks, Their Tuffs and Breccias

BY H. E. WEST*

The purport of this paper is to portray the typical features of a vein system situated in the Matagalpa district of Nicaragua. The explanation offered makes no pretense to being authoritative; on the contrary, it is a simple record of observations such as are necessary to the intelligent exploitation of any ore deposit. From the general topography of the locality it is apparent that the structural geology is a manifest of its volcanic nature. This inference is supported by: (1) The abruptly broken topography of the entire area; (2) the effusive overflows exposed on the high summits, mostly basalt tuffs, and breccias; (3) the rhyolite sheet in the low ground, with its several conical hills (this sheet has a strike almost east and west, and extends for several miles); (4) the andesitic-breccia south of the vein, with amygdaloidal sheets, andesite or possibly diabase.

In brief, the entire region, with an altitude of 2000 to 3000 ft. above sea-level, is composed exclusively of volcanic ejectamenta and lava flows. It would appear as if, for the most part, the central and western portion of Nicaragua, at surface, were composed of extrusive rocks. The deep-seated granite, diorite, and allied rocks, are absent, although possibly occurring and visible outside the influence of the more recent outflows. Sedimentary rocks appear to be entirely absent, although, some distance from the mine, there are said to occur small deposits of limestone.

Central America generally is noted for its products of vulcanism, and possesses several active volcanoes. In Nicaragua there may be half a dozen volcanoes still active, of which Momotombo, near lake Managua, is the most active. After enjoying a period of ten years of comparative quiet, during 1904 this mountain was the scene of a very active eruption. Bombs were hurled, it is claimed, thousands of feet in the air; dust settled on the neighboring cities, while streams of lava flowed to the base. The detonations from the crater were plainly heard in Matagalpa, a distance of 90 miles.

Vein Matter

Speaking generally, the valuable part of the vein consists of bands of vesicular quartz with a filling of soft manganese oxide and clay. The width of this material varies from a foot to posbily 20 ft. in places, having an average thickness of 3 to 4 ft. Bordering this on one or both sides, is often a brecciated wall-rock, cemented by quartz; which quartz, usually in crystalline form, radially surrounds the inclosed fragments. This friction breccia is often drusy and contains many beautiful quartz-lined vugs. The brecciated portion is invariably of low grade. From the open nature and porous structure of the vein, there is, as might be expected, a free circulation of groundwater; which accounts for the thorough oxidation and for the presence of a quantity of a red unctuous clay, occurring as a "gouge" against the walls, and also filling joints and interstices.

Outside the zone of brecciated wall-rock, as shown in Fig. 1, there extend in some instances, what might be termed "quartz-droppers," having a dip of about 60 deg. These droppers enrich the country, but rarely enough to make the rock profitable to mine.

A noteworthy feature is the presence of a blue-green rock, very hard and tough, usually impregnated with pyrite, and to a certain extent with zinc and lead sulphides. This rock, which has the appearance of being formed from fragments filling a fissure, cemented and hardened by silicious waters, may, therefore, be termed a clastic or fragmental dike, and I shall so designate it. This occurrence is found on the footwall side of the manganese section, and immediately contiguous to that part of the vein. The dike is never very wide; it varies from a few inches to 4 ft. It is strongly in evidence as far as 1300 ft. in adit No. 1, where it leads to a wide lens of ore; for the entire distance its presence is associated with the enrichment of the vein. Thence to the present end, almost 2000 ft. to the breast, this dike alters materially, and, in places, is not even apparent. It loses its distinctive color and is more open in texture, but it is still plainly fragmental; chert, with pyrolusite and psilomelane are marked associates. Coincident with this change is an impoverishment of the vein.

In Fig. 3 are shown sections of adit No. 1 at 620, 900 and 1850 ft. respectively. The view at the left is a normal exposure of the vein in the breast at the western end; in this, the dike, the vesicular quartz-bands and the included manganese ore are plainly shown. The soft north wall and the shaly hanging are also typical. In the center view the hard firm footwall is the clastic dike, while the hanging is shown extremely broken, an evidence of its weak, slabby nature. The roof is composed of the volcanic breccia, which is here remarkable for the brilliance of its coloring. The blue of crysocolla, the green of malachite, the brick-red of iron peroxide are mingled with the lighter shades of mauve, pink and yellow, and scattered through the mass are fragments almost pure white, usually roughly rectangular in section. Some of the constituents, such as the light-blue rock, are in masses 3 to 4 in. in diameter; but, for the most part, the fragments are small, usually from ¼ to ½ in. in diameter. Toward the eastern end of the adit the clastic dike gives place to a more coarsely

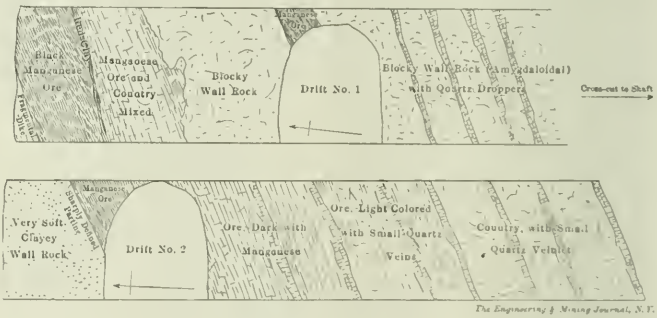


FIG. 1. SECTIONS AT CROSSCUTS IN ADIT NO. 1 AND ADIT NO. 2

*Mining engineer, El Oro, Mex.

fragmental rock, in which particles of chert are prominent; and, in addition some of the harder forms of manganese oxide, such as psilomelane, the hydrated oxide (with its conchoidal fracture) and also pyrolusite (of fibrous texture), and probably some manganite.

Enrichment of the Country Rock

An interesting example of the alteration of wall-rock to ore, either by replacement or impregnation, is shown in Fig. 2. Here we have the direct conversion of practically barren country with gold to the amount of 20c. per ton, being enriched to ore of $5.20; the physical appearance is changed, as also its chemical composition, in part due to the deposition of manganese oxide. Probably impregnation rather than molecular replacement, would be the more justifiable interpretation. The occurrence of small unaltered cores is interesting, showing how some of the wall-rock has resisted the encroachment of the circulating manganese-charged waters.

It would also appear as if, previous to the impregnation by manganese-bearing solutions, the wall-rock had been rent and subsequently filled with quartz, crystallizing out of deep-seated waters. These solutions were presumably low in manganese, as the quartz-filled fissures in the wall-rock usually contain but a filling of yellow clay, the alteration products of the feldspars. Fractures, possibly of another period from those forming the quartz veinlets, bearing manganese on their exposed faces, afford support to the hypothesis suggested.

At the left in Fig. 4, the roof of adit No. 2 presents a representative structure; there is the soft black wad on each side, with brecciated wall-rock cemented by quartz, and manganese oxide with included country. On the right in Fig. 4 is shown a sketch of the crosscut in the south wall, inside of a vein enlargement. This inner section contains but 80c. per ton in gold, and is, therefore, but slightly enriched; and it is plainly evident that this enrichment is due to the veinlets filling numerous fractures that seem to conform roughly with the large joint planes of the basaltic country. The arrows show that these slips cross one another, forming blocks. It would appear as if this were one of the earlier stages of ore formation following the first steps of decomposition along the joint planes. On the other hand, as the orebody seems to favor the softer breccia, by the alteration of which most of the ore appears to be formed, it is equally possible that this may be read as an example of the definition of the orebody, the basalts not favoring metamorphism to ore.

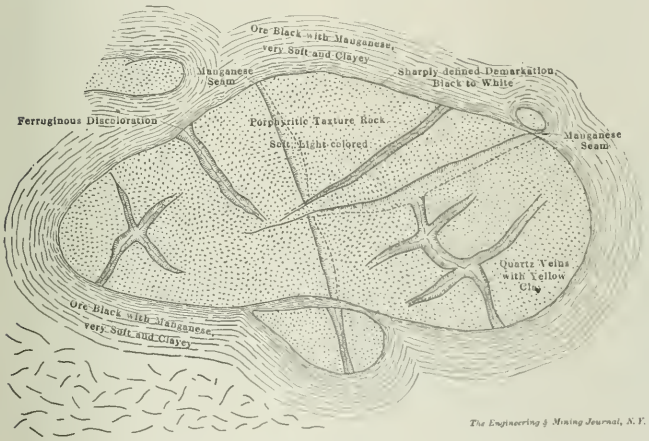


FIG. 2. ALTERATION OF WALL ROCK TO ORE BY FISSURING, SILICA INFILTRATION AND MANGANESE IMPREGNATION

Referring again to the section of the roof shown in Fig. 4, the gold and silver occurrence is noteworthy; here, again, the richest ore occurs in the dark manganese, the brecciated section being practically barren, and the included wall-rock carrying but a trace of either metal. The breast of adit No. 1, at 620 ft., in Fig. 3, is typical of a section showing some of the higher gold contents. This is usually the case when the vein has a banded structure with included manganese. It will be noted that the clastic dike is poor

Distribution of the Metal

From several experiments, I concluded that the gold is more intimately associated with the quartz, and the silver with the manganese. A sample was panned, washing off the manganese and clay, and the concentrate assayed. The results tend to confirm the assumption that the gold content is confined largely to the environment of the quartz, and the silver to the manganese portion. The occurrence of gold is mostly free, although very fine and rarely visible. The gold particles are, however, not readily amalgamated, owing probably to an enveloping film at present unascertained. There would appear to be evidence of a thin quartz seam comparatively rich in gold, and, at times, in native silver, passing through the richer portions of the vein.

There is a marked decrease in the silver content of the manganese ore in the eastern part of the mine. The gold content is more pronounced and the orebody wider when the vein passes through the soft porphyritic country, presumably a softened and altered andesite, which accompanies the vein from about the 600-ft. to the 1600-ft. mark. From this point east within the harder basaltic country the vein is both smaller and poorer; so that, generally speaking, the low parts of the contour may be regarded as more favorable to ore formation.

Another marked feature is the large amount of clay, the work of the groundwater on the soluble silicates of the vein walls. This clay is usually of a banded and fissile structure, often red and black alternating, so that when sun-dried, the mass falls to pieces with a distinctly conchoidal fracture, resembling the leaves of a crumpled book. A sample was dried and assayed, it gave $2.40 in gold and no silver. Generally speaking, the ratio of silver to gold in the deposit is as 1 to 10, allowing 50c. per oz. of silver.

Mode of Ore Genesis

It would appear that we have to account for one or more rock fractures; wall brecciation; a fragmental filling; silicification; and contemporaneous or subsequent impregnation by manganese, with gold and silver enrichments. Doubtless, the volcanic nature of the entire formation will satisfactorily account for the agency producing the primary rock fracture and wall brecciation, and also for any subsequent fracture and its filling with rock fragments.

The comminution of the rock faces by subsequent movements would account for the wider breccias; also the coursing through of deep-seated silicious thermal waters, which, in cooling, formed the cementing medium of this breccia. The latter breccia is very distinct from the silicified fragmental filling previously mentioned. The latter has an open texture and is full of vugs; the quartz, moreover, is crystalline and arranged

radially to the inclosed fragments; whereas the former is a dense, hard, blue-green rock, with the fragmental portions often all but undiscernible, and usually impregnated with metallic sulphides. Through the more open channels, due to the suggested secondary rock movement, there would appear to have been introduced circulating waters rich in manganese, the clastic dike to the north forming both an impenetrable barrier and acting as a guide to the manganese-enriching waters.

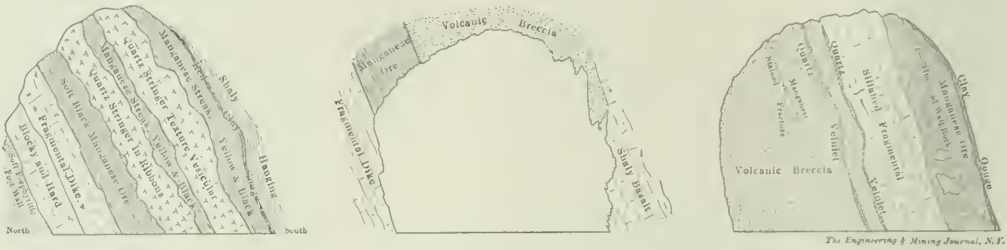
The question arises, whence came these large quantities of manganese oxide? It would appear in the first instance, that in the volcanic countries comprising Central America, there exist quantities of manganese; as, for instance, the northern part of the Isthmus of Panama. Possibly volcanism and an extensive circulation of acidic meteoric waters have a direct connection with the formation of manganese deposits. In many of the volcanic rocks of this region manganese is present, mostly combined as a silicate, but probably originally also as an oxide; and it is possible that the groundwater circulation in these tropical countries may act both as a solvent and collector of these manganese compounds.

The effusive rocks are, moreover, extremely permeable, and therefore the water circulation may be taken for granted as being both vigorous and comprehensive. Professor Kemp says, "In regions of expiring volcanic activity, waters may be expected at comparatively any reasonable depth and, therefore, comprehensive circulation of deep-seated waters may be expected;" and again in regard to sources whence circulating waters derive the elements of ores and gangue, "The generally accepted theory is that they are gathered from a condition of extremely lean dissemination in the rocks through which the underground waters migrate, and the contents leached out." We have, therefore, conditions favorable to a considerable circulation of waters, active in the deposition of ores and their gangues.

Source of the Manganese

Presumably the presence of the manganese in its present form of oxide is, for the most part, an alteration from its original state as an accessory mineral in the volcanic rocks, in some such form as in the iron, calcium, zinc and manganese silicates. Manganese deposition appears to have many features similar to those of iron; and it is probable that for both, immense as are the proportions they at times assume, these deposits are in the first place gathered from the complex silicates that are components of volcanic rocks. These minerals are soluble in both mineral and humus acids, such as occur in acidulated meteoric waters containing traces of sulphuric and carbonic acid; and probably are first altered to the carbonate, thence to the hydrous oxide whence is derived the dehydrated form, as in hematite and pyrolusite. With regard to their sulphides, those of iron are of common occurrence, as pyrite, marcasite and pyrrhotite, while the manganese sulphide, alabandite, is somewhat rare, and, therefore, cannot be accepted as a source of any considerable quantity of manganese deposition. The presence of wad can doubtless be accepted as an alteration, in respect to its physical characteristics, from the harder hydrous oxides, manganite and psilomelane. Neither rhodonite, the silicate, nor rhodochrosite, the carbonate, has been observed, and it would not appear as if rhodonite, the meta-silicate, were the primary form of the manganese.

Passing in brief review we have the following features characterizing this deposit: (1) The entire geological construction of the vein system composed


Volcanic Breccia
Manganese Ore
Fragmental Dike
Shaly basalt
Volcanic Breccia
Quartz
Manganese
Fragmental
Clay
Manganese Ore
Quartz
Fragmental
Quartz
Fragmental
Quartz
Fragmental

of effusive rocks, their tuffs and breccias; (2) earth movements with crushing of rock-faces, followed by silicification, forming quartz breccias; (3) a hard blue-green silicified fragmental, that almost invariably accompanies the manganese portion of the lode and its position on the north wall; (4) the presence of an unusually soft manganese filling with vesicular quartz bands comprising the ore of economic importance; (5) masses of red unctuous clay, the resultant decomposition of the feldspars and other soluble silicates, and affording evidence of the easily destructible nature of the basic eruptive rocks; (6) the association of the vein, for the most part, with a sheet of andesite breccia, at times thin, but of varying width, which breccia would appear to have formed (by impregnation and alteration) the larger bodies of ore; (7) the noticeable enlargement of the vein when passing through the soft and porous andesite, and its contraction and impoverishment in the more basic rocks, which from their close texture would not appear favorable to the passage of solutions for any distance into the inclosing walls although the vein itself be sharply defined: (8) and last, when the vein following the softer breccia is inclosed by basaltic rocks, the conditions are not as favorable to the formation of ore as when the breccia is incased by walls of porphyritic texture, usually andesite.

Australasian Mineral Leasing*

By A. C. Veatch†

The recent mining enactments of all the Australasian states regardless of political complexion, are based on the policy of mineral leasehold. Not only do all the political parties of Australia today heartily indorse this policy, but it represents a gradual evolution from the principle of freehold, through stages varying somewhat in different states.

The mining laws of all these states require continuous development, the enforcement of which is incompatible with the state of freehold. Development as a condition of possession was early recognized in mining practice in the United States; but the annual assessment work required by the present mining law fails to accomplish the continuous development which is requisite to a proper utilization of the mineral resources of the country. On this account the consideration of the extent to which the leasing policy succeeds in securing such development becomes of vital interest.

*An address delivered before the Conservation Commission, Dec. 3, 1908. Published with the permission of the director of the U. S. Geological Survey.

†Of the U. S. Geological Survey, Washington, D. C.

Western Australia

In Western Australia the development of the mineral land laws has been particularly simple. At the time of the first mineral discoveries in 1842, mineral lands were sold under the same conditions as agricultural lands. Later the purchase price was fixed and the option of lease provided. In 1872-73 the erection of a satisfactory mining plant was made a prerequisite to purchase of the land and the rate of lease rent was reduced. Then, after the gold finds of 1885, the abandonment of the principle of sale became a state policy, and in 1898 provision was made that land grants should contain a reservation of all minerals. Thus, in Western Australia the system of leasehold and claim-hold on the conditions of *bona fide* development came at a time most opportune for the test of practice. For the five years comprising 1881-1885 the average annual mineral production was less than £9000, while for the past five years the annual output has exceeded, £8,000,000. Not only was the law subjected to this practical test of great expansion in the mining industry, but an investigation by a commission on mining showed that throughout the goldfields the verdict was overwhelmingly in favor of leasing.

The same general satisfaction with the leasing system is found in the Collie coalfields, although the coal operations are not comparable with the gold mining. The coal-land law has promoted the development of the industry in this field, which is not so favored by natural conditions as most of the American coal lands. The provisions of this law encourage prospectors by granting exclusive prospecting rights over a considerable area for a limited period, followed by either reward or ordinary leases when discovery has been made. Continuous development is secured by the terms of the lease. The decision was reached in Western Australia that 2560 acres is a sufficient maximum for a single holding, except where the coal seam is at a depth of over 1000 ft., in which case 5120 acres is allowed, a decision which is in striking accord with the opinion independently reached in this country and embodied in one of the coal-land bills recently presented in Congress.

The Western Australian mining law is, in short, a wonderfully symmetrical and carefully balanced enactment, and while it may not be, as a whole, applicable to American conditions, it contains many suggestive provisions which merit careful consideration, as they are not the idle vision of some theorist, but the mature enactment of a legislature whose members are chosen entirely by the voters of a great democratic mining state, a state which ranks among the greatest mining countries of the world and which as recently as 1904 has reorganized and revised its mining laws to meet the practical work-a-day conditions of a mining region.

TABLE I. SUMMARY OF HISTORY OF GOVERNMENT MINERAL LEASING IN AUSTRALASIA.

By A. C. Veatch.

	Year of First Government Leases for			Year in Which Sale of Known Mineral Land Was Practically Abandoned.	Year of First Reservation of All Minerals.	Total Area Held Under Mineral Lease in 1905.[d]	Total Value of Mineral Production in 1905.	Percentage of Total Production From Government Leasehold.
	Gold.	Minerals Other Than Coal and Gold.	Coal.					
Western Australia....	1886	1865	1896	1886	1898	56,541	8,555,841	96
South Australia.....	1869	1854	1874	1872	1888	27,157	568,796	90+
Tasmania.....	1860	1862[a]	1853[b] 1862[a]	1859	1903	52,924	1,729,129	100
Victoria.....	1857	1861	1853–4[b] 1862	1860	1892	84,546	3,361,455	93
New South Wales....	1851	1856	1861	1884	1884	173,342	7,017,940	68
Queensland.....	1868?	1872	1891	1882	No reservations except in gold and mineral fields	38,874	3,726,275	91
New Zealand.....	1858	1852	1852	1875[c]	No reservations.	149,697	3,622,786	90±

[a]Date of act; date of first lease unknown, but soon after date given.
[b]Special leases.
[c]Isolated case; practically no known mineral land has been sold in New Zealand since 1850.
[d]A considerable area is also held under mining claims, or as prospecting areas.

The mining law of Western Australia is that of a state in which the mining industry is of preëminent importance. The mineral exports of the country are from five to six times the real value of all other exports. It is, moreover, a mining community in which the capital employed in development is almost wholly of foreign origin. On these accounts the evidence furnished by the development of mining laws in South Australia is to a large degree supplementary to that afforded by Western Australia.

South Australia

South Australia is a country in which mining occupies the subordinate position, the mineral exports amounting to less than one-tenth the value of the other exports, so that the mining law is that of the agricultural holder and local capitalist.

In South Australia the alienation of

minerals has been carried further even than in the United States, yet here too, the principle of leasehold has developed and been fully tested. The history of the mining law of this country becomes of special interest to Americans, as it shows the practicability of introducing a system of government leasehold after important mining properties have passed into private ownership.

There has resulted a surprising unanimity of opinion in favor of government leaseholds for all minerals. Mining engineers, operators, and capitalists unite in asserting that mining development is promoted more by leasehold than by freehold. The leaders of the several political parties agree that the matter of government leasehold is not a party question. It is important to note that the mining laws of both Western Australia and South Australia vere developed under Conservative or Tory governments, and while a Labor government has been in power for some years in South Australia, these mining laws cannot be characterized as "radical labor legislation." They are, in fact, nonpartisan enactments which antedate the present supremacy of the Labor party.

Victoria

In Victoria the national mining law has been enacted under conditions strikingly like those under which the American mining law developed, but with very different results. Here, as in California, there was, at the time of the discovery of gold, no law governing mining on the public lands. In both countries the discovery of valuable goldfields resulted in an enormous immediate influx of population and while the United States delayed dealing with the situation the Victorian government attacked the problem at once and by the time of the passage of the American Act of 1866 had evolved a very comprehensive mining law. In Victoria the development of the coal resources has been practically all under government leases notwithstanding the fact that considerable areas of coal land are in private ownership.

Tasmania

The mining law of Tasmania has been commended in the Australian mining press as the model among the Australian laws from the standpoint of the capitalist. This state was the first to provide that no lease should be forfeited for non-compliance with the development conditions during suspensions of work due to strikes. The last mining act also meets the demands of investors for more secure tenure by providing for the expression of the development covenant in money instead of men and by allowing, under certain restrictions, the excess of development expenditure in one year as a credit on the requirements of the next. In Tasmania, at the time of the early discovery of coal under the existing policy of alienation of lands the coal lands passed into private ownership. Yet, today all the working coal mines are reported as operating under government leasehold, showing that the terms of leasing must have proved satisfactory. The present act permits consolidation of leases to any extent in the discretion of the Minister of Mining.

New South Wales is the most important of the Australian states from the standpoint of its coal production. In this state there is the same general indorsement of mineral leasehold; indeed it may be said that there is absolutely no demand for private ownership of minerals. The history of government leasing in Australasia and the tenure and conditions under which leases are today issued in the various states are summarized in the accompanying tables.

In the Bennington group of mines at Iron mountain, Shasta county, owned by the Mount Shasta Gold Mining and Milling Company, there has been encountered at a depth of 100 ft. a 6-ft. ledge carrying the same high values as those found on the surface during the last four or five years. A 1600-ft. crosscut tunnel has been run with its mouth on a level with the Iron Mountain railroad, and it is in this tunnel that the ledge has been found.

A strike of gold quartz has been made in the San Carpajaro section above San Simeon landing, on the border line of Monterey and San Luis Obispo counties, Cal., the mine being actually in the former county. A 7-ft. ledge carrying free gold has been found in the old Cruikshank mine which was worked for a time some 20 years ago, but has been abandoned for a long period. The mine is in the Coast Range, and nearly on the coast line, where it was thought gold would not be found. Now high-grade ore has been found at the depth of 50 ft. It is probably another pocket such as was found years ago but the presence of the gold upsets some theories as to the nonexistence of gold deposits in the Coast Range of California.

TABLE II. TERMS AND CONDITIONS UNDER WHICH MINERALS ARE TODAY LEASED IN AUSTRALASIA.

	Western Australia.	South Australia.	Tasmania.	Victoria.	New South Wales.	Queensland.	New Zealand.
Term of years:							
For gold	21	42	21	15	20	21	42
For minerals other than gold and coal							42–62
For coal							66
For dredging	21	10					
Maximum area in acres:							
For gold	24	20	40	no limit	25	50	100
For minerals other than gold and coal	48	40	80	640	80	160	320–1000
For coal	320	640	320	640	640	320	2000
For dredging	5000	200			100		
Rent per acre per year:							
For gold	£1	1s.	£1	2s. 6d.	5s.	£1	7s. 6d.
For minerals other than gold and coal	5s.	1s.	5s.	1s. to £1	5s.	10s.	2s. 6d.
For coal	6d.	1s.	2s. 6d.	1s. to £1	1s.	6d.	1s. to 5s.
For dredging	6d.	1s.			2s. 6d.		
Royalty:							
For gold (per ounce)	none				none	none	2s. [c]
For minerals other than gold and coal	none	2½%	[a]	none	none	none	½%
For coal per ton	3d. first 10 yr., 6d. thereafter.				3d. to 6d. per ton.	[b] 3d. first 10 yr., 6d. th'after	2d. to 1s.
For dredging	1s. per oz.	none			1%		
Development conditions, expressed in men per acre per year:							
For gold	¼	¼	none	Fixed by minister	½	¼	¼ to ½
For minerals other than gold and coal	¼	1/10			1/10	1/10	1/20 to 1/30
For coal	1/20	1/10			1/100	1/10	
For dredging	none	1/10			1/100		
Development conditions, expressed in money per acre per year:							
For gold	Must be labor	Must be labor	£10	Fixed by minister	Must be labor	Must be labor	
For minerals other than gold and coal			£2				
For coal			£2				
For dredging	30s.	£20			£10		

[a] Such as may be fixed by regulation. None has been charged up to this time. [b] Rent a credit on royalty. [c] Only in North Island.

A Model Coal Mine in Westphalia

The Company Works 15 Seams, Varying in Thickness from 1 1-2 to 10 Ft. Each Bed Is Worked Retreating, and Product Is Carefully Washed

BY WILLIAM S. HALL*

The Zollern II colliery, which is described in this article, is one of the most extensive of several large collieries operated by the Gelsenkirschener Bergwerks-Actien Gesellschaft, and is situated at Merklinde near Gelsenkirchen in Westphalia. The great Westphalian coalfield lies on the west shore of the Rhine. On every side in this region are evidences of great industrial development. Essen with its immense Krupp works is in this district, and at Gelsenkirchen, Dortmund, Bochum, Herne and other large towns are numerous and varied industries with extensive plants. In 1906, 36,000,000 tons of lignite and 130,000,000 tons of bituminous coal were mined in this district. Most of the coal-mining companies are formed into a syndicate which controls about 90 per cent. of the production.

Many of the seams are thin, some are quite dirty, and at places they are highly inclined. One of the first things that strongly impresses an American is the lavish expenditure on the surface plants. The buildings are substantial, fine looking structures, always built of brick or stone, and the machinery equipment is superior. A washery is connected with nearly every colliery and sometimes the entire output goes through the washery. The finest culm coal is saved and is coked, or made into briquets on the premises.

Machinery Hall

Fig. 1 is a view at Zollern II, showing the administration building with the offices in the center, with a well kept lawn, trees and flower beds in front and a shaft with a group of mine buildings on each side. Machinery hall is one of the most imposing of the buildings. It is commodious, well lighted, with high ceiling, tiled floor, frescoed walls and stained-glass windows. The floor and machinery are kept scrupulously clean. Aside from its convenient appointments as a central power station, this structure architecturally and in ornamentation is veritably a thing of beauty. The main power plant consists of three triple-expansion horizontal steam engines, directly coupled to direct-connected dynamos. The engines make 90 r.p.m. with 1500 normal h.p. and 1950 maximum h.p., generating a current of 500 volts with 1100 normal kw. and 1450 maximum kw.. These machines generate current for the whole plant.

There are two electrically driven air compressors, providing 2300 cu.ft. of air per min. at 130 lb. pressure. The building also contains the winding engines and other machinery. In a detached building at one end of machinery hall are three banks of Babcock & Wilcox boilers with four boilers in each bank. These are heated by gas from the coke ovens.

Hoisting

There are two shafts similarly equipped and located about 250 ft. apart, as shown by the headframes in Fig. 1. Each headframe is constructed of steel and is given great strength and rigidity. The headframe is supported on heavy concrete foundations and is covered by a sheet-iron bonnet or hood.

The winding engines were built by Siemens & Halske. Each engine is a 350-h.p. machine, and is driven by a direct-current motor on each side of a 12-ft. steel flywheel weighing 40 tons. Ilgner's compensator or equalizer is a feature of the winding mechanism. The Koepe system of hoisting is employed.

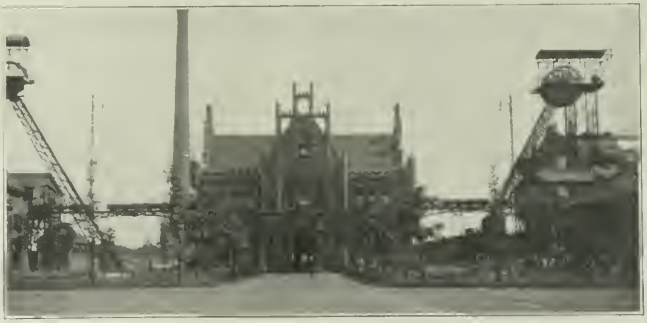


FIG. 1. A GENERAL VIEW OF OFFICE BUILDING AND SHAFT HEADFRAMES AT ZOLLERN NO. II MINE

The shafts are round, 18 ft. in diameter, 1000 ft. deep, and are walled with bricks. One shaft is used for hoisting and the other ordinarily serves only for ventilation, but is equipped so that it can be employed at any time for hoisting. The cages have four decks, each deck carrying two cars tandem. The flat rope has a cross-section of 2x8 in. Forty-six men are hoisted in a cage at one time. Hoisting continues for 15 hours each day and the daily output is 2000 tons.

Exploitation

The company operating Zollern II works as many as 15 seams in some of its collieries. These seams vary from 1½ ft. up to 10 ft. in thickness. The beds at Zollern II are moderately flat, the dip varying from 3 to 32 deg. Each bed is worked retreating toward the shaft and the seams are mined in regular order from the surface downward. The work is advanced with such uniformity that all the working faces form an outline that is approximately elliptical.

The method of exploitation varies with the conditions. One method is illustrated in Fig. 2. First the rectangular pillars *a a* are worked out simultaneously. Then the open square spaces are enlarged by working out the parts marked *b b*. Afterward the portions marked *c* and *d* are started, *c* being driven from both ends to meet in the middle. When *c* is well advanced, the next slice *e* is started at both ends. This method is sometimes varied by finishing each slice or strip before starting another.

Another method of exploiting the seam is illustrated by Fig. 3. This method is so apparent from the sketch as to require no further explanation. Two men work together in one of the rooms shown in Fig. 3.

Most of the mine timber is creosoted. A gangway timber set is made of two oak legs, each having a wrought-iron strap around the top to prevent splitting, and an iron I-beam for the collar. An iron angle bracket connects the collar with the leg on each side. The main haulage roads, especially near the shaft, are heavily lined with masonry. Side walls are sometimes substituted for the oak legs of the timber sets. Wooden headers are built into the walls so that a certain amount of yielding under the roof pressure may be provided for. Large regular flat stones are used

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to face the side walls, while the back is filled in with smaller stones. Wooden partitions are built to retain the culm that is flushed in to fill the worked-out chambers, and these remain in position until the material solidifies. Thus all the open spaces are filled up as soon as possible after they are vacated and the surface is not permitted to settle. In this way mining proceeds under the town without disturbing the buildings on the surface.

Iron props designed to telescope, without injury to the props when the pressure on one exceeds 15 tons, are much used in the rooms. There is but little water in the mine, all of which is drained to one sump in the deepest part and pumped to the surface in one lift.

Underground Haulage

Three systems of underground haulage are in use; rope, electric and animal haulage. The relative costs of these are as 1, 3 and 9 respectively. Endless-rope haulage and electric locomotives are used on main roads and horses are employed in the secondary haulage. The bodies of the cars are made of sheet iron with curved bottoms. The dimensions of a car are 5½x2½x4 ft., and it holds 8 tons. The car wheels are fixed on the axles, the journals are self oiling and are provided with ball bearings. The wheel base is 18 inches. The rails are unusually heavy for the small light cars. Switches are operated automatically so far as possible, and the air doors are opened by the moving trains and closed by springs or gravity. One endless rope haulage line is over a mile in length.

Each electric locomotive is run by a 4-h.p. storage battery and replaces 30 horses. The locomotive runs at a speed of 13 ft. per sec. hauling 30 loaded cars weighing about three-fourths of a ton each. Each engine has two motors in series or parallel. At the charging station, the locomotive is brought into position between two concrete piers, the tops of which are on the same level as the car platform on which the storage battery rests. In changing the batteries, the battery on the truck is pushed laterally on runners to the pier on one side, and the charged battery from the pier on the other side is substituted.

Washery

The washery is of the type in which the coal is classified at the top before being passed through the washery. The plant was installed by Schuchtmann & Kremer, of Dortmund. The cars are run directly from the cage platform into revolving tipples and are dumped, the coal passing down over an inclined screen which has a back and forward motion. The over-sizes go to a moving sheet iron picking belt, while the through sizes are elevated to the top of the washery, where they are classified and the different sizes are run to different jigs.

The sizing is done in four trommels having two divisions with different screen meshes in each trommel. The meshes of the first are 1.5 and 3 in.; second, 0.8 and 1.5 in.; third, 0.4 and 0.8 in.; fourth, 0.15 and 0.4 inches.

The slimes pass into large concrete settling chambers and the water after settling is pumped back and used over again. After the fine coal is drained off until it is sufficiently dry, which requires about 6 hours, it is sent to the coke ovens. The dirt is flushed into the mine. Running water carries the different sizes of coal to storage pockets placed above railroad tracks.

The capacity of the washer is 2000 tons

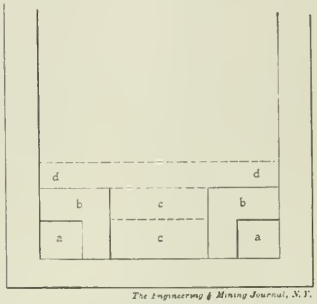


FIG. 2. A COMMON METHOD OF EXPLOITING THE SEAM

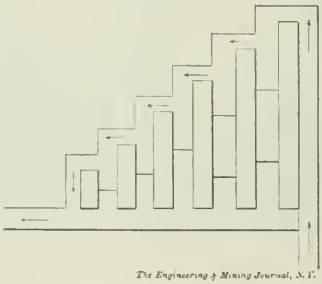


FIG. 3. A GENERAL ROOM-AND-PILLAR SCHEME OF DEVELOPMENT

in 24 hours, 3300 gal. of water per minute are required. The proportion of water to coal is about 1 to 3. There is approximately 10 per cent. of rock in the coal as it comes from the mine. The coke contains from 5 to 6 per cent. of ash. The coke ovens are close to the washery and an improved by-product recovery plant is installed.

Ventilation

The ventilation is effected by two Rateau fans. These are electrically driven and give 210,000 cu.ft. of air at 192 r.p.m. Air-test stations are located in various parts of the mine, where the temperature and the amount of air passing are periodically measured and samples of air are taken for gas analysis. The results of these investigations are conspicuously posted at each station. The anemometer used is a self registering one, and runs for ¼ of a minute before beginning to register, and records the amount passed for one minute. The law requires 10 cu.m. (350 cu.ft.) of air per minute for each workman.

When tests show the presence of as much as 1 per cent. of gas in the mine atmosphere, all work is stopped and the miners are taken out. The gangways are sprayed regularly to settle the dust and the timbers are kept wet.

Wash House

On every side are evidences of the high regard which is paid to the health, safety and comfort of the miners. One of the most interesting and commendable features is the provision made for bathing and change of clothing. The wash house for the employees is one of the largest and most important buildings on the premises. It is well lighted and heated, and has cement floor, tiled walls, and is furnished with a large number of hot and cold water shower baths. Attendants keep the room scrupulously clean.

The miner coming from work goes from the shaft through a covered and heated passageway directly to the wash house. Here he divests himself of all his mine clothing and takes a complete bath, using his individual soap and towel. Then by means of a cord which passes over a small pulley suspended from the roof, he lowers to the floor a complete change of clothing. After putting on his street clothes, he attaches his working clothes to the hook on the end of the cord and hoists them nearly to the high ceiling. The working clothes are dried and disinfected by a current of hot air before he returns to work. When the miner reports for work, he goes to the wash house where he substitutes mine clothes for his street clothing, then he repairs to a near-by lamp room where he is given a certain numbered safety lamp, which has been examined, put in good condition and filled since it was last used. The mine clothes are taken away and washed semi-weekly. All the miners are required to make use of the bath rooms.

Labor, Costs, etc.

The miners work in three shifts of 8 hours each. The night shift is occupied with repair work and with timbering, walling, tracklaying, etc. The miners are paid by the car which holds about half a ton, and receive from 15 to 18c. per car according to the nature of the work. The best miners make a maximum wage that falls between $1.50 and $1.75 per day. The total number of men employed is about two thousand. The miners are given a bonus of 3c. for every prop that is recovered. The work of filling and prop placing is done by the men without extra pay.

The sanitary arrangements leave little to be desired. Closets for the men are located at convenient places underground.

The closet tanks are removed daily, emptied and disinfected before they are returned.

Equipment for Fighting Fire

A fire-engine house, well equipped with chemical engine, hose reels, hook-and-ladder truck, etc., insure protection against fire. One portion of this building contains a sufficient supply of mine rescue apparatus designed after the Draeger system. One room is used as a temporary hospital and is equipped with ambulance, stretchers and everything that is needed in first-aid to the injured. Gangs of men are regularly drilled in fire fighting and rescue work.

The excellent treatment accorded to us on the occasion of our visit to this mine is deserving of special mention. The company is unusually well prepared to take care of visitors. Before entering, we were supplied with an entire change of clothing, even including underclothes, boots and hat, and were put in charge of a competent and courteous guide. We were given every facility to inspect the plant and all information for which we inquired was freely given. After coming up the shaft, we were conducted to a room in which there were a number of bathing compartments. Each bath room had a tiled floor, porcelain tub, hot and cold water, spray baths, etc. While we were bathing, an attendant brushed our clothes and cleaned our boots.

Pricing Public Coal Lands

Special Correspondence

The United States Geological Survey is placing even greater emphasis this year upon its work of classifying and valuing the public coal lands. The national policy of promoting the most advantageous disposal of the public lands is continued under Secretary Ballinger and by his instructions the Director of the Survey is transmitting to the commissioner of the General Land Office land classifications based upon the reports of findings of the field geologists. To the fullest extent possible under the law the effort is to secure the wisest utilization of the resources of the public domain.

Recently enacted legislation gives to the agricultural entryman whose entry was made prior to the passage of the act, the privilege of electing to take the surface rights, while the coal rights are reserved for future and separate disposition. The chief of the Denver field division of the General Land Office reports that from information received in his office 90 per cent. of the Colorado entrymen in areas supposed to contain coal will elect to take title to the surface reserving to the United States the coal rights. This alone indicates the value and wisdom of this legislation which is the first important amendment of the coal land act along the lines urged by Mr. Ballinger in 1907, when commissioner of the General Land Office.

If the entryman, on the other hand, chooses to contest, then the issue becomes one of relative worth between agricultural and coal values. In a report to Secretary Ballinger, the director of the Survey stated that in the case of the North Dakota lands, to which this act was supposed to be specially applicable, while all western North Dakota, a part of which had been withdrawn as coal lands, is believed by the geologists of the Survey to be actually underlain by workable deposits of lignite, yet in all but 54 townships this area is conceded to be at present more valuable for agricultural purposes than for its deposits of low-grade coal.

The regulations for the classification and valuation of the Government coal lands as revised in April provide for a somewhat more discriminating separation of the coal and the barren lands, and for the fixing of more adequate valuations upon lands underlaid by the higher grades of coal. These changes were determined upon by the Secretary of the Interior from the consideration of present conditions in coal mining in the Western States, where thinner and deeper beds are being mined than was formerly the case, and of current practice in the matter of coal royalties collected both by the States and by private land owners. Two of the regulations indicate the spirit of these administrative measures for safeguarding the disposal of the nation's remaining coal lands. The price of coal land containing the lowest grade bituminous coal or lignites is fixed at the minimum provided by law, the intent being to thus encourage, as far as the law permits, the immediate utilization of these low-grade fuels. Another rule states that in all valuations of coal beds, any special condition enhancing the value of the land for coal-mining purposes shall be taken into consideration.

The revised scheme used in the valuation of the coal lands differs from that formerly in force in two general respects. The basis is now specifically that of coal tonnage and the land prices thus determined for the better grades of coal, anthracite and coking bituminous are somewhat higher, the maximum being raised from $100 to $300 per acre, and indeed this maximum does not hold in "districts which contain large coal mines where the character and extent of the coal deposits are well known to the purchaser."

Scheme for Valuation of Coal Lands

The plan of valuing the public coal lands by accurate determination of coal quality and tonnage is the most equitable possible, and while adequate returns are secured to the Government, the land prices thus fixed rarely amount to one-fourth of the results prevailing in the same district under private interests.

The present scheme of valuation is as follows: Anthracite and coking-bituminous coals are valued at 2 to 3c. per ton. High-grade noncoking bituminous coals are valued at 1 to 2c. per ton. High-grade subbituminous and low-grade bituminous coals are valued at ½ to 1c. per ton. Low-grade subbituminous coals and lignites are valued at the minimum price fixed by law of $10 and $20 an acre. The tonnage is conservatively estimated and actual recovery ought always to exceed the tonnage upon which the valuation is based.

A few instances are cited as showing the comparative working out of valuations under the different land policies. In one township near Rock Springs, Wyoming, the valuation of which has just been completed by the Geological Survey, the coal-land values aggregate $2,800,000, on the basis of 1c. per ton. The amount for which the Government would have sold these lands on the basis of the minimum price allowed by law under the interpretation which held prior to 1906, is $460,000, while under the valuation plan of last year the amount would have been a little less than $1,000,000.

In a Montana township, near the town of Roundup, on the new line of the Milwaukee, the original amount which the Government would have received under the $20 minimum rate was $112,000; under the regulations of last year, $141,000; and under the present valuation scheme adopted April 21, by this administration, $370,000, some of the coal being now valued at $65 an acre where $20 and $25, respectively, would have been the former rates.

Near the great Castlegate coalfield in Utah the Survey is now valuing some of the Government land containing thick beds of coking coal. In this field, thousands of acres would run over the maximum of $300 an acre, as opposed to the $20 minimum price and $75 under the former valuation scheme. Dozens of other equally striking instances of comparative valuations might be cited.

Government Recovers Coal Lands

The conservatism of even the present valuation plan is clearly shown from an examination of the records in several cases where land was fraudulently entered by certain companies and in which suit for recovery of land and damages was instituted by the Government. In one instance of this kind a coal company secured a tract of land through fraudulent entries—paying $20 an acre, however—and instituted mining operations. The company has settled by paying the Government 8c. per ton royalty for all the coal mined and would have gladly accepted the privilege of being allowed to continue the mining at this rate. This, however, was not possible under the law. In this case the Government received the original $20 an acre, as well as $31,000

in royalty for the partial working of the coal on the 74 acres involved, and has also got back the land. Had the company been permitted to mine out the coal, including that left as pillars, the return to the Government would have been $1320 an acre. Under the present scheme of valuation this land would have been sold at $340 an acre.

Not only are the prices determined on the basis of the present plan believed to be not excessive, but a higher valuation would have been very properly approved by Secretary Ballinger were it not for the fact that the coal-land law limits the coal land that may be acquired to an acreage below what a mining company needs for economical operation. It is evident that a purchaser could well afford to pay a larger price per acre did the law permit the purchase of the larger tract.

It will be seen that the present coal-land policy provides for the saving to the Government and the people of enormous sums of money and prevents the monopolization by private interests of the western coalfields. The most advanced, scientific and effective methods of classifying and valuing the nation's remaining coal lands, which still constitute about 80,000,000 acres, have been adopted, and in brief the intent of the policy developed by Secretary Garfield and now further advanced by Secretary Ballinger is to promote development and economical utilization and at the same time to secure adequate returns from these valuable public lands.

Ohio and West Virginia Coal Railroads

SPECIAL CORRESPONDENCE

In a report sent to Congress May 10, the Interstate Commerce Commission has given the results of an investigation just completed with regard to certain coal roads in Ohio and West Virginia and designed to reveal their position under the "commodities clause" of the Hepburn act.

In this report the Commission presents a comprehensive history of the organization and operation of various coal companies in Ohio and West Virginia and their merging into one company which is controlled by a syndicate of railroad companies. The various coal companies considered are the Hocking Valley Railway Company, the Toledo & Ohio Central Railway Company, the Kanawha & Michigan Railway Company, the Zanesville & Western Railway Company, the Buckeye Coal and Railway Company, the Ohio Land and Railway Company, the Central States Construction Company, the Sunday Creek Coal Company, the Rayhould Coal Company, the Boston Coal Dock and Wharf Company, the Kanawha & Hocking Coal and Coke Company, the Continental Coal Company, the Sunday Creek Company, the Wheeling & Lake Erie Railroad Company, and what is known as the "Trunk Line Syndicate." This Trunk Line Syndicate consists of the Pennsylvania, the Baltimore & Ohio, and the New York Central systems, as well as the Hocking Valley, the Toledo & Ohio Central, the Zanesville & Western, the Kanawha & Michigan, the Wheeling & Lake Erie, the Chesapeake & Ohio, and the Norfolk & Western roads.

A great part of the report is taken up with a minute description of the manner in which the various coal companies and railway companies in this region were finally merged into the Sunday Creek Company, which was incorporated under the laws of New Jersey. In the history of these financial transactions the Commission goes into great detail as to the issue of stock and bonds and the giving of bonuses to various organizations accomplishing the mergers.

The report farther states that the Trunk Line Syndicate considered and passed upon track connections, operation of coal properties, reorganization of coal companies, merging of coal companies, and in general exercised supervision over such matters; also that the Trunk Line Syndicate was prominent in the policy of the roads in this district in refusing to make track connections at mines with other properties than those dominated by the syndicate.

The Commission considers that present conditions have resulted from the foregoing manipulations, and one of them seems to be the policy of the Hocking Valley and the Kanawha & Michigan railways to discourage all further development of coal mines tributary to their lines by refusal to make track connections and by imposing burdens upon the operators when the connections were conceded.

The evidence shows that in the period from 1902 to 1905 a large number of requests were made upon the Hocking Valley Railway Company by coal companies for track connections, which were not considered favorably by the railway company and in most of which the efforts of the coal companies failed.

The assistant to the president of the Hocking Valley railway could not name any other mines than the Johnson Coal Mining Company, the New York Coal Company, and the Sugar Creek mines at which connections had been made between 1900 and 1907, although it is stated that during this period there were 18 requests for connections. A similar condition of affairs appears as to the Kanawha & Michigan Railway Company in regard to refusing track connections and furnishing of cars.

It seemed to the Commission that after the organizations and mergers above described, the railway companies by various devices sought to discourage the further development of coal mines in the territory under discussion. The interest of the railroad officials in their coal companies and the guaranty by the railways of the bonds of the coal companies furnished an incentive to discourage further development of coal mines, and as far as possible to retain to these coal companies a monopoly of the coal transported by these railroads.

Coal Mining in Georgia in 1908*

The total production of coal in Georgia in 1908 was 264,822 short tons, having a spot value of $364,279.

Few States suffered more acutely from the financial depression of 1908, so far as coal production is concerned, than Georgia, the output of the State decreasing from 362,401 short tons in 1907 to 264,822 tons in 1908, a decline of 97,579 short tons, or 26.93 per cent., while the value fell off from $499,686 to $364,279, a decrease of $135,407, or 27.1 per cent. The output in 1908 was less than in any year since 1899 and can be attributed almost entirely to the depression in the iron trade, which particularly affected the production of high-grade coals and the manufacture of coke. The quantity of coal made into coke decreased from 141,031 short tons in 1907 to 71,452 tons in 1908—almost exactly 50 per cent. Of the total decrease in the State's coal production in 1908, 71 per cent. was in the quantity of coal charged into ovens for the manufacture of coke.

The number of men employed in the coal mines of Georgia in 1908 was 670, who worked an average of 261 days, compared with 808 men for an average of 262 days in 1907 and 737 men for 279 days in 1906. The efficiency record of the laborers in the coal mines of Georgia can not properly be compared with that of other States, however, as a great number—considerably more than half—are convicts leased by the State to the mining companies. Most of the men worked nine hours a day, but the statistics of production show that the average output per man each day during 1908 was only 1.51 tons, compared with 1.71 in 1907 and 1.62 in 1906. The average production per man for the year was 395 tons, compared with 440 tons in 1907 and 450.6 tons in 1906. This low efficiency is explained by the fact that the convicts employed in the mines have had no previous experience as coal miners. Where convicts are employed the operations are not subject to interference by labor troubles. There are no undercutting machines in use in the mines of Georgia. At one plant washing machinery is employed, and in 1908, 79,000 tons of coal were washed, yielding 71,452 tons of cleaned coal and 7548 tons of refuse.

*Report by United States Geological Survey.

TABLE OF WATER GAGES.

Water Gauge.	Ventilating Pressure Pounds per Sq Ft.	Pressure Ounces per Sq.Ft.	Pressure Ounces per Sq.In.	Velocity of Air Feet per Min. 4812 V h	Hight of Air Column. One Cu. Ft. Weighs 0.763 Lb.	Foot pounds in 1000 Cu.Ft. of Air.	Horse Power In 1000 Cu.Ft. of Air.
0.1	0.52	8.320	05	1,251	6.8	520	016
0.2	1.04	16.640	.12	1,780	14.0	1,040	.031
0.3	1.56	24.960	.17	2,465	20.4	1,560	0.048
0.4	2.08	33.280	.23	2,502	27.2	2,080	0.063
0.5	2.60	41.600	.28	2,839	34.1	2,600	0.079
0.6	3.12	49.920	.34	3,079	40.9	3,120	0.081
0.7	3.64	58.240	.40	3,272	47.7	3,640	0.110
0.8	4.16	66.560	.46	3,560	54.6	4,160	0.128
0.9	4.68	74.880	.51	3,777	61.4	4,680	0.141
1.	5.20	83.200	.58	3,945	68.2	5,200	0.159
1.1	5.72	91.520	.63	4,138	75.0	5,720	0.173
1.2	6.24	99.840	.70	4,330	82.0	6,240	0.188
1.3	6.76	108.160	.75	4,528	88.7	6,760	0.205
1.4	7.28	116.480	.80	4,715	95.5	7,280	0.225
1.5	7.80	124.800	.86	4,860	102.3	7,800	0.236
1.6	8.32	133.120	.92	5,055	109.2	8,320	0.252
1.7	8.84	141.44	.99	5,148	116.0	8,840	0.268
1.8	9.36	149.760	.03	5,293	122.8	9,360	0.283
1.9	9.88	158.080	.10	5,48	130.0	9,880	0.299
2.	10.40	166.400	.17	5,630	136.4	10,400	0.315
2.1	10.92	174.720	.21	5,726	143.3	10,920	0.331
2.2	11.44	183.040	.27	5,870	150.0	11,440	0.345
2.3	11.96	191.360	.32	6,015	157.0	11,960	0.362
2.4	12.48	199.680	.38	6,111	163.7	12,480	0.378
2.5	13.	208.	1.44	6,255	170.0	13,000	0.390
2.6	13.52	216.320	.50	6,399	177.4	13,320	0.409
2.7	14.04	224.640	.56	6,592	189.0	14,040	0.425
2.8	14.56	232.960	.61	6,640	190.0	14,560	0.441
2.9	15.08	241.280	.68	6,784	200.0	15,080	0.456
3.	15.60	250.6	1.72	6,833	204.0	15,600	0.471
3.1	16.12	257.920	.80	6,977	211.5	16,120	0.490
3.2	16.64	266.240	.84	7,073	219.0	16,640	0.504
3.3	17.16	274.560	.89	7,200	225.1	17,160	0.520
3.4	17.68	282.880	.96	7,266	230.7	17,680	0.536
3.5	18.20	291.200	2.01	7,410	236.8	18,200	0.551
3.6	18.72	299.520	2.08	7,554	245.6	18,720	0.567
3.7	19.24	307.840	2.13	7,602	252.4	19,240	0.583
3.8	19.76	316.160	2.20	7,747	260.0	19,760	0.600
3.9	20.28	324.480	2.25	7,843	266.1	20,280	0.614
4.	20.80	332.800	2.30	7,939	272.9	20,800	0.631
4.1	21.32	341.120	2.36	8,036	280.0	21,320	0.646
4.2	21.84	349.440	2.42	8,180	286.6	21,840	0.661
4.3	22.36	357.760	2.46	8,276	297.0	22,360	0.677
4.4	22.88	366.080	2.54	8,324	300.3	22,880	0.693
4.5	23.40	374.4	2.58	8,421	307.0	23,400	0.709
4.6	23.92	382.720	2.65	8,517	313.9	23,920	0.724
4.7	24.44	391.040	2.71	8,613	320.7	24,440	0.740
4.8	24.96	399.360	2.80	8,706	327.5	24,960	0.753
4.9	25.48	407.680	2.83	8,757	334.2	25,480	0.773
5.	26.00	416.00	2.87	8,854	341.2	26,000	0.789
5.1	26.52	424.320	2.94	8,950	348.0	26,520	0.800
5.2	27.24	435.840	3.02	9,046	357.4	27,240	0.825
5.3	27.56	440.960	3.04	9,142	362.0	27,560	0.835
5.4	28.08	449.280	3.10	9,239	370.0	28,080	0.850
5.5	28.60	457.600	3.17	9,287	375.0	28,600	0.866
5.6	29.12	465.920	3.23	9,383	382.1	29,120	0.884
5.7	29.64	474.240	3.30	9,479	389.	29,640	0.900
5.8	30.16	482.560	3.38	9,624	400.	30,160	0.193
5.9	30.68	490.880	3.40	9,667	402.5	30,680	0.930
6.	31.20	499.200	3.44	9,768	409.4	31,200	0.940
6.1	31.72	507.520	3.50	9,816	415.2	31,720	0.962
6.2	32.44	519.040	3.57	9,912	425.0	32,440	0.983
6.3	32.76	524.160	3.61	9,96	431.3	32,760	0.993
6.4	33.28	532.480	3.67	10,057	436.7	33,280	1.000
6.5	33.80	540.8	3.73	10,105	443.4	33,800	1.024
6.6	34.32	549.120	3.81	10,201	450.0	34,320	1.042
6.7	34.84	557.440	3.87	10,297	457.6	34,840	1.056
6.8	35.36	565.760	3.92	10,345	464.0	35,360	1.071
6.9	35.88	574.080	3.98	10,442	470.8	35,880	1.085
7.	36.4	582.400	4.01	10,490	479.0	36,400	1.103
7.1	36.92	590.720	4.10	10,583	484.5	36,920	1.120
7.2	37.64	602.240	4.17	10,682	494.6	37,640	1.140
7.3	37.96	607.360	4.19	10,730	498.4	37,960	1.150
7.4	38.48	615.680	4.24	10,778	505.0	38,480	1.166
7.5	39.00	624.	4.30	10,875	511.8	39,000	1.181
7.6	39.52	632.320	4.40	10,923	518.6	39,520	1.193
7.7	40.04	641.120	4.45	11,019	525.5	40,040	1.213
7.8	40.56	648.960	4.50	11,067	532.6	40,560	1.230
7.9	41.08	657.280	4.56	11,163	539.2	41,080	1.242
8.	41.6	665.600	4.52	11,211	546.0	41,600	1.262
8.1	42.12	673.920	4.68	11,260	552.5	42,120	1.274
8.2	42.84	685.440	4.70	11,404	562.4	42,840	1.300
8.3	43.16	690.560	4.76	11,452	566.3	43,160	1.308
8.4	43.68	698.880	4.82	11,500	573.7	43,680	1.320
8.5	44.20	707.2	4.87	11,548	580.0	44,200	1.340
8.6	44.72	715.520	4.96	11,645	586.7	44,720	1.360
8.7	45.24	723.840	5.02	11,693	593.3	45,240	1.370
8.8	45.76	732.160	5.08	11,741	600.0	45,760	1.386
8.9	46.28	740.480	4.16	11,836	607.4	46,280	1.400
9.	46.80	747.80	5.20	11,885	614.6	46,800	1.415
9.1	47.32	758.120	5.25	11,981	621.0	47,300	1.432
9.2	48.04	768.640	5.28	12,030	630.4	48,040	1.452
9.3	48.36	773.760	5.33	12,078	634.6	48,360	1.465
9.4	48.88	782.080	5.43	12,174	641.7	48,880	1.481
9.5	49.40	790.400	5.45	12,220	648.3	49,400	1.500
9.6	49.92	798.720	5.50	12,270	655.3	49,920	1.513
9.7	50.44	807.040	5.60	12,366	662.0	50,440	1.525
9.8	50.96	815.360	5.66	12,414	668.3	50,960	1.542
9.9	51.48	823.680	5.72	12,463	675.5	51,480	1.560
10.	52.	832	005.74	12,511	681.2	52,000	1.600

NOTE.—Table is based on one cubic foot of water, weighing 62.4 pounds. A column of water 1 inch in depth and 1 square foot in area equals 5.2 pounds.

Table of Water Gages

The accompanying table of water gages was compiled and copyrighted by Charles Kuderer, of Woodlawn, Penn. It is based on actual tests made on a centrifugal mine-fan wheel, 3 ft. wide, 6 ft. in diameter, and with 2 inlets of 3 ft. diameter. The fan wheel was inclosed in a casing, the air flowing from this casing into the atmosphere; the pressure in the fan casing and the corresponding air velocity were taken.

Tin Deposits of the Carolinas

By S. Mays Ball*

Tin is reported as having been discovered in North Carolina near Kings Mountain in 1883. It was not until 1886, however, that systematic prospecting was carried on in this vicinity. In 1888 a 10-stamp mill was erected by Mr. Ledoux and associates for test purposes, but owing to litigation, work on the property ceased in the latter part of 1899. A little work was done on the Chestnut Hill property about 1892. Since that time, little or no work was done on the tin belt until 1903, when the Ross mine, at Gaffney, S. C., was discovered. The principal developments to date are the Ross mine, at Gaffney, S. C.; the deposits in the vicinity of the town of Kings Mountain, N. C.; on the southern end of Chestnut Ridge, about 2½ miles northeast of Kings Mountain; and on the plantation of John E. Jones, 7 miles northeast of Kings Mountain.

The Ross Mine

The principal development of the tin belt has been done at the Ross mine, situated about one mile easterly from Gaffney, S. C. Near the top of a low hill, beside which flows a small stream, a shaft was sunk and an open cut made; in these were found saprolitic-pegmatitic dikes, carrying varying amounts of tin ore. Just above this shaft and pit another shaft 40 ft. deep was sunk. Trenches were cut across the supposed strike of the veins, but only a small amount of tin was obtained. Numerous pits and trenches in the vicinity showed from 12 to as high as 75 lb. of tin ore to the cubic yard. The average for the soil and gravel is about 25 lb. per cubic yard.

A 40-ft. trench run back from the stream showed some good ore in the sand and gravel overlying bed rock. The area over which cassiterite has been found in the soil and gravel is about 1000x600 ft.; all of this material will undoubtedly pay to wash.

Other Tin Deposits

Tin ore is found at a point about three miles above Grover, N. C.; a distance of about 13 miles from the Ross mine. From this point it has been found almost continuously to points a mile or two above Lincolnton, N. C.; a total distance of about 28 miles. However, the principal deposits are at a distance of 7 miles northeast and southwest of Kings Mountain.

The Ledoux property is situated about 4½ miles southeasterly from Kings Mountain. This was worked extensively some years ago by trenches and a shaft, but is now idle. Tin ore has been found at various points on the plantation of E. C. Faires, and also on the Weir plantation, just southwest of Kings Mountain. Northeast of the Faires plantation some work has been done on the Falls property. A number of shafts were sunk and trenches cut and some rich ore encountered, but it was found to be pockety. Cassiterite, in the form of small pieces from the size of a grain of sand to that of a pea, has been found in small quantities at various other points in this vicinity.

About two miles northeast of Kings Mountain, toward the southern end of Chestnut Ridge, on the property of M. M. Carpenter, tin-bearing boulders weighing from 50 to 100 lb. each have been found. A little to the east of the summit of Chestnut Ridge, about ½ mile from the Carpenter property, a shaft was sunk 122 ft. on a tin-bearing vein. This is reported to be 7 ft. wide at 100 ft. depth, and is said to carry 3 per cent. tin oxide. Judging from the dump, there was not a great deal of tin ore removed from the shaft. It is reported that ore was encountered in a trench on the Ormond property, on the north end of Chestnut Ridge. On the Hovis property, about 2 miles from the Ormond property, little tin has been encountered, but the ground adjoining it on the north again shows prominent tin-bearing boulders.

The Ramseur Mill property lies about 1/3 mile northeast of the Ormond; here a large pegmatitic dike outcrops, and a great deal of cassiterite has been found as float. A trench on this ground also exposed rock carrying cassiterite. One of the most promising deposits is found at the Jones mine, about 7 miles northeast of Kings Mountain and 3½ miles northeast of Bessemer. A number of shafts were sunk here, but they have since partly filled with waste, etc.

Production of Tin from the Carolinas

The first production of tin from the Carolinas was made in 1903, when the Ross mine shipped 38,471 lb. of tin concentrate to England for treatment. The Jones mine also produced some ore during development work, but none was shipped. No shipments were made during 1904, but development work was actively carried on by the Carolina Tin Company at the Jones mine. The Beaver Dam property, 11

*Atlanta, Ga.

miles northeast of Kings Mountain, was also worked in 1904. There was no production in 1905, although prospecting and development were actively carried on in the Kings Mountain district. At the old Ledoux mine, a mill was erected to handle, not only the Ledoux ores, but those from other neighboring properties. During 1905, a small mill was erected at the Jones mine; a small amount of ore was treated, but none was shipped. The property was worked to a depth of 100 ft. and some very good ore was exposed. Perhaps the most extensive development in 1905 was on the property of the Piedmont Tin Mining Company, beginning 2 miles southwest of Lincolnton. The property is about 2 miles long and 1 mile wide and has been prospected almost over its entire area. The greatest amount of underground work was done at the Main and Henry shafts.

In discussing the work in the Carolina tin belt for 1905, Dr. Joseph Hyde Pratt, geologist of North Carolina, states that although a comparatively large amount of work had been done, it had not yet proved conclusively the real value of the tin belt. The work demonstrated, however, that economical and careful management will be necessary to make the deposits profitable.

Much development work was done in North Carolina during 1906 and 1907, but no ore was shipped or sold. The Piedmont Tin Mining Company began the erection of a mill to treat its own ore. Present conditions are about the same as those of 1906 and 1907.

Cadmium in Soft Solders

While ordinary solder answers well for many kinds of work, in others its melting point is not sufficiently low. Erwin S. Sperry (*Brass World*, May, 1909) states that the mixture of about two parts of tin and one part of lead has the lowest melting point of any of the tin and lead mixtures, so that it is impossible with tin and lead alone to obtain a more fusible solder than this one It is not generally known that the addition of cadmium to soft solder containing tin and lead greatly improves it by lowering its melting point and increasing its strength. Now that cadmium can be obtained at a reasonable price, its use in making a soft solder with a low melting point should become extensive

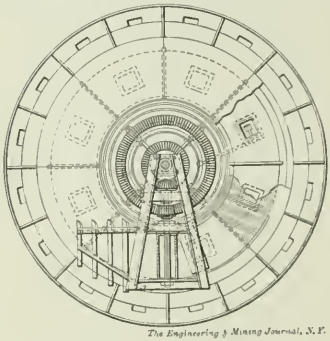
The best mixture for the soft solder containing cadmium has been found to be the following: tin, 50 per cent. (2 parts); lead, 25 per cent (1 part); cadmium, 25 per cent (1 part) The metals are melted together and a small quantity of sal-ammoniac is used on the surface as a flux This cleans it well Before pouring into bars, the solder should be well stirred in order to thoroughly mix the metals When cast, the bars of this solder have a slight roughness on the surface caused by crystallization, but this does not detract from their value. The cadmium increases the strength of the solder as can be easily ascertained by bending the bar. The stiffness will usually surprise those who are accustomed to use ordinary soft solder.

The melting point of this cadmium solder was carefully tested by means of an accurate thermometer and found to be 292.1 deg. F. (144.5 deg. C.). This is about 30 deg. lower than the best solder composed of two parts of tin and one part of lead.

As cadmium is now not very expensive, the cost of the solder is not increased very much. It will be found useful for soldering soft metals such as brittania, pewter, antimonial lead and similar metals of a low melting point, and will tend to render the soldering operation much safer, as there is less danger of melting the metal to be soldered.

Roasting Furnace

Francis D. Weeks, of Salida, Colo., describes (U. S. Pat. 916,903, March 30, 1909) an apparatus for calcining, agglomerating and sintering ores. As applied to a circular furnace, the apparatus is illustrated in the accompanying engraving showing a top plan view, partly sectional. The ore is put into a hopper mounted on the revolving frame and fed automatically to a stationary perforated grate below The frame revolves slowly enough to permit an oil or gas burner at one side of the hopper opening to ignite the ore as it is discharged and air drawn or forced through the ore completes the combustion When the frame has completed a revolution, that portion of the ore first ignited has become sufficiently calcined or sintered and is ready to be discharged from the grate surface by the scrapers attached to the revolving frame The ore to be treated is not moved from the time it is deposited on the grate until discharged into the bins around the periphery of the furnace. While a circular furnace is shown in the accompanying engraving, the apparatus may be applied to a straight-line furnace.



WEEKS ROASTING FURNACE

Conditions in Nicaragua

Judging from the reports of miners and others returning from Nicaragua, that country offers little or no inducement to the miner seeking employment. The majority of the mines employ negroes and natives almost exclusively, even on their staffs, because of the low cost for this class of labor The few mines that prefer white men are overrun with applicants for work. It is reported that many efficient miners, unable to secure employment, have found it necessary to apply to charity for funds with which to leave the country. Prospectors, unless plentifully supplied with money, fare even worse than the miners. Local assistance is practically impossible to secure, and as living expenses are very high, the prospector out of funds faces a serious problem. Some of the more unfortunate have found it necessary to walk out of the country on the beach over to Costa Rica or Honduras, feeding on cocoanuts and crabs during their tiresome journey.

It seems that there are on the Atlantic coast of Nicaragua promising deposits of various minerals, but without the aid of foreign capital, there is little hope for their development. The excessive import duties on provisions and export duties on gold have in a large measure retarded the investment of foreign capital. Mining concessions, moreover, are very questionable under all circumstances. Not only are mineral concessions contrary to the constitution, but all of them contain loopholes so that they can be annulled under some pretext or other Mineral concessions are often obtained by parties who have not the slightest intention of working the properties, but who plan to pass them off on the uninformed foreigner for whatever they can get

Mines which have been acquired under the mining code are, of course, fully protected, and such mines may be made to yield a fair profit by judicious management. Good prospects are numerous, but the money to work them must come from the outside.

In Russia there are several salt lakes and rock salt deposits in the Caucasus. According to consular reports, the more important ones belong to the state and are situated principally in the governments of Erivan, Baku and Stavropol, and in the provinces of Kars, Daghestan and Ter Their annual output is estimated at about 1,500,000 poods (24,100 tons). All salt produced in the Caucasus is either locally consumed or sent to Central Asia markets; none of it is exported

The Determination of Tungstic Acid in Low-grade Ores

The determination of small quantities of tungstic acid by known methods is difficult, and involves much time and labor. In a paper by H. W. Hutchin and F. J. Tonks (*Inst. Min. and Met.*, Bull. No. 56, May 13, 1909), the three methods of analysis in common use are described; in addition, a new scheme, more speedy and accurate, is investigated. Following are the methods of analysis in common use: (1) The aqua regia method; (2) aqua regia method with previous treatment with hydrofluoric acid; (3) fusion with alkalis and subsequent determination with mercurous nitrate.

Aqua Regia Method

Five grams of the finely powdered sample are digested at the boiling point with 50 c.c. of hydrochloric acid for several hours; 10 cc. nitric acid are then added and the digestion continued for one or two hours. The assay is well diluted with water and allowed to stand over night. After filtering and washing, the tungstic acid in the residue is dissolved in dilute ammonia, filtered and the ammonium-tungstate solution evaporated in a platinum dish. The tungstic acid obtained from ignition of the ammonium tungstate is evaporated with hydrofluoric acid to remove silica, and again ignited.

Aqua Regia Method with Previous Treatment with Hydrofluoric Acid

Five-gram charges are evaporated with hydrofluoric acid in a platinum dish to dryness. The dried residue is subsequently transferred to a beaker with water, giving a volume of about 40 c.c.; 5 c.c. nitric acid are added and the assay gently warmed to remove the bulk of the mispickel. After diluting well and allowing to stand over night, it is filtered and the residue washed on to the paper, dried and burned. The residue, after powdering again in an agate mortar, is decomposed by aqua regia, etc., as previously described.

Determination by Fusion with Alkalis and Subsequent Determination with Mecurous Nitrate

The silica and mispickel are removed from a 5-gram charge as described in the previous method. The residue is again powdered and fused in a nickel dish with caustic soda and sodium peroxide. The melt, when cold, is extracted with water and diluted to 250 c.c., of which 200 c.c. of a filtered proportion is used for the actual assay. The alkaline liquor is acidulated with nitric acid, followed by ammonia, till fairly alkaline, boiled, filtered and washed. The filtrate containing the tungsten is made neutral or faintly acid with nitric acid; mercurous nitrate solution is then added, followed by a little freshly precipitated HgO or a few drops of diluted ammonia. After warming and stirring, the precipitate settles well. It is determined as WO_3 by ignition in a platinum crucible, followed by treatment with hydrofluoric acid.

New Method

That wolfram is decomposed by boiling or by digestion on a water bath with caustic soda solution, was noted in the course of laboratory experiments on wolfram products. Investigations followed to see if the reaction could be adapted to replace the fusion with soda. With a view to its use as a solvent for wolfram in low-grade ores it was desirable first to test it on wolfram concentrate. A sample of wolfram concentrate was selected which had been agreed upon by buyer and seller; it contained 63.2 WO_3.

The finely powdered sample (0.4146 gram, was digested on a water bath with about 1½-inch stick soda and 15 c.c. of water in a porcelain dish for 45 min. The assay was diluted with water, a little sodium peroxide added, filtered and washed. The tunstic acid was determined in the filtrate by mercurous nitrate after removal of silica, etc., as in previous methods. The weight of WO_3 obtained was 0.2610 gram = 62.97 per cent. WO_3. The decomposition of wolfram under such conditions was sufficiently complete to make possible the assay of low percentages.

Details of New Method as Used for Low-grade Ores, Tailings, etc.

The charge taken may be 5 grams or more; it is better, however, to use 5.6, 11.2, 16.8, or any convenient multiple of 2.8, so that the milligrams of tungstic acid obtained represent simple ratios of pounds of WO_3 per long ton of ore. The reason for taking 2.8 grams (or multiple) is because only four-fifths of the solution is used for the actual assay, i.e., it is a convenient sort of assay ton for pounds per ton of 2240 lb. under the special conditions of the assay. The charge is digested in a 4-in. porcelain dish with 20 c.c. of a 25-per cent. solution of caustic soda (free from chloride) on a water bath for 30 to 45 min. The assay is next diluted, a little sodium peroxide added to oxidize any decomposition products of sulphides, then transferred to a ¼-liter flask and diluted to 250 c.c.; 200 c.c. of a filtered portion are first acidified with nitric acid, then made alkaline with ammonia. The assay is brought to the boiling point, filtered and washed. The filtrate is made slightly acid with dilute nitric acid and mercurous nitrate solution added in excess, followed by a few drops of dilute ammonia. On warming and stirring the precipitate settles readily. After filtering and washing the precipitate with weak mercurous nitrate solution, the paper and precipitate are ignited together in a porcelain crucible; or, if the ore is free from arsenic, in a platinum crucible. Weigh as tungstic acid; with a charge of 5.6 grams, the milligrams obtained, divided by 2, give pounds of WO_3 per ton.

For assays of ores and tailings, the sample may be reduced to a sufficient degree of fineness in a wedgwood mortar, but for concentrates an agate mortar is necessary; fine powdering is essential. For decomposing charges containing not more than 0.4 gram of tungstic acid, 20 c.c. of a 25-per cent. solution of caustic soda is sufficient. The attack with soda is rapid under these conditions, 0.4 gram of wolfram concentrates being decomposed in 15 min. to the extent of 98 per cent. of its tungsten content. As a rule, however, from 30 to 45 min. is given.

Strength of Mercurous Nitrate Solution

The solution may be conveniently prepared from mercury. From 2 to 3 oz. of mercury is digested on a hot plate for 1½ hours in a large beaker or flask (the hot plate being near the boiling point) with 25 c.c. of nitric acid (specific gravity 1.4) and 75 c.c. of water, and left on the hot plate over night. The extract, diluted to about 400 c.c., will give a saturated solution with the minimum of free acid; 20 c.c. is sufficient for most assays.

Where a porcelain crucible has (from the presence of arsenic in the ore) necessarily to be used, it is advisable to burn a batch of precipitates one after the other, and at the end transfer the accumulated tungstic acid to a platinum crucible for treatment with hydrofluoric acid. The loss of hydrofluoric acid is usually very small, e.g., on three assays of mineral from the battery, working with a charge of 5.6 grams, the total loss was 0.5 mg., equivalent to 0.08 lb. per ton on each assay. In the presence of scheelite, the method is not applicable, since the mineral is only partly attacked under the conditions of the assay.

According to the *Aust. Min. Stand.*, April 7, 1909, several discoveries of diamonds in Australia have been recorded. Some of them, notably those in the neighborhood of Bingera, Cope's creek and Inverell, have demonstrated the existence of the gems in fair number, but mostly of small size.

Statistics collected for THE MINERAL INDUSTRY show that the production of cadmium in the United States in 1908 was 10,000 lb., valued at $9300. This was the second year that cadmium was produced in the country, 15,000 lb., valued at $18,750, being produced in 1907.

Rules for Smokeless Consumption of Fuel

By Robert Grimshaw*

That the smokeless consumption of fuel by others than ourselves is a desirable end to attain, we are all ready to admit; but as a rule, we consider it to be an altruistic ideal which we cannot afford to entertain. There are times, however, when the law steps in and calls for it; and then we suddenly find that it is attended with fuel economy. The trouble is, how to attain it. The *"Magdeburger Verein für Dampfkesselbetrieb"* or "Association for Boiler Running," has laid down several rules by which the result may be attained; and the first four conditions are as follows:

1. During combustion there must be sufficient air supply.
2. The air and the combustion gases require constant intimate mixture.
3. In the fire-chamber it is necessary that all shall be red-hot, in order to ignite the incompletely consumed combustion gases.
4. Very solid fuel requires time for its complete combustion.

The permanent fulfilling of these conditions is certainly attended with a series of difficulties. The main trouble lies with the constant change of all the conditions and processes connected with combustion. For instance, the varying call for heat, caused by the fluctuating demand for steam, the varying size of the mass of coal on the grate, the intermittent addition of new coal thereon, the coking of the coal layer, the gradual collection of cinders and slack on the grate—all aid in effecting a constant change in the conditions of combustion, and increase the difficulty of maintaining the conditions constant. Farther, every kind of coal has different qualities from all the others. It is then not sufficient that the stoker shall know the proper conditions for perfect combustion; he must be careful and have practice, in order to combat the difficulties which confront him.

The Layer of Coal Must Not Be too Thick

In order that the proper amount of air shall always be present, the layer of coal on the grate must be kept loose and penetrable; that is, it must not be too thick. The proper thickness has to be learned by experience; so that with the greatest amount of draft, all the air that passes through shall be consumed. Naturally, coal which lies loosely on the grate may be carried thicker than that which by reason of its size and shape packs closely. The smaller the coal, the thinner the layer may be. The pieces should not be larger than one's fist; larger ones must be broken up; those the size of a potato being the best. With medium draft, the layer can be about 4 in. high. Pea and buckwheat coal should be fired only about 2 in. high or even less.

Whatever is the best thickness of layer on the grate, the stoker should keep it regular. He should not let the fuel burn too long without adding fresh coal. "Little and often" should be the rule. In firing, the layer should be kept as level as possible, that is, the thin places should receive special attention, so as to keep the layer level. I also believe that the fire should always be a trifle higher along the edges of the fire-chamber than in the center; there are apt to be leaks, and any draft in this circumferential line tends to cool down the walls, which should be kept glowing. Every locomotive fireman sees this without being told. The glow under the freshly laid coal should not be smothered; it must radiate through the new material into the combustion chamber; the flames should at once, on the fire-door being closed, break out anew and light the gases evolved from the latter. The fresh coal is to be strewed over the entire surface; not shoveled in, as into a wheelbarrow. Fresh coal is to be added as soon as the flame on the grate is thin and short, and before the glow is checked.

If enough air cannot be got through the grate to burn the gases evolved from the new coal, sufficient must be admitted through the partly open fire door to effect this; but only as long as these gases are evolved. The proper time can be determined by experiment.

Coking coal must be sliced before firing anew; otherwise it will not allow sufficient air to pass through it. This slicing often causes a greater development of gas than fresh firing; so that after slicing, air should generally be let in above the grate.

In order to mix the air as thoroughly as possible with the combustion gases, it is well to have a contracted space back of the fire-chamber. The size and shape of this space are best determined by experience, each case for itself.

The strength of the draft is not to be judged by the smoke, but measured by a manometer. If considerable air over the grate is desirable, and only a small amount of draft is necessary for the steam demand, it may be best to blow in the air above the fire; but for simplicity's sake this is, as far as possible, to be avoided.

Control of the Fire

Control of the condition of the fire is afforded by the flame. When seen from behind, it should not be short and broken, nor should it wave like a flag in the wind. This latter would be the sign of too thin a layer of coal on the grate. Under such conditions the flame is perfectly white, and the chimney does not smoke; but outside of the case of very "thin" coal, that is, that which is not "fat," the proper flame should be long, say 2 to 4 in.; must fill the entire flue passages, and roll and wave like a fiery sea. Such a flame is not perfectly white, but red or yellow. In any case it is bright, and the chimney will smoke but little, with a very gray smoke.

If the flame is dark, black and long, the stack will smoke plentifully; this is caused by lack of air or heat or both together in the fire-chamber.

The layer of coal should be disturbed as little as possible; it should be lessened only if it cokes or cakes. In such cases, one should be careful to let the ashes and cinder lie as far as possible untouched on the grate, and not let them get mixed with the coal; otherwise they will melt, cover the coal with a coating, and prevent its combustion. It is best that the cinder should not melt on the grate, but lie thereon as a dry, loose, porous mass. As soon as the ashes restrict the room in the fire-chamber, or the supply of air through the grate, they must be drawn off. It is advisable to have the upper edges of the grate bars slightly grooved, so that there will always be on each one a slight protecting layer of ash which will prevent them burning.

If the damper is always open, and after the admission of air above the grate there is not enough steam, that is a sign that the plant is overworked, and that smokeless combustion is impossible.

The above rules are especially adapted for stepped grates, and "half anthracite" coal.

*Engineer, Dresden A. Germany

An interesting experiment was made recently at the Garswood Hall colliery in Scotland. The screens at this colliery are near the downcast shaft, and a considerable quantity of dust is made in the process of screening, some of which finds it way back into the mine along with the ventilation. To obviate this, water-sprays have been fitted up at the bottom of the shaft, and also a frame has been put in the main airway a little distance from the shaft. Arranged around this frame are several sprays, the object of which is to wash the dust from the air as it passes through the frame. Quite a considerable amount of dust is thus washed out. With 40,000 cu.ft.of air passing through, 7½ lb. (weight after drying) of dried dust were recovered by means of a settling-tank in 14 hours, and probably as much more escaped collection, which means that the sprays washed down 14 or 15 lb. in the 14 hours. This dust originated partly at the screens and partly from the trams in the pit-shaft

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In the Usher sand process the pulp is run directly from the mill into the treatment tank where, as the tank fills, it is claimed that the slimes are completely separated and run to the slimes plant, leaving only clean sands in the vat, and after a short time only for draining, the treatment is started without the delay and cost of transfer.

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The Economics of Natural Gas Supply

Even at the present time there is a great deal of misapprehension respecting the value of a supply of natural gas. It is now well recognized that in no case is the supply inexhaustible, but on the contrary, with respect to any particular reservoir it is likely to be of short duration. Also it is now recognized that natural gas is not a costless fuel, although those who in the early days of some fields were able to obtain four or five million cubic feet per day from a single well (costing about $1500), connected with the factory by perhaps 2000 ft. of 4-in. pipe line, obtained a supply of fuel at very low cost indeed. In some cases, it was possible to obtain a gas well within the yard of the works. Such favorable conditions, however, no longer exist; or if they do, the instances are extremely rare.

A supply of natural gas involves expense under the following heads: (1) Acquisition of property and the right to drill for gas, either by purchase of the fee or by lease. (2) Drilling and equipping the wells, cost of which varies with the depth to which drilling must extend, and also with the percentage of dry holes. (3) Connection of the wells by pipe lines to the place where the gas is to be used, ordinary industrial piping being frequently from five to eight miles in length, the size of the pipe being commonly 4, 6 or 8 in. (seldom as small as 4 in. for a line of such lengths). (4) Care of wells, pipe lines and other equipment, an ordinary industrial supply usually requiring the continuous attention of a fieldman. (5) Prospecting and development, in order to extend the supply to take the place of that which is exhausted.

The gas lands of an industrial company, which furnish its fuel supply, are analogous to coal mines, and they should be considered as an independent mining department. Otherwise, the real cost of the fuel is likely to be overlooked. Gas mines differ from coal mines in that their product is not confined, and that other persons may secure it, unless the territory controls the entire area of a pool, which it is rarely possible to accomplish. In brief, gas lands merely confer the right to take gas from a common reservoir.

Natural gas occurs in nature in strata of sandstone lying at various depths below the surface. The original rock pressure appears to be more or less in proportion to the depth below the surface, being the higher the greater the depth. In order to retain an accumulation of gas, the sandstone must be covered by a stratum of some impermeable rock. The precise manner in which the natural gas occurs in the sandstone is unknown; but whether the original occurrence be as a gas or as a liquid saturating the porous sandstone, it is found that the existence of the gas is confined to certain circumscribed areas, which may be pictured as subterranean lakes, or pools, as they are commonly called. The existence of a pool having been determined, a well drilled anywhere within its boundary is likely to find gas; but not necessarily, inasmuch as it may go down in a barren spot, which may be conceived to be an island in the pool. As illustrative of the dimensions of a gas pool, the well-known Iola pool in Kansas may be cited. This was about 10 miles long and about three miles wide, and is perhaps the largest single pool yet found in Kansas. We have had occasion to study other pools, but none of which the dimensions were so great or the uniformity of the gas occurrence so striking as at Iola.

A gas pool is a reservoir of a more or less quantity of gas. When the gas has been drawn off, the life of the pool is ended. As the gas is drawn off, the pressure goes down. The condition is precisely analogous to that of a reservoir containing a quantity of compressed air. As the air is drawn off through a single outlet, the pressure decreases; and if it be necessary to obtain the same quantity of air, another outlet must be opened to secure it at the diminished pressure. So it is with a natural-gas pool. A few wells may for a time deliver a certain quantity of gas; but as the pressure goes down, the volume of gas delivered decreases also; and to maintain the supply, more wells must be sunk into the gas stratum.

In close connection with the gas, but in a way that is not clearly understood, is water. At the end of the life of a gas pool, water comes into the sand where the gas was originally. Sometimes the water does not come in until the gas pressure has fallen nearly to zero. In

other cases, water is a source of trouble and frequently cuts out a well when the gas pressure is still high. Why this should happen, we cannot say, but it is a fact that experience has shown. In this respect there is a considerable difference among gas pools. Some may continue to yield gas down to atmospheric pressure, or even less, in the latter event the gas being sucked out mechanically. In other pools, the gas supply of a well may be cut off by the influx of water when the gas pressure is still high, even as high as 300 or 400 pounds.

The measured volume of a gas well, or gas pool, is no criterion of its value. Measurements of volume are frequently of doubtful accuracy, and the occurrence of wells of large volume indicates merely that the sand is able to deliver its gas quickly without affording any idea of the quantity of gas existing in the subterranean reservoir. It has been the experience in Kansas that the wells of most endurance have been those of comparatively small flow that have been found in a dense sand which was the case of Iola. We have known a single well, or a pair of wells at that place, to supply large zinc smelters for three or four years. On the other hand, wells of immense volume, tapping a loose, open sand, have died out in a comparatively short time under a moderate draft.

An industrial company that is supplying itself with natural gas must, consequently, be careful and conservative in its figuring in order to be sure that what is apparently very cheap fuel is in reality cheap only at the expense of capital account. The actual cost is sure to develop in the final summing up, but inasmuch as that may be postponed indefinitely the opportunity for self-deception is expansive. The only safe course is to charge fully the gas supply with the current expenses of maintenance, and in addition make a liberal allowance for amortization to reimburse the principal invested. This allowance will be governed by the estimate of probable life of the pool, which is highly uncertain. An approximate idea may be obtained by periodical gaging of the wells tapping the pool and determining the rate of diminution of pressure. For this purpose, field observations should be made frequently and should be carefully recorded. In forecasting the probable life of a pool, however, the investor should be given the benefit of every doubt, in this more so than with respect to any other kind of venture.

The Price of Lake Ores

With very little preliminary discussion, the prices of Lake Superior iron ore for the present season have been fixed at last year's standard. These prices, on dock at a Lake Erie port, where most of the sales are made, are $4.50 per ton for Old Range bessemer; $4.25 for Mesabi bessemer; $3.70 for Old Range and $3.50 for Mesabi nonbessemer. The base guarantees are unchanged also, being 55 per cent. iron and under 0.45 phosphorus for bessemer ores; 51.5 per cent. iron for nonbessemer ores.

The adjustment of these prices no longer possesses the importance which it once had, since they apply only to the class of merchant furnaces which do not own their ore supply; or which use local ores to some extent and buy Lake ores to mix with them. The Steel Corporation and all the larger independent companies own their mines, and the price of ore to them is the cost of mining and delivering it. The mining may be conducted by a nominally separate corporation—in fact, it usually is—but any profit or loss shown by such a subsidiary is only a matter of bookkeeping, and it is the actual cost which enters into the calculation of the value of the final product.

There are, of course, wide variations in the cost of mining in the Lake Superior region. The ton of ore can be put on the cars for a much lower immediate price at one of the large steam-shovel mines on the Mesabi range than at a Menominee or Gogebic mine where hoisting is required and where it may be necessary to handle large quantities of water. The variations are not so great, however, when the heavy preliminary expenses of stripping and preparation for open-pit mining, under the present system, are taken into account. The cost of handling and carrying the ore to a Lake Erie port are nearly uniform and are well known; they will average about $1.60 per ton. If we take this average and add the cost of mining, there is probably, at this season's prices, only a small margin left over the value of $1 per ton for ore in the ground. That is about the current valuation of Lake ore as fixed in the transfer of the Hill ore lands to the Steel Corporation, and must probably be assumed in any future transaction. The day of leases at 25 cents per ton royalty has long gone by.

If the cost of transportation from Lake Erie to the furnace is added, the merchant furnace buying its ore must count on a cost of $4.50 to $5 per ton for its ore in all its calculations for the future. It is not likely that any future reductions will be made from the prices which prevailed during the past year of light demand. It is quite probable, indeed, that costs may increase; not, perhaps, in an advance of prices, but more probably in a decrease in the guaranteed iron content of the ores.

For the present—and for the future so far as can be foreseen—the furnaces of the North must depend largely upon Lake ores. A good deal has been said of the supply of Cuban ores. These, however, are available only on and near the seaboard, where they can be cheaply delivered by water. Moreover, the Cuban ores have become practically the property of two large steel companies, and are not offered for general sale, nor are they likely to be.

The cost of mining and delivering Lake ores must long continue to be a prime factor in the cost of steel; but the nominal selling price is, year by year, of less importance.

According to the U. S. Geological Survey, the number of buildings erected in the United States in 1908 was 163,087, which cost $546,467,300. An investigation of this subject strikes us as being far from the domain of geology. The U. S. Geological Survey will better serve the mining industry by confining its attention to a study of the geology and the ore deposits of the country than by scattering its attention among miscellaneous subjects that belong to the general field of industry. The miners of the United States want more contributions of the character of the Leadville report and the establishment of more general principles, like secondary enrichment. They are not particularly interested in statistical investigation as to the cost of buildings, bridges, etc., nor the method of manufacturing shoes. At present the Geological Survey is not only missing the bull's eye, but also is failing, a good part of the time, to see the target at all.

May Dividends

In the acompanying table is shown the amount per share and total amount, of the dividends paid during May, 1909, by a number of mining and industrial companies in the United States and foreign countries.

	Location.	A'mt. per Share.	A'mt Paid
Amalgamated, c	Mont.	$0 50	$769,439
Bunker Hill & Sullivan, s.l.	Idaho	0 15	45,000
Calumet & Arizona, c.	Mich	1 00	200,000
Camp Bird, g.s.	Colo.	0 24	196,800
Homestake, g	S.Dak.	0 50	108,200
Inter'l Nickel, pf.	N. Y.	1 50	133,689
MacNamara, s.g.	Nev.	0 01	7,283
Snowstorm, s.l.	Idaho	0 03	45,000
Lehigh Coal & Nav	Pa.	$2 00	$764 520
Buffalo	Ont.	$0.03	$27,000
Cobalt Central	Ont.	0 01	47,615
Dolores	Mex.	0.15	60,000
N.Y. & Hond. Ros	C.A.	0.10	15,000
Right of Way	Ont.	0 10	49,951
Trethewey	Ont.	0 10	94,545

International Nickel Company

The report of this company for the year ended March 31, 1909, shows no change in the stock issued, the amounts being $8,222,662 common, $8,912,626 preferred, and $54,698 stocks of constituent companies not owned. The bonded debt was $9,296,837, a decrease of $55,000 during the year.

The income account for the year may be stated as follows:

Net earnings constituent companies	$2,162,594
Depreciation and renewal funds	$267 102
General expenses	139,393
Interest on bonds	173,500
Exhaustion of mines, etc	100,205
Sinking fund reserve	177,000
Reserve for foreign consolidated companies	30,599
Special depreciation reserve	200,000
Total charges	$1,387,799
Surplus for the year	$774,795

From this dividends of 6 per cent on preferred stock, amountin to $534,733 were paid, leaving a balance of $240,862 Adding $2,216,799 brought forward from previous year made a total surplus of $2,456,861 at the close of the year

The report of President A. Monell says: "All construction work has now been completed, with the exception of repair shop and foundry at Copper Cliff The payment of four quarterly dividends of 1½ per cent. each on the preferred stock was authorized by the board of directors out of the surplus earnings of the fiscal year, and they were all paid. The board has deemed it advisable to appropriate from the surplus a further sum of $200,000 to write down the cost of the properties, as set forth in the balance sheet. The last fiscal year followed as an aftermath of the panic of 1907, and brought with it all of the depressing conditions incident to such a state of affairs Many of our customers worked their stocks up very close. As our sales are largely to steel manufacturers, they are susceptible to the influences which govern that industry.

"Energetic efforts which had been made in the introduction of the Monel metal commenced to bear fruit during last year, and the indications are that the production of this metal from our Creighton ores will be an important factor in the company's future operations and earnings. The American Sheet Steel Company, a subsidiary of the United States Steel Corporation, has taken up this metal vigorously. After a most severe test, the Pennsylvania railroad adopted this metal for the roof of its large terminal buildings in New York, and it has also been successfully used for propellers and many other purposes. While the tonnage is yet small, it is constantly and rapidly increasing."

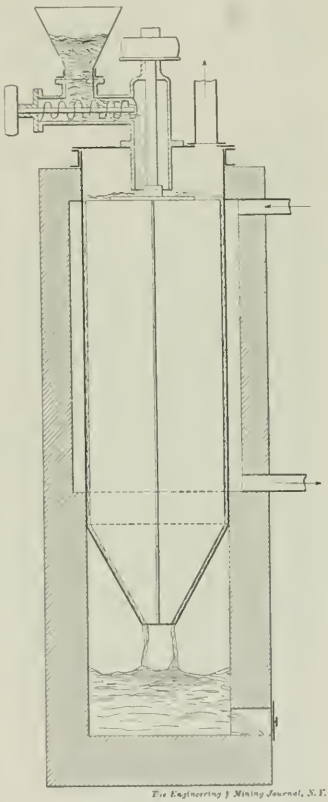
Utilizing Products of Detinning Processes

Dr. Hans Mennicke describes in British Pat 16,248 of 1908, a process for preparing, smelting and utilizing various products containing tin, particularly the metallic sponge and slime obtained by the electrolytic removal of tin from tinplate scrap. The sponge is converted under water by stamp batteries or wet-ball mills into compact metallic lumps from which the alkali-lye is drawn. After the iron has been removed by magnetic separators, the lumps are smelted with carbon and soda, or other easily fusible salts, in externally heated crucibles, the contents of which are shut off from air The soda or salt slag is ground and dissolved in boiling water, filtered, and the tin, dissolved as stannate, is precipitated from the liquid as oxide. The filtrate after being treated with lime can be used as soda lye, or sent back as electrolyte direct into the detinning process Some of the new features claimed are, the obtaining of granular metallic tin and of raw tin free from iron, besides the possibility of completely condensing the flying dust and the recovery of volatile products

The making of tinplates originated in Bohemia, according to a recent paper by William F. Gray, hammered iron plates having been coated with tin in that country some time before the year 1600. Tinplate working was introduced in England [illegible] being brought there from Saxony. In France the first tinplate factory was established in 1714. The first [illegible] manufacture of tinplates in [illegible] States was at Pittsburg, in [illegible] industry did not develop [illegible] 1840.

Smelting a Pulverized Iron Charge

Carl G. T. de Laval, of Stockholm, Sweden, describes (U. S. Pat. 913,405, Feb. 13, 1909) a method for reducing iron from a finely pulverized charge of iron ore, carbon and slag-producing agents, the thin layer of the charge being brought in contact with a heated surface whereby



The Engineering & Mining Journal, N.Y.

DE LAVAL FURNACE

the reduction is carried out. A vertical section of the apparatus employed is shown in the accompanying illustration. The pulverized charge from the hopper is fed to the center pipe by a screw conveyer, falls through the pipe to a rotating disk, which spreads it in a thin layer, and is then caught by vanes and thrown toward the hot wall of the shaft The wall is kept hot by introducing hot gases in the space between the shaft and brickwork surrounding it The charge gradually descends and the reduction takes place as the charge comes in contact with the shaft wall The lower part of the shaft is funnel-shaped and opens into a chamber, where the reduced charge gathers.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Publicity in Buying Equipment

The importance of making full use of publicity when about to purchase electrical or steam machinery is often little realized by the man behind the check book. In dull times, of course, manufacturers' agents are so keenly alive to the importance of even small sales that the announcement that one is in the market for equipment immediately brings a flood of advertising matter and starts many interviewing salesmen toward one's office. To refuse to make the most of publicity at such a time is to neglect the widest field of selection, to throw aside the opportunity to buy most wisely, and frequently at the lowest terms. In prosperous times it is still more important to make one's prospective wants known early and over the entire field, since in this way quicker deliveries can often be obtained.

In entering the market for a number of motors of different size, for example, if a company simply writes a few letters to the manufacturing houses which naturally come to mind, the freedom of choice is bound to be somewhat restricted. It cannot be assumed that any one company or group of manufacturers enjoy a monopoly of all the best designing in the motor field, for improvements are constantly being made in machinery of this kind, and orders for special motors are always being filled. The larger the number of special machines developed, the wider is the choice available to the consumer, and the more likely it is that each particular engineering problem will be solved skilfully.

This is not an argument in favor of multiplying special designs, for there is often a tendency toward overdoing this phase of electrical and mechanical work. In reality, the purchase of a special type of motor by another consumer than the original buyer helps to standardize the type, and in most cases paves the way toward a lower market price. Similar points apply in the purchase of a steam engine. Here the question of speed is frequently one of great importance, and it is only by considering a wide range of propositions and sizes that machinery best adapted to the conditions of load and economy can be selected.

It is a matter of but a few moments to cast aside the propositions which are plainly inapplicable to the situation, and the man who fears to canvass the entire available market through an inexpensive notice in the press simply throws away some of his chances of obtaining the best technical solution of his problem. And it is a matter of dollars and cents in these times to do one's utmost to secure the most efficient machinery for the requirements.

Finally, the announcement that one is shortly to become a purchaser helps both the consumer and the manufacturer. If certain of the factories are hard pressed, the circulation of an inquiry through a wider field often enables the purchaser to secure one or more machines remaining in the hands of the dealers on account of the cancellation of a previous order, or else to select a machine of slightly different type which happens to be available. It is unquestionably true that the wider the range of the announcement of intending purchase, the better will be the deliveries secured. On his part, the manufacturer can do a much better business if he is forewarned as to prospective demands for his product. The cost of handling the order tends to decrease, since preparation can be made at the plant, if necessary, to turn out the apparatus more quickly and more economically. There is room for analysis in the economic relations of plant capacity, production conditions, and the times at which orders are received. The purchaser and the manufacturer each have much to gain by the practice of full publicity in approaching equipment selections.

H. S. Knowlton.

Newton, Mass., May 22, 1909.

Patenting Mining Claims

Doubtless every man appreciates the importance of the conservation of our natural resources, and none more than the mining engineer. He has seen the depletion of these resources by extravagance and waste but he knows, on the other hand, that the term waste is a relative one. Some of the methods of conservation, some of the lines that have been drawn about the uses of property, and interpretations that have recently been given existing laws are unreasonable and peculiarly irritating. These restrictions are a heritage from the Roosevelt regime, and much as we may admire that regime and appreciate some of its results, a sharp protest should be made.

I am thinking now particularly of the lines that have been drawn about the patenting of lode-mining claims. The attitude and procedure adopted by the land office in enforcing the requirements of mineral showings on lode claims prior to patent are such as must have an effect directly contrary to that intended by the law, and are making it doubly hard for the prospector or man of small capital to secure patent at all. The federal statute on this subject provides for the "location of mining claims upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper or other valuable deposits" and it states that "no location of a mining claim shall be made until the discovery of the vein or lode within the limit of the claim located."

Of course, the former custom of permitting a location to be patented with no investigation of the supposed mineral-bearing lode and no knowledge on the part of the proper officers of government of the facts as to whether or not there did actually exist upon the property any mineral bearing lode at all, was unnecessarily loose and careless. This has been gradually changed from time to time until now the requirements are as much too severe as they were too simple.

The present policy of the land office seems to be to enforce strictly the letter of the federal statute and to require clear proof that the discovery of a mineral-bearing lode in place within the lines of each location has been made, before issuing patent. In carrying out this policy each claim for which patent application has been made is inspected and reported upon by an officer of the land department before the claim is approved for patent.

Under the land-office regulations now in force, the country is divided into so-called field divisions, at the head of each of which is the chief of the field division, and the inspection of mining claims is made under his direction. When an application for patent is filed in the local land office steps are taken at once to have it examined and reported upon by an inspector. If within a forest reserve inspection is made by a forest supervisor, or by someone acting under his direction, and if not in a national forest it is examined by an inspector sent by the chief of the field division. In either case the inspection is controlled by the chief, and the report based upon it may be accompanied by recommendations from him. His attitude is, therefore, of importance.

Papers relative to the case are forwarded to the general land office at Washington. If the inspection and report are favorable patent issues without unusual delay, but if unfavorable the local land officers are apprised of the fact and send a notice to the mineral claimant specify-

ing the charges made against the issue of a patent. The claimant is then required to file, within thirty days, an answer under oath to these charges, denying them, or setting forth a state of facts showing them to be immaterial, and calling for a hearing. At this hearing the Government is represented by the chief of the field division, who acts in direct opposition to the claimant. This is not his province, for the Government should not, and probably does not, desire that the claimant shall be loser in the contest, or shall be made to struggle against the concentrated power of the United States, but that he shall have justice. The local land officers before whom the case is heard decide on the evidence, which is then subject to review by the general land office at Washington.

The land department is much more exacting in enforcing the requirement that a lode be discovered within the lines of the claim than it should be, than the laws intend it to be. Recent hearings all through the Southwest, and probably elsewhere, have established this fact. In one hearing of which I happen to know, the chief, who personally represented the Government, contended for the cancellation of an entry on the ground that "commercially valuable" copper had not been discovered on the claim. And yet, according to the decisions of the courts, the size of the lode and the value of its contents are immaterial except where the mineral claimant is opposed by an agricultural claimant, a townsite claimant, or some other applicant who seeks to have the land removed from the operation of the mining laws. In the case mentioned there was no such opposition.

A chief of a field division was recently taken over the surface of the Gardner claim of the Copper Queen Consolidated Mining Company at Bisbee, where is a deep shaft and from which many millions of dollars worth of copper have been taken, and where there are many more millions remaining in the ground. But there is no trace of a mineral-bearing lode in place on the surface. He stated, in all seriousness and with no realization of the absurdity of the position he was taking, that "if this claim should now come before me for review, I should be obliged to report unfavorably." And the Gardner claim is on the formation.

Take the case of a claim where the mineral-bearing formation is overlaid by some later rock, conglomerate, or something else. It would be impossible, under the present rulings, for the government agents to recommend a patent, even though geologists might be absolutely sure, by their observation or even by drill or other examination made underground of the extension of the formation thereunder. All the Junction company ground at Bisbee, scores of claims in the Burro mountain region surrounded by productive areas, extensive tracts in Globe, and everywhere else, for that matter, that are proved mines would be impossible to secure, except by the sinking of a shaft into the formation and by sufficient exploration therein to determine to the satisfaction of these agents that a commercially profitable lode did actually exist there.

Where will the individual, the prospector, the poor man who is trying to develop and sell properties come out in such a case? He must give up and let some strong concern take up his lands and develop them. Such, I take it, was not the intention of the framers of the mineral laws of the United States. This extreme position taken by the land department now seems to be the rule everywhere. It is unwarranted, unjust, illegal and a distinct hardship to those who are trying to develop the mineral resources of the West.

DWIGHT E. WOODBRIDGE.

Duluth, Minn., May 17, 1909.

Slime Filtration

In the JOURNAL of May 15, 1909, appeared an interesting article on "Improvements in the Treatment of Slime by the Vacuum Filter Process," by Arthur W. Allen, of the Palmarejo & Mexican Goldfields Company, referring to certain innovations in connection with slime filtration. He has, however, omitted to say that the filter referred to is a Butters filter. The modification described illustrates one of many possible variations from the usual practice. We know of several modifications of the Butters filter that have been made by independent users and it might be of material help to the industry if others would follow Mr. Allen's example and make known interesting variations in the practice of slime filtration.

THE BUTTERS PATENT VACUUM FILTER COMPANY, INCORPORATED.

New York, May 20, 1909.

Rustless Iron

An interesting subject was touched upon by Mr. Cushman at the Iron and Steel Institute meeting recently held in this country; it was mentioned that in the past in India, the secret of nonrusting or nonoxidizing iron was known to skilled workers at that time, but has become a lost art to modern metallurgists. The monument at Delhi was mentioned, as an example for all time of the knowledge of those past masters in preventing iron from rusting, which at present is deplored as great wastage. Now we know India is famed for the purity of its iron ores ranging from the northern mountains of Kumâun to the extreme south of the Madras Presidency. The chief difficulty in smelting iron ores in India is that the three necessary elements, viz., the ore, flux and fuel, are not sufficiently near to each other. Another great drawback is the large amount of ash contained in the coal (over 20 per cent.) But returning to the rustless monument at Delhi and the process, of which those experts the Moors and the Hindus have held the profound secret, can any of the readers of the JOURNAL give any further details of this monument at Delhi? Has anyone experimented to prevent iron from rusting by furnace work, chemical treatment, etc? My own experience and experiments in this direction have resulted thus far only in retarding the oxidation.

D. O. LEWIS.

Swansea, May 19, 1909.

Electrolytic Production of Metallic Calcium

In British Pat. 24,396 of 1907, recently issued, S. O. Cowper-Coles describes an electrolytic process for obtaining calcium deposits upon one or more rotating disks of graphite or iron in proximity to the fused salt, such as calcium chloride, contained in a crucible at the bottom of which is a layer of molten metal preferably lead forming the anode connection. In the furnace the calcium chloride is first introduced into the calcining chamber, then passes into the fusing chamber, from which it flows in a molten condition to the crucible with the disks, these being rotated by electric motors or other suitable means. Mr. Cowper-Coles also proposes to use in the electrolytic separation of metals from fused salts a rotating cathode in the form of a disk immersed in the fused salt. This, however, would not be suitable for the production of metallic calcium, owing to the fact that the deposited calcium would be redissolved by the electrolyte.

In British Pat. 6029 of 1908, the Company Bismarckhütte describes a method of improving steel produced in electric furnaces. The steel previously refined in a basic electric furnace is passed into a crucible with an acid lining and allowed to settle. A mechanical readjustment takes place, the steel taking up silicon, and a favorable influencing of the internal structure of the steel is claimed. In addition it permits the production of iron alloys in a controlable manner, or the addition of modifying agents. The latter is accomplished by passing the unalloyed steel into the crucible before adding the modifying constituents.

The United States production of antimony ore for 1908, as shown by reports collected for THE MINERAL INDUSTRY, was 360 short tons as compared with 210 short tons in 1907; the value of the 1908 output $19,800, as compared with $28,432 for 1907.

The Analysis of Oklahoma Blendes

By L. T. Merrill*

The ordinary methods of zinc-ore analysis are not applicable to the ores of the Miami district because of the variable results produced by the bitumen and natural oil which is never absent. Until this was recognized and the proper remedy applied the chemists of the Joplin district were wont to report results of such great variability that they were frequently bewildering.

The first two cars of this ore analyzed by our laboratory (September, 1908), gave the following results: No. 1, sellers' analysis, 44.7 per cent. zinc, 3.6 iron; buyers' analysis, 42.6 zinc, 7.7 iron. No. 2, sellers' analysis, 44.8 zinc, 2.7 iron; buyers' analysis, 45.1 zinc, 4.5 iron. This made a difference of $6.20 and $2.10, respectively, on every ton of ore. I may say here that any difference in analyses over $1 per ton is not ordinarily tolerated.

A series of analyses run on these two samples was only negatively successful, the results varying to such an extent that it was evident that something, most probably the method, was at fault. An exhaustive complete analysis showing no striking dissimilarity between these and other ores of the Joplin district which caused no trouble, the bitumen and oil was evidently the disturbing factor.

To get rid of this oil was naturally the first expedient. The weighed charge was slowly brought to a red heat in a porcelain crucible, cooled, transferred to a flask, and the analysis carried out by the usual method. The results were most startling; all irregularities ceased, the results checking closely, but in every case the iron percentage obtained was higher than that shown previous to the preliminary heating, the difference being generally from 1 to 5 per cent. The irregularities in the zinc analyses ceased, but no very marked differences were manifest.

Subsequent investigations have shown that the oil and pitch surround particles of the ore (chiefly the marcasite and pyrite) and prevent reduction by the acids. This roasting method has since become almost general throughout the Joplin district and with uniformly good results. The following is a brief description of this method as practiced in our laboratory:

Scheme

The ore ground impalpably fine in an agate mortar, is weighed into a porcelain crucible of about 20 c.c. capacity; in this it is brought very slowly (to avoid any decrepitation) to a low red heat. The crucible and contents are then cooled and the ore transferred to a "copper determination" flask of about 200 c.c. capacity by means of a small camels'-hair brush. Decomposition of the ore is effected by 8 c.c. of 1:1 hydrochloric and nitric acid. When complete, 3 to 4 grams of chemically pure ammonium chloride are added and the contents allowed to boil until intumescence occurs; 50 c.c. of hot water is then added and when all is in solution, 7 c.c. of ammonia. The contents are brought to a brisk boil, then filtered into a No. 3 beaker.

The ferric hydrate, etc., is well washed on the filter with a hot dilute solution of ammonium chloride. After thorough washing the ferric hydrate is dissolved with 1:5 hydrochloric acid into the original flask through the filter, the filter washed, the iron precipitated with 5 c.c. ammonia and boiled and the filtering repeated. The filtrate is then acidified with 15 c.c. hydrochloric acid, warmed and titrated with standard $K_4Fe(Cu)_6$ solution.

The chlorides are washed from the precipitate of ferric hydrate, which is then dissolved into a clean flask with 1:5 sulphuric acid; a few grams of granulated zinc are added, the contents brought to a boil, taken off, allowed to stand until the zinc is all dissolved, and the solution cold. Then titrate with standard $KMnO_4$ solution.

*Chemist, Cockerill Zinc Company, Webb City, Mo.

Finished Iron and Steel Production

The American Iron and Steel Association has just published statements of the production of finished iron and steel in 1908, which serve further to show the trade depression of the year. The production of rolled iron and steel in various forms is given below, in long tons:

Products.	Iron.	Steel.	Total.
Rails	71	1,921,540	1,921,611
Structural shapes	2,423	1,080,758	1,083,181
Plates and sheets	54,033	2,595,660	2,649,693
Nail plate	15,482	30,265	45,747
Wire-rods	509	1,816,410	1,816,949
Rolled forging blooms and forging billets	282	121,039	121,321
Merchant bars	685,233	1,301,405	1,986,638
Skelp, flue, etc	297,049	853,534	1,150,583
Splice-bars	10,502	81,308	91,810
Hoops	1,000	169,860	170,860
Bands and cotton-ties	293	238,148	238,441
All other	171,572	380,383	551,955
Total	1,238,449	10,590,340	11,828,789
Total, 1907	2,200,086	17,664,736	19,864,822

Of the plates and sheets reported last year 1,271,021 tons were classed as plates, being No. 12 gage and thicker; 1,378,072 tons were sheets, No. 13 gage and thinner.

While exact figures cannot be given, as the two reports are in different forms, it is approximately correct to say that the United States Steel Corporation last year produced 55 per cent. of the total finished iron and steel made and sold.

The total decrease in rolled products last year was 8,036,033 tons, or 40.5 per cent. The production of rails has been heretofore given in detail.

Nails

The production of nails of all kinds for two years past was as follows, in kegs of 100 lb. each:

	1907.	1908.	Changes.
Cut	1,109,138	956,182	D. 152,956
Wire	11,731,044	10,662,972	D. 1,068,072
Total	12,840,182	11,619,154	D. 1,221,028

All the wire nails and 646,062 kegs of the cut nails were made from steel. Last year wire nails were 91.8 per cent. of the total, and cut nails 8.2 per cent.

The nail make showed a much smaller decrease than any other form of steel, except tinplates.

Tinplates

The production of black sheets and of finished tinplates and terne-plates is reported as below. The black sheets are the plates rolled for coating with tin. The figures are in long tons:

	1907.	1908.	Changes.
Black plates	504,072	513,771	I. 9,699
Finished:			
Tinplates	444,933	468,257	I. 23,324
Terne-plates	69,842	68,829	D. 1,013
Total	514,775	537,086	I. 22,311

Of the black plates rolled in 1908 only 2954 tons were of iron. Tinplate production was the only form of iron or steel which showed increased production last year.

Charcoal Iron Blooms

The production of iron blooms, billets and bars in charcoal bloomaries from pig iron or from pig iron and scrap, for the consumption of the makers or for sale, amounted in 1908 to 55,973 tons, against 84,623 tons in 1907 and 94,099 tons in 1906. The charcoal iron blooms, slabs, etc., produced in 1907 and 1908 were made in Pennsylvania, Maryland, Kentucky and Ohio. In 1906 these products were made by these four States and Delaware. Charcoal iron blooms are chiefly used in the manufacture of skelp for boiler tubes and in the manufacture of black plates for terne plates. About four-fifths of the annual production is consumed by the makers.

Forges for the manufacture of blooms and billets from iron ore have not been in operation in the United States since 1901, in which year the blooms and billets so made amounted to 2310 gross tons, all made in the State of New York. All the Catalan forges in the United States have long been abandoned.

The only charcoal blast furnace in England is at Backbarrow in Cumberland. It was recently relined and repaired, and went into blast again early in May. It has been in operation over 60 years.

New Publications

High-tension Underground Electric Cables. By Henry Floy. Pp. 135, illustrated. 5x7½ in.; cloth, $2. New York, 1909: Electrical Publishing Company.

Sanitation and Sanitary Engineering. Revised Edition. By William Paul Gerhard. Pp. 174. 5x7½ in.; cloth, $1.50. New York, 1909: Published by the author.

The Manufacture of Explosives. Twenty Years' Progress. By Oscar Guttmann. Pp. 84, illustrated. 6x9 in.; cloth, $2. New York and London, 1909: Whittaker and Company.

Second Report on the Clay Deposits of Georgia. By Otto Veatch. Geological Survey of Georgia, Bulletin No. 18. Pp. 453, illustrated. 7x10 in.; cloth, Atlanta, Ga., 1909: Geological Survey of Georgia.

Investigations of the Coalfields of Wyoming by the United States Geological Survey in 1907. By J. A. Taff, E. W. Shaw, C. W. Washburne, E. G. Woodruff, E. E. Smith, M. W. Ball and A. R. Schultz. U. S. Geological Survey, Bull. No. 341B. Pp. 282, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

The Rhodesian Miner's Handbook. Revised Edition. By F. P. Mennell. Pp. 167, illustrated. 5¼x8½ in.; cloth. Bulawayo, Rhodesia, 1909: Ellis Allen.

Contents: Geological formations. The origin of ore deposits. Character of orebodies. Prospecting, etc. Work with the blowpipe. Precious metals. Base metals, etc. Precious stones. Coal. Working notes.

Alloys and their Industial Applications. By Edward F. Law. Pp. 269, illustrated. 5½x9 in.; cloth, $4. Philadelphia, Penn., 1909: J. P. Lippincott Company; London, Charles Griffin & Co., Ltd.

Contents: Properties of alloys. Methods of investigation. Constitution. Influence of temperature on properties. Corrosion of alloys. Copper alloys (bronze). Copper alloys (brass). Copper alloys (special bronzes and brasses). German silver and miscellaneous copper alloys. White metal alloys, lead, tin and antimony. Antifriction alloys. Aluminum alloys. Silver and gold alloys. Iron alloys. Miscellaneous alloys.

Principles of Mining. By Herbert C. Hoover. Pp. 109, illustrated. 6x9 in.; cloth, $2.50. New York and London, 1909: Hill Publishing Company.

Contents: Valuation of copper, gold, lead, silver, tin and zinc lode mines. Development of mines. Stoping. Methods of supporting excavation. Mechanical equipment. Ratio of output to the mine. Administration. The amount of risk in mining investments. The character, training, and obligations of the mining engineering profession.

This book is appropriately entitled the "Principles of Mining" because it deals with the fundamentals of the art from the economic standpoint, and that, of course, is the only reason why mining is prosecuted at all. The great treatises that discuss in detail the technics of the art concern themselves with the means how. Mr. Hoover treats broadly of the means how, but confines himself chiefly to the reasons why, and so far as we are aware he is the first author to take up that elemental phase of the subject. It has been done, of course, in a fragmentary way in contributions to the technical press and the proceedings of the societies, but no one previously has elaborated a treatise upon it. It is singularly fortunate that Mr. Hoover should be the first to elect to do so, because we can conceive of no one else so thoroughly competent. He is so well known in the profession and in the industry at large that it is unnecessary for us to expand respecting his capacity. It is sufficient for us to say, and this merely for the information of the laymen, that he is not only eminent as an engineer, but also as a manager of mining enterprises of the first magnitude in many parts of the world. The profession and everyone interested in the mining industry are to be congratulated that he has taken the trouble to write this book.

Building Construction and Superintendence. Part I, Revised Edition. By F. E. Kidder. Revised and enlarged by Thomas Nolan. Pp. 965, illustrated. 7x10 in.; cloth, $4. New York, 1909: William T. Comstock.

Contents: Foundations on firm soils. Foundations on compressible soils. Masonry footings and foundation walls. Shoring and underpinning. Limes, cements and mortars. Building stones. Cut-stonework. Bricks and brickwork. Architectural terra-cotta. Fireproofing of buildings. Concrete and reinforced concrete construction. Iron and steel supports for masonwork—skeleton construction. Lathing and plastering. Specifications.

It is unnecessary for us to enter into any description of this well known work, which for many years has been a classic among architects, engineers and builders. It was Mr Kidder's intention to publish a thoroughly revised edition, but personally he was unable to undertake it. Shortly before his death he expressed the wish to his friend, Thomas Nolan, assistant professor of architecture in the University of Pennsylvania, that he should do it. In carrying out that wish Professor Nolan endeavored to bring it down to the present day in such form that it will continue to hold a high place as one of the best contemporary practice in the elements of architectural masonry construction and superintendence. In the execution of that idea he has been entirely successful. There has been an entire revision, and many new chapters have been supplied. The book will continue to hold its place as a classic, with the additional advantage of being thoroughly uptodate. Of course, it is a work that no architect or builder can afford to be without. We may add that it is of the highest importance to constructing engineers in general practice, many of whom do not possess the acquaintance with it that they ought.

Crelle's Calculating Tables. New Edition. By O. Seeliger. 10x15 in.; cloth, $4. Berlin, 1908: George Reimer.

This book is useful chiefly for tabular computation where many numbers are to be multiplied by the same factor. It gives directly, without further calculation, the products for the multiplication of every two numbers from 1 to 1000, quotients up to 1000, obtained from divisions, and the application to multiplication and division of all numbers above 1000. Methods are given for readily obtaining square, cube, and biquadratic roots. The tables enable procedure with three figures at a time, in obtaining roots, instead of with one at a time, as in ordinary calculating. Each page contains 2000 products, i.e., those of each of the two factors at the top of the page with all numbers from 1 to 1000. In multiplication the hundreds of the second factor are found along the same horizontal line as the first factor, at the top of the page. The tens and units in a column to the left of the page. The product is found by following down the hundreds column to the horizontal line of the tens and units. The last two figures are placed apart in the last vertical column to the right of the page, as they are the same for all products given on the same line.

In dividing, the nearest product below the one given is found on the page of the other number. (One of the numbers is considered as the dividend, the other as the divisor.) The heading of the column under which the product is found gives the hundreds of the quotient and tens and units are found on the same horizontal line, in the last column to the left of the page.

These tables have been rearranged so as to be much more convenient and so as to minimize the chances for errors entering the work. Originally the tens-multiples of any factor were omitted. These have been supplied in the present publication so that products of all multiples of tens can be directly read off. Other alterations have been made to make the tables more complete and easy of manipulation. They are of great use to engineers and others who have to make many computations. The price is surprisingly cheap considering the magnitude and character of the work.

Devices for the Prevention of Overwinding

Several efficient combinations of throttle-closing devices and automatic brakes have been invented and patented by the Sullivan Machinery Company. Where these are in use, writes S. T. Nelson, superintendent of the Chicago Works of the Sullivan company, in *Mine and Quarry*, a dangerous overwind is practically impossible. Someone not familiar with these devices may ask the question, "In case of a lower boiler pressure than that for which the hoist in intended, if the throttle is closed at the same point as it would be closed if the boiler pressure were higher, will not the engine come to a standstill before the landing is reached?" Regarding this, it should be explained that after the main throttles are automatically closed the engineer cannot reopen them until the engine is reversed. Should it be necessary to admit more steam to the cylinders a small bypass throttle is provided for this purpose, connected with the operator's platform by means of a hand lever or foot treadle. From this small throttle the steam is conveyed to the main cylinders through a pipe varying from 1 to 2 in. in diameter according to the size of the machine, and a sufficient amount of steam is admitted to the cylinders to complete the lift without increasing the speed of the engine beyond one at which the automatic brake can safely be applied. The automatic closing devise is so adjusted that with the heaviest boiler pressure and the lightest load the engine will come to a standstill, or nearly so, before the point is reached where it is desired to apply the automatic brake and stop it entirely.

The bypass throttle is also very convenient to use instead of the main throttles when hoisting officers and miners or examining the shaft. Due to the small size of the bypass throttle and the small amount of steam admitted through it, a large hoisting engine can be much more conveniently controlled with it than with the large throttle.

The automatic throttle-closing device is not only a means of safety, but a means of economy as well. A great many hoisting engineers will not shut the throttle until late in the trip, at least part of the time. The hoist is then running at such a speed that the brake has to be applied to arrest the momentum long before the landing is reached, whereas had the throttles been closed several revolutions earlier that much steam would have been saved, instead of being wasted in the neutralization of its energy by the brakes.

Several instances are recorded in which the hoisting engineer has come up to a level, taken on a load and, by mistake, reversed the engine and lowered the load, instead of hoisting it. The down going skip pulled the engine backward at full speed, with the steam admitted to the cylinders in the same direction, thus acting with gravity, instead of against it.

But even though the speed of the machine was controlled by the down-going weight and not by the steam, the automatic brake was applied, and with the exception of breaking a part of the overhead sheave, no damage was done. Had not the automatic brake gone into action the loaded down-going skip would have shot the empty up-coming skip through the top of the shaft house.

Salt Production with Exhaust Steam

By Norman B. Beasley*

There is now going on in the salt industry, especially in Michigan, a transformation almost as radical as occurred when Michigan lumber first brought out Michigan salt. It is a change from the saw-mill system of producing salt, in which fuel economy was no object, to a time that is almost here when fuel will be the main consideration. Much of the future salt supply of this section is destined to come from mineral fuel, in which case its cost directly becomes an important factor in the salt production, or indirectly, as in the case of a salt works using exhaust steam from a manufacturing plant. Either of these situations forces upon the salt producer a realization of the fact that steam costs money. Economy and efficiency then become important factors.

Steam economy and evaporative efficiency are subjects that are always of interest and there is a relatively small amount of literature on the subject of brine evaporation available for general reference. To secure reliable data on this subject, George B. Willcox, of the Willcox Engineering Company, Saginaw, Mich., made a number of evaporative tests on salt-producing apparatus of different kinds. Some of these tests were made on salt grainers. The objects of the test were: (1) To determine the amount of steam required to produce a barrel of salt—280 lb.; (2) to record, for future reference, the variations in temperature of the brine as evaporation proceeded; (3) to ascertain the amount of brine required to make a barrel of salt; (4) to record the fluctuations in steam pressure, pressure of the atmosphere, temperature of the air above the grainer, and temperature of the outside air in order to show, if possible, the effect of these items on the economical production of salt.

No attempt was made to secure especially favorable conditions, the plant being run during the test exactly as the salt maker had been accustomed to run it. The salt was obtained from a natural brine and the steam for the salt plant was exhaust steam from a factory, the pressure averaging 1.6 lb. per sq.in. and containing 3 per cent moisture. The test was divided into eight intervals as shown in the accompanying table. The rate of condensation was at first rapid and fluctuated considerably for the first 9 hours at which time the salt was being raked out. The rate of condensation for the next 37 hours, period No. 2, was approximately uniform, but changed to a different rate, which was substantially followed for the ensuing 53 hours.

BRINE EVAPORATION WITH EXHAUST STEAM.

Period.	Hours.	Salt, Pounds.	Steam, Pounds.	Pounds per Hour.		Pounds Steam Required to Produce One Pound Hot Salt.
				Salt.	Steam.	
1	9	.....	26,320		2,924	
2	37	25,297	91,354	684	2,466	36 05
3	53	32,968	110,570	623	2,086	33 48
4	17½	11,783	39,396	673	2,245	33 36
5	34½	20,896	69,286	605	2,008	30 1
6	4	2,468	7,594	617	1,898	30 76
7	24	10,640	45,452	443	1,477	31 8
8	13	6,900	24,040	531	1,849	34 9

By comparing the total steam condensed in any period with the total salt produced in that period, we obtain the pounds of steam required to produce a pound of salt during a given period. Knowing the cost of the steam we can find the cost of producing a pound of salt during each of the given periods, and an analysis of the conditions existing during that period gives us an insight into the conditions required for economical production. There were many variable conditions, such as specific gravity of the brine, changes in ventilation in the grainer room, agitation of the brine surface, and depth of brine above the grainer pipes. These data are not available at the present time but a study of the general results given in the table will perhaps prove illuminating.

*Detroit, Mich.

The 1908 production of fine silver in the United States, according to figures of The Mineral Industry, only amounted to 51,708,053 oz. ($27,382,523) against 56,514,700 oz. ($30,019,358) in 1907. The low price of the metal in 1908 curtailed the output.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

C. Colcock Jones has been at Manhattan, Nev., examining placer ground for Los Angeles people.

Frank Huntziker is now connected with the office of Victor Rakowsky, at Duluth, Minn., as associate enineer.

Victor Kerr has been appointed superintendent of the Gold King Mining Company at Silverton, Colorado.

Eli T. Conner has opened an office in the Real Estate Trust building, Philadelphia, Penn., as consulting mining engineer.

D. M. Haynes, of Golden, Colo., has gone to Yucatan, Central America, to look over mines in the interests of eastern people.

J. H. Robeson has been appointed general manager of the Dives-Pelican and Seven-Thirty mines at Silver Plume, Colorado.

J. A. Whittier, manager of the Goodenough mine, Slocan, B. C., has returned to Nelson, B. C., from California, where he spent the winter.

Burr & Fergusson, civil, hydraulic and mining engineers, have opened offices in the Loo building, Hastings and Abbott streets, Vancouver, British Columbia.

William E. Miller, secretary of the Arizona Copper Company, and George Richmond, one of the directors, are in Clifton, Arizona, inspecting the work of the company.

Herbert Haas has left San Francisco for Salt Lake City in reference to his sintering process, and will continue his trip to Cleveland, Ohio. He expects to be gone for at least a month.

James Cronin, of Spokane, Wash., formerly manager of the St. Eugene lead-silver mine, East Kootenay, has gone north to develop a mining property in the Babine mountains, Skeena River district of British Columbia.

Arthur C. Fox has resigned as representative of the fee-owners of the Silver mine at Virginia, Minn., and has left for Clealum, Wash., where he has accepted the position of superintendent of the Duluth-Pacific Copper Company.

W. W. Keefer, recently with the Monongahela River Consolidated, has been appointed vice-president and general manager of the Pittsburg Terminal Railroad and Coal Company, and will have charge of all the coal-mining operations.

Samuel M. Robins, for years superintendent of the New Vancouver Coal Mining Company's collieries in the Nanaimo district, Vancouver island, B. C., is now living at Ilfracombe, Devonshire, England, and has much improved in health.

Charles S. Witherell, formerly superintendent of the copper department, Perth Amboy plant, American Smelting and Refining company, has been appointed to similar position with the Balbach Smelting and Refining Company, Newark, New Jersey.

Victor Rakowsky has been superintending concentrating tests at Dallas, Tex., and from that point left for the Cascade mountains, Wash., and Butte, Mont., for the purpose of examining mining properties. He will return to Duluth, Minn., about the middle of June.

James S. Douglas, for a number of years connected with the Phelps-Dodge interests, has resigned the position of manager for that company in Sonora, Mexico, and will be succeeded by J. S. Williams, Jr. Mr. Douglas has built a house in Douglas and will move to that city from Naeozari, his intention being to spend a year in traveling, during which he will visit the principal copper mines of the world.

Hon. Edgar Dewdney, of Victoria, B. C., who was engineer in charge of the work of making a road much used by Cariboo pioneers and the trial from Hope, on the Fraser river, to Wild Horse creek, the scene of another important gold rush nearly half a century ago, recently celebrated the jubilee of his arrival in British Columbia from England. Beside having been associated with much pioneer work in connection with placer gold mining, Mr. Dewdney has served as a member of the Dominion government, and has been lieutenant-governor of the Northwest Territories and of British Columbia.

Obituary

Major J. R. Graham, of London, England, technical adviser for the East Tilbury (Canada) Oil Fields, Ltd., died suddenly at Chatham, Ont., May 26. Prior to entering the oil business, Major Graham saw active service with the British Army, subsequently becoming British military attache at Washington.

Francis X. Pund, vice-president of the D. T. Williams Valve Company, Cincinnati, O., passed away at his home, after a brief illness, Saturday morning, May 8, aged 57 years. He was born in Cincinnati and after service with several firms, in 1904 he entered the manufacturing business and with David T. Williams, founded the D. T. Williams Valve Company. Mr. Pund was a prominent member of various business organizations in which he took a great interest.

George C. Edson, who died suddenly at St. Albans, Vt., May 21, was recognized as an authority on geology and studied particularly the Cambrian division. Only recently he discovered what is called Mid-dle Cambrian in Vermont, with many fossils not before found in the State. He had long been in correspondence with the Smithsonian Institution and United States Geological Survey. He had been engaged for years under the direction of Professor G. H. Perkins, State geologist, in studying and writing of the geology of the upper part of the State.

Societies and Technical Schools

Lackawanna Chemical Society—This association held its monthly meeting May 25, in the new laboratory of the Delaware, Lackawanna & Western Railroad, at Scranton, Penn. This building, with its fixtures, will have cost about $40,000 when complete in detail. Testing machines for metals, cement, wood and rubber hose are in place including a Reihle 200-000-lb. machine. There are fine soapstone topped chemical benches on the second floor, with a complete system of hoods, and other methods of ventilation. The Lackawanna finds that it pays to test boiler water, fuels, oils, cement, metals, paints and almost all supplies purchased in large quantities.

American Society of Engineering Contractors—This organization has a membership of about 1500, scattered over the United States, Canada and Mexico. The object is to assist engineers and contractors to better the conditions under which they work, to establish a high professional standard, obtain better contracts and specifications and to bring together on a common ground engineers, contractors and the manufacturers of engineering tools and equipments. The following officers have been elected for 1909: George A. Jackson, Chicago, president; Halbert P. Gillette, New York, first vice-president; D. E. Baxter, New York, second vice-president; Daniel J. Hauer, New York, secretary; Prof. Alex. Haring, New York, treasurer.

Coal Mining Institute of America—The summer meeting will be held at Punxsutawney, Penn., June 29-July 1. The following papers are promised:

Address of Welcome, A. W. Calloway; "The Safe Use of Electricity in Mining," George R. Wood, Pittsburg; "Clay Mining and Its Relation to Coal Mining in Central Pennsylvania," R. R. Hice, Beaver, Penn.; "The Sociological Side of Coal Mining," C. Rae King, Crabtree, Penn.; "Mine Inspection with Respect to Car Allotment," H. B. Douglas, Philipsburg, Penn.; "The Preservation of Mine Timbers," John M. Nelson, Jr., Washington; "European Coal Mines; J. W. Paul, Pittsburg; "The Heat of Coke Ovens," J. R. Campbell, Scottdale, Penn.; "Methods of Bringing Down Coal Other than by Blasting," William Seddon, Brownsville, Penn. Wednesday June 30 visits by special train to mining plants in Indiana and Armstrong counties have been arranged.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Johannesburg

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 26—The phenomenal success of quartz miners at Alleghany, Sierra county, within the past two months has been such as to attract the attention of mining communities in all the Pacific Coast States. Large numbers of men have gone to that section prospecting and trying to buy old properties or prospects. The region has been worked for nearly 60 years, though it has never been placed where capital has done much. Indeed, the location is to a certain extent an isolated one, there being no railroads anywhere near it, and not even good wagon roads. As a result the miners who have worked there for years have made comparatively little development as far as deep mining is concerned, and a large number of discovered prospects have remained prospects for years, until now they have taken on a value owing to the finds in several of the mines which have been properly worked. A year or more ago the finding of a large body of exceptionally rich ore in the Tightner mine, owned by H. L. Johnson, first called attention to the possibilities of the Alleghany section. Men who have gone in there since have discovered even richer and larger orebodies than those of the Tightner. Capitalists from all directions are trying to get hold of such available claims as they can. It is a Colorado man, E. H. Wilson, who has developed the richest mine of the section—the Sixteen-to-One—from which he took some $400,000 in six weeks after the discovery in the tunnel on April 1, and the mine is still yielding largely. Mr. Wilson makes no secret of the mine's production as it is not for sale and he owns most of it.

Within the past two weeks other strikes of magnitude have been made in the Alleghany section. H. L. Johnson, owner of the Tightner, bonded the El Dorado two weeks since, and a few blasts in specimen rock loosened between $50,000 and $60,000 worth of gold ore. The Morning Glory mine, near by, owned by Rohrig Brothers, has broken into rock of immense value, some $70,000 being taken out in a few days. The Rainbow mine at the same place, I. P. Woodbury, manager, has struck "jewelry" rock also. In this property they expect to cut the Tightner vein in their tunnel within a week. As may be supposed, these developments have had the effect of starting up work on a number of old and new properties in the vicinity. Not only that, but other parts of Sierra county are sharing in this prosperity. The Bonanza King, a Southern Sierra property near the Middle Yuba river, has begun shipping very high-grade ore to the smelter. Ole Johnson, of Mountain House, a few miles from Alleghany, has unearthed a rich surface pocket. The Chipps mine above Sierra City is again in bonanza ore. San Francisco men, represented by F. M. Phelps, have bonded the West Point mine, seven miles from Downieville, and are opening it. The White Bear drift mine, seven miles from Downieville, has broken into high-grade gravel. The manager, John Costa, has found deep blue gravel which pans freely. The old Alaska mine, at Pike City, after five years' struggle against water, now has it under control with the big electrical pumps. The crosscut from the bottom of the new 580-ft. shaft is expected to cut the long-sought ledge soon. Manager George St. John has his mine now well equipped. The Keystone company at Sierra City has been reorganized by W. H. Perryman, T. C. Batting and others as leasers, and the mine is being worked again. The old Cleveland mine, between Sierra City and Downieville, has been bonded to John W. Shinn, of Pelham Manor, N. Y., and is being started up.

Had any of these strikes occurred in one of the southern Nevada mining camps there would have been a "rush" and wild excitement on the stock exchanges. But none of the California mines are listed on the stock boards, so that little is said in San Francisco papers about what is being done in Sierra county.

The strike of miners in Amador and Calaveras counties, over the eight-hour law, and the enforcement of the provision adopted by mineowners that men must work eight hours "at the face," at one time last week threatened to become serious. In Amador county particularly, many miners quit work. Agents of the miners' unions came to Jackson where the big mines are, and endeavored to force the employers to come to their terms, but without success. The strike has finally been settled according to terms offered by the mineowners and the men have gone back to work on the new schedule by which they use their own time, not the owner's, in going to and coming from the place they work in the mine. One of the big companies started to sell its supplies and timbers and the miners feared a general shut down of the other properties. After consultation they decided to accept the owners' offers. The same thing occurred in Calaveras and other counties, so that it looks now as if the mineowners had won their point. No test case, however, has yet been commenced.

The tramline of the Balaklala Copper Company at Coram has been again started up and is delivering 500 tons of ore daily to the smelter. The wreck of the ore bunkers stopped matters for a month or so but the mine is again at work with 225 men on payrolls. The bulk of the fluxing ores for the smelter comes from Nevada, though some is mined at the Reid property in Shasta county.

W. S. Fletcher and associates, of Los Angeles, who have bonded a number of gravel properties on the Forest Hill and Michigan Bluff divides in Placer county, have commenced development work on them. At the Home Ticket, near Last Chance, 20 men are working on the channel. Work has begun on the Red Sea mine in Devil's Cañon and the Paragon drift mine near Forest Hill. Several of these mines are on gravel channels of proven richness but have laid dormant for want of capital to run the necessary bedrock tunnels. They are all drift properties.

The Mose Rogers group of mines in Quartzburg district, Mariposa county, has been bonded to New York men through James F. Peck of San Francisco. They include the Washington, Franklin, Jenny Lind, No. 9, Quartz Mountain, Pool and several others. Some of these mines have been large producers and some are equipped with hoists, mills, etc. After necessary repairs the power will be obtained from the Exchequer company's electric plant on the Merced river. The mines are near Hornitos.

The Anti-Débris Association is afraid that the laws against hydraulic mining are not being obeyed, because they find that the miners are making efforts to keep the watchmen or "spies" away and keep themselves posted by telephone or otherwise when a watchman is likely to come to their neighborhood. In Placer and Nevada counties notices have been conspicuously posted, meant chiefly for the Anti-Débris watchmen. The "warning" states: "You are now on private property and amenable to law as a trespasser. Retrace your steps as speedily as possible or you will be roughly handled and subject to arrest. We are not hiring any help and do not want any sightseers. Get out and stay away. These orders will be enforced by local police officers and a detective agency."

Butte

May 20—News comes from New York that J. G. White & Co., of that city have underwritten the $2,500,000 bond issue of the Butte & Helena Electric Railway Company, recently formed for the purpose of constructing an electric line between Helena and Butte. It is probable that work on the construction of the line will be begun immediately.

J. W. Murphy, Jessie S. Murphy, Duncan McRae and Margaret McRae have instituted action in the local district court against J. M. Kennedy and Maurice Eisenberg for the recovery of 20,000 shares of stock of the Butte Hill Copper Mining Company. In the complaint it is alleged that the defendants received the stock for use in promoting the company but that they have failed to use the stock for that purpose and have converted it to their own use. Certified articles of incorporation of the Montana, Idaho & Pacific Railway Company have been filed in the office of the county clerk of Missoula county. The company is an Idaho corporation with a capital of $16,000,000 and was organized for the purpose of constructing a road from Lapwai Junction, Idaho, to Butte, via the Lolo pass of the Bitter Root mountains.

The annual report of the Anaconda Copper Mining Company for 1908 has recently been made public. In the report it is stated that 64,869,176 lb. of copper were produced as compared with 63,055,661 in 1907. The mines were not opened until March, 1908, and the expenses incident to the reopening were such that there was a deficit during the first six months of the year. It is stated that considerable difficulty was experienced with the mine fires in the Anaconda, St. Lawrence and Never Sweat mines but that the completion of the Belmont shaft will increase the facilities for mining the ores of those mines without interference by the fires. The report further states that long term contracts have recently been closed by which electric power for use in the Butte mines will be secured at low rates.

A decision of great importance to every locator of a mining claim within the boundaries of a national forest was delivered today by Register Miracle and Receiver Freeman in the case of the United States against Joseph Garneau and Louis Hickey, and is in favor of the defendants. This is the first case of the kind which the officials of the Helena land office have ever passed upon, and in the decision some important principles are enunciated.

Garneau and Hickey located quartz claims within the boundaries of the Elkhorn division of the Helena national forest, and charges were brought against each location, alleging that there had been no discovery of mineral in rock in place. The results of samples taken by the Government expert did not come up to the standard which he considered necessary to constitute a location.

Denver

May 28—A few years ago a pyritic smelter was erected at Golden by Dr. Carpenter, and affiliated with it at that time was the Saratoga mine of Gilpin county. From the smelter great things were expected by the producers of pyritic ore in Gilpin and Clear Creek counties; but after a short and uneventful career, it was compelled to close down. Later a new company was formed, and the smelter once more placed in blast, with abundant promises from producers of pyritic ore to keep the plant amply supplied, notwithstanding competitive rates that might be established by the American Smelting and Refining Company. The producers, however, allowed the pyritic smelter to fall short of ore, and it was again closed. The North American Smelter and Mines Company, organized under the laws of this State, has now secured the above plant, and expects to have it in operation soon. The producers of auriferous pyrite of Gilpin and Clear Creek counties again expect great benefits, and the outcome will be watched with much interest. The new corporation has taken control of the mines owned by the Banner Consolidated and its subsidiary companies in Clear Creek county, and of the Kilton Sampling Works at Idaho Springs.

The mining operations of the various camps in this State for the past week, in addition to the work of the regular producers, is largely confined to extensive preparations for the summer's work, and this has been long delayed by the abnormally late snow fall, which, at the high mines, has been continuing up to this time. The only news of special interest is that new strikes of rich gold ore have been reported in the Portland mine of the Cripple Creek district, and in the Camp Bird in the San Juan region. The Iowa-Tiger Leasing Company, of the Silverton district, has declared a dividend of 40 per cent., 20 per cent. payable May 15, and 20 per cent. June 15.

The deep drainage tunnel of Cripple Creek has now been driven 9000 ft., or about two-thirds the distance to that part of the district where it is expected to tap the underground waters.

In Routt county, in the vicinity of Lay, on the projected line of the Denver, Northwestern & Pacific Railway, are some extensive gold placer deposits, which were first discovered in 1887 at the same time as the Four Mile placers near the Wyoming line. Four years ago a dredge was installed in Lay Creek valley, and about [illegible] acres worked over, but it was not a success, largely owing to the scarcity of water. The beds are light colored quartz gravel. The gold is in nugget form, rather [illegible] and very pure, ranging from [illegible] fineness. Its origin is undetermined, but the deposits lie in what appears to be a lake basin of Tertiary age. The Iron Springs Placer Mining Company, has just filed its articles of incorporation with the Secretary of State, with offices at Denver, Mason City and Chicago, and will begin systematic work this summer. The manager is A. G. Wallihan, of Lay, who has lived there for twenty years as locator and part owner in the coal beds which also underlie this territory, and which are owned by the Wisconsin Fuel and Mining Company, of Milwaukee.

The Modern Smelting and Refining Company has erected a copper smelting plant at Utah Junction near Denver and expects to be able to receive ores soon. The ores most desired are those of gold, silver and copper. Such ores containing a good percentage of iron and sulphur can be obtained from Gilpin county, and the company has already made a number of contracts with shipping mines. H. C. Reno, 610 Ideal building, Denver, is president of the company.

Indianapolis

May 31—Abraham Parks and five other coal miners have brought suit against Thos. L. Lewis, national president and other officials of the Mine Workers' Association to recover $2000 each, as alleged damages for having expelled them from the association, depriving them of their union cards and of opportunity to secure employment. The suits are the outgrowth of the plaintiffs having been fined $1 per day by the Vandalia Coal Company for refusing to enter the Rosebud mine after an explosion took place therein. The plaintiffs recovered by suit from the Vandalia Company the money so retained as fines, and the national officers made the amount good to the coal company because of the agreement that such a fine should be collected in case of a walkout pending differences. This led to the expulsion of the plaintiffs who now seek damages from President Lewis and others. If they win 22 other miners will likewise bring suit.

Charged with being the instigators and leaders in the riotous movement that caused the expulsion of 50 foreign coal miners from Hymera, nine American miners have been placed under arrest and are now under bond at Sullivan.

In consequence of this matter a movement has been started to appoint a deputy sheriff in each mining camp in the State to report any trouble among the miners and to make arrests when conditions warrant, in order to keep the peace and prevent racial troubles.

Salt Lake City

May 27—G. A. Overstrom, professor of mining and mill design at the Uni-

versity of Utah and the inventor of the Overstrom concentrating tables, has invented a new classifier. The proposed device depends on the different velocities of water to separate the different sizes of ore. The classifier consists of a number of parallel upright pipes fed at the bottom by a common pipe. The water flows into these pipes with greater velocity in the ones of smaller diameter and in this way the slimes are taken off in the first pipes which are of relatively large diameter and the concentrates in the last ones, which are of smaller bore.

The report of the Daly West Mining Company, for the last quarter shows receipts from ore sales of $132,558, with disbursements amounting to $130,652. It was necessary to draw on the reserve fund, which on March 31 amounted to $314,630, to meet the regular dividend, the blocking of the road to the mine and the failure of the water supply lessening the receipts. The report says that the production cost will be cut down materially by the driving of a crosscut to the vein on the 1700-ft. level.

The output of the Tintic mines during the week was 209 cars. The shipments in 50-ton cars were: Ajax, 1; Bullion Beck (leasers), 2; Centennial Eureka, 42; Eureka Hill (leasers), 1; Grand Central, 5; Iron Blossom, 3; Grand Central, 5; May Day (crude ores), 2; May Day (concentrates), 2; Mammoth, 14; Sioux Consolidated, 14; Victoria Consolidated, 1; Victoria, 4; in 20-ton cars; Beck Tunnel, 5; Brooklyn, 6; Colorado, 26; Dragon Iron, 33; Iron Blossom, 44; Swansea Consolidated, 2.

As a result of several conferences with Gifford Pinchot, chief of the forest service, the committee of the American Mining Congress on mining in the national forests has received an encouraging communication from Chief Pinchot, outlining the friendly attitude of the forest service toward legitimate users of timber and giving a resumé of the instructions recently sent to the members of the forest service on this subject. Mr. Pinchot said in part: "I hope that these new instructions will remove any possible doubt as to the friendly interest of the forest service in the mining industry. The service desires that men engaged in prospecting or developing mining claims in the national forests should have a liberal free use of timber from the forests, if the timber on any claim is not sufficient for its development, so long as it is a prospect and not a producing mine. When a prospect becomes a mine and begins to produce ore, it is then a commercial enterprise and no more entitled to free use of government timber than any other business. This policy will be followed in the administration of the national forests, and a conveniently accessible and permanent supply of timber for mining will be provided whenever practicable."

Toronto

May 27—The Canadian Pacific railway is commencing boring operations for natural gas at Bassano, Alta, 83 miles east of Calgary. Eugene Coste, of Toronto, has been engaged for some time in making an examination of the field, and has reported that he is convinced that gas occurs in large quantities. He is of opinion that a series of gas pockets follow the same strata as that from which the Old Glory well on Bow island, Medicine Hat, gets its supply. The company will also undertake drilling for oil at Bow island. If gas in paying quantities is struck at Bassano it will be piped to Calgary.

D. D. Cairns and party, from the Geological Survey, have left to conduct investigations in the copper-, silver- and goldfields of the Watson and Wheaton districts in the southwestern section of Yukon territory.

The Ontario Government has appointed H. W. Richardson, R. V. Rogers and T. W. Nash, of Kingston, and Prof. Willet G. Miller, of Toronto, as its representatives on the board of governors of the Kingston School of Mining.

Johannesburg

May 5—Eight years ago the two boreholes put down by the Turf Mines, Ltd., (recently amalgamated with the Village Deep) cut the Main Reef series and provided important testimony as to the persistence of the Rand gold carriers to a depth of over 4000 ft. For various reasons the sinking of a shaft to exploit the property was delayed, but the first sod was cut and sinking commenced in June, 1906. It was then estimated that the series would be reached at a depth of 3700 ft. In April, of this year, the forecast was confirmed with creditable accuracy by the intersection of South Reef at 3756 feet.

Unfortunately the reef disclosed is narrow and of poor grade. There are good reasons, however, for not allowing this fact to cause anxiety as to the future prosperity of Central Rand deep levels, quite apart from the danger of considering a single shaft exposure as a reliable sample for the valuation of a large area. The experience of the Village Deep workings alone, and of development in the neighboring City Deep, has gone to indicate a distinct falling off in the average grade of the South Reef, but an equally marked compensation in the higher gold contents of the underlying Main Reef leader. This reef should be cut in the Turf shaft two weeks after passing the South Reef. The announcement of poor assays from the South Reef at this depth would doubtless have had a depressing influence upon Rand mining, had it not been proved by thousands of feet of development in the City Deep that the theory of gradual impoverishment with depth is without justification. In a less eminent degree the Village Deep itself has proved that while changes of grade may be expected upon the extension of operations on the Dip, an improvement may be looked for as reasonably as a reduction in gold contents.

Commenced, as stated above, in June, 1906, the Turf Mines shaft (or the Turf shaft of the Village Deep, as it should now be termed) has been sunk at an average speed of 114 ft. per month and, at a total cost of $170 per ft., including all equipment. The speed does not come up to that maintained in the recently sunk Brakpan shaft in the East Rand, owing to the much more difficult formation passed through and to the use of skips instead of buckets. The Turf shaft has passed through numerous dikes, some of which, almost vertical, cut diagonally through the excavation and necessitated a special ingenuity on the part of the management to arrange hearers providing for permanent security. With the dikes, too, a great influx of water always occurs. Although no one could attempt to minimize the excellence of the work performed in sinking the Brakpan vertical shaft, its freedom from such troubles must be noted in comparative references. The employment of buckets in that case also made for great rapidity of sinking. In the Turf shaft skips were used after the initial stage with a view to greater safety. With skips, the timber sets are carried about 15 ft. from the bottom of the excavation, instead of 50 or 60 ft with buckets.

The Turf shaft is of seven compartments—the standard for present deep levels—and measures 48x8 ft. in the clear. Its long axis is at right angles to the strike of the formation—a provision for greater strength which doubtless proved of great importance when the several stretches of troubled ground were being negotiated.

Hand labor, the cheapest and quickest means of sinking under Rand conditions, was employed throughout. There were three 8-hr. shifts, and on the average, 40 holes, 30 to 40 in. deep, were put in and blasted per shift. About 80 natives were employed each shift on shoveling and drilling. The work has throughout been under the control of Mr Saner, manager, and Mr Coombe, mine captain, who are now engaged in also sinking the South Rand shaft of the Crown Mines, Ltd. It has often been pointed out that these great vertical shafts will play a less important part in Rand mining than was at one time contemplated, owing to the more favored policy of amalgamation and the consequently facilitated extension of the inclines from existing verticals for the service of the deeper ground. At the same time there will still be need for new verticals in the Central Rand and the basin of the Far Eastern Rand will require many new shafts, of a depth of 3000 to 4000 ft for its economic exploitation.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

VALDEZ

Dr. E. T. Griffith, of Chicago, who has been developing important copper deposits near Landlock, has purchased machinery in Seattle, including power drills and hydroelectric plant with which to rush further operations. It is claimed that the orebody is 100 ft. in width and of a good grade.

F. H. Moffit, of the United States Geological Survey, will arrive here in a few days with a party of four men for work in the Copper river valley, while R. H. Sargent, topographer, will lead a party of seven men into the Matanuski country at the head of Cook's Inlet to make maps of the coal country.

Alaska Commercial Oil Company—This company, with offices in Seattle, has acquired ten oil claims near Katalla, and it is the intention to ship the product to the Orient. W. B. Kavanaugh is president.

Arizona

COCHISE COUNTY

Shattuck-Arizona—The mine is shipping ore from the development work on the 600-ft. level.

Copper Queen—Two additional furneces were blown in at Douglas, making nine furnaces now in operation. The air compressor for the central power plant at the Casey shaft, Courtland, has arrived and is now being installed.

Great Western—Work has been started on a three-compartment shaft on the Mamie claim, at the upper end of the patented ground of the Courtland Townsite Improvement Company. A gasolene hoist will be installed for preliminary work. The new shaft is near the Humboldt shaft, which is one of the oldest shafts in the Turquoise district.

Shamrock—This is the name of a new town in the Chiricahua mountains, organized by the Bisbee-Sonora Development Company.

Bisbee-Sonora—The property is opened by two 340-ft. tunnels, which cut the orebody at a depth of 150 and 235 ft. respectively. Work has begun on a 600-ft. tunnel which will strike the orebody at a depth of 275 feet.

GILA COUNTY

Inspiration—Reports from the mine are encouraging. The main shaft is 800 ft. from the Miami, and is 180 ft. deep, 80 ft. of which are in a low-grade copper sulphide.

Arizona-Commercial—The concrete foundations for the new machinery will be completed within a week. The new double-drum hoist has a capacity for sinking to a depth of 1500 feet.

Cordova—Work has been begun on a new three-compartment shaft on the Eureka property.

MARICOPA COUNTY

Esperanza—R. D. Le Grand and other capitalists of Pasadena, Cal., have purchased this group of mining claims, situated three miles east of the Harqua Hala mine. Development work will begin at once.

PIMA COUNTY

Twin Buttes—About 60 tons of ore per day are being taken out in development work and shipped over the company's railroad to Tucson, and thence to the smelter at El Paso.

PINAL COUNTY

El Tiro—The installation of a 250-h.p. hoist, three boilers, a compressor plant and steel headframe for the three-compartment working shaft has been completed. A 300-kw. generator is being put in, and a mill will be built soon. H. C. Smith is general manager.

Helvetia—Ninety men are employed on development work. Preparations are being made to connect the Copper World and Leader shafts with a crosscut 400 ft. long. Sixty tons of ore per day are being hauled with teams to Vail, and thence shipped to the Old Dominion smelter at Globe.

SANTA CRUZ COUNTY

Lock-Mcdonald—The mine was recently sold to William Kemp and associates, who are now putting it in shape for ore production. J. M. Thomas, of Globe, Arizona, is superintendent. The property is 12 miles from Patagonia.

Castle Butte—The mine is four miles from Patagonia, and will be prospected by a churn drill, which is now being put in place. The mine was recently bonded by California people, who have made part [illegible] ment.

Four Metals—The raise to connect the [illegible] and lower tunnels at the Red Hill mine [illegible] completed. This connects the tunnel [illegible] the opposite sides of the mountain [illegible] ventilation in the mine

California

AMADOR COUNTY

Amador Mines Company—J. J. McSorley, of Mokelumne Hill, Calaveras county, has sold to the Amador Mines Company, of Amador City, the Original Amador mine for $35,000. The mine adjoins the Keystone on the north.

BUTTE COUNTY

Carlisle—A vein which has been hunted for years has been found in this mine at Forbestown. A mill and compressor are being fitted up and a pipe-line constructed. The mine is under bond to Eugene Schmidt, former Mayor of San Francisco.

J. H. Leggett Dredging Company—At Oroville a pit is being excavated for a new dredge on 300 acres of land north of Palermo. When the new dredge is finished, the machinery of Dredge No. 3, which has worked out its ground, will be placed in it. J. H. Leggett, of Oroville, is manager.

CALAVERAS COUNTY

Boston Flat—Alcaraz & Sorensen, while working their gravel claim near San Andreas, struck a quartz claim which assays well.

North Star—The main shaft of this mine near San Andreas has been cleaned out and repaired for the inspection of men desirous of taking hold of the property.

Reiner—The new power line has been completed and steam will no longer be used.

INYO COUNTY

Four Metals Smelting and Mining Company—This company at Keeler is now running its 50-ton smelter regularly and has the properties of the Great Western Ore Purchasing Company under lease. The aërial tramway connecting mine and smelter is 5½ miles long. The upper terminal of the tramway is at the old Cerro Gordo mine. The office of this company is at San Jose, Santa Clara county; Henry T. Welch is president and A. R. Short secretary.

MADERA COUNTY

Europa—R. L. Hargrave, near Raymond, has let a contract for a 300-ft. drift which will be connected by an upraise with the upper level. All the machinery including the mill, is run by gasolene engines.

MODOC COUNTY

Cinnabar ore has been discovered in

Willow Ranch district, near Goose lake, and a number of claims have been staked, though not much development has yet been made. Fort Bidwell people are the owners.

MONO COUNTY

Quartz—The discovery of rich gold quartz 12 miles from Bodie by Edward Gray and Albert Belmont has drawn a number of prospectors from Bodie in that direction.

Snow Drift—O'Hanley, McCarty & Burnett, leasers, are taking out $26 ore from the old workings.

NEVADA COUNTY

Empire Mines Company—At this property, Grass Valley, Geo. E. Starr manager, the first of the twin five-plunger pumps has been tested with satisfactory results. Each has a contract agreement to lift 500 gal. a minute a vertical lift of 600 ft. The pumps are to be put on the 2000- and 3400-levels as sinking to a greater depth is intended.

Ocean Star—This mine at Ormonde, four miles from Washington, has been bonded to E. C. Reed and F. U. Hubbell, of San Francisco. The latter will be resident superintendent.

Pittsburg—The new eight-drill compressor has been started at the Grass Valley mine; Mark B. Kerr is manager.

Republic—The new 10-stamp mill of this mine in Graniteville district has been started up. It is expected that the National will be consolidated with this property.

PLACER COUNTY

Big Giant—Dependener & Tyler are running an adit into this mine on a 13-ft. vein. Several rich pockets have been found.

Herman Property Syndicate—This is a new company which has taken hold of the old Herman mine at Westville. E. B. Quigley has charge. The mine has an old 10-stamp mill and a new one of 30 stamps partly finished.

Placer Queen—Cavanaugh and Cullen have struck good gravel at Robinson Flat. The tunnel is in 2500 ft. The channel is at a great altitude in the mountains.

PLUMAS COUNTY

Crown Point—Geo. McCall, one of the leasers on this property, has found a small but rich vein and ore is now being taken out.

California & Nevada Consolidated—In addition to the strike made in this mine in March, another has been made in which the orebody is large and rich.

SAN BERNARDINO COUNTY

Twenty Nine Palms Consolidated—In a shallow shaft at Twenty Nine Palms crosscut opened a 3-ft vein of ore which runs up to $20 per ton.

SIERRA COUNTY

Brush Creek & Ante-Up—This Chicago company, which has a bond on the old Brush Creek mine, near Mountain House, is about to reopen it. When the men were driven out by water years ago there was a wide vein in the bottom of the 700-ft. shaft carrying good values. L. A. Armstrong is engineer in charge.

SISKIYOU COUNTY

Advance—This mine is about to start up again. Howard V. Lewis is superintendent.

Eastlick—The Eastlick mines and ditches at Oro Fino have been purchased at forced sale by the Reichman Company, of Fort Jones.

TRINITY COUNTY

Dorleska—At this mine, Coffee Creek, some very good ore has recently been uncovered. The mine is still isolated by the snow.

TUOLUMNE COUNTY

Esmeralda—This mine near Carters, on the East Belt, is now showing up a larger vein than was at first found, and the grade of ore is satisfactory.

Colorado

CLEAR CREEK COUNTY

Honest John—A larger air compressor is to be installed, and the company is considering the installation of an aerial tramway 7000 ft. in length, to transport the ores from the mine to the mill. J. F. Puchert, Georgetown, Colo., is manager.

Waldorf Consolidated—Another unit of 125 tons is to be added to the company's mill in the Argentine district. E. J. Wilcox, 314 Colorado building, Denver, Colo., is manager.

Gold Treasure—Denver people are interested in this property and intend to install machinery. Ira Pollard, Idaho Springs, Colo., is manager. They have recently opened up some smelting ore.

GILPIN COUNTY

Great Bonanza, Limited—This company has an option on the German Consolidated group of claims contiguous to its property. If the option is taken up larger machinery will be needed. Cecil C. Morgan, Central City, Colo., is manager.

Federal and Lillian—Eastern people have taken hold of these properties in the Russell district, under a lease and bond, with G. Knutzen, Russell Gulch, Colo., as manager.

Gandon Mining and Investment Company—Clinton Reed and associates, of Denver, have organized this company to operate the Leavenworth mine in the Russell district. An air-compressor plant may be installed. W. C. Le Prowse is in charge.

Gomer—A four-ton shipment of exceptionally high-grade ore was recently sent to the sampling works. A. A. Johnson, Russell Gulch, Colo., is manager.

Egyptian—A pool of Austrian leasers has taken hold of this Quartz Hill mine, owned by McFarlane & Sons, of Central City. Good milling ore is being obtained.

Grand Central—Rhode Island people are interested in the resumption operations at the mine on Gunnell hill. Dan MacMasters, Central City, Colo., is manager.

LAKE COUNTY—LEADVILLE

Tribune—Several months ago a lateral was started in the Yak tunnel about 100 ft. west of Ibex No. 4 shaft, to develop this vein; the lateral is now in 500 ft. and a fair body of gold-bearing ore has been encountered. The vein is from 5 to 7 ft. wide, and the trend is northeast and southwest. It is near the Little Vinnie and Little Jonny. Before this vein was encountered a body of sulphide ore was opened about 250 ft. from the tunnel, but was considered too low to ship. It is now the intention of the lessees to sink a winze on this orebody and develop it. Willis S. Brown, of Belvidere, Ill., is president of the leasing company.

South Evans Gulch—With the opening of spring a number of properties in this section have resumed work, among them being the Ella, which is shipping several cars, weekly, of oxide ore from the 150-ft. level. On other properties development work is in progress as follows: Martha, prospecting is being carried on at the 150-ft. level; Wall Street, sinking from the 100-ft. level; Crucifixion, shipping oxide from the 150-ft. level; Silent Friend, driving from Yak tunnel to connect with workings 300 ft.; Cleveland, shipping 120 tons daily; Tenderfoot and Valley, shipping, respectively, 30 and 40 tons daily; Favorite, development work is being done and the shaft will be probably sunk another 150 feet.

Garbutt—This property is shipping daily 35 tons of lead sulphide ore. The orebody is 25 ft. high and 35 ft. wide, and has been developed for several hundred feet. It is under lease to John Cortullini and associates.

Fortune—Several days ago connections were made with this mine and the Yak tunnel, and 25 tons of ore are now going out daily through the big bore, the ore is of excellent grade.

Last Chance—B. DuBois will resume work on this mine in a short time. At present surface work is being done preparatory to sinking.

Gnu—This shaft belonging to the Nisi Prius company and under lease to John Harvey *et al.* is producing 25 tons of good lead ore daily.

Pyrenees—The large pumps recently installed have started to raise the water from the lower levels; it will take about six weeks to unwater the ground.

OURAY COUNTY

Camp Bird—Report for April: Mill ran 29 days; crushed 6684 tons of ore; produced 613 tons of concentrates and 13,357 oz. bullion; total sales, $282,434; expenses, $54,243; balance applicable to profit, $228,191; development work, 672 feet.

Idaho

SHOSHONE COUNTY

The shipment of the first consignment of ore, to go all the way to the smelter by rail, was made from the Murray district recently. The shipment was made from the Black Horse mine.

Iowa

WAPELLO COUNTY

Ottumwa Iron Works—A report has been circulated through the Associated Press that this plant was totally destroyed by fire. This report probably originated from the burning of the foundry roof. The damage has not only been repaired, but the foundry has been enlarged and improved machinery added to increase the output of mining machinery.

Michigan

COPPER

Ahmeek—Arrangements have been made with the Franklin company to handle approximately 750 tons of Ahmeek rock daily. Shipments of about the same amount will be continued to the Tamarack mill. A contract has been let for the construction of the railroad spur connecting the mill with the lines of the Mineral Range railroad.

Mass—This company has reached the new lode by means of one of the crosscuts it is driving from the 15th level, but has not yet entered it far enough to determine its width or copper contents. The other three crosscuts are nearing the formation and when the lode is opened by these four points, in addition to the drift from the 17th level, which is now about 130 ft. in length, its commercial value should be practically determined.

Victoria—A continuous stretch of good ground has been opened up at the 22d level. A crosscut is being driven from the 12 level to ascertain the condition at that point. The hydraulic plant is working satisfactorily with an ample water supply.

Mohawk—Ground is to be broken by this company on the site of its new, or No. 6 shaft within a few days. This will go down in the foot wall, about 60 ft. behind the lode which it will open by means of crosscut from the various levels. Shipments aggregating about 2700 tons daily are being made to the mill from the other shafts.

Adventure—This company contemplates opening up the newly discovered Mass lode on its property by means of crosscuts. The crosscut from No. 1 shaft will reveal the lode close to surface and at No. 3 about 800 ft. deep. This vein has also been traced on surface by means of trenches and holds forth great promise.

La Salle—Work has been discontinued at No. 2 shaft on the Caldwell tract, after carrying on considerable exploratory work without striking any encouraging results. It is now planned to sink a new shaft between the shaft on the Tecumseh tract and No. 1 shaft of the Caldwell. No. 1 shaft of the Tecumseh is opening some very encouraging ground.

Hancock—The winze from the 13th to the 18th level, at which point it will intersect the main working crosscut from the 15th level of No. 2 shaft, is down to the 15th level. This winze is sinking on what is known as No. 3 lode and has disclosed good mineralization throughout its depth. Good ground is also being blocked out in the extensions of the drifts from the 13th and 14th levels. No. 2 shaft is sinking close to the 18th level and should cut the orebody at the 20th level, which, at the present rate of sinking, will be in August. No. 2 shaft is to have railroad facilities in the near future.

Wolverine—A fire destroyed the roof of this company's main boiler-house, but little damage was done to the boilers or compressors which were in this building. Operations were delayed only a few hours.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

Goode Brothers—Plans are being made for the erection of a large mill on their lease of the Little Boss Mining Company.

Sycamore—Jones & Garvan, of Granby, have bought a mill which they will erect on the land of the Little Boss Mining Company, at Granby.

Sunrise—C. V. Millar, manager, is rebuilding the mill at Spring City, which was recently destroyed by fire.

Microbe—Adam Scott, manager, Joplin, will erect a mill on this lease at Spring City.

Delta—This mine, at Spring City, has been reopened under new management. A new shaft will be sunk.

United Zinc—The company has taken the McKinley lease on the Connor ground at Prosperity and will thoroughly drill and develop it. George T. Fletcher, of Joplin, is manager.

Silver Plume—The mill is being rebuilt and will start operations at once. Warren Heaton, of Joplin, is manager

Herald Zinc and Lead—New and larger machinery is being installed at the mine near Cave Springs.

Cameron—The building of the new Cameron mill at Sarcoxie has added another producer to that already enterprising camp. The mill has a capacity of 400 tons per day and is now turning out a fair tonnage.

Coahuilla—Four men were killed recently in this mine by a slab of rock falling from the roof.

Montana

BUTTE DISTRICT

Amalgamated—It is reported that at the Gagnon mine plans are being made for the sinking of a new shaft. In that event the incline shaft, 2300 ft. deep, now in use will be abondoned. For the past several years the mine has made a poor showing but recently developments indicate that the property has greatly increased in value at its present depth and that the expenditure of money necessary for the new shaft will be justified.

Butte & Superior—A strike of copper ore is reported on the 1200-ft. level at a point about 400 ft. west of the shaft. It is stated that the ore runs 2 per cent copper and 30 per cent. zinc.

Copper Eagle—Work is progressing on the 350-ft. level. On this level drifting has been done 300 ft. east of the shaft and 50 ft. west. The shaft is 365 ft. in depth.

BROADWATER COUNTY

Ohio-Keating Company—Machinery has been ordered and work of unwatering the shaft will be begun shortly.

FLATHEAD COUNTY

Northern Idaho & Montana Power Company—The company has recently purchased the plant of the Kalispell Water and Electric Company. The new company plans an expenditure of $200,000 on improvements on the plant and system of the old company.

JEFFERSON COUNTY

Jefferson Lime Company—The company has recently sold its plant and ground to the Pittsmont Copper Company, of Butte. This is part of the plan of the East Butte company to carry on active operations at the Pittsmont company's smelter. The ground purchased is located on the Northern Pacific Railway at Lime Spur, and the limestone will be conveyed by that road direct to the smelter of the Pittsmont company.

LEWIS & CLARK COUNTY

East Helena Smelter—A demand has recently been made by the employees for an increase in wages of 50c. per day. While no definite statement has been given out, it is expected that the demand will be refused.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Kansas City Velvet—Another shipment is being prepared on this lease and will be sent out in a few days. The ore is

being taken from a vein 18 in. wide which runs $60 per ton.

Goldfield Daisy—This property is now working two shifts employing between 50 and 60 men. A daily production of 10 tons is being maintained, five tons of which, coming from the 200-ft. level, runs about $100 per ton. The balance is dump ore and assays from $20 to $25 per ton. Development work is being carried on in both the 300- and 500-ft. levels.

Goldfield Florence—Another tube mill is to be installed at the mill as soon as the order can be filled. This will increase the capacity of the mill about 25 per cent. At present the mill is treating from 140 to 150 tons per day. Much underground development is in progress.

Stoneham Moore—This lease, operating on the Combination No. 2 lode of the Consolidated property, will sink to the 1000 ft. level. Particular attention will be given to prospecting on the 500-ft. level where a streak of high-grade ore was recently encountered.

Grizzly Bear—A new 75-h.p. electric hoist and large gallows frame have been installed. The shaft, now 500 ft. deep, will be sunk to the 1000-ft. level. On reaching the footwall of the Clermont vein, now showing in the shaft, a station will be cut and the vein prospected.

Esmeralda County—Hornsilver

Great Western Mine—This property has been closed down for an indefinite period. Howard Russell, secretary and one of the principal owners of the company, is credited with stating that the mine will remain closed until better transportation facilities are afforded or a mill is constructed in the camp. The Tonopah & Tidewater Railroad is sending a corps of engineers in the field to make a preliminary survey between Hornsilver and Cuprite, the shipping point on the railroad, 16 miles distant.

Lander County—Austin

Highland Mary—George Kilborn, of Reno, has taken an option on this property which is one of the oldest in the district.

Lincoln County—Pioche

Nevada Utah Mining and Smelting Corporation—This company is now shipping about 125 tons daily to the Salt Lake smelters, from its Day mine 15 miles northwest of Pioche. Superintendent Gaskill estimates that 175,000 tons have been opened up by recent development.

Ohio Kentucky—This company is negotiating with the Nevada Utah company for the purpose of reaching some agreement regarding disputed territory held jointly in Pioche. The property has been idle for nearly two years because the companies could not come to an agreement.

Prince Consolidated—This property, situated about two miles southwest of Pioche, shipped three carloads last week to the Tintic smelter. Ernest L. Godbe, of Salt Lake City, is manager, and Wm. Lloyd, of Pioche, superintendent. The shaft is now 550 ft. deep. At this level there is 3 ft. of ore running high in silver and lead.

Pioche King—Several feet of manganese ore, also carbonates and sulphide of lead, were encountered at about 180 ft. depth, the latter carrying precious metal. John A. Kirby, of Salt Lake City, is president and manager.

Golden Prince—George Coxe, manager, has encountered manganese ore in the shaft at 430 ft., and in the west drift at 400-ft. level, 140 ft. from the shaft, ore showing good assay returns has been found.

Gold and Silver Prince—Dean R. Low, Pioche, manager, has just installed a new 25-h.p. Alamo hoist and compressor. The shaft is now about 90 ft. deep.

Pioche Demijohn—This property, of which Owen Bailey, Salt Lake City, is manager, adjoins the Gold and Silver Prince on the northwest. Some high-grade ore was recently found on the 125-ft. level, but it is understood to have been only in small quantity.

Pioche Metals—The property of this company, about two miles northwest of the Demijohn, is working several men and hoisting some good ore. John A. Kirby and associates control the property.

New Hampshire

Coos County

Milan Mining and Milling Company—A model B Cadillac has been transformed from the road wheels to 18-in. flange wheels for a narrow-gage railroad, and is now hauling 100 tons of ore in 10 hours from the new mill to the ore bins at the railroad siding, a distance of ⅛ of a mile. The average grade is 3½ per cent., and the cost is 4c. per ton. The new 250-ton ore-dressing, crushing and concentrating plant is now successfully adjusted and operating satisfactorily.

Oklahoma

Ottawa County

Old Chief—This company, at Miami, will rebuild the mill recently destroyed by fire.

Moosehead—The company will build a mill on the lease at Miami.

Miami-Yankee—L. C. Church, manager, has struck rich ore at a depth of over 200 ft. on the Emma Gordon ground, at Miami.

King Jack—Chapman & Lennan, of Webb City, are rebuilding the mill at Miami, which was recently destroyed by the explosion of the boiler.

Oregon

Baker County

Morning Mine—The mill is treating 30 tons of ore per day averaging from $30 to $40 per ton. The Psyche 20-stamp mill has been purchased and will be moved to the Morning mine as soon as the roads are in condition.

South Pole—It is reported that a rich body of gold ore has been found in the main tunnel run from the Rock Spring side of the mountain. Andrew Hansen is the owner, and a five-stamp mill will be started up this month.

Utah

Beaver County

King David—At the 300-ft. level of the shaft a big bore is being driven in a body of iron sulphides. The sinking of the shaft will be continued as the bottom indications are excellent.

Lydia—H. T. Hanks, who has been operating this property in the Star district has uncovered a large orebody. On the 50-ft. level he has drifted 60 ft. and on the 100-ft. level has drifted 35 ft., all in ore. A gasolene engine and other machinery is being installed to hasten the work.

Salt Lake County

Columbus Consolidated—The new pump is being taken to the mine at Alta and will be in commission early in June. The new pump weighs 30,000 lb., has a capacity of 800 gal. per min. and is run by a 150-h.p. motor.

Summit County

Silver King Consolidated — Manager Solon Spiro, 426 Atlas block, Salt Lake City, visited the mine recently and reports that a winze being sunk from the south drift on the 1100-ft. level is now in good ore. The wagon road to the mine has been cleared of snow and the mine will be able to ship at once.

Tooele County

Old Glory—The wagon road to Wendover on the new Western Pacific has been completed and the shipment of the high-grade ore will start at once. With these transportation facilities available, the company will now install a compressor plant and machine drills and increase the force at the mine. D. L. Fulop, 216 Dooly block, Salt Lake City, is president of the company.

Washington

King County—Berlin

Miller River and Money Creek districts are coming to the front through the operations of the Apex, Seattle Cascade, Excelsior, Surwalk and the Cleopatra properties.

Seattle Cascade—This company is installing a 115-h.p. power plant, with an air compressor to correspond, and within 60 days will be equipped to carry on development work.

SNOHOMISH COUNTY—EVERETT

Nonpareil—In the Index district this company is surveying 35 claims for patent under United States Deputy Mineral Surveyor Hans Mumm, who resigned the position of city engineer of Everett to take up this work.

Northwestern Consolidated—An order for 6000 ft. of steel wire cable for an aërial tram near Monte Cristo, and a complete telephone system to connect with the terminus of the railroad has been placed by this company. J. C. Morton is manager of the company.

Canada

BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

Awaya, Ikeda & Co.—Another big ore-body has been encountered in the lowest tunnel (No. 3) of the Japanese company's mine at Ikeda bay, Moresby island. The tunnel is 40 ft. in ore and the footwall not yet reached. The ore averages about 5 per cent. copper and $3 per ton in gold. Shipments are being made to the Tyee Copper Company's smelter at Ladysmith, Vancouver island.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 22 were: Coniagas, 64,300 lb.; Crown Reserve, 126,400; Kerr Lake, 203,760; King Edward, 43,130; La Rose, 291,400; McKinley-Darragh, 50,670; Nipissing,, 453,850; Peterson Lake, 67,580; Right-of-way, 249,130; Temiskaming & Hudson Bay, 60,000; total 1,610,220 pounds.

YUKON TERRITORY—DAWSON

In a previous issue reference was made to the early breaking up of the ice in front of Dawson, permitting local navigation. Fifty-Mile river, a branch of the Yukon, is now open from White Horse to the head of Lake Lebarge, but the lake itself is still frozen. At Hootalinqua the river is also breaking up. It is expected that navigation will open June 9 for the whole length of the river.

The copper deposits of the Yukon adjacent to the Bonanza properties of the Guggenheims have gained official recognition through an examination by a government mining engineer, A. J. Beaudette, whose visit was by instruction of Governor Henderson.

Last year the largest navigation company operating on the Yukon received $73 per ton for cargo from Seattle to Fairbanks, while this year the rate is $65, while another company is quoting rates of $50. The opinion prevails that while the temporary cut in rates due to competition will be of immense benefit for this season, the final result will be a little higher, and yet much lower than in previous years.

Bonanza Creek—Claim No. 39 below on Bonanza has been staked by C. W. Cornish, of the Yukon Gold Company. This claim was allowed to lapse in 1908 and recent investigation pursued quietly proved the claim to be of great value.

Bonanza Creek Gold Mining Company, Ltd.—The Guggenheims have acquired the properties of this company, formerly known as the Weinheim company, which operated under the concessions granted to Matson & Doyle.

Dome Lode Development Company—Progress on the Dominion Dome has taken on new life through the appointment of D. J. McDonald as manager; formerly of Le Roi Mine of Rossland. This is considered significant, since Mr. McDonald would hardly consent to take charge of a property that did not possess future promise.

Herbert Creek—Dolan & Pinkiert have confirmed their good judgment in the purchase of the upper thousand feet of discovery on Herbert creek, several shafts disclosing pay dirt of exceptional value.

YUKON TERRITORY—WHITE HORSE

Work has been stoppd on the spur from the White Pass Railway to the copper mines near White Horse with only one-half of the track laid. Resumption of this work will depend upon the intentions of the mineowners. The railway company can finish the extension in six weeks time.

Mexico

CHIHUAHUA

Candelaria—These old mines are now shipping at the rate of 150 to 200 carloads monthly to the El Paso plant of the American Smelting and Refining Company. The working force numbers about 600. The new pumping plant is handling about 3000 gal. of water per minute and keeps the old workings sufficiently dry to permit of ore extraction in the lower levels and for the sinking of deeper shafts. George A. Laird is in charge.

Mary Mining Company—This company, operating in the Archuyvo district in the western part of this State, has the necessary machinery on the ground for a 10-stamp mill. The property is best reached from Alamos, Sonora. E. McLean is the superintendent.

Santa Eulalia Development Company—An English company, represented by I. M. Cockerell, has a purchase option on the Sonnambulo and Nueva Chihuahua mines in the Santa Eulalia camp and will begin immediate development.

[illegible] Lardes—This company is making surveys for a railroad to its property in the San Carlos section, in the northern part of the State. One line as projected [illegible] from the Southern Pacific at either Boquillas or Sanderson, Texas; the other is to run to the Orient railroad in eastern Chihuahua. Dr. C. V. F. Caracristi is general manager.

Urique—It is reported that transfer of the Santa Reyes and Trumbo mines near Urique, has been made to John Paul and Dr. Sheldon, representing New York parties.

Watterson Gold—Among the late bullion shipments received at the local bank is one of nine bars of gold-silver from this company, valued at 19,000 pesos.

DURANGO

La Luz—Daniel E. Webster is making a topographic survey of this and the Santa Inez Mining property for the owners W. R. Giesecke and associates of Gomez Palcio.

Cinco de Mayo—The new shaft has been completed to the water level and obtained an abundant supply of water. With this water available, the work of extracting the ore from the upper workings will begin. It is reported that a rich body of copper ore was recently cut at a depth of 320 feet.

Guanacevi Tunnel Company—At Guanacevi, Durango, the company is receiving bids on an electric equipment for the driving of a development-transportation tunnel 12,000 ft. long. A. D. Meloy, of New York is chief promoter of this enterprise.

GUANAJUATO

Santa Natalia—The first shipment of bullion was made from this mine recently.

Africa

WEST AFRICA

Gold production of the Gold Coast and Dahomey is reported by the West African Chamber of Mines at 21,491 oz. in April, being 1795 oz. less than in March. For the four months ended April 30 the total was 102,032 oz. bullion in 1908, and 88,897 oz. in 1909; a decrease of 13,135 oz. The bullion reported this year was equal to $1,746,885, or 84,513 oz. fine gold.

South America

BRITISH GUIANA

Gold exports for the four months ended April 30 were 17,627 oz. bullion in 1908, and 18,385 oz in 1909; an increase of 758 oz. The bullion reported this year was equal to $317,955, or 15,373 oz. fine gold.

Exports of diamonds for the four months were 537 carats, valued at $3246; an increase of 149 carats over last year.

Guiana Gold Company—The large new gold dredge built by this company on the Conawarook river sank just after it had been completed, and the day before it was expected to begin work. Faulty construction is suspected to be the cause.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 2—From the West reports come of an improvement in the demand for steam coal which is growing much faster than it has been for some time past. So far this improvement has not been generally accompanied by any advance in prices, mainly for the reason that producers have been rather too anxious to take advantage of any gain, and have shipped coal to the central market points too freely. Consumption is increasing, however, and the complaints of forced sales to avoid demurrage are not very serious.

In the East improvement in the bituminous trade seems to be much slower than in the West, and a good many complaints are still heard of slow purchasing of coal. That there is some improvement, however, is not denied.

The anthracite trade is steady and rather quiet; many collieries are still running on short time and may continue to do so for another month before accumulated stocks are worked off.

Lake Coal Rates—In Charleston, W. Va., May 27, Judge Keller, of the United States Circuit Court, dissolved the temporary injunction issued by him last April restraining the Kanawha & Michigan, the Chesapeake & Ohio and Norfolk & Western railroads from filing with the Interstate Commerce Commission a proposed tariff increasing the rates on local shipments of coal from West Virginia fields to the lake regions on the ground of lack of jurisdiction. In the case of the Columbus Iron and Steel Company against the Kanawha & Michigan railroad to prevent the filing of the tariff the Court held it had no right to prevent filing before the Interstate Commerce Commission had determined equity of rate. Similar injunctions in the case of the Imperial Colliery Company versus the Chesapeake & Ohio Railroad and the Powhattan Coal & Coke Railway versus the Norfolk & Western were dissolved. This permits the new rates on Lake coal to go into effect.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 22 short tons:

	1908.	1909.	Changes.
Anthracite	2,177,732	2,101,826	D. 75,906
Bituminous . .	12,590,625	13,659,697	I. 1,069,072
Coke.....	2,688,395	3,878,226	I. 1,189,831
Total	17,456,752	19,639,749	I. 2,182,997

Increase for the week, 91,050 tons. Total increase this year to date, 12.5 per cent.

New York

ANTHRACITE

June 2—There was a little spurt in the market last week brought about by parties who wanted to get in orders on the May discount. It did not amount to very much, however, and trade generally has been quiet but rather steady. On June 1 another 10c. was taken off the discount and prices for prepared sizes are now $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

BITUMINOUS

The Seaboard trade grows slowly, although some advance is perceptible. Taking of coal under contracts is the principal improvement noted. The far East is reported to be thinking about sending in orders, but has hardly got to the point of action. The Sound is doing a little better, and all-rail trade better yet. New York harbor is quiet. Some coal continues to change hands at rather low prices; otherwise there is not much movement.

Coastwise trade is fair, but not as active as it might be. Vessels being in good supply, rates are unchanged.

Birmingham

May 31—The coal trade in Alabama shows little improvement. Some price cutting has been going on, but this has not included any great amount of business. A large number of miners are out of employment and those who are working are not getting in steady time. The coke demand continues good. The annual convention of the United Mine Workers of America, Alabama district No. 20, will be held in Birmingham, June 14. The attendance promises to be small as the union has not been doing much since the strike last year.

Chicago

June 1—While the consumption of steam coals is increasing, the shipments to this market of Illinois and Eastern lump are so large that a good deal of price cutting, due to demurrage regulations, again exists. Fine coals, on the contrary, are comparatively scarce and are advancing slowly. Springfield screenings, a favorite summer fuel, bring $1.45 readily and other screenings from Illinois and Indiana mines sell for $1.55@1.75. Run-of-mine remains at $1.65@1.75, and lump finds purchasers, with difficulty, at $1.75@2.25, these being car prices. Domestic bituminous coals are hardly in the market, sales being very light.

Contract making has been brisk and a larger volume of coal has been sold on contracts than a year ago. But prices are very low on most of this business and the open market seems to have a brighter outlook.

Eastern coals are selling well, but smokeless run-of-mine and Hocking are off 10 or 15c. from list prices because of demurrage. The best smokeless and Hocking, however, hold up well to list quotations. Youghiogheny ¾-in. gas brings $3.15, with a steady market; Pittsburg No. 8 is in similar shape at $2.65 for ¾-in. Anthracite finds a light but steady sale, well distributed.

Cleveland

June 1—The local coal trade is improving and sales are better than they have been. Mills and factories are taking more steam coal. Prices are strengthening, though some coal has been sold low, to avoid demurrage. No. 8 district brings about $1.90@$2.05, Cleveland, for lump; $1.80 for run-of-mine and $1.35@$1.40 for slack. Middle District coal sells at $1.80@$1.95 for lump, $1.70 for run-of-mine and $1.30@$1.35 for slack, all Cleveland.

Lake trade is so slow yet that the railroads are putting an embargo on shipments from mines, the yards being full of coal waiting for vessels up the Lakes.

Indianapolis

May 31—A general review of the coal-mining and market situations shows a decided improvement over the previous week. Operators say that progress is slow, but constant, and with the reported revival in iron and steel industries justifies a hopeful outlook. That more optimism is being shown is evidenced by the opening of several mines during the past week that have been closed from one to two years.

The activity among retail dealers in buying their storage supply which set in the last few days has been encouraging.

The decreasing number of empty cars reflects the increasing run of summer orders. Operators, however, do not believe that conditions will justify anything above a conservative advance in prices at present.

Pittsburg

June 1—The coal market continues quiet, with continued price cutting. Nominal prices remain at $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at mines, but these prices are being shaded 5 to 10 cents a ton as formerly. Slack is quotable at 60 to 65 cents.

Connellsville Coke—The chief topic of conversation in the trade is the merger. The promoters insist that it will be put through and will be able to make fair profits, but the trade at large figures by various methods that it cannot possibly be a success, on account of the high prices asked for the properties, these prices being held to be such that nearly a dollar a ton would have to be earned to carry interest and exhaustion charges, pointing to $2.35@2.50 for coke. In view of the many other sources of supply it is maintained that such prices cannot be obtained.

The Thompson Connellsville Coke Company has made a contract to supply the Jones & Laughlin Steel Company with 400,000 tons of coke a year for a period of time, believed to be three years from Sept. 1 next. A flat price is to be paid, which is somewhat unusual in such cases. While the price is not stated authoritatively, it is believed in some quarters to be about $2 at ovens.

The coke market is a trifle firmer for prompt coke, $1.50@1.60 being demanded for prompt furnace, second half-contracts remaining at $1.60@1.80, according to grade. Foundry coke is $1.80@2 for prompt and $1.90@2.25 for contract, depending on grade.

The *Courier* notes a gain of 16,000 tons in production in the Connellsville regions in the week ended May 22 as compared with the preceding week, the output being given at 278,720 tons. Shipments are reported at 3296 cars to the Pittsburg district 5433 cars to points west of Pittsburg and 742 cars to points east of Connellsville; a total of 9471 cars a gain of 309 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.
Anthracite	703,018	699,360	D. 3,658
Bituminous	2,350,186	2,072,696	D. 277,490
Total coal	3,053,204	2,772,046	D. 281,158
Coke	258,242	330,370	I. 72,128

Canada took this year 1,991,594 tons or 71.8 per cent. of the total coal. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.
Anthracite	15,023	3,115	D. 11,908
Bituminous	604,142	388,077	D. 216,065
Total coal	619,165	391,192	D. 227,973
Coke	41,444	64,186	I. 22,742

Canada sent this year 330,926 tons of coal and nearly all the coke; Australia, 44,048 tons of coal. Imports are chiefly on the Pacific coast and on the northern border, into Montana and Washington.

Imports of coal into Spain in January were 172,866 metric tons, an increase of 33,073 tons; of coke, 25,757 tons, an increase of 10,151 tons.

Nova Scotia Coal—Coal shipments from Nova Scotia mines, four months ended April 30, long tons:

	1908.	1909.	Changes.
Dominion	778,291	549,632	D. 228,659
Nova Scotia Steel	155,746	112,141	D. 43,605
Cumberland	144,528	124,355	D. 20,173
Acadia	106,421	75,831	D. 30,590
Inverness	68,691	48,957	D. 19,734
Intercolonial	90,055	80,139	D. 9,916
Total	1,343,732	991,055	D. 352,677

The total decrease this year to date was 26.2 per cent. In the March statement, recently published, the figures for 1908 and 1909 were accidentally reversed.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 22: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.30; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port. This is an advance on Welsh coals.

Iron Trade Review

New York, June 2—There are signs of a slight lull in buying following the extreme activity which the iron and steel trades showed in the latter part of May. It does not appear that this will be a serious check, but rather a pause to take stock and see what has been done. The effect of the recent activity has been to fill most of the mills with work for at least three months to come and put buyers in a position to supply the actual and expected demands from consumers. Some slight advances in price have been made, but the great bulk of the business placed has been at the lowest figures.

In pig iron basic sales continue active and a good deal is still being done in foundry iron. Furnaces in blast are increasing in number, especially those owned by the steel companies. A few of the latter have been buying bessemer pig from outside furnaces, which has not been done for over a year and a half. The merchant furnaces are consequently rather firm on prices, not making advances for immediate deliveries, but making no concessions and looking for 25 or 50c more for third- and fourth-quarter deliveries.

Running parallel with the demand for basic iron has been an increased demand for scrap. This has been felt to some extent in foundry scrap, but in a much greater degree in the call for heavy steel melting scrap which is beginning to be rather scarce.

In finished material, structural steel is still in the lead, but large business has been placed in plates, sheets and bars. The railroads are still holding back on rails, although small orders are coming in more freely, and there is quite a market for light rails. The railroads have been ordering a good number of steel cars and are also asking bids for many locomotives.

Tinplate Capacity—It is announced that the Jones & Laughlin Steel Company, in addition to other improvements, will build a tinplate mill of large capacity, entering into active competition with the American Sheet and Tin Plate Company.

Baltimore

June 1—Exports for the week included 1,390,731 lb. tin-scrap to Rotterdam; 2894 tons rails and 100 tons rail fastenings to Buenos Aires; 3853 tons rails and 299 tons rail fastenings to Mexico. Imports included 4525 tons iron pyrites from Spain; 16,450 tons iron ore from Cuba.

Birmingham

May 31—Southern pig iron manufacturers are encouraged over the steady inquiry that is being received; some orders are developing. Some selling is still going on and the quotations are strengthening, third-quarter iron being held firmly for $11.50 per ton, No. 2 foundry, and fourth-quarter iron at $12. Reports are still current that one or two companies are inclined toward a lower price, and that $11 is being accepted for June and July deliveries. There is a quantity of iron to be seen in furnace yards, but the statement is that it awaits instructions as to delivery. The foundrymen and machine shop proprietors in this section of the country have recently been receiving a number of orders and their business is better. Some bidding is going on also on machinery orders. The blowing out of two furnaces this month will be followed by the blowing in of two others in the next few days. It is expected also that within a month the Southern Steel and Iron Company, successor to the Southern Steel Company, will have started preparations looking to a resumption of operations at three blast furnaces, the steel plant at Gadsden and the mills at Ensley. W. H. Hassinger, of Birmingham, was elected president of the reorganized company. Rumors prevail that the Tennessee company will add a structural-steel department to the steel plant at Ensley

This plant is still idle. The Bessemer rolling mills will resume operations this week after a month's idleness.

Chicago

May 31—Quiet exists in the pig-iron market. The situation has been forecasted in the gradual slackening of the last month or six weeks; it seems due to the fact that foundries in this territory are well provided with iron, up to the last quarter at least, and their proprietors have decided again to go slowly. For needs of the third and fourth quarters the standard purchase remains small—under 500 tons. The selling price of Southern remains nominally $11.50 Birmingham ($15.85 Chicago), but $11.25 and even $11 is done on some business. Northern is quoted at $16.50, but can be had in any good-sized quantity at 25 or 50c. les. With both sellers and buyers watching the market keenly, any decided change stiffening the market will result in comparatively heavy buying, but no such change seems imminent.

In the iron and steel products market conditions continue good, especially in structural material and railroad supplies, and with no notable falling off in any line. Coke is improving as to sales and holds to $4.70 for the best Connellsville.

Cleveland

June 1—Buying of iron ore continues at a fair rate. So far as shipments are concerned, the strike is causing trouble, but not enough to stop boats, or to prevent the movement of ore.

Pig Iron—The sales are steady, but not in large lots. Prices have not been advanced, but are more firmly held, the basis continuing about $15.25, Cleveland, for No. 2 foundry.

Finished Material—Structural steel is in demand still. In other lines the market is quieter, owing chiefly to the recent heavy sales. The mills are busy and buyers are supplied for the present.

Philadelphia

June 2—A stronger tone exists in the pig-iron market. The large buyers of foundry iron have covered their requirements for the most part, but the firming up of prices has brought out many orders from small people, who would not buy before. Prices are a step higher, No. 2X bringing $16.25@16.50, while many sellers ask 25c more for third quarter and 50c for fourth quarter iron. A large movement in basic still continues. Alabama iron is not much in evidence, but Virginia furnaces are getting some business. Forge iron is looking up.

Steel Billets—Business is chiefly in small lots. Sellers are stiffer in their ideas of price.

Scrap—Prices seem to be advancing, and dealers are not pressing sales, believing that they will do better by holding back. Heavy steel-melting scrap is in demand.

Pittsburg

June 1—The general iron and steel market has become quieter since last report. While there has been no loss in prices there has been a slight loss as to activity. It has become clearer that the buying of finished steel products in the past three months represented a distinct movement, and not the establishment of a rate which would be followed indefinitely. Buyers provided for their known requirements for some distance ahead, while there was a large tonnage bought to be placed in stock, as in many instances the lowest prices were not made unless the buyer would obligate himself to take out a given tonnage by July 1. Thus a heavy pressure is brought upon the mills for the time being. The current rate of production is probably considerably in excess of consumption, this excess going into stocks of jobbers and manufacturers, which were very low.

Pig Iron—The market has been quieter since the advances noted in last report. Buyers seem to be well covered to July 1, while those who have not bought for third quarter seem to be in no hurry to do so. Stocks of unsold iron are large, being estimated by a prominent buyer last week at 1,300,000 tons, of which there are probably 150,000 tons in Alabama and 250,000 tons in Virginia, leaving 900,000 tons for the northern districts. No effort is being made to dispose of these stocks, but should the holders suddenly conclude to liquidate prices would naturally suffer. The market at present is firm. Standard bessemer is firm at a minimum of $15, Valley, for any delivery, some sellers quoting $15.25@15.50. Basic is quoted by a few sellers at $14.50, Valley, for second half delivery, the majority quoting $14.75, while for prompt iron $14.35 has been done, and this price could possibly be duplicated. Foundry iron is $14.50@14.75, Valley, sales having been made at both prices. Malleable is quoted at $14.50@14.75, Valley, and forge at $13.50@13.75, Valley, the freight to Pittsburg being 90 cents.

Steel—A sale of 1000 tons of sheet-bars for June delivery has been made by a local steel producer to a local tin mill. It is reported that a local steel interest has sold a supply of sheet-bars to a prominent independent tinplate interest for delivery over the second half at a price below the recognized market, which is $25.50, delivered. Billets remain at $23, Pittsburg, with light transactions. Bessemer rods are $29, f.o.b. Pittsburg, and open-hearth $30. Deliveries of plates have improved further. The Pressed Steel Car Company and Standard Steel Car Company are now running at fully half their capacity, and with orders on books will be able to maintain this rate for several months. Plates are firm at 1.30c., Pittsburg, except that this basis is shaded occasionally in the case of large structural contracts.

Sheets—If anything, the market is a trifle weaker, although tonnage is as good as it was. The regular market is 2.20c. on black and 3.20c. on galvanized, on attractive orders, but in special cases these prices are sometimes shaded an extra $1 per ton.

Ferromanganese—The market is quiet. The regular quotation is $41, Baltimore, or $42.05, Pittsburg, but occasionally this price is shaded.

Metal Markets

New York, June 2—The metal markets continue to improve and there is increased buying by manufacturers in almost all lines. Confidence seems to be felt in the future, orders being placed for some time ahead.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver:			
April 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,467,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298,582	" 2,750,269

Exports from the port of New York, week ended May 29: Gold, $300,000, chiefly to Argentina; silver, $693,525, chiefly to London. Imports: Gold, $124,034; silver, $80,434, both principally from Central and South America.

Gold and silver movement in Great Britain, four months ended April 30:

	Imports.	Exports.	Excess.
Gold.....	£20,878,859	£14,472,579	Imp. £6,406,280
Gold, 1908...	16,824,776	11,485,953	Imp. 5,368,823
Silver.....	4,202,376	4,321,269	Exp. 118,893
Silver, 1908.	3,408,028	4,579,870	Exp. 1,171,842

Of the silver imported this year £3,574,425 came from the United States.

Gold and silver movement in France, three months ended March 31:

	Imports.	Exports.	Excess.
Gold... Fr.	165,570,000	F.23,020,000	Imp. Fr. 142,550,000
1908..	150,009,000	7,568,000	Imp. 142,441,000
Silver..	36,557,000	30,599,000	Imp. 5,958,000
1908...	31,120,000	43,519,000	Exp. 12,399,000

Imports of copper and nickel coins, 18,000 fr. in 1908, and 16,000 fr in 1909; exports, 90,000 fr. in 1908, and 75,000 fr. this year.

Gold—There was no special demand for gold in the open market in London this week, and the prices continued unchanged at 77s 9d. per oz. for bars and 76s. 9d. per oz. for American coin. Most of the gold was taken by the Bank of England, and for Austrian account. In New York $1,250,000 was taken today for shipment to Buenos Aires.

Platinum—Business has been rather slow, as is usual at this season. Prices are about 50c. lower, dealers quoting $22.50@23 for refined platinum, $25 for hard metal and $18@20 for scrap.

Silver—The market continues very steady, and indications point to small fluctuations for the present.

SILVER AND STERLING EXCHANGE

May-June.	27	28	29	31	1	2
New York....	52⅛	52⅞	53	....	53	52⅞
London.....	24½	24⅝	24⅜	....	24⅜	24⅝
Sterling Ex..	4.8785	4.8780	4.8780	....	4.8790	4.8785

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to May 20:

	1908.	1909.	Changes.
India.... ...	£ 3,083,318	£1,938,300	D. £1,145,018
China.....	516,400	1,075,100	I. 558,700
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,689,918	£3,096,200	D. £ 593,718

Imports for the week, £2000 from Chile, £7000 from the West Indies, £4000 from Mexico, £159,500 from New York; total, £172,500, Exports, £385,000 to India.

Copper, Tin, Lead and Zinc

May-June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
27	13¾ @13⅞	13⅛ @13¼	61	29⅛	4.30 @4.35	4 25 @4.30	5.07½ @5 10
28	13¾ @13½	13⅛ @13¼	60⅞	29	4.35	4 25 @4 30	5.07½ @5.12½
29	13¾ @13⅝	13⅛ @13¼	....	29	4.35	4.25 @4.30	5.07½ @5.12½
31	.....	.....	....	....	.....	.....	....
1	13½ @13⅝	13⅛ @13⅜	60¼	29¼	4.35	4.25 @4.30	5.10 @5.12½
2	13½ @13⅝	13⅛ @13⅜	60	29⅛	4.35	4.25 @4.30	5 10 @5.12½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—While business continued very active and transactions were numerous and on a large scale during the early part of the week, the market has quieted down since prices were raised on June 1. The market closed steady at 13½@13⅝c. for Lake copper; 13⅛@13¾c. for electrolytic in ingots, cakes and wirebars. The average for casting copper during the week was 13@13⅛ cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire has been advanced ¼c. to 14¾c. base, carload lots at mill. Business is good.

The standard market in London held firm until Tuesday, when a realizing movement of large proportions set in with the publication of an increase in statistics of 5400 tons. The close is lower and easy at £60 for spot, and £60 16s. 3d. for three months

For refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@77.

At the beginning of May copper was on the basis of 13c. for Lake and 12½@12⅝c. for electrolytic. The important demand that developed at the end of April expanded during the first half of May and transactions became extraordinarily large. The volume of business was somewhat smaller during the second half of May, but continued large. The total sales for the month were very much in excess of the production. However, it is to be remarked that they covered deliveries extending several months ahead. At the beginning of May sellers were willing to make contracts for August delivery and some such transactions were made, but when the demand increased in strength the agencies generally refused to make contracts for later than July, except at an advance in price corresponding to carrying charges. At the end of May, however, some sales were being made for August delivery. The demand from domestic consumers improved very much during the month but at the end it appeared to be more or less satisfied, sales for near-by delivery being effected rather slowly. A large part of the transactions in May were speculative, there having been a rampant bull movement in the London market, emanating largely for this side. The superior advantages of speculating in copper, as compared with shares in the companies, was extensively urged. This speculation was a reminder of that which occurred last fall, when many outsiders took an interest in the market. Under these influences the price for standard copper in London was bid up above the parity of refined, and of course, the international houses took advantage of the opportunity to sell standard and deliver refined against their sales. As in the former case this implies an element of danger in the London market. At the best it indicates merely a transfer of a part of the accumulated stock. Indeed the European statistics at the end of May show an increase in the supply, while the American statistics, it is anticipated, will show a decrease. In the New York market there was a steady advance in price during May and at the close Lake copper was 13½c. and electrolytic 13 3/16 cents

Exports of copper from the United States, four months ended April 30, are reported by the Bureau of Statistics at 88,040 long tons; this includes estimated contents of ore and matte, which were comparatively a small quantity. Exports for May are estimated at 31,423 tons, making a total of 120,363 tons for the five months.

Tin—The market in London remained very quiet. The only feature of interest which developed was the favorable statistics for the month of May which were published on June 1. The effect on quotations, however, was only minimum, and the small advance could not even be maintained. The market closes steady at £131 17s. 6d. for spot and £133 2s. 6d. for three months.

The domestic market moved in sympathy with the London market, attaining its high point on the first of the month, but closes somewhat easier at about 29⅛ cents.

Lead—The market is firm and the leading sellers have again advanced their price to the extent of $1 a ton, thus making the quotation at New York 4.35, while St. Louis is quoted at 4.25@4.30. Chemical lead has sold at St. Louis as high as 4.32½ cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 2, that lead is strong at the advance. Missouri brands are selling at 4.32½@4.35c. basis, East St. Louis.

The London market is again somewhat lower, the close being cabled at £13 2s. 6d. for Spanish and £13 5s. for English lead.

Spelter—The improvement in the steel and iron industry continues to exercise a favorable influence upon the price of spelter, and under the impetus of a good business, the market advanced to 5.10@5.12½c., St. Louis, 5.22½@5.27½c., New York.

The London market is firm, and the close is higher at £22 2s. 6d. for good ordinaries, £22 7s. 6d. for specials.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 2, that the latest sales of spelter have been on a basis of 5.15c., East St Louis.

New York quotations for spelter, May 27, were 5.22½@5.25c.; May 28 and 29, 5.22½@5.27½c.; June 1 and 2, 5.25@5.27½ cents.

Base price of sheet zinc is 6¾c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—The market has been dull. In the absence of large sales quotations are unchanged at 8⅛c. for Cookson's; 7⅞c. for U. S., and 7⅛@7⅝c. for outside brands.

Aluminum—Business is fair; otherwise there is no change. Prices are 22@24c. base for No. 1 ingots; 31@32c base for wire; 33@34c base for sheets

Quicksilver—Business has been better, but New York prices are unchanged at $44.50 per flask of 75 lb. San Francisco, $44 for domestic orders and $42 for export. London price is £8 7s. 6d. per flask, but 5s. lower is quoted from second hands.

Nickel—Large lots, contract business, 40@50c per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots, for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States, four months ended April 30, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	88,940	48,577	Exp. 40,363
Copper, 1908....	124 406	27,219	Exp. 97,187
Tin, long tons....	129	14,332	Imp. 14,203
Tin, 1908.....	100	10,518	Imp. 10,418
Lead, short tons.	31,592	34,998	Imp. 3,406
Lead, 1908....	26,832	37,768	Exp. 10,936
Spelter, sh. tons	1,894	1 101	Exp. 793
Spelter, 1908....	1,167	267	Exp. 900
Nickel, lb....	3,653,292	6,255,032	Imp. 2,601,830
Nickel, 1908....	4,341,453	4,807,773	Imp. 466,320
Antimony, lb. ..	4,032	2,830,303	Imp. 2,826,271
Antimony, 1908.	2,616	2,624,131	Imp. 2,621,515
Platinum, oz.....	.....	39,995	Imp. 39,995
Platinum, 1908.	.....	12,388	Imp. 12,388
Quicksilver, lb	143,266	.....	Exp. 143,266
Quicksilver, '08	81,488	.....	Exp. 81,488
Aluminum, value	$150,735	.....	Exp. $150,735
Aluminum, 1908	137,316	.....	Exp. 137,316
Ores, etc..			
Zinc oxide, lb. .	9,701,223	.....	Exp. 9,701,223
Zinc oxide, '08..	8,919,325	.....	Exp. 8,919,325
Zinc dross, lb....	7,875,465	.....	Exp. 7,875,165
Zinc dross, '08..	9,077,781	.....	Exp. 9,077,781
Zinc ores, lg. tons	2. 25	31,543	Imp. 29,518
Zinc ores, 1908.	10,118	10,900	Imp. 782
Antimony ores, lb.	504	3,311,160	Imp. 3,310,656
Ant. ores, 1908.	.....	306,203	Imp. 306,203
Chrome ore	.....	15,272	Imp. 15,272
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 21,230 tons calamine and 10,315 tons other ores, against 5104 and 5706 tons, respectively, in 1908. Chrome ore was not reported separately last year.

Zinc and Lead Ore Markets

Platteville, Wis., May 29—The highest price paid this week for zinc ore was $43, the base price, $40.50@$41 per ton of 60 per cent. zinc. For 80 per cent. lead ore, $55@$56 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 29.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	1,054,346	... ...	249,000
Strawberridge.....	880,000	... ..	.
Cuba City	517,930	.	160,000
Hazel Green	495,600	.	.
Benton	437,000	.	.....
Livingston	380,000	. ....	.....
Galena..... ...	88,000	. ...	.....
Total.	4,840,776		409,000
Year to May 29	47,253,729	1,950,035	3,918,000

Highland, Linden, Harker are not reported. In addition to the above there was shipped to the American Zinc Ore Separating Company, 90,100 lb., and to the Joplin Separator Works, 409,000 lb. zinc concentrates.

There was shipped in the previous week, not then reported, from Highland, 65,800, from Linden, 56,220, from Harker, 77,750 and from Montfort, 40,000 lb. zinc ore; from Highland, 54,600 lb. lead ore.

Joplin, Mo., May 29—A sharp competitive market has advanced prices to $46 per ton for the highest grade of zinc sulphide ore. Offerings of $43.50 base were numerous, and ore is reported sold on flat bids at a price equivalent to a base of $44 per ton of 60 per cent. zinc. The base price for slimes, or sludge ore, was $38. Silicate of zinc ore sold on a base of $17@19.50 per ton of 40-per cent. zinc, the highest sale being at $25.50. The average price, all grades, was $39.36. The high price for lead ore was $59, with medium grades selling at $57@58. The average price, all grades, was $57.86 per ton.

The zinc-ore market has been in a nervous and excitable condition all this month, and all efforts to establish any semblance of unity of price offerings by smelters, or of acceptance terms by sellers, have proved futile. For three weeks buyers have made purchases varying from $1 to $2 per ton for the same grade of ore. Instead of anticipating the advance sellers have been as greatly at sea as buyers.

SHIPMENTS, WEEK ENDED MAY 29.

	Zinc, lb.	Lead, lb.	Value.
Webb City Carterville	4,090,260	652,080	$100,914
Joplin	2,122,180	179,800	50,841
Prosperity	910,880	39,220	19,808
Galena	804,710	87,040	18,434
Duenweg	452,230	143,600	13,434
Aurora	543,710	48,480	10,405
Carthage	336,540	....	7,066
Spurgeon.....	282,600	58,500	6,739
Granby . . .	436,650	11,500	5,452
Shoalsburg-Saginaw..	162,630	62,630	4,270
Alba-Neck	131,840	.....	3,931
Badger	162,690	.....	3,416
Oronogo.....	244,010	.....	3,376
Zincite	241,780	5,020	3,076
Carl Junction.....	114,100	5,300	2,544
Cave Springs.....	128,550	.....	2,635
Quapaw.....	95,180	14,940	2,287
Scott City	109,570	.....	2,246
Sarcoxie	106,000	.....	2,170
Totals	11,445,470	1,309,100	$263,044
Five months.....	249 361,660	40,097,510	$5,591,240
Zinc value, the week, $225,172;		5 mos.,	$4,528,006
Lead value, the week, 37,872,		5 mos.,	1,063,234

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	$37 60	$41.25	$35.56	$38.46	$46 88	$52.17
February.....	36.63	36.94	34 92	34.37	49 72	50.50
March... ..	36.19	37.46	34 19	34 71	49 06	50 87
April...	35.40	38.63	31.08	37 01	52 47	55 [illegible]
May.....	31.19	40.06	33 39	37 42	56.05	[illegible]
June.....	33.06	.	32.07	...	60.48	.
July	34.55	..	31.67	.	59.90	
August	36.59	.	33 42	.	60.34	.
September	37.63	.	34.44	. .	54 59	.
October... .	35.95	.	33.28	. .	52.63	.
November.	39.13	.	35.02	.. .	54 83	.....
December..	42 75	.....	39.63	. .	49.68	.. ..
Year.....	$36.63	.....	$34.31	.. .	$53 93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, June 2—Current demand in most lines is for moderate sized lots. Heavy shipments are restricted chiefly to contract business.

Copper Sulphate—Sales are better and prices a little firmer. Quotations are, $4.25 per 100 lb. for carload lots, and $4.50 per 100 lb. for smaller orders.

Arsenic—Sales have been fair and quotations are a little higher, 2⅞@3c. being asked for white arsenic.

Nitrate of Soda—The market is good with many sales. Spot nitrate is steady at 2.25c.; futures are a shade lower, at 2.12½c., in view of good supplies reported afloat.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, four months ended April 30, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	1,873,866	E.	1,873,866
Bleach, lb	30,017,652	5,152	I. 30,012,500
Potash salts, lb..	133,685,384	1,374,219	I. 132,311,165
Soda salts, lb....	4,726,522	237,378	I. 4,489,144
Acetate lime, lb	.....	32,085,786	E. 32,085,786
Nit. of soda, tons	116 562	2,709	I. 113,859
Phosphates, tons	3,997	340,206	E. 336,209
Sulphur, tons..	9,631	9,820	E. 189
Pyrites, tons.....	223,733	....	I. 223,733

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 90,124 long tons.

Mining Stocks

New York, June 2—After a holiday extending from Friday over to Tuesday the Stock Exchange opened rather strong and prices were well held on a good volume of trading. The most notable feature in the market continues to be the strength of Steel Corporation stocks, especially the common, which has advanced steadily and holds at a new record price. It is thought by many that this is an inside movement, but its object is not clearly apparent. Matters on the Exchange look very much as if preparations were being made for a strong bull movement.

On the Curb also there was an active market, but the movement was rather mixed, some stocks going over last week and others losing. Copper shares were in good demand and showed considerable buying, especially Nevada-Consolidated and Cananea. Fly, while Ray Consolidated made a fair advance. In the Nevada stocks Goldfield Consolidated was heavily dealt in and some other stocks showed considerable strength. Some attention was also given to the Cobalt stocks, La Rose and Nipissing being the

leaders. There was some sales of Yukon Gold, but little change in price.

Boston, June 1—The week covers but four days of stock market, as the Saturday preceding and the Monday following May 30 were market holidays. Prices, however, have shown a gradual hardening tendency, and commission houses report increased business, which indicates that the public is taking an interest. The ease of money is a contributing cause, although there is room for improvement, market-wise.

Mass mining has been the feature, showing an extreme advance of $3.87½ to $18.25, but today it broke to close to $14 on selling from the Lake Superior district. Stop orders were reached which facilitated the decline. It seems that a mill-run test is being made on the recent strike of rich ore and precedent has established the rule that it is a good time to realize profits.

North Butte has been less of a market factor and selling pressure has been removed, for the time being at least. After stiffening $2.75 to $59, it fell back to $56.75 again. Calumet & Hecla is up $40 for the week to $675 per share, which cannot be construed any other way than favorable. Copper Range has been dull, although it showed animation today up to $82.25 on declaration of the usual quarterly dividend of $1 per share.

The Curb market has been principally in stocks that will sooner or later be taken over on the Stock Exchange list. As a rule, it has been firm in tone.

STOCK QUOTATIONS

NEW YORK June 2		BOSTON June 2	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Minc.....	.57	Adventure.....	9¼
Amalgamated	85⅜	Allouez.....	40
Anaconda.....	51⅝	Am. Zinc.....	‡25½
Balaklala.....	12⅛	Arcadian.....	57
British Col. Cop..	8⅝	Arizona Com.....	42½
Buffalo Mines....	‡3½	Atlantic.....	9½
Butte Coalition...	27⅝	Boston Con.....	15
Colonial Silver....	‡¼	Calumet & Ariz...	104
Cum. Ely Mining.	8¼	Calumet & Hecla	675
Davis-Daly.....	5⅛	Centennial.....	‡24
Dominion Cop....	.07	Copper Range....	82
Douglas Copper..	2⅛	Daly-West.....	7½
El Rayo.....	2	East Butte.....	14
Florence.....	3⅛	Franklin.....	16¾
Foster Cobalt.....	.32	Greene—Can....	10⅝
Furnace Creek...	.10	Hancock.....	11¼
Giroux.....	7⅞	Isle Royal.....	28½
Gold Hill.....	⅛	Keweenaw.....	4¾
Goldfield Con.....	7⅛	La Salle.....	14
Granby.....	‡104	Mass.....	15
Greene Gold.....	½	Michigan.....	10¼
Greene G. & S....	9	Mohawk.....	66
Guanajuato.....	1⅛	Nevada.....	23
Guggen. Exp.....	105	North Butte.....	57
Hanapah.....	.15	Ojibway.....	11½
Kerr Lake.....	8⅜	Old Colony.....	‡.60
McKinley Dar....	.85	Old Dominion....	‡55
Miami Copper....	15	Osceola.....	137
Micmac.....	¾	Parrot.....	35¼
Mines Co. of Am..	⅛	Quincy.....	‡90
Mitchell Mining..	2¾	Rhode Island....	‡4¾
Mont. Sho. C.....	‡1¼	Shannon.....	16
Nev. Utah M. & S.	2⅛	Superior.....	41½
Newhouse M. & S.	‡2½	Superior & Bost..	1 7/16
Nipissing Mines..	10⅞	Superior & Pitts..	14½
Old Hundred.....	½	Superior & Pitts..	71
Silver Queen.....	.37	Tamarack.....	14
Stewart.....	¼	Trinity.....	50
Tennessee Copr.	41¼	U. S. Smg. & Ref..	4¾
Tri-Bullion.....	⅛	U. S. Sm. & Ref. pd	42¾
Union Copper....	1 7/16	Utah Con.....	5
Utah Apex.....	6½	Victoria.....	6
Utah Copper.....	51⅝	Winona.....	148
Yukon Gold.....	5 9/16	Wolverine.....	3
		Wyandotte.....	

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡30
Am. Smelt. & Ref..	94
Am. Sm. & Ref., pf	‡109¾
Colo. Fuel & Iron.	41⅞
Federal M. & S., pf.	‡91
National Lead....	87
National Lead, pf.	108
Pittsburg Coal....	12¾
Republic I. & S....	30
Republic I. & S., pf.	97
Sloss-Sheffield....	83¾
Standard Oil.....	676
U. S. Steel.....	65⅝
U. S. Steel, pf.....	120½
Va. Car. Chem....	50¾

BOSTON CURB	Low.
Ahmeek.....	160
Black Mt.....	.98
Chemung.....	17
Globe Con.....	‡4⅝
Helvetia.....	6⅝
North Lake.....	17⅝
Ray Central.....	3 1/16
Ray Con.....	18
San Antonio.....	11½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	May 29	
N. of Com.	High.	Low.
Adams.....	40	.30
Am. Nettie..	.08	05
Center Cr'k	2 00	1.50
Cent. C. & C..	81.00	80.00
C. C. & C. pd.	80.00	79 00
Cent. Oil....	110 00	100 00
Columbia....	8.00	5 00
Con. Coal....	20 00	19 00
Doe Run....	110 00	100 00
Gra. Bimet.	25	20
St. Joe	12 00	11 00

LONDON	June 2
Name of Com.	Clg.
	£1 58 0d
Dolores.....	0 3 1½
Stratton's Ind.	1 1 6
Camp Bird....	2 19 6
Esperanza ...	1 2 6
Tomboy	1 6 3
El Oro.....	0 13 9
Oroville.....	

Cabled through Wm P. Bonbright & Co., N. Y

NEVADA STOCKS. June 2.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.....	16
Belcher.....	.50	St. Ives.....	.10
Best & Belcher...	.35	Triangle.....	01½
Caledonia.....	.09	BULLFROG STOCKS	
Challar.....	.06	Gibraltar.....	03
Comstock.....	.31	Homestake King.	.01
Con. Cal. & Va....	.66	Mont. Shoshone C.	1 87½
Crown Point.....	.50	Tramp Cons.....	.06
Exchequer.....	.25	MISCELLANEOUS	
Gould & Curry....	.08	Bonnie Clare.....	..
Hale & Norcross..	.20	Lee Gold Grotto..	...
Mexican.....	.79	Nevada Hills.....	1.12½
Ophir.....	1.20	Nevada Smelting	.87½
Overman.....	.14	Nevada Wonder..	.50
Potosi	13	Nevada-Utah.....	2 37½
Savage.....	.19	Penn-Wyoming...	.04
Sierra Nevada....	.28	Pittsburgh S. Pk..	50
Union	.31	Rawhide Cnol'tn.	...
Utah	.04	Round Mt. Sphinx	10
Yellow Jacket....	56		
TONOPAH STOCKS			
Belmont.....	.78		
Extension.....	.50		
Golden Anchor....	...		
Jim Butler.....	.15		
MacNamara.....	.22		
Midway.....	.22		
Montana.....	.68		
North Star.....	.92		
Tono'h Mine of N.	7.12½		
West End Con....	.27		
GOLDFI'D STOCKS			
Adams.....	.02		
Atlanta.....	.14		
Blue Bell.....	.03		
Booth.....	.15		
Columbia Mt.....	.10		
Comb. Frac.....	.75		
Con. Red Top.....	.02		
Cracker Jack.....	.02½		
Dia'dfield B. B. C.	.04		
Goldfield Belmont	.04		
Goldfield Daisy...	.29½		
Great Bend.....	.08		
Jumbo Extension	.12		
Kendall.....	.04		
Lone Star.....	.04		
May Queen.....	.04		
Oro.....	.08		
Red Hill.....	.08		
Roanoke.....	...		
Sandstorm.....	.10		

COLO. SPRINGS	May 28
Name of Comp.	Clg.
Acacia.....	.07
Black Bell.....	....
C. C. Con.....	.03⅛
Dante.....	‡.06
Doctor.....	.08½
Elkton.....	.63
El Paso.....	.47⅜
Findlay.....	‡.15
Gold Dollar.....	.11½
Gold Sovereign...	‡.03
Isabella.....	.20½
Jack Pine.....	.06¾
Jennie Sample...	‡.07
Jerry Johnson...	‡.05¾
Mary McKinney..	.38
Pharmacist.....	.03⅛
Portland.....	.89
Un. Gold Mines..	.05¾
Vindicator.....	.57
Work.....	‡.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida.....	May 8	June 5	$0.005
Bullion, Nev	June 14	July 13	0.05
Challenge Con., Nev.....	June 22	July 13	0.05
Chollar, Nev.....	June 8	June 30	0.10
Confidence, Nev.....	May 18	June 8	0.20
Con. Imperial, Nev.....	May 26	June 17	0.01
Dalton M. & M. Utah....	May 26	June 9	0.00
Echo, Ida	May 1	June 1	0.005
Exchequer, Nev.....	May 5	May 26	0 05
Gould & Curry, Nev.....	June 8	June 26	0.10
Iron M. & M., Utah.....	May 15	June 14	0.05
Julian Con., Nev.....	May 24	June 17	0 03
Lucky Ida. Ida.....	Apr. 7	May 1	0 003
Mexican, Nev	June 28	July 14	0 10
New Superior	Apr. 10	May 1	0.07½
Pa'myra G. & C. Utah....	June 11	June 30	0.001
Reindeer G. & G., Ida.	Apr. 28	May 28	0.005
Scorpion, Nev	June 14	July 6	0.02
Silver Nevada, Nev.....	May 4	May 25	0.10
Union Treas. H. P. Utah..	May 20	June 9	0.01
Union C. Nev.....	June 28	July 19	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January....	55.678	51.750	25.738	23.834
February....	56.000	51.472	25.885	23.706
March.....	55.365	50.468	25.570	23.227
April.....	55.505	51.428	25.133	23.708
May.....	52.795	52.905	24.377	24.343
June	53.093	.....	24.760	.....
July	53 115	.....	24.514	.....
August	51.083	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51 431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year.....	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January...	13.726	13.893	13.901	14 280	62 386	57.688
February	12.905	12 949	13.098	13 295	58.786	61 198
March	12.704	12 387	12 875	12 826	58.761	56 231
April	12.743	12 561	12 928	12.93	58.331	57.363
May ...	12.598	12.893	12.788	13.228	57 387	.....
June	12.675	.....	12.877	.....	57 842	.....
July	12.702	.....	12.933	.....	57.989	.....
August ..	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October ..	13.354	.....	13.616	.....	60 132	.....
November	14.130	.....	14.386	.....	63.417	.....
December.	14.111	.....	14.411	.....	62.943	.....
Year.....	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January ..	28.380	28.060	July	29.207	.....
February ..	28.978	28.290	August	29.942	.....
March	30.557	28.727	September	28.815	.....
April ..	31.702	29.445	October .	29.444	.....
May..	30.015	.....	November .	30.348	.....
June	28.624	.....	December .	29.154	.....
			Av. Year..	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	3.691	4.175	4.025	4.169	13 113	
February	3.725	4.018	3.868	4.250	13.313	
March	3.838	3.986	3.835	13.975	13.438	
April	3.993	4.168	4.051	13.469	13.297	
May.....	4.253	4.287	4.214	12.938	.....	
June.....	4.466	.....	.....	12.600	.....	
July	4.744	.....	.....	13.000	.....	
August.....	4.580	.....	.....	13.375	.....	
September ...	4 515	.....	.....	13.125	.....	
October.....	4.351	.....	.....	13.375	.....	
November	4.330	.....	.....	13.538	.....	
December.....	4 213	.....	.....	13.156	.....	
Year.....	4.200	.....	.....	13.439	.....	

New York and St Louis, cents per pound. London, pounds sterling per long ton

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.990	20.563	21.425
February ..	4 788	4.889	4.648	4 739	20.875	21.563
March	4 665	4 757	4.527	4.607	21.075	21.438
April..	4 645	4.965	4 495	4.815	21.344	21.531
May	4.698	5.124	4 458	4.974	19.906	.....
June	4.543	.....	4 393	.....	19.000	.....
July	4.485	.....	4 338	.....	19.031	.....
August.....	4.702	.....	4.556	.....	19.350	.....
September..	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November .	5 059	.....	4.909	.....	20.875	.....
December .	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

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9365—WELDING—Aluminum Welding. M. U. Schoop. (Electrochem. and Met. Ind., May, 1909; 2 pp.) Notes on the applications of aluminum welding and description of the most suitable type of burner. Illustrated. 40c.

ANTIMONY

9366—METALLURGY AND USES of Antimony. E. B. Wilson. (Mines and Minerals, May, 1909; 2 pp.) Notes on the use of antimony; its ores, methods of testing; wet and fire assays and metallurgical processes. 20c.

ASBESTOS

9367—QUEBEC ASBESTOS: World's Supply Controlled. Alex Gray. (Min. Journ., Apr. 3, 1909; 1 p.) Statistics on the asbestos industry in Canada; the names of the companies in the asbestos combine, together with notes on prices and markets. 40c.

ASPHALTUM

9368—GRAHAMITE DEPOSITS of Southeastern Oklahoma. Joseph A. Taff. (Bull. No. 380-H, U. S. Geol. Surv., 1909; 12 pp.) Notes on the location and occurrence of grahamite in southeastern Oklahoma, together with a review of the geology of the district.

9369—NEVADA—An Occurrence of Asphaltite in Northeastern Nevada. Robert Anderson. (Bull. No. 380-H, U. S. Geol. Surv., 1909; 3 pp.) Some notes on the occurrence and character of asphaltite as found in Northeastern Nevada.

9370—WEST AFRICA—Bitumen and Oils in West Africa. T. Hugh Boorman. (Eng. and Min. Journ., May 22, 1909; 1 p.) A brief report on the occurrence of bitumen in Nigeria with analyses in which it is compared with that of Trinidad and Bermudez. 20c.

BORAX

9371—CALIFORNIA—Borate Deposits of California. Wilfred B. Wainewright. (Trans. Manchester Geol. and Min. Soc., Part IV, Vol. XXXI, 1908-1909; 7 pp.) A short description of the mineral deposits, together with notes on the refining of crude borax.

CALCIUM CARBIDE

9372—MANUFACTURE of Calcium Carbide. (Engineering, Apr. 2, 9, 16 and May 7, 1909; 8 pp.) Continuation of article previously indexed, describing the installation and operation of the electric generating plant, and general arrangement of the works at Odda, Norway. Also gives details of the cableway used in handling raw material, the carbide furnaces, crushing machinery and the manufacture of drums and barrels for the finished product. $1.40.

CEMENT

9373—COLORADO—The Niobrara Limestone of Northern Colorado as a Possible Source of Portland Cement Material. G. C. Martin. (Bull. No. 380-J, U. S. Geol. Surv., 1909; 13 pp.) Notes on the general geologic features of the district; requirements for cement materials, a description of the material occurring near Ft. Collins, Colorado, together with analyses of cement rock.

9374—COMPOSITION AND CHARACTERISTICS of Cement. Alfred C. Crider. (Min. Sci., Apr. 8, 1909; 2 pp.) Some notes on the history, advancement, uses and various forms of cement. Illustrated. 20c.

9375—MONTANA—Cement Material Near Havre, Mont. Leon J. Pepperberg. (Bull. No. 380-J, U. S. Geol. Surv., 1909; 9 pp.) Notes on the geology of the district and composition of cement materials. Also notes on the economic conditions.

9376—PORTLAND CEMENT. John L. Howard. (Min. and Sci. Press, May 1, 1909; 4½ pp.) An historical review of the cement industry, together with notes on tests for soundness, fineness, tensile strength and compressive strength. 20c.

9377—TESTING—Standard Methods of Testing Cement. Carney Hartley. (Min. Sci., May 13, 1909; 3 pp.) An article dealing with the importance of a proper test of the cement prior to use, giving specifications for cement and the method of determining quality. Illustrated. 20c.

CLAYS

9378—FLORIDA—Notes on the Clays of Florida. George C. Matson. (Bull. No. 380-K, U. S. Geol. Surv., 1909; 24 pp.) A description of the clays of different geologic periods together with a number of chemical analyses. Also a description of the mining method and manufacturing processes.

COAL AND COKE

9379—ALBERTA—Coal Mining in Alberta During the Year 1908. (Can. Min. Journ., May 15, 1909; 3½ pp.) A review of the mining industry in Alberta during 1908; the development of old mines and the opening of new ones, and the names of the principal operating companies. Illustrated. 20c.

9380—ANALYSIS of the Subject of Coal Analysis. N. W. Lord. (Power, Apr. 13, 1909; 3 pp.) A discussion of the chief things coal users wish to know, with notes on the value of the various methods used in analyzing coal. Paper before the Illinois Fuel Conference at Urbana, March 13. 20c.

9381—BITUMINOUS COAL. Methods of Firing Cheap Grades of Bituminous Coal. William Kavanagh. (Elec. Wld., May 8, 1909; 1 p.) A discussion of six different methods for firing with soft coal, with notes on the advantages of each. Illustrated. 20c.

9382—BRIQUET MAKING. W. Gallowny. (Proc. South Wales Inst. Engrs., Vol. XXVI, 1909; 47 pp.) Statistics and a general description of the process of briquetting, together with notes on the cost of installation and operation. A short description of a briquet plant at the Holland colliery, Westphalia. Illustrated.

9383—COAL CUTTING MACHINES. A Comparison of Coal-cutting Machines. Sydney F. Walker. (Eng. and Min. Journ., May 22, 1909; 4½ pp.) Notes in which various coal cutting machines are compared; a statement of costs which show the economy of machine mining; a discussion of compressed air as compared with electric power. 20c.

9384—COAL DUST to Date, and Its Treatment with Calcium Chloride. Henry Hall. (Trans. Min. Inst. of Scotland, Vol. XXXI, Part 4, 1908, 36 pp.) A short review of coal dust literature; tests of coal dust in airways; effects of watering; effects of calcium chloride treatment of dust and a description of the method of its application.

9385—COAL DUST PROBLEM, The. John Verner. (Mines and Minerals, May, 1909; 3½ pp.) Discusses the mechanical influence of air currents in furnishing conditions favorable to dust explosion. Illustrated. 20c.

9386—COKE. Donohoe Coke Company. C. R. King. (Mines and Minerals, May, 1909, 4 pp.) A description of the plan of the works and mine, arrangements for economic expansion and contraction of output; and notes on the managing of the liquor question. Illustrated. 20c.

9387—COKE—Koppers By-Product Coke Oven Plant at Joliet. R. Gunderson. (Progressive Age, May 1, 1909; 2¾ pp.) A general description of a plant of 280 by-product coke ovens now in use at the works of the Illinois Steel Company. Illustrated. 20c.

9388—COKE—The Genesis and Development of the Coking Oven. W. Galloway. (Proc. South Wales Inst. Engrs., Vol. XXVI, 1909; 12 pp.) An historical review of the coke industry covering a period of over 200 years. Illustrated.

9389—COLORADO—The Grand Mesa Coal Field, Colorado. Willis T. Lee. (Bull. No. 341-C, U. S. Geol. Surv., 1909; 20 pp.) General notes on the geology and geography of the district, together with short descriptions of some of the local deposits. Illustrated.

9390—COLORADO AND NEW MEXICO—The Coal Field Between Durango, Colorado, and Monero, New Mexico. James H. Gardner. (Bull. No. 341-C, U. S. Geol. Surv., 1909; 13 pp.) A short description of the geology of the district, together with some notes on the various coal beds. Illustrated.

9391—COLORADO AND UTAH—Coal Fields of Northwestern Colorado and Northeastern Utah. H. S. Gale. (Bull. 341-C, U. S. Geol. Surv., 1909; 35 pp.) A preliminary statement of the results of investigations in these fields during 1907, dealing with their geology, and giving a detailed description of the coal fields, illustrated by geologic maps.

9392—COST OF MINING: An Investigation of the Cost of Mining Coal. J. R. Finlay. (Eng. and Min. Journ., May 8, 1909; 3½ pp.) An analysis of the operating cost in which it is shown that the rate of wages is an effect and not a cause in the economy of mining. 20c.

9393—ELECTRICAL PLANTS—Notes on Safety of Working Electrical Plants in Coal Mines. S. A. Simon. (Electrician, Apr. 9, 1909; 2 pp.) A consideration of the precautions necessary in installing and employing electrical apparatus in mines, with notes on tests carried out some years ago in Europe to determine the value of enclosing electrical conductors as a protection against explosion. Illustrated. 40c.

9394—EXPLOSION—Notes on the Norton Hill Colliery Explosion. H. M. Morgans. (Eng. and Min. Journ., May 15, 1909; 1½ pp.) A discussion of the action of fire damp and coal dust in mine explosions, with comments on the mine inspector's report of the disaster. 20c.

9395—EXPLOSIONS—Mine Explosions as Related to Earthquakes. W. A. Spalding. (Eng. and Min. Journ., May 1, 1909; 1½ pp.) A supplemental list of coincidences and close approximations of earthquakes and mine explosions. 20c.

9396—EXPLOSIVES—Relation of the Use of Powder to Mine Accidents. (Black Diamond, May 15, 1909; 1¾ pp.) Statistics on the use of powder in mines showing that an excess of powder invariably results in greater fatalities. Illustrated. 20c.

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9611—WINDING ROPES—Stresses on Winding and Conducting Ropes as Used in Mine Shafts. Joseph Hindley and John Stoney. (Trans. Manchester Geol. and Min. Soc., Vol. XXXI, 1908-1909; 7 pp.) A short mathematical discussion of stresses in winding ropes with some notes on an indicator for ascertaining the stresses. Illustrated.

ORE DRESSING

9612—CONCENTRATION—Calculations in Ore Concentration. Rudolf Gahl. (West. Chem. and Met., April, 1909; 19 pp.) Notes on the value of assays, screen tests, distribution of pulp, together with methods of calculations used in ore concentration. Illustrated. 80c.

METALLURGY—GENERAL

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MINING AND METALLURGICAL MACHINERY

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9619—BOILER WATER—Feed Water Heaters as Purifiers. J. C. William Greth. (Industrial Engineering, April, 1909; 8 pp.) Heat and its relation to the purification of water for industrial uses, especially boiler feed, is discussed, together with tabulated results of laboratory experiments. 40c.

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9622—CONVEYING MACHINERY — A Unique Belt Conveyer. E. C. Soper. (Journ. A. S. M. E., May, 1909; 8 pp.) A description of a belt conveyer one quarter of a mile long used for the handling of Portland cement material. Illustrated.

9623—CONVEYING MACHINERY—Automatic Feeders for Handling Material in Bulk. C. Kemble Baldwin. (Journ. A. S. M. E., May, 1909; 9 pp.) This paper presents a brief description of the various types of automatic feeders now in use including the undercut-gate, lifting gate, screw conveyer, roll and plunger feeders. Illustrated.

9624—CONVEYING MACHINERY—Mechanical Appliances Used on the Mines of Western Australia. W. G. Manners. (Monthly Journ. W. A. Chamber of Mines, Feb. and Mar., 1909; 9½ pp.) Notes on the transportation of material by mechanical means, with special reference to launders, rope haulage and belt and push conveyers. Illustrated. $1.40.

9525 — CONVEYING MACHINERY — Modern Material-Handling Machinery for Industrial Plants—I. A. G. A. Schmidt. (Ind. Eng., April, 1909; 26 pp.) A discussion of chain blocks, derricks, I-beam systems, traveling cranes, locomotive cranes, with some notes on coal storage systems. Illustrated. 40c.

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9630—HYDRO ELECTRIC PLANTS—The Design of Steel Pipes for Hydro-Electric Plants. Richard Muller. (Eng. Rec., May 1, 1909; 1¾ pp.) A mathematical discussion of the design of steel water pipes to be used under heavy pressure. Illustrated. 20c.

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CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Berts, good drill quality, carat.		$85.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs; Turkish flour	"	.01½@.02
Grains	"	.03½@.04
Naxos flour	"	.01½@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
Peekskill flour, f. o. b. Easton, Pa.	"	.01½@.01¾
Grains, in kegs	"	.02¼@.03
Garnet, per quality	sh. ton.	25 00@35.00
Pumice Stone, Am. Powd., 100 lb.		1.60@2.00
Italian, powdered	per lb.	.01½@.01¾
Lump, per quality	"	.05@.30
Rottenstone, ground	"	.02½@.04
Lump, per quality	"	.05@.30
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.02½ up
Boric	"	.07
Hydrofluoric, 30%	"	.02½@.03½
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°, per lb.		1.25@1.50
Nitric acid, 38°	per lb.	.04½@.04½
Sulphuric acid, 50°, bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.10
66°, bulk, ton		18.00
Oxalic	per lb.	.06½@.07
ALCOHOL—Grain 95%	gal.	2.64
Denatured	"	.45@.47
Refined wood, 95@97%	"	.50@.55
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.03¾@.05
ALUMINUM—Sulphate, com'l.	lb.	1.50@1.75
AMMONIA—24 deg. lb.	"	.04½@.05½
" 26 deg. lb.	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.28
Carbonate	"	.07¾@.09½
Muriate grain	"	.05¾@.06½
Lump	"	.09½@.09¾
Sulphate, 100 lb.		2.85@2.90
Sulphocyanide com.		.30
" " chem. pure	"	.40
ANTIMONY—needle, lump	"	.03¾@.04
ARSENIC—White	"	.02¾@.03
Red	"	.07¾@.08
ASPHALTUM—		
Barbadoes	per ton.	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.09@.10
Gilsonite, Utah ordinary	per ton.	32.00
Trinidad	"	20.00@25.00
California	"	22.00@28.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated 96@98%	"	36.00@40.00
Powdered, 80@90%	lb.	.02¼@.02½
Chloride com'l	ton.	37.00@39.00
Nitrate powdered, in casks	lb.	.05½@.06½
Blanc Fixe, dry, bbl.	per lb.	.02¼@.04
BARYTES—		
Am. Ground	sh. ton.	12.00@17.00
Floated	"	17.00@20.00
Foreign floated	"	20.00@22.00
BISMUTH—Sub-nitrate	lb.	1.40@1.45
BLEACHING POWDER—35%, 100 lb.		1.25@1 50
BLUE VITRIOL—copper sulphate), carload, per 100 lb.		4 25@4.50
BONE ASH	lb.	.02½@.04
BORAX, sacks	"	.04½@ 05
CALCIUM—Acetate, gray, 100 lb.		1.75@1 80
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65 00
Chloride, f.o.b. N. Y.	"	11.00@14.00
CEMENT—		
Portland, Am. 500 lb	bbl.	1.50@1.60
Foreign	"	2 25@2 90
"Rosendale," 300 lb	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	14 00@16 00
Bricks, f.o.b. Pittsburg, per M.		175 00
CLAY, CHINA—Am common ex-dock, N. Y.	ton.	7 00@10 00
Foreign	"	10 00@17.50
COBALT—Oxide	lb.	1 10@1.50
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground	sh. ton.	8.00@12.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20 00@23 00
Special extra		30 00@35.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8 00@10 00
Ground	"	12 00@14.00
Foreign crude ex. dock	"	8.00@10.00
FULLER'S EARTH—Lump, 100 lb.		.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02½@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Largel ump	"	.08½@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4 00@7.00
INFUSORIAL EARTH—		
Ground Am. best	lb.	.01½@ 02½
German	lb.	.02½@ 02½
LEAD—Acetate (sugar of) brown.	lb.	.07¾@ .08
Nitrate, com'l	"	.07¾@.08½
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	30.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	
(foreign	"	.90@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@ 01½
75@85% binoxide	"	.01½@ 01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	8 50@9.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 07%, with 5% Thorium oxide, nominal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
Sulphate, double	"	.06½@.08
NITRATE OF SODA—		
100 lb. 95%		2 25
95% for 1910		2 25
96% is 2½@7½c. higher per 100lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.05½@.06½
English glassmakers'	"	.08½@.08½
Lithopone	"	.03¾@ 07
Metallic, brown	sh. ton.	16.50@22 00
Red	"	14.00@18 00
Ocher, Am. common	"	8 50@9.00
Best	"	16.00
Dutch, washed	lb.	.02¾@ .03
French, washed	"	.01½@.02
Paris green, pure, bulk	"	.21½
Red lead, American	"	.06@ 06½
Foreign	"	.08½@ .08¾
Turpentine, spirits bbl., per gal.		.42@ .43
White lead, Am., dry	lb.	.05½@ .05¾
American, in oil	"	.06½@ .07
Foreign, in oil	"	.10½@.10¾
Zinc white, Am. extra dry	"	.05½@.05¾
French, process red seal, dry	"	.06¾@.07
French, process green seal, dry	"	.07½@ .07½
PHOSPHATES—Acid		.57@.60c per unit
*Fla., hard rock 77		7 50@8.00
land pebble 68		3 75@4.00
†Tenn., 78@80%		5 00@5.50
75%		4 75@5 00
68@72%		4 25@4 50
‡So. Car. land rock 60		3 50@4 00

*F.o.b. Florida or Georgia ports †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.08½@.08¾
Bicromate, Am.	"	.08½@.08¾
Scotch	"	.10½
Bromide	"	.20
Carbonate (80@85%)	"	.03½@.04
Caustic, ordinary	"	.06½@.06¾
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.09½@.09¾
Crystals	"	.09@.09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons	"	.20@ 22½
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13½
Red	"	.30@.33
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported, non-arsenical, furnace size, per unit		.12@ 12½
Imported, arsenical, furnace size, per unit		.11½@.12
Imported fines, arsenical, per unit.		.09
Imported fines, non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form

SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry	lg. ton.	10.00@15.00
Silex, ground	"	13.00@15.00
Silex, floated	"	35 00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb.	.04½@.05
"Alkali," per 100 lb., 58@48	"	.80@.87½
Bicarb. soda, per 100 lb	"	1 00@1.30c.
Soda, caustic, per 100 lb., 78@60	"	1 90@2.00
Soda, caustic, powdered	"	.02¾@.03½
Salt cake, per 100 lb., bulk	"	.40 up
Salt cake, bbl.	"	.65@.85
Soda, monohydrate, per lb.	"	1.40@1.75
Bicromate	lb.	.06½@.06¾
Bromide	"	.20
Chlorate, com'l	"	.08½@.09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.	"	1.30@1.50
German	"	1 60@1.70
Phosphate	100 lb.	2.20@2.50
Prussiate	"	.08½@.09
Sal soda, f.o.b. N. Y.	"	.65@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1 50
Sulphate, com'l (Glauber's salt)	100 lb.	.60@ .80
Sulphate, com'l, calcined	"	.65@ 85
STRONTIUM—Nitrate	lb.	.07½@.08
SULPHUR—Louisiana (prime) to New York	lg. ton.	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1 85@2 15
Flour	"	2 00@2 40
Flowers, sublimed	"	2 20@2.60
Sicilian extra qual. unmixed seconds, crude brimstone to New York	lg. ton.	$22 00
Other ports	"	22 50
TERRA ALBA—Fr & Eng.	100 lb.	.80@1 00
TALC—Domestic	sh. ton.	15 00@20.00
French	"	15 00@25.00
Italian, best	"	30 00@40.00
TIN—Bi-chloride, 50%	lb.	.09
Crystals	"	.20½@ 23
Oxide, lb.	"	.32½@.35
URANIUM—Oxide	"	3.50
ZINC—Chloride sol com 20°	"	.02½
Chloride, granular	"	.05@ 06
Dust	"	.05@ 05½
Sulphate	"	.02½@.03

NOTE—These questions are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Par Val.	Total to Date.	Dividends. Latest. Date.	Amt.
Alaska, Mexican, g.	Alas	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas	200,000	5	10,455,000	April '09	0.50
Alaska United, g.	Alas	180,200	3	513,520	April '09	0.25
Amalgamated, c.	Mont	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.	500,000	100	16,000,000	April '09	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	30,625,000	April '09	1.75
Am. Smelters, pf. A	U. S.	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf B.	U. S.	300,000	100	6,000,000	June '09	1.25
Am. Zinc, Lead&Sm	Kan	80,000	25	250,000	Nov. '07	0.50
Anaconda, c.	Mont	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c.	Ariz	3,682,520	...	6,182,520	April '06	0.50
Atlantic, c.	Mich	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s.	Mont	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D.,pf.,l.z.	Wis	196,607	1	10,949	Nov. '08	0 1½
Boston & Montana.	Mont	150,000	25	53,400,000	April '09	3.00
Bull,Beck. & Cham.g	Utah	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull.	Ida	300,000	10	10,971,000	May '09	0.15
Butte Coalition, c. s.	Mont	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizona,c.	Ariz	200,000	10	10,500,000	May '09	1.00
Calumet & Hecla, c.	Mich	100,000	25	108,950,000	June '09	6.00
Camp Bird, g., s.	Colo	820,000	5	5,904,000	May '09	0.24
Carisa, c. g.	Utah	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s.	Utah	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c.	Utah	283,340	5	226,832	Oct. '07	0.20
Con. Mercur, g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich	384,185	100	8,452,074	July '09	1.00
Creede United, g.	Colo	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l.	Utah	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l.	Utah	180,000	20	5,731,000	April '09	0.30
De Lamar, g. s.	Ida	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.	Mo	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.	Colo	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.	Colo	2,450,000	1	4,115,545	April '09	1.01
Fed Sm., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.	Idaho	120,000	100	4,751,250	June '09	1 75
Findley, g.	Colo	250,000	1	337,500	Sept. '06	0.01
Florence, g.	Nev	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev	912,000	1	546,000	Jan. '08	0.05
Gemini-Keystone.	Utah	5,000	100	2,000,000	Aug. '07	0.10
Gold King Con.	Utah	3,750,000	1	1,407,504	May '05	0.01
Goldfield Con., g.	Nev	3,546,013	10	2,834,232	July '09	0.30
Grand Central, g.	Utah	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g.	Cal	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.	S. D	218,400	100	24,372,440	May '09	0.50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.	Ariz	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf.	N. Y.	89,126	100	1,871,646	May '09	1.50
Iron Blossom, s. l.	Utah	1,000,000	0.10	80,000	April '09	0 08
Iron Silver.	Colo	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal	390,000	10	347,100	April '09	0.02
Jerry Johnson.	Cal	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.	Mont	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s.	Colo	130,551	5	130,440	Jan. '07	0.15
Lightner, g.	Cal	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah	190,000	1	57,000	Sept. '07	0.07½
MacNamara, s. g.	Nev	728,341	1	21,850	May '09	0 01
Mammoth, g. s. l.	Utah	400,000	2 50	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l.	Utah	500,000	1	108,000	Sept. '08	0.01½
Mohawk, W.	Mich	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Purch.	Mont	80,833	25	9,437,274	Jan '07	15.00
Nevada Hills, s.g.	Nev	746,000	5	373,000	Dec. '07	0.10
New Century, z. l.	Mo	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah	600,000	10	300,000	Sept. '07	0.50
New Idria, q.	Cal	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc.	U. S	100,000	100	12,000,000	May '08	4.00
North Butte	Mont	400,000	15	7,200,000	June '09	1.00
North Star, g.	Cal	250,000	10	1,911,988	Mar. '09	0.30
Old Dominion, c.	Ariz	293,245	25	849,332	Mar. '09	0.50
Old Dominion,M&Sc	Ariz	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.	Nev	201,600	3	1,816,360	May '08	0.10
Osceola, c.	Mich	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. a.	Mont	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, c.	Cal	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co	U. S.	44,934,600	1	1,123,365	April '09	0.02½
Portland, g.	Colo	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.	Nev	100,000	10	375,000	July '07	0.20
Quincy, c.	Mich	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q.	Utah	1,000,000	1	225,000	Nov. '06	0.00½
St. Joseph, l.	Mo	1,000,000	10	6,308,357	Mar. '09	0 15
Shannon, c.	Ariz	300,000	10	450,000	July '07	0.50
Silver Hill, g. s.	Nev	108,000	1	81,000	June '07	0.05
Silver King, g. s. l. †	Utah	150,000	20	11,187,500	July '07	0.35†
Silver King Co't'n. †	Utah	1,224,425	5	1,105,402	April '09	0 15
Sioux Con	Utah	746,389	1	335,585	April '09	0 07
Snowstorm, s. l.	Ida	1,500,000	1	735,000	May '09	0.03
Standard Con., g. s.	Cal	175,394	10	5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo	1,000,000	5	4,895,865	April '06	0 12½
Swansea, g. s. l.	Utah	100,000	5	329,500	Mar. '07	0 01
Tamarack, c.	Mich	60,000	25	9,420,000	July '07	4 00
Tennessee, c.	Tenn	200,000	25	2,056,250	Sept. '08	1 25
Tomboy, g. s.	Colo	300,000	5	2,016,000	Dec '08	48
Tonopah of Nev.	Nev	1,000,000	1	4,600,000	April '09	0 35
Tonopah Belmont.	Nev	1,500,000	1	600,000	April '07	0.10
Tonopah Ext'nsion.	Nev	928,433	1	283,030	April '06	0.15
Tonopah Midway.	Nev	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l.	Utah	500,000	1	295,000	Dec '08	0.02
United States, com.	Utah	350,933	50	2,148,099	April '09	0.50
United States, pfd.*	Utah	185,845	50	5,306,49	April '09	0 87½
United States, pfd.*	Utah	453,000	100	5,9[illegible],500	Aug. '07	1.75
United Cop. com.	Mont	50,000	100	1,500,000	May '07	3 00
United, c. pf.	Mont	19,556	25	312,582	Jan. '08	0 50
United, z. l., pf.	Mo-Kan.	300,000	10	1,388,322	Mar. '09	0 75
United Verde, c.	Ariz	100,000	100	1,000,000	Jan. '07	1 50
U. S. Red. & Ref. Pf.	Colo	39,458	100	[illegible]	[illegible]	0 02
Utah, g. (Fish Sp'gs)	Utah	100,0[illegible]	10	[illegible]	April '09	0 50
Utah Con., c.	Utah	300,000	5	[illegible]	[illegible]	0 50
Utah Copper.	Utah	727,[illegible]	10	[illegible]	Mar '07	0 04
Victoria, Utah.	Utah	250,000	1	[illegible]	[illegible]	0 03
Vindicator Con., g.	Colo	1,500,000	1	[illegible]	April '09	0.05
Wolverine, c.	Mich	60,000	25	[illegible]	[illegible]	0 01
Work, g.	Colo	1,500,000	1	[illegible]	[illegible]	0 03
Yankee Con	Utah	1,000,000	10	938,789	Aug. '07	0 20
Yellow Aster, g.	Cal	100,000	10	[illegible]	[illegible]	[illegible]

*Previous to consolidation $1,436,250 were divided. †Assessable.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Par Val.	Total to Date.	Dividends. Latest. Date.	Amt.
Allis-Chalmers, pf.	U. S	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S	181,530	100	1,747,620	April '09	3.00
American Cement.	Pa	200,000	10	1,288,000	Jan. '09	0.30
American Coal	Md	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa	150,000	100	900,000	Nov. '06	0.75
Cambria Steel	Pa	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo	51,250	100	2,613,750	April '09	1.50
Central C. & C., pf.	Mo	18,750	100	1,476,562	April '09	1.25
Col.&Hock. C.&I., pf.	Ohio	69,244	100	383,818	April '08	1.50
Consolidated Coal.	Ill	50,000	100	350,000	July '08	1.00
Consolidation Coal.	Md	102,500	100	x10 431,650	Jan. '09	3.50
Crucible Steel, pf.	Pa	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf.	N. J	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem., com.	U. S	74,103	100	2,297,193	June '09	1.00
General Chem., pf.	U. S	100,000	100	6,255,000	Jan. '09	1.50
International Salt.	Penn	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., cm	Pa	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'f C. & I., pf.	Pa	15,000	100	900,000	Feb. '09	2.50
Kern River Oil	Cal	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav.	Pa	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf.	Md	18,850	100	‡2,030,997	Dec. '08	2.50
Monon R. Coal, pf.	Pa	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com.	U. S	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf.	U. S	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com	N. Y	149,054	100	3,456,497	July '09	1.25
National Lead, pf.	N. Y	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel&Wire,pf.	N. Ye	25,778	100	631,561	May '08	1.75
New Central Coal	Md	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf.	W. Va	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax	Cal	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil	Cal	92,000	10	711,000	June '08	0.06
Penna. Salt	Pa	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.	Pa	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.	Pa	664,800	50	*24,250,000	Feb. '09	0.75
Phila. Gas, pf.	Pa	129,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf.	Pa	297,010	100	11,434,962	April '09	1.75
PocadontasC.C., pf.	W.Va	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.	W. Va	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala	100,000	100	2,133,000	June '09	1.25
Sloss-Sheffield, pf.	Ala	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil	U. S	970,000	100	652,802,905	June '09	9.00
Tenn. C. & I., com.	Tenn	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal.	Texas	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling.	U. S	50,000	100	5,875,000	Jan. '09	5.00
U.S. Steel Corp., cm.	U. S	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S	180,000	100	14,700,869	April '09	2.00
Warwick I. & S.	U. S	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal	Pa	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. xStock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Par Val.	Total to Date.	Dividends. Latest. Date.	Amt.
Amistad y Conc'rdia	Mex	9,600	50	$417,070	April '08	$1.36
Batopilas	Mex	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.	Ont	900,000	1	399,000	May '09	0.01
Buttes' Salvador, g.	Sal	100,000	5	600,000	April '05	0.25
Cobalt Central, a.	Ont	4,761,500	1	139,845	May '09	0.01
Coniagas, s.	Ont	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass.	B. C	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. a.	Mex	400,000	1	660,000	Aug. '09	0.15
Dominion Coal, com.	N. S	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf.	N. S	30,000	100	†630,000	Feb. '08	3.51
Dos Estrellas, g. a.	Mex	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. a.	Mex	1 080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.	Mex	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, a.	Ont	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn	B. C	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper	Mex	864,000	10	6,137,800	Mar. '07	0 40
Guanajuato	Mex	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. a.	Mex	10,000	100	30,000	July '08	3 00
Guggenheim Expl.	Mex	105,000	100	5,535,000	July '09	2.50
Hinds Con., g. s. c. l.	Mex	5,000,000	1	100,000	Feb. '09	0.02
Kerr Lake, a.	Ont	600,000	5	1,108,000	June '09	0 30
La Rose Con.	Ont	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., g.	B. C	200,000	25	425,000	Dec. '06	0 48
Le Roi No. 2, g.	B. C	120,000	25	889,200	Mar. '09	0 48
Luck'y Tiger-Com., g	Mex	65,000	10	71,500	Dec. '08	0.30
McKinley-Darragh, s	Ont	2,000,000	1	480,000	Jan. '09	0 05
Mex. Con. M.&S. Co	Mex	240,000	10	660,000	Mar. '08	0 25
Mex. Mill.&Trans.pf.	Mex	12,000	100	35,450	Jan. '08	3 00
Mines Co. of Am.	Mex	2,000,000	1	3,605,000	Aug. '09	0.03
N. Y. & Hond. Ros.	C. A	150,000	10	2,497,000	May '09	0.10
Nipissing, s.	Ont	1,200,000	5	2,640,000	April '09	0.25
N. S. St.&Coal, com.	N. S	9,876	100	1,087,856	April '08	1.50
N. S. St. & Coal, pf.	N. S	10,300	100	479,130	April '09	2.00
Penoles*	Mex	2,500	100	8,630,000	Dec. '07	20.00
Peregrina, pf. s.	Mex	10,000	100	538,656	Mar. '09	3.50
Pinguico, pf. s.	Mex	20,000	100	240,000	Oct. '08	3.00
Reco, g. s. l.	B. C	985,000	1	527,082	April '06	0.02
Right of Way	Ont	499,518	1.00	264,701	May '09	0.10
Securities Corp., pf.	Mex	2,000	100	42,639	July '08	3.50
Silver Queen, s.	Ont	1,500,000	1	345,000	Nov. '08	0 05
Temiskaming, s.	Ont	2,500,000	1	525,000	April '09	0.06
Tezuitlan Copper	Mex	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c.	N. F	89,000	2	495,630	May '08	0.55
Tretheway, s.	Ont	945,450	1	311,998	May '09	0.10
Tyee, c.	B. C	180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The Pneumelectric Machine Company, of Syracuse, N. Y., has established a new agency with Eastin & Haley, in the Madisonville Savings Bank building, Madisonville, Ky.

Traylor Engineering Company, Allentown, Penn., reports that it has just closed an order with the Boston Idaho Mining Company, of Boston, Mass., for a 100-ton concentrating plant.

It is reported that the Berwind-White Coal Mining Company, Windber, Penn., has installed four more Pneumelectric coal punchers. This brings the total up to twenty-six now in use by this company.

Du Bois Iron Works advises that its office, formerly located at 1206 Park building, Pittsburg, Penn., and managed by G. E. Webb, has been moved to 1429 Park building, giving more commodious quarters.

The John Simmons Company, 102 Centre street, New York City, has about perfected the new Baldwin acetylene safety lamp. It is constructed on lines as simple as the regular models and is also about the same size and weight as the present type of safety lamp.

The C. O. Bartlett & Snow Company reports the following recent orders: Benson Mines Company, Benson Mines, N. Y., one skip hoist; Geo. H. Clippert & Bro. Brick Company, Detroit, Mich., one low-pressure brick dryer, capacity 30,000 brick per day; Baldwin Bros., Cleveland, Ohio, one gravel outfit for disintegrating, elevating, screening and washing gravel.

A report has been circulated that the Ottumwa Iron Works, Ottumwa, Iowa, has been totally destroyed by fire. This report probably originated from the burning of the foundry roof. The damage has, however, not only been repaired, but the foundry has been enlarged and improved machinery added to increase the output and the quality of the product of the company.

The C. O. Bartlett & Snow Company announces that owing to the increased eastern business of the company, it has established an office at 50 Church street, New York City, in charge of H. H. Bighouse, chief engineer, who will give personal attention to all matters pertaining to the elevating, conveying and economical handling of materials, as well as mechanical drying and other lines of the business.

Chalmers & Williams, Inc., Chicago, Ill., report the following sales: Five stamp mill to M. K. Rodgers, Alaska; No. 5 Kennedy gyratory crusher, two sets of 36-in. by 14-in. rolls and twelve 6-ft. frue vanners to Bunker Hill and Sullivan Milling and Construction Company; 3½-ft. Huntington mill plant for Cape Gracias, Nic.; No. 6 Kennedy gyratory crusher, with screen and elevator, to Arthur McMullen and Company, New York City.

Asa Whitney, formerly of A. Whitney & Sons' Carwheel Works, Philadelphia, who has been for some years secretary and metallurgist of the Sanford-Day Iron Works, Knoxville, Tenn., has severed his connection with that company and will engage in the manufacture of mine equipment and car wheels at Bristol, Tenn. Mr. Whitney is a grandson of Asa Whitney, a pioneer in the manufacture of chilled wheels and at one time president of the Philadelphia & Reading Railway.

Penberthy Injector Company, Detroit, Mich., offers to send sample copy of "The Penberthy Engineer and Fireman" free. The subscription price is 50 cents a year, including a handsome silver-finish watch fob premium. The magazine does not write up the company or any other concern. Its circulation is 10,000 copies each month and it has over 3500 paid subscribers, contains 80 pages of choice, interesting, instructive reading. Handsome cover and good quality paper throughout.

Circular 1502 issued by the Westinghouse Electric and Manufacturing Company contains much valuable information on alternating current distribution covering transformers, lightning arresters, insulators, cross arms, etc. Considerable space is devoted to underground and overhead construction applicable to congested and scattered districts. There is also given information on potential regulating systems. The circular contains 52 pages of information of value to any central station man or any other connected in any way with the distribution of power by alternating current lines.

Since the appearance on the market of ready roofings that need no painting, there has been a very lively curiosity on the part of many people to see the goods. Accordingly the makers of Amatite have arranged to supply samples to any inquirer free of charge. These samples show the goods complete with the mineral surface which replaces paint as a protection against the weather, and it is easy to obtain a very good idea of just what Amatite is like. All you have to do in order to obtain the sample is to send a postal card request for same to the nearest office of Barrett Manufacturing Company, at New York, Chicago, Philadelphia, Boston, Cincinnati, Cleveland, Pittsburg, Minneapolis, St. Louis, Kansas City or New Orleans.

Foote Mineral Company has issued the twelfth edition of its complete mineral catalog, compiled by W. M. Foote. This notable compend is of permanent value to the field amateur, as well as the professional mining man. The present volume has been completely overhauled by the compiler from cover to cover and embodies an inexhaustible fund of information relative to metalliferous minerals, including important data on the rare metals which will intuitively appeal to the student and all around mining man. The work adheres closely to the Dana system and the different types and varieties follow each species heading with more elaborate descriptions of the forms and physical characters of each than was practical in earlier issues. The catalog will prove a useful addition to the industrial library of the professional worker.

A large installation of squirrel-cage induction motors, aggregating 2200 h.p., is being made at the Bonnie Cotton Mills, Kings Mountain, N. C. These motors, which have been furnished by the Crocker-Wheeler Company, of Ampere, N. J., will operate on a 2080-volt, 3-phase, 60-cycle circuit. There are 32 machines in all, varying in output from 20 to 100 h.p. Each unit is controlled from a separate panel, built of Blue Vermont marble. Two 10-kw., 2200 110 volt-Crocker-Wheeler transformers will also be installed in this plant. The Youngstown Sheet and Tube Company, Youngstown, Ohio, has added to its 5000 h.p. of Crocker-Wheeler motors by installing a 500-h.p. synchronous motor. This machine will operate on a 3-phase, 25-cycle circuit at the unusually high potential of 6000 volts. It will be used to drive a centrifugal pump. The Indiana Steel Company, Gary, Ind., has placed an order for twenty-one form W motors, aggregating 655 h.p., of the type developed by the Crocker-Wheeler Company for rolling-mill service. These machines will be used to operate cranes on a 220-volt, direct-current circuit.

A. Leschen & Son Rope Company has just issued a very handsome book of views, entitled "Over the Waters of Lake Michigan." The various views in this pamphlet show the construction and arrangement of the Leschen company's patent friction grip wire rope tramway furnished to the George W. Jackson, Inc., Chicago, Ill. The tramway is 8000 ft. long and, with the exception of a few hundred feet, is built over Lake Michigan—connecting a temporary crib out in the lake with the shore. The tramway is used to transport rock and other material excavated in the construction of the new water supply tunnel for Chicago. The excavated material is elevated through a shaft in the crib out in the lake and is then loaded into the tramway carriers or buckets. At the land terminal the rock is discharged into bins, where it is later crushed for the making of concrete. The workmen go to and from the crib over the tramway in specially designed carriages. The carriers hold an average of 1000 lb. of material each and are fitted with a patent friction grip, whereby each carrier is automatically released from the rope on entering a terminal station. By means of a series of overhead rails it is possible to move the carriers to any desired point for loading or discharging. The gripping of the carriers to the rope is performed mechanically. The power necessary to operate the system is applied through bevel gearing at the shore terminal.

Trade Catalogs

Denver Fire Clay Company, Denver, Colo. Bulletin. Her disc pulverizer. Illustrated.

Sullivan Machinery Company, Chicago, Ill. Booklet. Air compressors. Illustrated, 20 pages, 3½x6 inches.

The Goulds Manufacturing Company, Seneca Falls, N. Y. Catalog. Power pumps. Illustrated, 188 pages, 7x8 inches, paper.

The Ball & Wood Company, Elizabethport, N. J. Catalog. Rateau-Smoot turbines and generators. Illustrated, 6x9 inches, paper.

Joseph Dixon Crucible Company, Jersey City, N. J. Booklet. Valuable graphite products. Illustrated, 22 pages, 3½x6 inches, paper.

Jacobson Machine Manufacturing Company, Warren, Penn. Bulletin No. 27. Gas and gasolene engines. Illustrated, 24 pages, 6x9 inches.

Alberger Condenser Company, 95 Liberty street, New York. Catalog No. 13. Wainwright water heaters. Illustrated, 16 pages, 6x9 inches.

Robins New Conveyor Company, 72 Front street, New York. Catalog. Robins genuine Balata belting. Illustrated, 14 pages, 3½x6 inches, paper.

American Electric Furnace Company, 45 Wall street, New York. Bulletin. Rochling-Rodenhauser and simple induction furnaces. Illustrated, 24 pages, 9x12 inches.

C. W. Hunt Company, 45 Broadway, New York. Pamphlet No. 094. Mast and gaff automatic railways, coal tubs, hoisting blocks, etc. Illustrated, 8 pages, 6½x9 inches.

Keuffel & Esser Co., Hoboken, N. J. 1909 catalog. Drawing materials, engineering and surveying instruments, drafting-office furniture. Illustrated, 540 pages, 6x9 inches, cloth.

The Hartz Machinery Company, 607 Arch street, Philadelphia, Penn. Catalog No. 3. Power transmitting machinery and supplies. Illustrated, 36 pages, 3½x6 inches, paper.

Fairbanks, Morse & Co., Chicago, Ill. General Catalog No. 60. Hoisting engines, motors, locomotives, cars, pumps, drills, valves, scales, etc. Illustrated, 640 pages, 6x9 inches, cloth.

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Foundations of the Goldfield Consolidated Mill

About 7000 Cubic Yards of Concrete in Place Cost $11.82 per Yard, The Average Mixture Being 1—3.6—3.67. Labor Cost High

BY PERCY E. BARBOUR*

The new 600-ton mill of the Goldfield Consolidated Mines Company at Goldfield, Nev., which has recently been put in operation, presents an example in the matter of concrete foundations in metallurgical mill construction, that is notable in several ways. The size of the job is not the least interesting of the data to be given in this connection. In excavating for the mill foundations, 28,325 cu.yd. of rock were blasted. Nearly 7000 cu.yd. of concrete have been placed, data on 6182 yd. of which are here given. The steel-mill building weighs 1,453,304 lb. and the machinery and equipment resting on the concrete will weigh as much more, not including the pulp in process in the tank, which will be 600 tons of ore per day with treatment water amounting to 6 tons of water to the ton of ore. In addition to this, the battery ore bins when full hold 4000 tons of ore.

The equipment of the mill and the plan of treatment were described in the JOURNAL of Sept. 5, 1908. When the design of the mill was in hand, it was estimated that the concrete would cost $12 per yd. in place. Detailed cost sheets for 6182.7 yd. show an actual total average cost of $11.82 per yd. of concrete in place, which is certainly a lasting compliment to J. H. MacKenzie, general manager, and to J. B. Fleming, the mechanical engineer, under whom the original design was made.

THE GOLDFIELD CONSOLIDATED MILL, ABOUT TWO MILES NORTH OF GOLDFIELD, NEV.

MILLSITE, SHOWING CONCRETE PLANT AND GRAVITY TRAM—GOLDFIELD CONSOLIDATED MINES COMPANY

Concrete Plant

The mill is of the usual terraced construction and is situated about 2 miles

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town of Goldfield. At the top of the hill was the plant for crushing the rock and making the concrete. This plant consisted of a No. 3D Gates gyratory crusher, set to give a 2½-in. product. From this crusher the rock was carried by a steel-light bucket elevator to a 48x84 in. revolving screen which ran 21 r.p.m., and was set with a pitch of 1¼ in. per foot. The oversize from this screen was discharged directly into a storage bin below. The product through the screen was passed through a set of 26x15-in. style A Allis-Chalmers rolls set directly below the screen. These rolls were set for a ½-in. product. This fine product, much of which would pass a 16-mesh screen, was used for sand in the concrete and was discharged from the rolls into a second compartment of the storage bin below. The crushing plant was driven by a 75-h.p., 3-phase, 440-volt, 60-cycle, Bullock motor.

The rock to be crushed was hauled to the top of the hill by two-and four-horse teams and was dumped on a platform level with the hopper of the gyratory crusher, into which it was shoveled by hand. The rock and sand were drawn from the storage bin through standard rack-and-pinion ore gates into Sterling concrete buggies on the mixing platform, which was about 10 ft. wide. From these buggies it was dumped into a No. 2 Ransome mixer of ½ yd. capacity. This mixer was driven by a separate 10-h.p. motor. Cement was brought to the mixing platform from the storehouse by a short semi-gravity inclined tramway about 175 ft. long, operated by a small electric hoist. Concrete buggies receiving the mixture dumped it into a short chute leading to a skip car underneath the platform. This skip was one of two on an inclined gravity tramway which lowered the concrete to the wall that was to be poured.

Rock and Sand

The rock for the concrete was quarried from Pilot Knob, a mile from the millsite on a prominent mound and hence cost nothing except for the quarrying, hauling and crushing. The larger proportion of the sand used was a product from the crushing of this rock. The rest of the sand was dug from various deposits found in the adjacent desert and was also free. Little good sand can be found for concrete purposes near Goldfield, as it contains such a large proportion of volcanic ash that it would make poor concrete. All of the pit sand used was dumped into the big crusher, although only rarely were there any rocks or pebbles large enough to be broken. It was then elevated to the screen, and thence to the rolls and thus brought to size.

Hauling the rock from the quarry to the concrete plant was done by contract teams. A two-horse team was paid $8.50 per day and hauled 1 yd. at a load. A four-horse team was paid $14 per day and hauled 3 yd. at a load. In either case eight loads were required as a day's work. The total amount of rock quarried was 6267.4 yd., of which there was used in the concrete 3842 yd. of crushed rock, the balance being used as rock sand. In the lower portion of three of the larger walls, large coarse rocks were embedded in the concrete.

Foundations

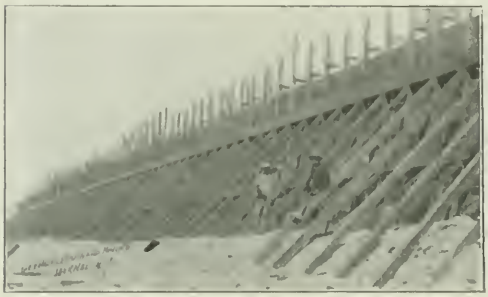
The concrete used in the foundations required 1045.7 cu.yd. of cement, the average mixture of cement, sand and rock being 1—3.6—3.67 respectively. The mixture used in some of the individual walls may be of interest. For the low retaining wall *A*, the mixture was 1—2.7—3.96; for the battery block *D*, it was 1—3.14—3.14; the mixture 1—4—4 was used for the sampling mill and mill foundations *B* and *C*, retaining walls *I*, *J*, *K*, foundation piers *L* and for certain of the tank foundations. The mixture for the tube mill foundations was 1—3.67—3.67, being almost identical with the average mixture of all concrete used.

The gravity tram was located on the center line of the mill, the shortest wall of which was 210 ft. long and the longest 294 ft. There were twelve walls and rows of foundation piers exclusive of the piers for machinery and tanks. The difference in elevation between the top of the first and the last foundations is about 132 ft., and the horizontal distance between the two is 395 feet.

The retaining walls and piers for building columns are designated by letters beginning *A*, *E*, *F*, etc., to and including *L*. *B* and *C* are rows of piers for intermediate columns under the ore bins; *D* is the concrete mortar block. All the retaining walls and foundations which carry building columns are 2 ft. wide on top; the back of the wall is in each case vertical and the front wall has a batter of 1½ in. per foot.

Beginning with wall *E*, all walls are reinforced with Johnson reinforcing bars of ¾-in. corrugated steel. Wall *A* is a plain low retaining wall; *B* and *C*, as already stated, were for ore-bin columns. The sampling-mill foundations were plain low walls and joined the main mill at the south end of the ore bins. The battery block *D* is an interesting block of concrete construction. It is 192 ft. 10 in. long by 6 ft. wide on top and has a cross-sectional area of 96 sq.ft. Instead of anchor bolts set solidly in the concrete mass, rods were used for holding down bolts and subsequently inserted in 2-in. pipes which were set in the concrete in the usual way. Wide and deep apertures were left for the nuts and washers on the lower end. The thin webs between these apertures are each reinforced with two ¾-in. steel bars 3 ft. long. Wall *G* when constructed had a form for its face only. The back wall was built up of dry rubble as an experiment, which was not so satisfactory in saving of expense as to prompt a repetition. Piers *L* were building-column piers, 2 ft. square on top with the regular batter and from 12 in. to 2 ft. deep, to reach to bedrock.

The tube-mill foundations were the usual piers for the pillow blocks for the tube mills and the necessary main line shafting for driving them and are very heavy on account of the severe service imposed. The foundations for tanks consisted of straight walls 12 in. wide on top, both sides having a batter of 1½ in. per ft., and were from 12 in. to 4 ft. high depending on the nature of the



FORM FOR RETAINING WALL F

CONCRETE FOUNDATIONS—GOLDFIELD CONSOLIDATED MILL

ground. Their only purpose was to furnish level, uniform supports for the timbers which were placed 24 in. apart, immediately under the wooden-tank bottoms.

Costs

The cost per yard of concrete in place for the retaining walls varied from $10.05 to $12.27, the latter figure being for the retaining wall *F* and the former for the retaining walls *I* and *J*. The battery block *D*, comprising 810 cu.yd. of concrete in place, cost $11.60 per cu.yd. The tube-mill foundations cost $12.65 per yd., and other foundations range from this figure up to as high as $19.31 for some of the smaller blocks. The total average cost per yard of concrete in place was $11.82, and is divided approximately as shown in the accompanying table. The item of reinforcing appears too low per yard in this table because it is apportioned over a somewhat larger number of yards than were actually reinforced. The proper cost per yard reinforced is 48 cents.

COST OF CONCRETE IN PLACE

Cement		$5.03
Rock		1.06
Rock-sand	$0.67	
Pit-sand	0.45	
Sand total cost		1.12
Labor		1.32
Forms		2.76
Engineering and Superintendence		0.15
Reinforcing		0.38
Total cost per yard		$11.82

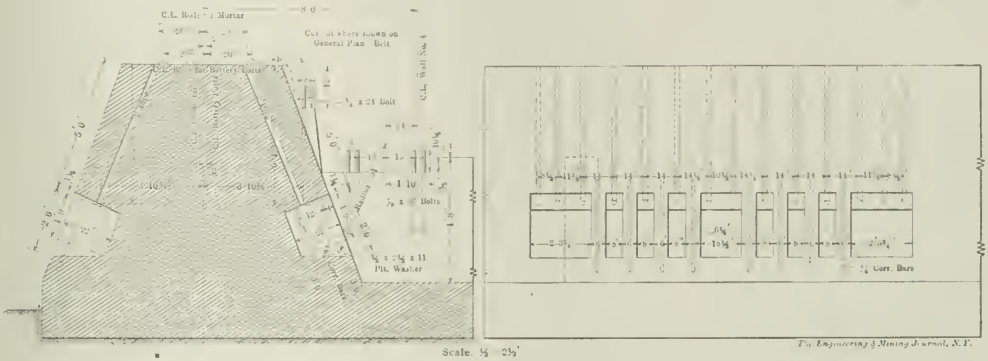
High Labor Expense

The scale of wages for this job was high, as everything is in Goldfield, and was approximately as follows per 8-hour shift: Carpenter foremen, $6; carpenters, $5; carpenter helpers, $4; concrete foremen, $5; concrete laborers, $3.50.

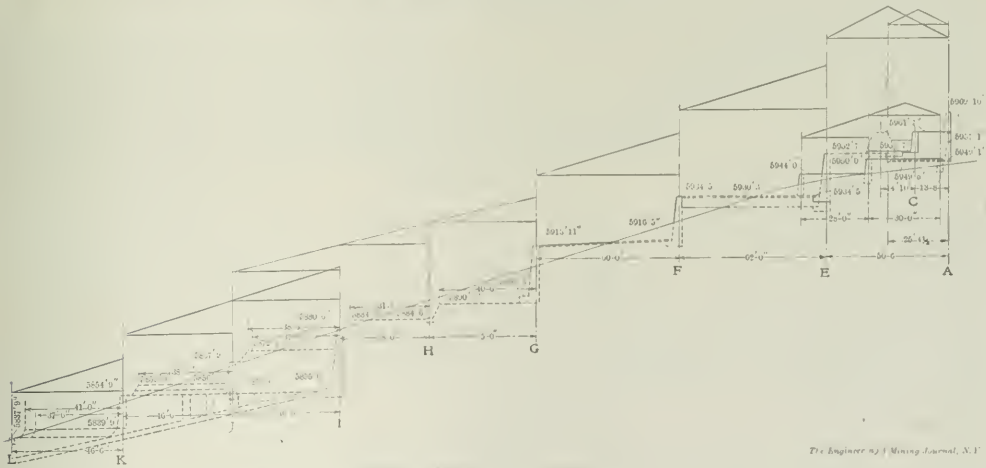
Under labor the expense includes a uniform charge of 25c. per yd. for all work to cover the drawing of the crushed material from the bins, wheeling across the short platform, dumping into mixers, adding cement and water, and running the mixer. The average labor cost for placing the concrete from the gravity tram cars to the forms was 35c. per yd., but varied between 25 and 85c., the latter figure applying on the small foundation piers *L*. The longest wall was 294 ft., making the wheel from the gravity tram cars 147 ft. Tamping cost varied between 31c and $1.20, the average expense being 72c. per yd. of concrete laid. With the high cost of Goldfield labor, these labor items are all very high and it should be noted do not include any labor in connection with the building and tearing down of the forms.

Preparing the Forms

In building forms for the foundations some of the lumber was used several times, and on the average it could be used three times before destruction. The forms were made of 2-in. planks; the ties were 2x4 in. and the braces were of 4x4-, 4x6- and 6x6 in. timbers. The forms for the higher walls were tied together by telegraph wire, twisted between the braces. All foundations bolts were hung in the usual way from cleats which



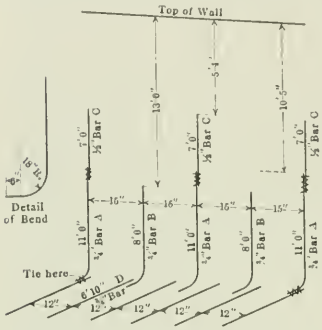
SECTION AND ELEVATION OF CONCRETE BATTERY BLOCK—GOLDFIELD CONSOLIDATED MILL



PROFILE OF MILL FOUNDATIONS—GOLDFIELD CONSOLIDATED MILL

were wired at the bottom to keep them in the proper position.

The charge for engineering and superintendence includes the total time of a concrete superintendent, a civil engineer running a transit and a chainman, but does not include designing or drafting office expense. Power cost for running the crushing and mixing machinery was extremely low, owing to the efficient system of purchase and distribution of electricity by the company. The total average cost per horsepower-hour was $0.009. The power was secured from the Nevada-California Power Company, being brought from Bishop, Cal., 150 miles west of Goldfield.



REINFORCING BARS FOR RETAINING WALL F

British Steel Production

As already noted, the production of pig iron in Great Britain in 1908 was 9,289,840 long tons; being a decrease, as compared with 1907, of 634,016 tons, or 6.4 per cent.

The British Iron Trade Association has now reported the production of steel for 1908, which shows a greater comparative decrease than that of pig iron, the total decline having been 1,227,106 tons, or 18.8 per cent. The make of steel for two years has been, in long tons:

	1907		1908	
	Tons.	PerCt.	Tons.	PerCt.
Bessemer	1,859,259	28.5	1,478,539	27.9
Open-hearth	4,663,489	71.5	3,817,103	72.1
Total	6,522,748	100.0	5,295,642	100.0

The division, according to acid and basic steel was as follows in 1908:

	Acid.	Basic.	Total.
Bessemer	906,466	572,073	1,478,539
Open-hearth	2,578,840	1,238,263	3,817,103
Total	3,485,306	1,810,336	5,295,642
Total, 1907	4,665,095	1,857,653	6,522,748

The increased proportion of basic steel last year was due to the fact that the decrease in basic open-hearth production was very much smaller than in any other kind.

The production of finished material of all forms from open-hearth ingots is reported at 3,804,129 tons. This would indicate that considerable stocks of ingots must have been carried over from the previous year, or that some foreign material was used. The latter is more probable, as Great Britain was a large importer of billets and blooms last year, chiefly from Germany. For some periods of the year British mills could buy billets, forced on the market by the German Steel Syndicate, for less than it cost to make them in their own works.

The make of finished material from bessemer steel is not fully reported, bars, forgings and some other important items being omitted. More than half the bessemer steel was used in making rails. The total production of rails for two years was, in long tons:

	1907.	1908.	Changes
Bessemer steel	832,576	715,407	D. 117,169
Open-hearth	79,532	192,525	I. 112,993
Total	912,108	907,932	D. 4,176

The remarkable point here is the great increase in open-hearth steel rails, which points to a movement in their favor similar to that which has been going on in this country.

The production of wrought or puddled iron was in direct opposition to that of steel. For several years this output has been declining, but in 1908 it showed a large gain; advancing from 975,083 tons in 1907 to 1,168,115 tons in 1908, an increase of 193,032 tons, or 19.8 per cent. The reason for this change is not altogether clear. The total production of bars, plates and all other finished forms from wrought iron last year was 1,050,772 tons.

Behavior of Tellurium in Assaying

Previous writers have been in substantial agreement regarding the use of a basic slag in crucible assays of telluride ores and the conducting of the fusion slowly at moderate temperatures. The behavior of tellurium in assaying has been investigated by S. W. Smith (*Inst. Min. and Met.*, Bull. 44).

The effect of litharge on tellurium was investigated in various ways. Lead buttons containing lead, 6 parts; gold, 1 part tellurium 1.5 parts; were fused or soaked under litharge at a temperature of about 800 deg. C. for 15 min. and then cupelled. The litharge was black, lustrous and opaque. The lead button when cupelled yielded 96 per cent. of the gold. Duplicates of these fusions were left in the furnace and the temperature raised to 1000 to 1100 deg. C. for another 15 min. and on cupelling the recovery was only 94 per cent. The slag was dark, red and glassy; evidently some of the tellurium had been reduced as indicated by the gold recovery. Again, equal portions of pure lead were fused separately with samples of the opaque and the glassy slags containing equal quantities of tellurium, with the result that the lead from the fusion with the opaque slag showed far more tellurium than the other. This would seem to indicate that a portion of the oxidized tellurium is reduced again when the temperature is raised.

A lead button of the same composition as previously described was dropped into litharge to which a little sand had been added, and which had been kept at a temperature of 1000 to 1100 deg. C. for 30 min. and allowed to remain in the furnace for 10 or 15 min. more. The weight of the button was unchanged and it was completely absorbed on cupellation. The slag was straw color and gave no indications of tellurium except for a slight reddish cloud, near the button. A repetition of the experiment, except that after the formation of the silicates the temperature was lowered and maintained at a low point after the introduction of the button, gave similar results. After the formation of silicates there is practically very little tendency for the tellurium to oxidize. An examination of the slags seemed to indicate that the reaction between the litharge and tellurium is represented by the equation:

$$2\ PbO + Te = Pb_2O + TeO.$$

and that the reverse of this reaction takes place at higher temperatures.

The effect of scorifaction, unless the operation is carried out at a moderately low temperature, is to concentrate the tellurium in the button. The most effective way to remove tellurium is to "soak" the button under litharge either in a scorifier or crucible at low temperature.

The effect of tellurium in a lead button containing gold and silver is to weaken the surface tension of the molten metal during cupellation. This effect of tellurium, assisting the general tendency of the film of litharge in the same direction, results in the tendency of the molten metal to "wet" the sides of the cupel. If the amount of lead is small in proportion to the silver, gold and tellurium, small portions of metal become detached and either pass into the cupel or leave minute beads.

Lead is more readily oxidizable than tellurium, especially at high temperatures; if sufficient tellurium remains toward the end of the cupellation, complete absorption may take place, or in other words, complete absorption and subdivision are the result of insufficient lead. The tendency to become "wetted" is greater with bone-ash cupels than with patent cupels.

The presence of silver protects gold by acting as a diluent during the cupellation of buttons containing tellurium. The absorption loss due to the presence of tellurium is a function of the temperature of cupellation. An excellent bibliography is given in connection with the paper.

The Panel System as Applied to Metal Mining

The Conditions to Be Met Were a Wide Orebody with Horizontal and Vertical Jointings, and a Weak and Treacherous Hanging-wall

BY H. E. WEST*

In metalliferous mining the efficiency and economy of extraction is largely governed by the physical characteristics of the deposit. Usually ore deposits are bounded by recognizable walls, although one, and possibly both, may be lacking in definition. Perhaps of all factors that determine the method of extraction, the character of the walls and the width of the deposit are preëminently the most important. The nature of the walls, especially that of the hanging, is an essential consideration. The character of the employees has to be considered, especially when dealing with unskilled native races.

Much depends on the character of the orebody, whether it is hard or soft, homogeneous or broken with slips or faults, or even blocky, with well developed joints or bedding planes.

As an example of the evolution of a system suitable under certain conditions, a deposit such as is illustrated in the accompanying sketches may be considered. Fig. 1 shows the shape of the deposit, together with the segregation of the several grades of ore. It will be seen that roughly the orebody may be divided into three classes: (a) Low-grade; (b) medium-grade ore; (c) rich ore. The richest ore lies against the hanging-wall, the lower grades toward the footwall.

The hanging-wall is composed of a crushed slicken-sided shale, possessing no element of stability; indeed, when at all laden with water, it behaves much like sand or thickened mud. In this shale occur ill-defined stringers, that are, however, very rich. The ore is usually from medium to hard, varying from a silica gangue on the hanging side to a barite gangue toward the footwall. The ore is stoped to a width of about 50 ft. The deposit is contiguous to the contact of an igneous and sedimentary rock, the ore being a replacement of the latter. The dip is about 70 deg. southerly. The particularly unfavorable feature of the orebody lies in the almost horizontal joints, that probably represent the bedding planes, together with a vertical jointing connecting same. The "horizontal" joints are actually inclined upward toward the slate hanging. The footwall is a hard clastic rock, considerably softened by water flowage along the line of contact.

The conditions here presented are a wide deposit, with an extremely weak and treacherous hanging-wall; the roof of the orebody has seams and joints and, moreover, is considerably faulted after deposition. The eastern end is more shattered and [illegible] bly weaker than the western. A very considerable water circulation exists along the slate hanging and, during spring, within the orebody. The one markedly favorable feature is the firm footwall and ore toward that wall.

First Method of Working

The initial method of opening up this deposit was by a center drive, cribbing and filling with waste rock. On working toward and approaching the hanging-wall, the inclined jointing or bedding planes caused the ore to break higher than the normal stope and thus expose an undue surface of the weak hanging. The consequence was that the wall ran and the roof settled, often in large masses. The hanging-wall streak was temporarily left to support the weak wall. It was found a matter of considerable difficulty to extract such ore afterward; in fact, much of it never was recovered.

On the sill stope being taken out, cribbed and filled, and on the second stope being opened up for stoping similarly, still greater falls were encountered. The settling of the hanging, moreover, was so severe that the cribs and level sets were thrown over and the latter fractured so that eventually the level had to be abandoned.

A little reflection showed the unfavorable and also certain favorable and char-

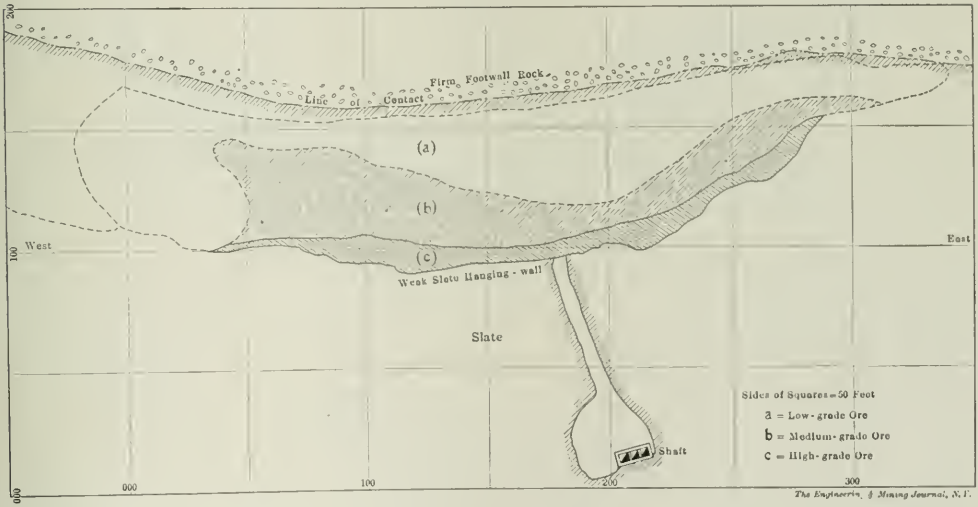


FIG. 1. TYPICAL ORE SHOOT

*Mining engineer, El Oro, Mexico.

acteristic features of the deposit, which evidently had to be taken into account in evolving an efficient method of extraction. It was evident that stoping *toward* the hanging-wall encountered peculiar difficulties. It was also evident that but little of the hanging could be exposed, unsupported with timber, at one time. It was equally clear that were any considerable area of roof left without support, a serious fall might be expected, which had the particular disadvantage of spreading upward and proving troublesome in each succeeding stope. To maintain a center drive open by any system of timbering was impracticable. Masonry was inadvisable, and probably would have shared a similar fate. Moreover, a central drive was unnecessary, unhandy for tramming, and unfavorable for the maintenance of chutes.

The Panel System

Clearly the first thing to do was to open up a rock drift along the contact, where the ground was favorable, and, moreover, rendered sufficient support to maintain such drift permanently. From the rock-drift crosscuts were driven through the deposit at 50-ft. intervals, until the hanging wall was reached. The orebody was thus cut up into panels of about 45 ft., in width. The next operation was to connect the several crosscuts by running a small drift in the slate, taking out what stringers might be encountered, timbering this drift with light sets, and filling with, preferably, large rock. Thus a solid bulkhead was erected against the soft hanging to the full hight of the stope, maintained at 7 ft., and throughout the length of the shoot. The second slice of about 6 ft. wide, consisting mainly of the rich streak, was extracted, but only through one half of the panel (about 20 ft.), unless under a firm roof, when the whole width could be safely stoped. The second slice was then filled, and the third extracted and filled, and so on toward the footwall. Thus was the half panel extracted from the hanging to the footwall. Greater freedom was exercised toward the footwall, owing to the firm character of the roof; still, this liberty could not be abused. Alternate half panels were thus extracted and filled. With the roof packed with filling, together with what sets or cribs were essential, there was little trouble experienced in extracting the remaining half panel in a similar manner. When conditions would permit, such as in the western end, panels could be turned off the lateral and stoped for the full width toward and up to the hanging. In such cases both roof and hanging were firm. Modifications between the two methods were utilized, governed by conditions.

Every stope was carefully carried to 7 ft. in hight, and worked out squarely against the hanging- and footwall. Two horizons could be simultaneously worked and, indeed, such was advisable, so that the production should be continuous and not suffer through all the preparatory blocking out falling at one period. Usually the ends were maintained in advance of the middle of the stope. Subsequent stopes were opened out and worked in a similar manner, cutting down both lateral and crosscut over the ones below, but leaving the roof of the rock drift intact. Cribbed bins were placed at the mouth of each crosscut and midway between, or about 25 ft. centers. The bins were 3 ft. square within timbers, each alternate chute being provided with a manway. All chutes delivered into the lateral, the mouth of the chute being protected with a grizzly made of 2½-in. angle iron set 6 in. apart; these were firmly spiked to the chute timbers. Winzes were sunk at 50-ft. intervals from the level above and near the footwall for chuting down filling within each panel.

Opening Up the Lower Horizon

Figs. 2 and 3 show how it was proposed to open up a lower horizon, where speed was an important factor. A preliminary, though optional, lateral is here shown in the hanging. From this crosscuts are periodically turned off. These crosscuts serve to show definitely any ore in the slate and also the extent of ore on the footwall, and determine where the footwall lateral may most advantageously be run by connecting such crosscuts. This slate lateral is then filled, as it has served the purpose. The slate, with what ore it may contain, is then extracted against the hanging wall streak as before, timbered and filled. Stoping then proceeds as shown.

Doubtless much of this preliminary work seems superfluous. It is capable of some modification, as for instance, the preliminary drift may be omitted and the footwall lateral run from the main crosscut and the work expedited from the several winzes sunk. The footwall rock being much harder, considerable more time would be consumed which, in this case, was an element of importance. Again, where the hanging wall was firm and the roof favorable, the panels could be driven from the lateral and breast stoped toward the hanging.

It was impracticable to carry forward a wide breast longitudinally as in a solid orebody, or lodes with firm walls. Square

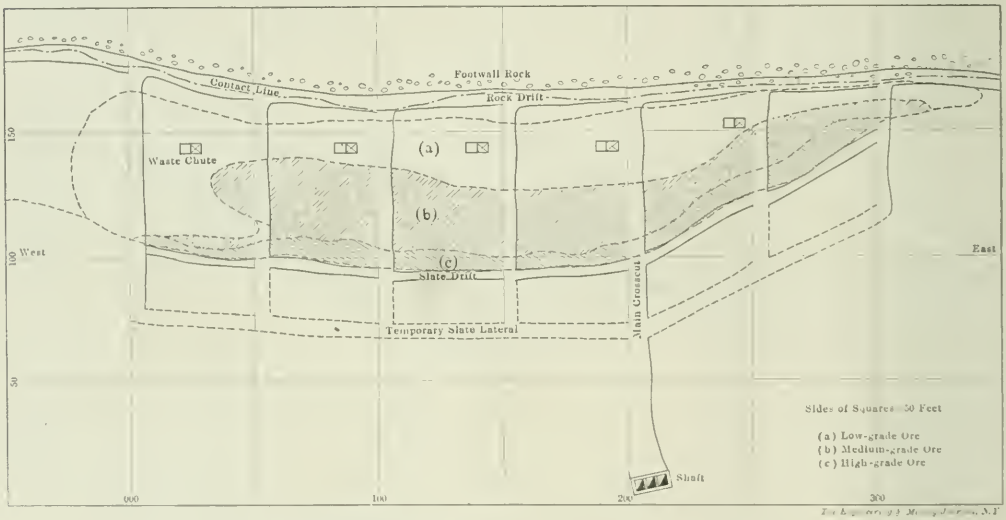


FIG. 2. PROPOSED METHOD OF OPENING UP LEVEL WHERE SPEED WAS A FACTOR

setting, though an admirable method, was impracticable both by reason of a limited timber supply and inefficient labor. Of course, had the shaft been on the footwall, there would have been no need to maintain a tramming road through the deposit.

Features of the System

The essential features of the method, which I call the "panel system," are as follows: (1) The footwall lateral, giving easy access to the deposit and insuring the permanence of the tram road. (2) The cutting up into panels, with waste-filling and ore-discharging facilities in each. (3) The extraction first either of the slate on the hanging, against the rich streak, or the rich streak itself, with the formation of a solid rock-filled bulkhead. (4) The exposure of a small area on the roof, by sectional stoping; and the stoping of half the panel leaving pillars; the supporting of the roof by filling, and subsequently the safe stoping of such pillars. (5) The comparatively large area of stoping ground exposed; the safety of the workmen, as they are never far from a safe lateral or crosscut. (6) The determination of the definition of the deposit, insuring no irregular stringers or branches being overlooked on the hanging and on the footwall, the complete blocking out of all low-grade ore. (7) The manifest facilities for estimating the grade and quantity of the ore, and the maintenance of systematic assay sheets for each stope.

It will be seen that as the hanging-wall streak is of great value, any admixture with fallen slate would occasion considerable loss; especially so as such ore is scarcely distinguished from slate. This is prevented by this panel method and, moreover, a high extraction is secured throughout the deposit.

In addition, the roof is so well secured that any considerable fall is improbable. Consequently, the stopes go up in solid ground, without the inconvenience and expense of spiling or supporting ground that has been allowed to break away overhead. A clean extraction and the keeping of the ground in place is assured. It is imperative to start the sill stope right. To maintain the roof intact at the first stage is to maintain it intact throughout, with the converse equally true.

The timber consumption is moderate, usually confined to small timber, much of which is available for reuse. The ventilation is always good. Filling is supplied with little handling where required, and the ore, with a short shoveling, or wheel, is fed into the chutes, which are readily accessible and at frequent intervals.

On the other hand, there is considerable blocking out to be done, which means expense. This is largely compensated for by the number of working faces open, an especially desirable feature, as often toward the hanging-wall the ore won daily from any particular working face is small.

It may be of interest to add that the panel system is a development of the "pachuca" or "lateral-drive" method used in Mexico for wide lodes with soft or hanging wall, adapted to the peculiar conditions caused by a combination of weak hanging and fallen ground at the Yuspenskiy mine, Siberia. The method was subject to many modifications dependent on conditions of the ground. The opening out and stoping by panel was, however, maintained.

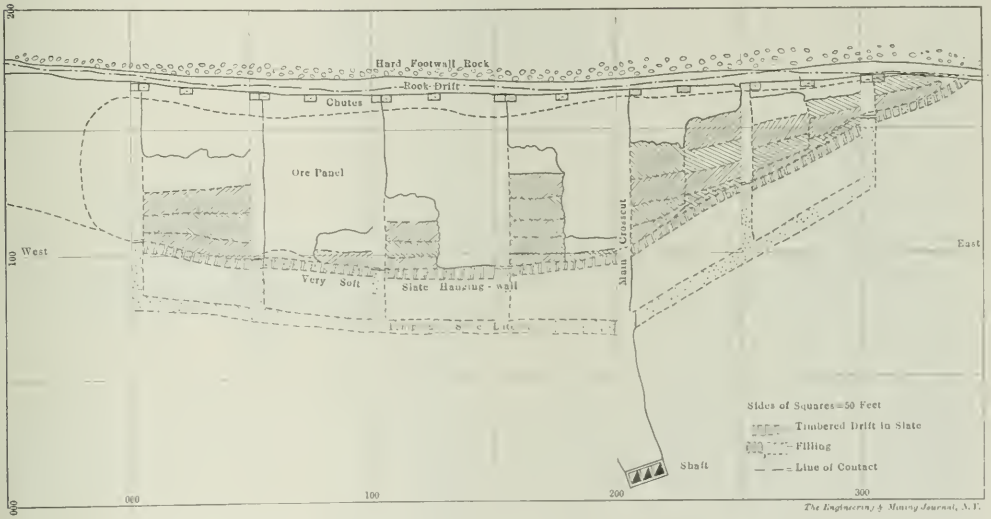


FIG. 3. METHOD OF STOPING WEAK ROOF AND HEAVY HANGING-WALL; "PANEL SYSTEM," SECTION STOPING AND FILLING.

A Successful Rhodesian Gold Mine

Special Correspondence

The report just issued by the Globe & Phœnix Gold mine of Rhodesia states that during the year 1908 the ore milled was 75,413 tons at a cost of $6.24 per ton including 96c. for development redemption. Working costs have been reduced 48c. per ton compared with the previous year. The value of the bullion won amounted to £154,555, or $9.84 per ton. After deducting administration charges in London and depreciation the profit for the year amounted to £39,511. Four dividends of 24c. each per share were paid making a total distribution for the year of 20 per cent on the issued capital of £200,000.

The development of the mine was satisfactory and the ore reserves were increased from 100,155 tons of a value of 11.1 dwt. at the close of 1907 to 144,348 tons of a value of 10 dwt. at the close of 1908. This increase in value and tonnage is due to an improvement in the mine at the 14th and 15th levels.

The main shaft is down 2307 ft. making it probably the deepest mine in Rhodesia. The poor extraction obtained in the mill, referred to by the consulting engineer is due to the presence of antimony. A sorting and jigging plant has been erected, but as the new plant did not start until late in November, no reliable data are yet available as the benefit to be derived therefrom.

An Improved Type of Mine Car Wheel

By J. E. Johnson, Jr.*

One of the principal difficulties in mining operations is to obtain cars so constructed that they will turn around the short curves required without undue friction and at the same time will have wheels and axles that are reasonably durable. The difficulty arises from two circumstances, one of which is that where the wheel base of the car is an appreciable fraction of the radius of the curve, the axles are not coincident with the radial lines of the curve. This makes the flanges bite and runs the rolling friction up very high. The only cure for this trouble is to place the wheels as close together as the radius to be turned may require. But it must be borne in mind always that the stability of the cars lengthwise will be small if the two wheels are close together; and if the car bodies are long the strain on them, being supported only at the center, will be high.

The Greatest Difficulty

The more important difficulty comes from the fact that the outside wheel on a curve has to travel through so much greater distance than the inner, when the radius is short, that the effect in going around the curve with both wheels fast to the axle is as much like a sled as it is like a wheeled vehicle. Just what this can amount to is not generally appreciated. A right angle turn of 20 ft. radius and a gage of only 3 ft. will cause the outside wheel to go 15 per cent. farther than the inside one. So with tight wheel cars there must be a relative skidding of 7½ per cent. of the distance traveled on each wheel; that is, one wheel must skid backward 2.4 ft. and the other forward an equal amount, or in some way there must occur skidding to the amount of 4.8 ft. What this means in pulling a heavily loaded car around a curve is obvious.

The effects of this have been so objectionable that most mine operators have gone to the other extreme and use cars with both wheels loose on the axle, the axle itself not turning. These are now always made with self-oiling hubs and the cost of lubricating such wheels is much less than it formerly was; but wheels of this type are open to an objection inherent in their construction. The wear necessarily makes the hole through the hub constantly larger and the axle constantly smaller. The result is that wheels soon become "drunken" and get so much play that they split frogs, drop through any possible place in the track that is at all wide of gage, and become so utterly objectionable that they have to be replaced with new ones.

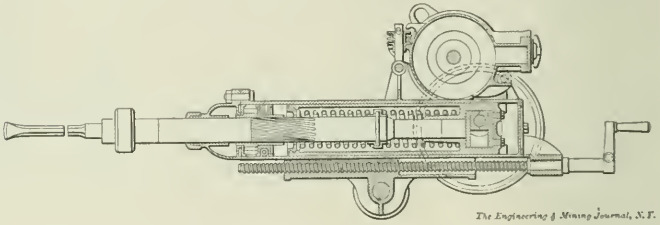
The same condition of drunkenness does not obtain with the tight wheel cars for the reason that the two wheels and the axle in the latter case constitute practically a single structure of so much larger size than the single wheel that an equal amount of play would correspond to much less wear. But far more important than this is the fact that the wear is in only one direction, viz.; upward into the journal boxes, and this wear is always taken up by the weight of the car with the result that a pair of wheels may be worn until the rails have cut through their treads without showing any signs of drunkenness. These facts are quite generally known and understood but this review of them has been given in order to pave the way for what is to follow.

Solution of the Difficulty

The solution of the entire difficulty is absolutely simple and inexpensive. The particular one which I have in mind may or may not be known to the mining public, but considerable missionary work on some of the best wheel manufacturers has been necessary to induce them to make the wheels which avoid the difficulty. It would seem, therefore, that publication again may not be amiss even though the ideas set forth are old to some.

The solution of the difficulty is to make one wheel on each axle tight and one loose and let the axle run in journal boxes. The simplicity of these in construction will astonish those who have never tried it. Journal boxes of the commonest type may be employed and whether they are outside the wheels or inside makes no difference. One wheel is pressed on to its axle just exactly as in ordinary railroad practice. The other wheel may or may not be of the self-oiling type but it is made a running fit on the axle and if not self-oiling, grease cups are provided for lubrication. Any desired arrangement of collar or groove to hold the wheel in its proper relation to the axle may be used. One of the standard modern construction of self-oiling wheel with a key in a groove in the end near the axle inside the hub is about as good as any. The axle should preferably be held to its place by the tight wheel and one collar or by two collars between the journal boxes. The journal boxes are made in one piece if the journals are outside and in two pieces with a cellar if the journal is inside the wheel. The superiority of this construction over the loose wheel construction is so great in practice that it will not be believed by most people until they have made a trial of it; but there is a good reason for this superiority.

All mine tracks are more or less curved but the average radius of curvature is generally not very small. In coal mines, for instance, there are right-angle bends turning off from the main entry but there are hundreds of feet of straight track leading up to these bends and leading into the room beyond them, so that in coal-mining practice probably 80 per cent. of the track is perfectly straight, and if the curvature of the remainder is 20 ft. centers this would make the average radius of curvature 100 ft. This is rather an extreme case but deliberately so taken. If now the gage be 4 ft. one wheel will have to travel 4 per cent. faster than the other on this average radius. With the type of construtction described the tight wheel drives the axle positively. The other wheel in the case assumed would turn relatively to the axle 4 per cent. of its total revolutions. In other words, the relative wear between hub and axle would be exactly one-twenty-fifth of what it would be with two loose wheels. This amount of movement is so small that with a properly constructed hub no objectionable degree of wear will be developed until the tread of the wheel is worn out.



CONSTRUCTION OF CRANK IMPACT DRILL

Interesting Points Regarding Trucks

I have bought standard trucks, that is wheels, axles and axle holders, from one of the best manufacturers in the country. These trucks were of the loose-wheel type. The hubs were extra long, an excellent self-oiling arrangement was provided, and everything was done to prevent wear and the consequent drunkenness; but after a short time these wheels began to get loose on their axles and the cars gave trouble by getting off the track. As the cars with their load weighed about three tons, sat very low to the ground, and had a very short wheel base, this was most objectionable. These wheels had been bought on the reputation and guarantee of the manufacturer, rather

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contrary to my own judgment of what was right, but it did look as though the people who made wheels ought to know more about them than the man whose misfortune it was to have them to use, so we bought about 30 or 40 sets of this kind in groups of ten. By the time the last group was put into use it became evident that the inevitable consequences of the loose-wheel construction existed in this maker's design as well as poorer ones, and in spite of conscientious efforts to remedy it. Thereupon inquiries were made among mine-car manufacturers for trucks of the tight-and-loose-wheel type. One manufacturer agreed to make them and at a price about the same as that required for the two loose-wheel construction, the boxes, cellars and babbitt being included in the quotation.

These wheels were put in service, with results that were, from a practical point of view, almost disastrous, because the people who had to use them showed such a great preference to them that they were almost unwilling to continue to use the loose-wheel type. These wheels have now been in use for a period far longer than it took to develop drunkenness in the loose-wheel type, without showing a sign of this or any other defect. They are oiled by waste in the cellar, as in standard railroad practice, with great economy of oil. The loose wheel of course requires to be oiled occasionally but on account of the very small amount of rotation required this is a factor that is almost negligible.

Cost

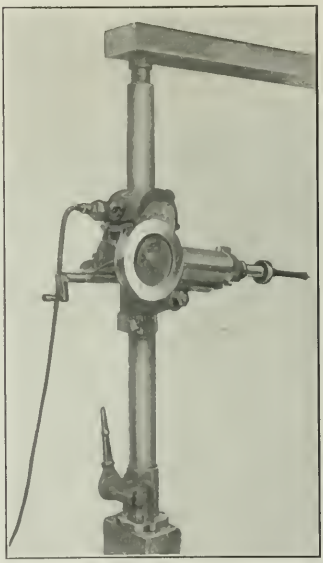
As to cost, it must be noted that this construction permits the use of one wheel with plain hub instead of the more expensive self-oiling hub. The boxes for fastening to the mine-car frame are but little more expensive than the cast-iron holding-blocks furnished for this purpose by the manufacturer aforesaid for the loose-wheel type of truck. The net result is that the first cost per set is not much different in the two cases. The advantages of the tight-and-loose wheel construction are: (1) Far greater durability; (2) Much greater rigidity as a construction approximating to the standard tight-wheel type of construction; (3) In consequence of the two preceding advantages infinitely less trouble with derailments and consequent injury to tracks, cars and wheels; (4) A reduced consumption of oil; (5) As a result of the greater durability with virtually the same cost, lower annual cost for wheels.

There is no intention on my part to patent this construction. In fact, the probabilities are that it is very old in the patent office, but its merits are very high and should be more widely known. I have no hesitation in saying that its universal adoption in the mines of this country would result in a saving of hundreds of thousands of dollars per year.

A Novel Rock Drill

By A. Gradenwitz*

The crank impact-drill represented in the accompanying illustrations has been designed recently by the Siemens-Schuckert works. It is operated by a 1-h.p. motor, fitted directly to the drill and is said to be far more efficient than the usual design of rock drill with flexible shaft and motor box. The electromotor is located in a saddle in the back of the drill and is rapidly removable.



DRILL ON RIGHT OF COLUMN; MOTOR ABOVE DRILL

Like the drill itself, it is inclosed in a dust- and water-proof casing. According as the drill is working on the right or left side of the supporting column, the motor is placed above or below the drill. This difference in the location of the motor, however, exerts no influence on the working of the drill; it may be used as well on a horizontal column or transportable supports provided it is fitted with a special feeding slide. If employed with a convenient fitting, the drill can be used as well for cutting and cleaving.

This electric drill can be used in boring rocks of any hardness. The initial diameters of bore generally vary between 40 and 50 mm., the adoption of a smaller diameter being advisable only in the case of very substantial rock. A length of 5 to 10 cm. per minute can be drilled in hard granite with 35 to 40 mm. diameter of bore, and 15 to 30 cm. in sandstone, according to the hardness of the latter. For drilling soft rock or earth, a rotary drill of lighter and cheaper construction should be used.

A special advantage of the crank drill illustrated is its low consumption of energy, six drills being operated at a time with an expenditure of 10 h.p. The amount of electrical energy consumed by each machine is 1 k.w. and no energy is used up during the exchanging or shifting of the drill, the motor being then stopped.

Current is supplied through flexible well-insulated conductors wound upon transportable drums in lengths of 69 to 100 m. These cable drums are located permanently near the connection box, which contains the terminals of the stationary circuit and fuses for each pole, the length of the conductor actually used being wound off the drum. At the loose end is attached a substantial plug, designed for rough handling, which fits into a contact box of the motor. After fitting this plug, the operator has only to turn the crank situated on the motor to start the latter as well as the drill.

DRILL ON TRIPOD FOR QUARRY WORK

The motor drives through a spur wheel gearing a double-bearing crank shaft provided with a flywheel, which in turn effects the alternate motion of a slide. In the latter are incased the two working springs surrounding the impact piston, keeping between them the flanged impact box, which is susceptible of a rotation, but not of a longitudinal motion on the piston. The reversal of the drill after

*Berlin W 50, Regensburgerstrasse 3.

each stroke is effected in the well-known manner by means of a nut with one-sided click which engages with the elongated thread of the impact piston. The click-holder of the ratchet nut is located on springs, so as to prevent any damage to the nut. Two men are required to operate the machine. The weight of the latter, exclusive of the motor, is 100 kg., the removable motor being 47 kg. and the supporting column (of 125 mm. diameter) 115 kg. in weight.

The Chile Mill

By M. R. Lamb*

The article by Captain Narvaéz which appeared in the Journal of Nov. 21, 1908, describing his milling plant, and giving general information concerning his Chile mills, deserves careful study. He makes claims for his mills which are really startling when compared with a combination of stamps and tube mills.

Before analyzing his results it will be of interest to state that approximately similar results are attained by Mr. Pattinson at the El Bote mine in Zacatecas, Mexico, where the same Allis Chalmers Chile mills are in use. The only difference between the two sets is in the number of mills and in that the Pachuca mills are set in wooden frames, while the El Bote mills have steel framework.

The comparison between the two styles of mill, Chile vs. stamps and tube mills, is shown in the accompanying table. Capacity is based on ordinary quartz such as is produced by the mines of Pachuca. The San Francisco, San Rafael and Progreso stamp mills are treating ore from the same mine that supplies Captain Narvaéz' mill, and this ore is considered to be of average hardness. The ore at El Bote is quite hard and dense, yet the Chile mills crush 18.6 tons per 24 hours through 180 mesh, of which 70 per cent. passes 200 mesh.

The figures given in the table are based on cost of ironwork without framing, as the latter would be about the same in either case. The tubes figured were 3.5x14 ft., and the stamps 1050 lb. Among the points not covered in the table is head room, the loss of which is much less with the Chile mill, thus giving greater latitude in choice of sites. Less actual ground space is also required. Supporting framework, building and erection costs, including a simple hand crane for the Chile mills are about the same in either case, while depreciation, attendance (skilled as well as unskilled), accessory equipment, breakages and probable delays are all decidedly in favor of the Chile mill. The best quality of the stamp mill, its ability to withstand rough handling, is possessed by the Chile mill. Neither over-feeding nor under-feeding has any effect on its continuous operation, these conditions merely reducing capacity temporarily. The accompanying cuts show six such Chile mills as erected in the shops preliminary to shipment to Mexico.

CHILE MILLS ERECTED IN SHOPS READY FOR SHIPMENT

COMPARISON OF CHILE MILLS AND STAMPS AND TUBE MILLS.

	5 Chile Mills.	25 Stamps, 2 Tube Mills.
Capacity to 150 mesh	100 tons	100 tons
Cost of mills and power plant	$24,000	$17,000
Weight of mills and power plant	195 tons	127 tons
Power required	46 h.p.	95 h.p.
Wearing parts renewed	every 2 yrs.	every 3 mos.

*Milwaukee, Wis.

According to Consul-General Julius G. Lay, of Cape Town, it is believed that the most promising petroleum field yet discovered in Cape Colony is situated at Zwart Kops, near Port Elizabeth, where one well has already been sunk about 2000 ft. In the district of Carnarvon, there are surface indications of petroleum and a well is being sunk

Statistics collected for The Mineral Industry show that in 1908 the production of crushed steel in the United States was 630,000 lb. ($44,100), against 840,000 lb. ($58,800) in 1907.

Selection and Use of Bits for Power Drills

A Discussion of the Different Types of Drill Bits, Bringing out the Effect of Size, Shape and Cutting Edge on the Results Obtained

BY M. DE GENNES

The success of almost every drilling operation depends on the selection and treatment of the bits. If the steel has been carefully selected and the bits properly formed, sharpened and tempered for the work, and if they are changed just as soon as their gages and edges are worn, the results will be economical. The functions of the drill sharpener should be considered as of almost equal importance to those of the chief mechanic in charge of the drills. The best sharpener is not any too good, even if he does not have enough work to keep him busy all the time. It is cheaper to let a high-salaried drill sharpener and his assistant loaf part of the time, than to have two or three drill gangs changing bits every few minutes, or pounding on the drill stem to start the bit when it is stuck, thereby only ruining the inside mechanism of the machine.

Shape of the Drill Bit

The flat bit is the oldest form. When it has a straight cutting edge (Fig. 7), the shock is very severe on the drill; when the edge is pointed (Fig. 6), the shock is less severe, but in both cases, and especially with the straight cutting edge, the bit has great difficulty in turning, and in cutting the outer edge of the hole. Such a bit generally turns in jerks, and makes a three-cornered hole.

With air not highly compressed as was the case in former days, a pointed, flat bit would move so slowly that it would have time to turn in the hole, but even then it was severe on the turning mechanism. As pressures increased, the speed of the bit increased but its turning ability remained the same, resulting in universally three-cornered holes. When a cartridge is put into this kind of a hole, there is always an air space in the corners that detracts from the power of the explosion. Star or mitered bits were then tried, and if they did not come into immediate favor it was because they were so hard to make, even for the most experienced blacksmith. Within recent years specially shaped swages have come into use, and star bits are now easy to make.

The cross bit, which is the form most commonly used, can be made in several shapes. The corners may be behind or in advance of the center; the cutting edges concave or convex, with straight or curved edges; the upset part of the bit may be long or short, thin or stubby; and the angle of the cutting edge may be sharp or obtuse. Let us examine the effect on the rock of each of these forms of bit.

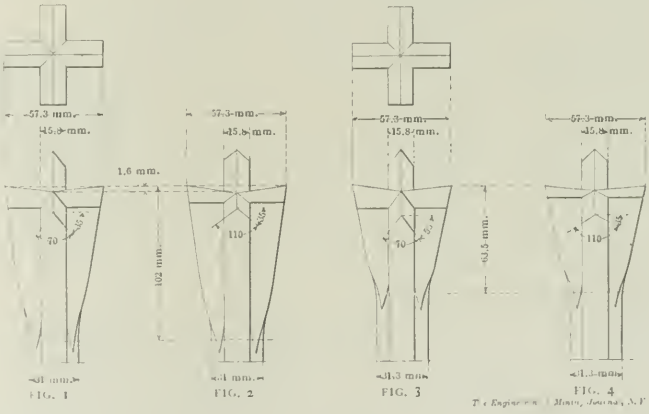
The bit shown in Fig. 8, which is the most commonly used, has a concave cutting edge; after using such a bit, the central part is found to be much less worn than the outer, probably because the blows of the corners weaken the rock at the center of the hole, leaving less work for this part of the bit. With the convex bit shown in Fig. 9, on the contrary, the rock is solid clear to the center of the hole, the corners have less work to do and the center of the bit therefore gets most of the wear

With the pointed cross bit (Fig. 10) all the work is done by the center, since the corners come into contact only with the fissured part of the rock. The rock around the edge of the hole breaks suddenly leaving the point of the bit striking alone for a few blows; by the time the full face of the bit has begun to work again, another lateral fissure has formed in the rock, which breaks off suddenly and the operation is repeated. The only advantage of this type of bit is seen in quarries, where holes are put down in line The shape of this bit permits a hole to be placed exactly where it is wanted but it works well only in marble, sandstone and other soft, homogeneous rocks.

The X-bit (Fig. 5) is most useful in thinly bedded rock, for drilling holes parallel to the bedding. A cross bit, in these circumstances, is likely to fitcher and give difficulty in turning. The X-bit overcomes this objection.

Shape of the Cutting Edge

Figs. 1 and 2 show two bits designed for homogeneous hard rocks. They are identical except for the angle of the cutting edge; that in Fig. 1 has about the sharpest angle that it is possible to use without danger of breaking the steel. That in Fig. 2 is one that can be used in rocks of varying characters, without change. While working in hard rock, the sharp-angled edges can be used, at full pressure, without danger of blocking the mouth of the hole, since the quantity of rock broken off at each blow is so small that the mud is readily drawn out with the return stroke, especially as this is the more vigorous when working at high pressure. If use is made of this kind of a bit, under full pressure, in a soft rock, the cuttings would be of so much greater volume that they would not be discharged freely, especially as the rebound of the drill in a soft rock is less vigorous. The remedy is either to decrease the speed of the drill, which is not desirable, and only reduces its ability to withdraw the mud, or to use a more obtuse cutting edge (Fig. 4). Sometimes



NOTE—Abstract of a paper presented at a meeting of the Société de l'Industrie Minérale at Paris, Nov. 26, 1908.

the edge must be so obtuse as to be almost flat, to give good results.

Length of Upsetting

The length of the cutting blades, the upset part of the bit, should vary with the nature of the work to be performed. Figs. 1 and 2 show the maximum length for use in a very hard rock; Figs. 3 and 4 show shorter bits, in which the cuttings have a freer opportunity to escape, making this the most desirable form for usual work. A short upset also gives faster clearance of the cuttings. In a rock, however, which grinds the sides of the bit, reducing its dimension rapidly, a long upset should be given.

The wings, or blades, of bits having the dimensions shown in Figs. 1 to 4 should be not less than 16 mm. thick. They must be of the same thickness throughout, to permit rapid removal of the cuttings. If the gage is to be less than 57 mm., the blades may be proportionally shortened.

Gage

In order to maintain a hole to size, it is very important that the cutting edges be straight and not curved, as in Fig. 8. The wear on the corners of such a bit would prevent the maintaining of the proper bore. The amount of work that a bit will do before losing its dimension should be accurately ascertained. In the hardest rocks it is never possible to use a bit the second time, and the greatest length that can be drilled is the total length of the feed, or 60 to 75 cm. in the largest machines. It is necessary, therefore, to have a sufficient supply of bits on hand so that a new set can be used for each hole. In a soft rock, or in an ore, it often happens that the cutting edge is not dulled, even after having made several holes; the runner is then likely to neglect the question of gage, as long as the cutting edge is sharp, and gets into difficulty, for it is the diminution in the size of the hole that causes friction, delays the drilling, wastes power, and adds to repairs.

For example, suppose a workman is given two sets of freshly sharpened steel to bore a certain distance in a moderately soft rock in which, let us say, each set will bore two holes without difficulty. In the third hole, the drills will stick and the workman will pound on the stem with a hammer or wrench, and rather than go to the surface, find the blacksmith and get a fresh set of drills, will waste more time in trying to drive the third hole than he took for the first two. I have known mine managers who have laid heavy penalties on every drill runner whose bits show marks of having been pounded.

As soon as the gage of a bit has been so reduced that its hole fails to take the next following bit, of smaller size, it is better to take a new set altogether. Even if one bit of the set appears to be still good, time will be saved by taking an entirely new set. In a moderately soft rock, in which a bit will satisfactorily drill more than one hole, the engineer should determine by experience just how many holes may be drilled by each set, and the blacksmith and the drill runner need not be consulted in this matter. The runner should be instructed to drill only so many holes with one set as the engineer prescribes, and the blacksmith should be required to furnish bits to exact gage. This plan necessitates a large number of bits, but the advantages in more rapid work and fewer repairs more than outweigh this expense.

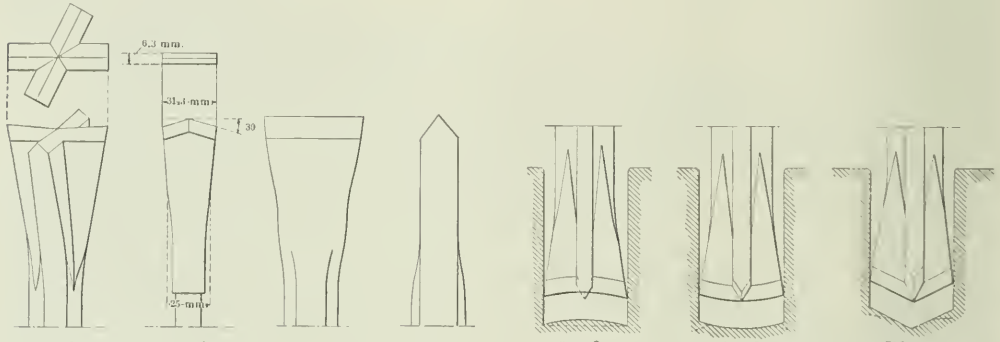


FIG. 5 FIG. 6 FIG. 7 FIG. 8 FIG. 9 FIG. 10

The Engineering & Mining Journal, N. Y.

Statistics collected for The Mineral Industry show that in 1908 the amount of magnesite produced in the United States was 8867 short tons, valued at $52,342. This is larger by 2562 tons than the 1907 production, but the value of the output is lower by $5378. California contributed practically all of the production of the United States.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the four months ended April 30 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $58,155,091 in 1908, and $48,209,062 in 1909; a decrease of $9,946,029, or 17.1 per cent. The leading items of export were, in long tons:

	1908.	1909.	Changes.
Pig Iron	11,915	10,960	D. 955
Billets, ingots & blooms	54,269	36,264	D. 18,005
Bars	19,125	21,494	I. 2,369
Rails	55,777	69,037	I. 13,260
Sheets and plates	31,464	49,890	I. 18,426
Structural steel	47,332	30,974	D. 16,358
Wire	49,146	55,960	I. 6,814
Nails and spikes	15,762	16,038	I. 276
Pipe and fittings	39,598	49,588	I. 9,990

There were several increases in quantities during the month of April.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States four months ended April 30 were valued at $7,113,203 in 1908, and $7,941,493 in 1909; an increase of $828,290, or 11.6 per cent. Leading items of imports were, in long tons:

	1908.	1909.	Changes.
Pig iron	32,132	40,232	I. 8,100
Scrap	1,621	1,558	D. 63
Ingots, blooms, etc.	3,069	4,261	I. 1,202
Bars	10,788	5,827	D. 4,961
Wire-rods	4,005	4,157	I. 152
Tinplates	21,699	17,686	D. 4,013
Sheets and plates	895	1,494	I. 599

The only considerable change was the decrease in tinplates.

Iron Ore Movement—Imports and exports of iron ore in the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.
Imports	238,589	350,440	I. 111,851
Exports	29,666	32,921	I. 3,255

Of the imports this year, 239,082 tons were from Cuba.

Imports of manganese ore four months ended April 30 were 73,626 tons in 1908, and 68,123 in 1909; decrease, 5503 tons.

The Chinese imperial agent at Lhassa has been instructed to prepare a full report on the gold deposits of Tibet.

Operations of Utah Copper Co. During 1908

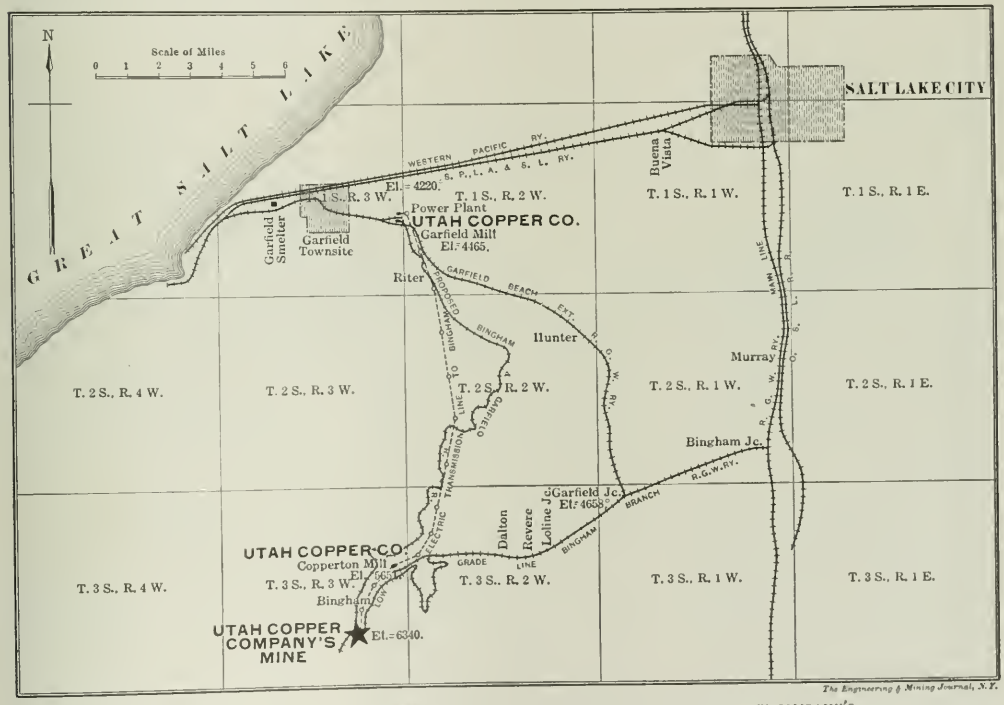
More Than 10 Miles of Tunnels, Drifts and Raises Driven; Proportion of Ore Removed by Stripping Shows Increase; Output 56,895,998 Pounds

BY D. C. JACKLING*

In the last annual report it was stated that the underground developments, on Dec. 31, 1907, amounted to approximately 90,000 linear feet of workings. Since that time, we have driven more than 10 miles of tunnels, drifts and raises; but, at the same time, we have destroyed a very large percentage of our underground workings, partially by stoping operations in connection with our underground mining, but more largely as the result of the operations of steam shovels over areas that had been previously blocked out by tunneling and drifting. The areas containing these workings have, to a certain extent, been dug out by steam shovels but have to a greater extent been excavated by heavy blasting incident to steam-shovel work, so that they are not now accessible. As a result of the destruction of both old and new workings in the manner above described, we have not now to exceed approximately 20 miles of openings available for use in underground methods of mining, or accessible for inspection.

In the report for the year ending June 30, 1907, the statement was made that the developed and partially developed area amounted to 72 acres. Developments since then have resulted in extending this area about 8 acres, so that now the known ore area, fully and partially developed, is approximately 80 acres. The ore thicknesses and values of this additional territory are, generally speaking, similar to those described in the former report, so that the new developments have resulted in additional ore reserves to the extent of about 8,000,000 tons, or at a rate during the period of over three times the rate at which ores were extracted for reduction. The net result of the developments we have made during the period has been that fully developed ore remains approximately as stated in our last annual report, viz., 20,000,000 tons, as the area of this class of ore has been increased to an extent that will more than offset the quantity of ore mined.

The two classes of partially developed ore, described in the former report, have been increased in the aggregate to the extent of approximately 8,000,000 tons, as above stated, so that we now estimate 60,000,000 tons in these two classes of reserves. In other words, of fully developed, partially developed and reasonably assured ore, the total amounts to about 80,000,000 tons. Of this total tonnage, 65,000,000 tons can be classed as of the better or normal grade, averaging about 2 per cent. copper, and 15,000,000 tons as of the lower grade, approximating 1½ per cent. copper. In addition to this, we have the lower zone, as described in the previous annual



PARTIAL MAP OF SALT LAKE COUNTY, SHOWING RELATIVE POSITIONS OF UTAH COPPER COMPANY'S MINES, MILLS AND RAILWAY CONNECTIONS

*General manager, Utah Copper Company, Salt Lake City, Utah.

NOTE—Taken from the fourth annual report of the Utah Copper Company, for the 18 months ending Dec. 31, 1908.

report, the average value of which has been indicated to only a limited extent by diamond drilling, but which is estimated to contain a minimum of 40,000,000 tons that will probably average 1½ per cent. In discussing the above quantities throughout, consideration should be given to the fact that the stated figures include the quantities of ore mined during the fiscal period. This would amount, in percentage, to approximately 3 per cent. of the above described three classes of ore aggregating 80,000,000 tons reserves.

All the development done during the period has been on the easterly end of the property and on both sides of the cañon, but the larger part of it has been on the south side of the cañon, in the southeasterly portion of the company's territory. The ore-bearing area is still being extended in that direction.

Stripping

Stripping operations since their commencement, in August, 1906, have resulted in the removal of 1,705,322 cu.yd. of capping. Of this amount, 1,335,233 yd. were removed during the fiscal period under discussion. During the first six months of the fiscal period, 367,950 cu.yd. were removed; during the second six months, 446,460 cu.yd. were removed, and during the last six months of 1908, 520,823 cu.yd. were removed.

The total area over which stripping operations have been conducted to date is 19.7 acres. The average thickness of capping, as disclosed by these operations, remains the same as that stated in our last anual report, approximately 70 ft. corresponding to 113,000 cu.yd. per acre. The total amount removed is, therefore, equivalent to stripping of, approximately, 15 acres and, at the present time, the actual area completely stripped is slightly in excess of 7 acres.

The average cost of stripping, throughout the entire operations from their beginning in 1906, has been, approximately, 32c. per cubic yard; this cost covering only the removal of capping and its conveyance to available dumping ground. Applying this cost to the average thickness of stripping removed and ore uncovered, the cost per ton of ore uncovered is somewhat less than 4c. Stripping operations have been more expensive and difficult in the past than they will be in the future, on account of the very limited area upon which the shovels could work and the expensive tracks it was necessary to build in starting these operations in the narrow cañon. As we develop more room, the rate at which shovels can operate will be increased, and the cost of shoveling correspondingly reduced; but the expected decrease in the actual cost of loading the material will probably be offset by the increased cost of hauling the waste material for greater distances, so that it may be expected that our stripping costs will remain about the same as in the past.

Since the last annual report, we have secured by purchase and lease the surface rights of about 120 acres of ground, outside of our own property, for dumping purposes. Of this total area, 75 per cent. was acquired by purchase and the remainder by lease. The total dumping capacity of this surface amounts to 6,330,000 cu.yd., or the equivalent of the capping overlying 50 acres of ore, using the average thickness of 70 ft. so far determined. As a matter of total capacity, the ground already secured will be more than is necessary to accommodate any amount of capping that we will wish to deposit in this vicinity, for the reason that plans are now under way to dispose of the capping in another and profitable manner, as will be hereafter referred to in this report.

Mining

Of the total ore mined during the fiscal period, 33.2 per cent. came from underground, and 66.8 per cent. from steam shovels. During the first six months of the period, the percentages were 39.6 per cent. from underground, and 60.4 per cent. from shovels. During the following six months, the percentages were 34.6 and 65.4, respectively. During the six months ending Dec. 31, 1908, the percentages were 28.7 and 71.3. During the last three months of 1908, the percentages of underground and steam shovel ore were 25 and 75 per cent., respectively. These figures are given to indicate the gradual decrease of underground mining; or, more properly, the steady increase in the quantity of ore mined by steam shovels.

The increase in the volume of ore mined by steam shovels is reflected directly in a corresponding decrease in our mining costs. The average cost of both steam shovels and underground ore for the first six months' period above described was 43c.; for the second period, it was 35c.; for the third period, 30c. The average costs stated cover, respectively, the total costs of every nature at the mine, including development, as well as their proper proportions of all general and fixed charges, such as office expenses, taxes and insurance. The average costs for the entire period, as applying to the two different methods of mining, were 66½c. per ton for all ore mined underground and 19½c. per ton for all ore mined by steam shovel—a saving in favor of the steam shovel method of 47c. per ton.

As has been previously stated, the cost of removing the capping from a ton of ore, as shown by our entire experience in the past, amounts to, approximately, 4c. The net difference in favor of the steam-shovel method, therefore, becomes 43c. per ton; this applying to practically all the steam-shovel mining we have done, as we only mined a few thousand tons by steam shovels before July 1, 1907.

From the beginning of stripping operations to date, the equivalent of 15 acres of ore has been stripped, and the total cost of all this work has been about $550,000. It is proper to add to this, however, a proportion of the cost of grading and laying railway tracks about the property and to our dumping grounds for the disposition of capping. The total net cost of such tracks, and of all other construction incident to stripping operations up to date, including general expenses, has been, after crediting retirement fund, approximately, $285,000. If we charge all the proper proportion of general expenses and 20 per cent. of all the construction costs to the stripping operations, the total cost to date becomes about $690,000. It would not be proper to charge more than 20 per cent. of these construction costs to the stripping already done, because less than that percentage of the area for which these facilities were provided has been stripped. The 43c. per ton saved on ore mined during the fiscal period by steam shovels, as against what it would have cost to mine the same quantity of ore from underground, amounts to, approximately, $695,000. It therefore, appears that had we charged the entire cost of all our stripping operations, from the date of their inception in 1906 up to the present time, against the steam-shovel ore recovered in 18 months only, it would still have been more economical to mine by the steam-shovel method than by the underground method; or, considered in another way, we have stripped 15,000,000 tons of ore, and have mined only slightly more than 10 per cent. of that quantity with steam shovels, but the entire cost of stripping the total quantity of ore could be charged against the mining of one-tenth of it and still the result would show the steam-shovel method of mining our ores to be the more economical.

Our costs of steam-shovel mining will decrease, rather than increase, in the future, and it is consequently quite evident that our best interests lie in decreasing as rapidly as possible the scope of underground mining and correspondingly increasing our steam-shovel output. It will be necessary, for some years to come, to do some underground work, but we will probably be mining fully 90 per cent. of our ore with steam shovels by the end of 1909, and the underground method, as applying to anything but the development and mining of isolated, and comparatively small, bodies of ore, will be gradually, and as rapidly as possible, discontinued.

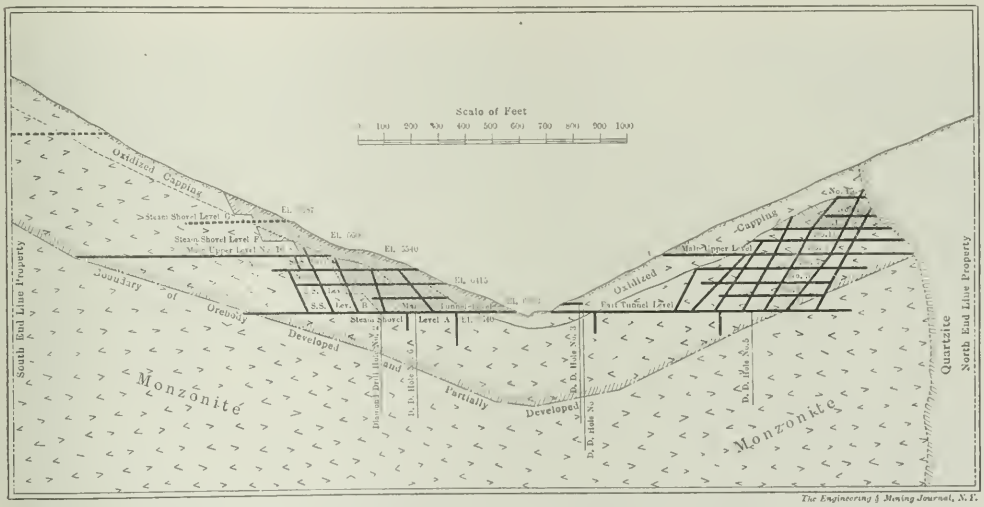
Up to the present time, surface-mining operations have been seriously hampered by our inability to secure from the company transporting our ores to the mills an adequate and regular supply of cars, such as to enable us to continuously and most economically operate our ore shovels. Our surface workings have been developed to such an extent that by the end of 1909 we should have no difficulty in

producing regularly 10,000 tons per day, if an additional unit to the Garfield plant should be decided upon, thus bringing our milling capacity up to the tonnage stated. In the meantime, we could increase our output gradually to the extent of supplying tonnage for the sections of the new unit as rapidly as they could, in all probability, be completed.

The ores that have been mined up to date by steam shoveling have not been as high grade as the normal average of the property, because of the necessity of including with them considerable quantities of the partially oxidized and lower-grade capping. Before steam-shovel operations were begun, some parts of the area where we are now working were mined out for a thickness of 20 to 40 ft., along or below the dividing plane between capping and ore. As this mining was done by caving, the capping settling into the stopes increased the irregularity of the line between ore and capping, and made it impossible to keep the underlying ore as clean as we would have otherwise been able to do. Moreover, aside from this occurrence, which has aggravated the condition, the dividing line between ore and capping is naturally very irregular, and it is impossible to entirely remove all the oxidized material without wasting some good ore. It is, therefore, necessary to continue taking some of this low grade material into the ore, until such time as the first cut from the top of the ore has been removed over a considerable area; in fact, this condition will always apply to newly stripped areas. This feature is the only one of disadvantage that we have encountered in steam-shovel mining, but, in the long run, there will be advantages which will very much more than offset it—the principal one being that by this method of mining our operations will slowly, but gradually, become more economical, and, in the end, we will have recovered 100 per cent. of our ores; whereas, by any other method of mining, it would be impossible to avoid losing a considerable percentage of them.

Equipment

Since our last annual report, we have added to the mine equipment 2 steam shovels, making 8 in all; 2 locomotives, making 17 in all; and have extended our railroad tracks for mining and stripping purposes to a total of 9.2 miles. During the year 1909 we shall add to our present equipment at least one more shovel and two more locomotives, and shall construct about 6.8 miles of additional standard gage railway for handling capping.



LONGITUDINAL SECTION AND PROJECTION OF UTAH COPPER COMPANY'S BINGHAM MINING PROPERTY

Operations at the Mills

Garfield Plant—In our last annual report, it was stated that four sections of the Garfield plant were in commission. Four additional sections were started—one each in the months of August, September, November and December, 1907; and the remaining four, one each in the months of March, April, July and November, 1908. During the fiscal period there was in operation the equivalent of 8½ sections for the entire period, or about 71 per cent of the plant. However, the difficulties experienced in obtaining tonnage for the plant, principally through the lack of proper transportation facilities and service, resulted in our being able to provide only 77 per cent of the rated capacity of that part of the plant prepared for continuous operation, as above stated, or [illegible] of the capacity that the [illegible] and has been since November, 1908, prepared to handle. Had we been able to secure tonnage, the sections of the plant could have been started up more rapidly and the entire plant put in commission at an earlier date.

Copperton Plant—The Copperton plant also suffered from a deficiency of tonnage, but not to the extent that applied to the Garfield plant, partially for the reason that it is closer to the mines. Of the total tonnage treated at both mills during the period, 83 per cent. went to the Garfield mill and 17 per cent. to the Copperton mill.

Production

The total gross output of copper at both plants for the period was 56,895,998 lb. of copper contained in concentrates, resulting in a net production of 54,051,212 lb. after smelter deductions were made. The concentrates produced also contained 182,160 oz. silver and 20,072 oz. gold. The average grade of concentrates for the period was approximately 27 per cent.

Of the total gross production of copper above mentioned, 43,873,918 lb. were produced in the 12 months of 1908, this being 77 per cent. of the total for the period. Dividing the 18 months into periods of 6 months, the respective productions were as follows:

	Pounds.	Per Cent.
July 1 to Dec. 31, 1907...	13,022,080	23
Jan. 1 to June 30, 1908....	20,096,329	35
July 1 to Dec. 31, 1908....	23,777,589	42
Totals.	56,895,998	100

Had we been able to secure, throughout the period the full capacity of the 71 per cent. average of the Garfield plant that was in operation, we would have produced at that plant alone approximately 62,000,000 lb.—a total, for both plants, of about

71,000,000 lb. for the period; or an average of nearly 4,000,000 lb. per month. If our entire Garfield plant, which is now in operation, could be supplied with its capacity of 6000 tons per day, and its operation should result in the same percentage of recovery we have experienced in the period under discussion, and upon the same grade of ore, the output for both plants would be at the rate of 96,000,000 lb. for 18 months; or an average of 5⅓ million pounds per month, corresponding to a production of 64,000,000 lb. per annum. This is what we may expect to do in the immediate future, provided transportation for the required tonnage can be supplied; in fact, we can do somewhat better than this on the same grades of ore, if we can have transported all the tonnage needed, as the Copperton plant can also take more tonnage than it has been receiving in the past.

It is to be remembered that the results of the period under discussion have been achieved on an ore containing 4 lb. less of copper per ton than the average normal contents of our ore. In addition to this, because of the low-grade and oxidized material that has been taken into the ore through contamination of the steam-shovel output by capping, the ores have contained an average of fully 5 lb. of their copper contents in oxidized minerals, of which only indifferent percentages could be recovered. Both the grade of ore and the percentage of copper recovered will improve gradually as cleaner ore is procurable, as a result of the extension of completely stripped areas.

Cost of Production

The average price applying to our sales of copper for the entire period was 13.2c. The average cost per pound was 8.85c., this being based upon the net pounds of copper resulting after smelter deductions and allowances were provided for, and including all expenses of transportation, refining and disposition of the metal.

The deficiency of tonnage, as applying particularly to the Garfield plant, has resulted in the cost per pound of copper being fully a cent higher than it would have been had we been able to secure full tonnage for even the 71 per cent. of the plant averaging in operation. As formerly stated, we were able to mill only 77 per cent. of the capacity of the portion of the plant in operation. The additional 23 per cent. which we were unable to mill owing to the transportation difficulties before mentioned, could have been treated at little or no additional cost for labor, and, in fact, not so great a cost per ton, because a shortage of ore involves us in more expensive methods of handling it through our ore bins. We, therefore, would have saved the milling labor cost on this additional tonnage, which amounts to more than 1c. per lb. of copper produced. If both plants could have been operated at their fullest capacity, a still greater reduction would have been made in the per pound cost. Our other costs would not have increased in direct proportion, as, for instance, the mine, if it had been able to load ore continuously, could have done so at a considerably decreased cost per ton.

Capacity of the Garfield Plant

We have been able to operate the Garfield plant at full capacity only for short periods since it was completed, on account of our inability to transport the tonnage. For a few days at a time, however, we have demonstrated that it can handle continuously a greater tonnage than its rated capacity. This determination has also been checked by the capacity of the individual sections, which have proved themselves capable of treating more than their rated tonnage. No difficulties have been experienced in the operation of the plant, and no changes, other than in the way of unimportant details, have been found necessary. Considering the quality of ore we have been reducing, its operation has been, and is, entirely satisfactory.

Power Plant and Water Supply

The construction and operation of our own power plant, to provide power for the entire enterprise, has proved of great advantage and economy in many ways. We are assured of a constant and uniform supply of power for continuous operation at all points, and the cost of power at the Copperton plant and at the mines at Bingham has been very much reduced over that applying formerly, when power was generated at Copperton for the operation of that plant and purchased from others for the operation of the mine. As stated in our former annual report, the power plant at Garfield has a greater capacity than is necessary for the operation of our milling plants at their present capacity, and it will, therefore, be unnecessary to provide additional power in connection with another 3000-ton unit at the Garfield plant when such addition is made.

Up to the present time, the springs owned by the company adjacent to the Garfield plant, have produced ample water for any tonnage we have handled, and it is believed that they will furnish sufficient for the full capacity of the plant, without making it necessary for us to resort to the use of our proportion of the water we are entitled to take from the Garfield Water Company. We, therefore, have demonstrated conclusively that our total water supply will be ample for very much greater tonnage than we are now prepared to mill.

Transportation

A number of references have been made in this report to the difficulty we have experienced in securing adequate transportation facilities, as provided for under our contract with the Rio Grande Western Railway Company. Our losses, and the disadvantages under which we have operated, as a result of the failure on its part to give us the desired and necessary service, have been greater than would be indicated by the direct deficiency in tonnage that we desired to mine and mill, but which the railway company was not prepared to transport, for the reason that the tonnages that have been delivered to the mills have been handled at a disadvantage and at an extra cost. We have used every effort to induce the railway people to give us better service, but so far without very much encouraging result, and we have, therefore, located and surveyed a line for a railroad of our own between the mines and mills. This location is shown on the appended map of the Bingham and Garfield territory. Negotiations are now pending, which, if consummated, will relieve the situation and give us the transportation facilities we require. If these negotiations fail, I recommend that construction be commenced on our own railway at an early date.

General Remarks

In a former portion of this report, reference was made to a proposed method of disposing of capping. We have found that the 1,705,322 cu.yd. of capping so far removed from our orebodies average not quite 1 per cent. copper. Experiments conducted some years ago, and since verified, demonstrate that the larger part of this copper is contained in such forms as can be extracted by a simple leaching process.

As soon as weather conditions will permit, an open-air plant, of moderate capacity, will be constructed at the Garfield mill, and the proposed metallurgy of this material demonstrated on a fairly liberal working scale. If this experiment proves that our former results along this line of investigation are reliable, it is proposed to build a very large leaching plant in which to treat, along the general lines suggested, the capping removed from the property. The chemicals necessary in the proposed method of treatment should be produced cheaply, as a by-product, at any of the smelters adjacent to Salt Lake City.

The production of crystalline graphite in the United States in 1908 was 3,433,033 lb., valued at $149,763. In 1907 the production amounted to 4,586,149 lb., valued at $149,548. Despite depressed trade conditions the output of artificial graphite continued to increase. The total production was 7,385,511 lb., valued at $502,067, against 6,024,000 lb., worth $58,800, in 1907. This information is gained from reports collected for The Mineral Industry.

The Barrow Hematite Steel Company at Barrow, England, has recently installed a plant of four large blowing engines driven by the waste gases from the blast furnaces. It is the largest plant of the kind in England.

The Largest Coke-oven Gas Engine Plant

A Practical Plan Whereby a Modern Colliery Can Cover All Its Power Requirements at a Minimum Cost and with Maximum Efficiency

BY J. B. VAN BRUSSEL*

The development of the gas-engine power station at the Anna II mine, of the Eschweiler Mining Company at Alsdorf, near Aix-la-Chapelle, Germany, is a good example of how an uptodate colliery is able to cover all its power requirements in a practical and economical way by taking full advantage of recent engineering progress. At this colliery, as at most others, the coke-oven gas was used until recently as fuel for boilers, the steam of the latter being consumed by the different steam engines about the works. Each of these comparatively small steam-engine plants needed special spare engines, and, in consequence, the maintenance and working costs were high. The calorific value of the gas was thus utilized inefficiently, as a steam engine of the best design is only able to transform into power 15 per cent. (maximum) of the calorific value of the gas, without even reckoning the great condensing loss in the long pipes.

Nearly One-third of the Calorific Value Can be Transformed into Power

Good gas engines, however, are able to transform 30 per cent. of the calorific value of the gases into power, and, therefore, the total efficiency of a gas-engine plant is practically more than double that of a steam-engine plant.

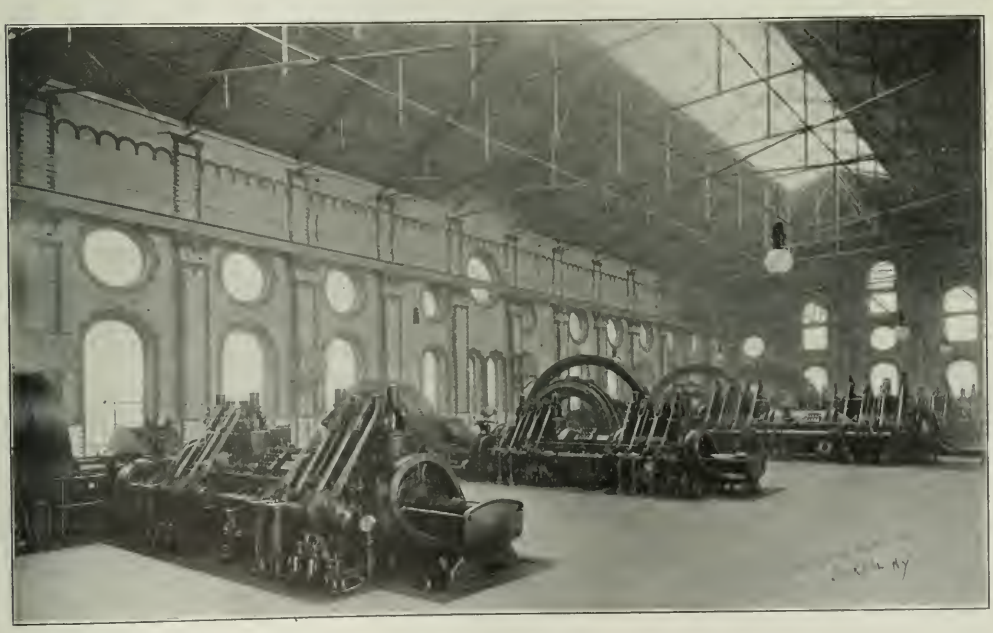
Fully realizing this fact, the directors of the Eschweiler Mining Company decided to scrap the different steam engines, one after the other, and to erect a large power station of gas engines for driving dynamos. The gas engines were to be driven by coke-oven gas sufficiently free from tar, because a by-product recovery plant was to be provided. A special iron-oxide cleaning plant was to be erected for extracting the sulphur from the gas, such sulphur varying in quantity according to the coal used. The installation began with two gas engines of 500 brake-h.p. each, which were ordered from the Maschinenfabrik Augsburg-Nürnberg, for direct coupling to the three-phase dynamos of 500 volts.

Larger Units Were Installed

The coke-oven gas engines of the Eschweiler Mining Company were set to work during 1904. The engines gave such excellent results that it was decided to erect larger units. During 1904 and 1905 three engines—two of 1000 brake-h.p. each and one of 1200 brake-h.p.—were erected, and in 1907 two twin-tandem engines each of 2400 to 2600 brake-h.p. were installed, all being of the Nuremberg type. These were followed in 1908 by a further order for two engines of 2600 to 2800 brake-h.p. each, so that the total output now is 14,500 to 15,000 horsepower.

This total output of 15,000 brake-h.p. represents about twice the amount of power formerly produced by the steam plant, and it exceeds to a large extent the power requirements of the colliery itself. Consequently, one part of the current is used at the Edward pit, where the winding engine is driven by means of an Ilgner transformer, the current having a tension of 5500 volts. Another part of the power, about 3000 brake-h.p., is transformed from 5500 into 35,000 volts, and is transmitted to the Eschweiler mine, about 11 miles distant, where it is used as auxiliary power for the pit pumps as well as for other purposes.

It is further intended to take about 1500 to 2000 brake-h.p. out of this high-tension conduit to the Maria pit, about 1½ miles



GENERAL VIEW OF THE ESCHWEILER PLANT AT ALSDORF, GERMANY

*Brussels, Belgium.

distant. The accompanying photograph shows the gas-engine power station of the Eschweiler Mining Company, which, it is understood, is, or will be—when all the engines now ordered have been delivered—the largest coke-oven gas-engine plant in the world.

The following figures give the results of tests made by Professor Lange, of the Technical University at Aix-la-Chapelle, of the two 2400 brake-h.p. gas engines in Alsdorf. Owing to these tests taking place on a Sunday, it was impossible to overload the engines, but preliminary trials had shown an overload capacity of 16 per cent. At the same time the reliable parallel running of the gas engine, combined in every possible manner and under different loads was well proved:

RESULTS OF GAS ENGINE TESTS.

	Test 1	Test 2.
Output in kw.	1550	1554
Heat consumption guaranteed in B.t.u. per i.h.p. and hour	8000	8000
Tested consumption in B.t.u. per i.h.p. and hour	6865	6862
Total efficiency, taking the efficiency of the dynamo at 0.945	0.794	0.794
Proved efficiency at full load	0.844	0.857

Following these trials, Professor Lange tested one of the engines—designed for coke-oven gas—with the special object of ascertaining how it would work when driven by producer gas made from coke.

Owing to the quality regulation of the contractors, it was proved that the engine was able to work at full load without any alteration of the valves of governing gear, either with coke-oven gas of 340 to 450 B.t.u. per cu.ft. (3000-4000 cal. per cu.m.), or with producer gas of 113 B.t.u. per cu.ft. (1000 cal. per cu.m.). Such results would not be possible with the so-called "quantity" regulation which is largely adopted.

The producer-gas plant is erected as an auxiliary plant in case of strikes, or if the coal production and the working of the coke ovens is interrupted for any other reason.

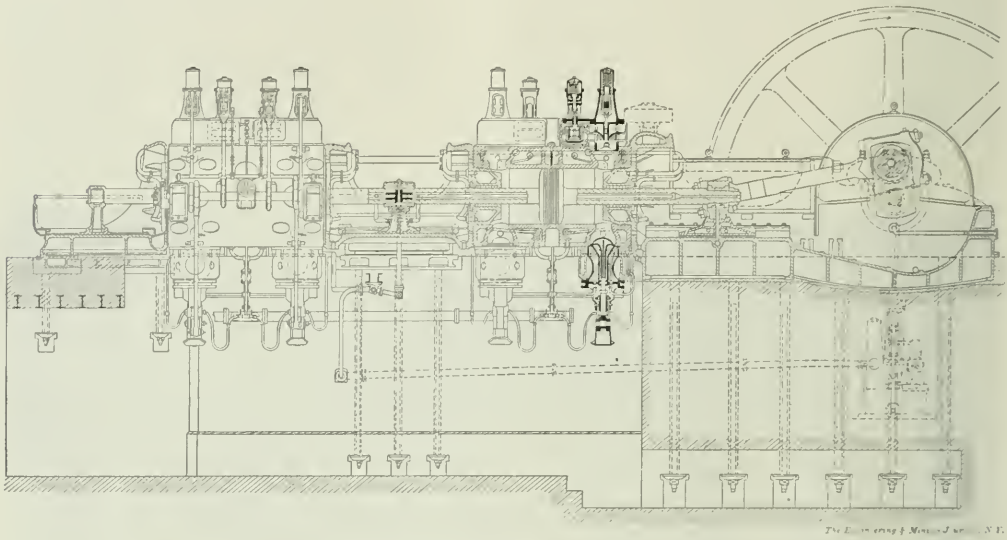
The gas-engine plant of the Eschweiler Mining Company was designed on a large scale, and its actual working proves conclusively the great advantages of large gas engines for an uptodate colliery.

List of Permissible Explosives

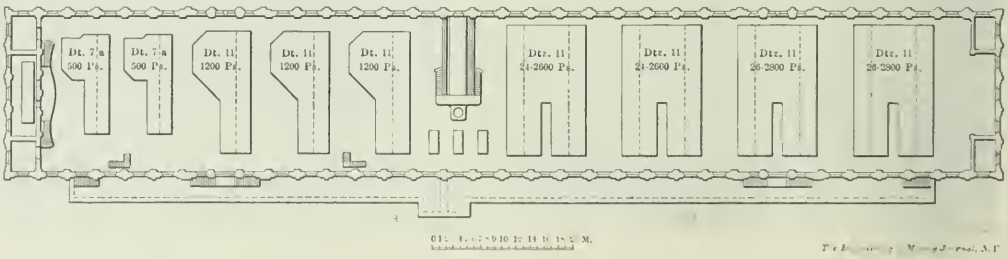
As a part of the investigation of mine explosions authorized by Congress in May, 1908, it was decided by the Secretary of the Interior that a careful examination should be made of the various explosives used in mining operations, with a view to determining the extent to which the use of such explosives might be responsible for the occurrence of these disasters.

The preliminary investigation showed the necessity of subjecting to rigid tests all explosives intended for use in mines where either gas or dry inflammable dust is present in quantity, or under conditions which are indicative of danger.

With this in view, a letter was sent by the Director of the United States Geological Survey on Jan. 9, 1909, to the manufacturers of explosives in the United States, setting forth the conditions under which these explosives would be examined and the nature of the tests to which they would be subjected.



LONGITUDINAL SECTION OF NUREMBERG GAS ENGINE OF 2800 HORSEPOWER



PLAN SHOWING GENERAL ARRANGEMENT OF GAS-ENGINE PLANT

In response to this communication, applications were received from 12 manufacturers for the testing of 29 explosives. Of these explosives the 17 given in the following list have passed all the test requirements set forth, and will be termed permissible explosives.

Subject to the following conditions, a permissible explosive is defined as an explosive which has passed all the gas and dust-gallery tests. Provided:

1. That the explosive is in all respects similar to the sample submitted by the manufacturer for the test.

(*b*) The permissible explosives are one and one-fourth to one and three-fourths times as strong, and are said, if properly used, to do twice the work of black powder in bringing down coal; hence only half the quantity need be used.

(*c*) With 1 lb. of a permissible explosive, or 2 lb. of black powder, the quantity of noxious gases given off from a shot averages approximately the same, the quantity from the black powder being less than from some of the permissible explosives and slightly greater than from others. The time elapsing after firing, before the miner returns to the working face or fires another shot, should not be less for permissible explosives than for black powder.

PERMISSIBLE EXPLOSIVES TESTED PRIOR TO MAY 15, 1909.

Brand.	Manufacturer.
Ætna coal powder A	Ætna Powder Co., Chicago, Ill.
Ætna coal powder B	Do.
Carbonite No. 1	E. I. Du Pont de Nemours Powder Co., Wilmington, Del.
Carbonite No. 2	Do.
Carbonite No. 3	Do.
Carbonite No. 1 L. F	Do.
Carbonite No. 2 L. F	Do.
Coal special No. 1	Keystone Powder Co., Emporium, Penn.
Coal special No. 2	Do.
Coalite No. 1	Potts Powder Co., New York City.
Coalite No. 2 D	Do.
Collier dynamite No. 2	Sinnamahoning Powder Co., Emporium, Penn.
Collier dynamite No. 4	Do.
Collier dynamite No. 5	Do.
Masurite M. L. F	Masurite Explosives Co., Sharon, Penn.
Meteor dynamite	E. I. Du Pont de Nemours Powder Co., Wilmington, Del.
Monobel	Do.

2. That double-strength detonators are used of not less strength than 1 gram charge consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate (or its equivalent), except for the explosive "Masurite M. L. F.," for which the detonator shall be of not less strength than 1½ grams charge.

3. That the explosive, if in a frozen condition, shall be thoroughly thawed in a safe and suitable manner before use.

4. That the amount used in practice does not exceed 1½ lb. (680 grams) properly tamped.

The above partial list includes the permissible explosives that have passed these tests prior to May 15, 1909. The announcement of the passing of like tests by other explosives will be made public immediately after the completion of the tests for such explosives.

A description of the method followed in making these and the many additional tests to which each explosive is subjected, together with the full data obtained in each case, will be published by the Survey at an early date.

Notes and Suggestions

It may be wise to point out in this connection certain differences between the permissible explosives as a class and the black powders now so generally used in coal mining, as follows:

(*a*) With equal quantities of each, the flame of the black powder is more than three times as long, and has a [illegible] 3000 to more than 4000 times [illegible] of the permissible explosives, [illegible] of explosion is slower.

The use of permissible explosives should be considered as supplemental to and not as a substitute for other safety precautions in mines where gas or inflammable coal dust is present under conditions indicative of danger. As stated above, they should be used with strong detonators; and the charge used in practice should not exceed 1½ lb., and in many cases need not exceed 1 pound.

Inasmuch as no explosive manufactured for use in mining is flameless, and as no such explosive is entirely safe under all the variable mining conditions, the use of the terms "flameless" and "safety" as applied to explosives is likely to be misunderstood, may endanger human life, and should be discouraged.

Production of Coal in California in 1908*

The total production of coal in California in 1908 was 18,755 short tons, having a spot value of $54,840.

California is not an important coal-producing State, but it is one of the few [illegible] the output in 1908 showed an increase over that of the preceding year. All of the production was the result of recent developments in new territory. [illegible] mines at Tesla, in Alameda [illegible] reported by United States Geological [illegible] county, and at Black Diamond, in Contra Costa county, were idle throughout the year. The recent developments have been at Ione, in Amador county, and at Stone cañon, in Monterey county. The production in those two counties in 1908 exceeded that of 1907 by 4805 tons, and the increase in value amounted to $16,627.

The coal-mining industry of California has been adversely affected, first, by the importation of foreign and better coals, brought largely as ballast, and, second, by the increased production of petroleum and its use as fuel in manufacturing establishments. As a result of these conditions the production of coal in the State had decreased from over 170,000 tons in 1900 to 77,050 in 1905, to 25,290 tons in 1906, and to 13,950 tons in 1907. Up to the close of 1908 all the coal mined in the State had been of the lignite or subbituminous variety. During the last year, however, the development of the mines in Stone cañon, Monterey county, has placed on the market a bituminous coal of a quality adapted to compete with the foreign coals brought into the San Francisco market, and it is believed that this will result, to some extent, in the rehabilitation of the coal-mining industry of the State. It is understood to be the intention of the promoters of this enterprise to cater to the domestic fuel trade, in which petroleum does not figure as a competitor.

The production of petroleum in California increased from 33,098,598 barrels in 1906 to 39,748,375 barrels in 1907, and to 44,861,742 barrels in 1908. This enormous output of crude petroleum has almost eliminated coal as a fuel for railroad and manufacturing purposes in California, where it is used almost entirely for domestic purposes. There is promise of additional coal supplies from Monterey and San Benito counties if transportation facilities are procured.

Mine Explosions and Their Causes*

By James Taylor†

Too much reliance is often placed by the management of our mines on the supposed security of ample ventilation. The most disastrous explosions caused by windy, or blown-out shots in the mines of Illinois, have occurred when the ventilation was of superior character. This is natural, as the oxygen in the good ventilating current aids in the quick ignition and combustion of the carbon-monoxide gas given off by the incomplete combustion of the powder.

The explosive range of marsh gas varies from 6 to 14½ per cent.; the explosive range of carbon monoxide is much wider

*Abstract of paper read before the Illinois Fuel Conference, Urbana, Ill., March 12, 1909.
†State mine inspector.

than this. Carbon-monoxide gas is always found after the firing of shots. This latter gas has much greater power to elongate a flame than has firedamp, on account of its wider explosive range.

The practice in the majority of the mines of Illinois in getting the coal by blasting off the solid, has little to recommend it. Statistics showing the number of accidents and the coal wasted in Illinois during recent years, are so startling that it is evident there should be a betterment in the present system of mine development. As one who is in constant touch with the practical management of mines, I would advocate the abolition of our present system of blasting coal, as the most effective prevention of mine explosions. Although it is useless at this time to advocate a return to the lump-coal system of mining, nevertheless, I believe such a change would be the surest cure for the reckless use of powder and the lack of proper preparation of shots.

Coal Dust a Greater Enemy than Firedamp

It is universally admitted that coal dust is a greater enemy than firedamp; however, it is a fact that sufficient attention is not always paid to the prevention of its production and accumulation. I believe that this end can only be attained by a proper system of mining and a constant and efficient cleaning of roadways, in preference to the adoption of such systems of sprinkling as are now so generally advocated.

We have had several explosions in our Illinois mines caused by a lack of forethought on the part of the mine management. A violation of the mining law, whereby the miners entered the Zeigler Coal Company's mines, on April 3, 1995, after the fan had stopped, caused an explosion in that mine, killing 50 men. A few weeks ago 28 men lost their lives in this same mine, due to a lack of forethought on the part of the management in not making a thorough examination of all the working places before allowing the men to work therein.

It is unfortunate that unskilled labor is gaining a foothold in the coal mines of Illinois. However, the fact that this is so is before us, and a remedy is needed. It is probable that the best way to correct this evil is to make every man that desires a place as a miner, show that he has previously served an apprenticeship loading coal, before he is allowed to handle powder and prepare shots. Life and property are not safe when in the keeping of densely ignorant and inexperienced men.

If our mine inspectors are to render the most efficient service, they should have the power to discharge and to arrest those violating the law. Having such authority, they could compel obedience to all rules and laws, and establish such discipline as to greatly lessen the danger of accidents.

Tests of Life-Saving Appliances for Mines

By Robert Grimshaw*

The experiments here described in detail had for their object to determine how much work a man equipped with life-saving apparatus could do, and to determine the condition of the atmosphere delivered to him. They were made by Wetzke, Christern and Wext of Lubeck; the first a chemist, the latter two, physicians; and were carried out with that thoroughness which characterizes the German scientific investigator—a thoroughness which does not extend to the average German manufacturer or workman.

There was employed to represent the mine or burning dwelling, a workman's house of four rooms in a row; first, a "smoke room;" next a room for the registering instruments; third, a preparation room and the fourth to clean up in.

In the smoke room there were two machines arranged with weights of 20 kg. = 44 lb. each, which should be lifted 1.25 m. = 4.1 ft.; the number of times being registered automatically. Each lift represented 25 meter-kilograms, or 180.825 foot-pounds. Two workmen were employed: Pilz 1.74 m. = 68.56 in. tall, and Holtz 1.66 m. = 65.5 in. Pilz weighed 79 kg. = 174.1 lb. and Holtz, 69 kg. = 152.1 lb. Each was to lift the weight 20 times and then take a rest; so that in each period of work 500 meter-kilograms = 3,616.5 foot-pounds were done.

The tests for carbonic acid were made in about 4 to 5 min. each with a maximum error of ¼ per cent.

Four different apparatus were tried: (A) The "Shamrock," from the Machinen Fabrik Westphalia. (B), (C), (D). Three different apparatus of the Draeger type. In the mouth pipes of the "Shamrock" device, there was 10 cu.in. of air left over; in the "Draeger C," 0.167 liter or 10.2 cu.in. In the new Draeger apparatus D, there was practically none.

The air discharged from the apparatus contained, when no work was done, 2.3 to 2.6 per cent. of carbonic acid; when, however, considerable work was done, the carbonic acid content amounted to from 3.7 to 4.1 per cent. Where the air was held a minute in the lungs, or breathed again and again for the same time, the percentage of carbonic acid was 4.6 to 5.6 per cent.

The Actual Work Accomplished is Lowered by Weight of Machine

Working in the open air, a man, loaded with the apparatus on his back, performed 43,500 meter-kilograms = 314 foot-pounds of work. In two hours, loaded with the apparatus, but not breathing from it, his performance was 40,000 meter-kilograms = 289,320 foot-pounds. This shows that the performance of a man is lowered 8 per cent. by the weight on his back.

Considering the best results obtained with the Draeger apparatus (36,500 meter-kilograms = 264,000 foot-pounds in two hours), it is seen that the work was lowered 8.7 per cent. by breathing in the apparatus. If this loss is considered with relation to a less effective apparatus, where for instance only 18,000 meter-kilograms = 130,195 foot-pounds of work were delivered in two hours, the diminishing of capacity is 55 per cent.

There is a general but false impression that the hurtful effect of breathing carbonic acid may be done away with by breathing oxygen; but oxygen has not this property, and its effect on the human body is only produced when the air breathed is free from carbonic acid. The development of the life-saving apparatus shows a constant endeavor to get rid of the CO_2. The workman were capable of full duty only when the carbonic acid was entirely absorbed.

The ability to work when the lungs are impeded by the presence of carbonic acid is different in different persons; so that some persons can do a good hour's work even with the help of apparatus that delivers air charged with carbonic acid. The two workmen who made these tests were chosen from five; the other three having shown themselves unable to go through with the tests with one of the four apparatuses used.

Five to six per cent. of CO_2 may be regarded as causing "bad air;" 11.5 per cent. is characterized as unhealthy; 18.5 per cent. as dangerous; 27.5 per cent. represents the air as breathed out, and is very poisonous, while with 37.5 per cent. CO_2, the air is deadly.

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According to statistics collected for The Mineral Industry, the production of iron ore in the United States during 1908 fell off badly, amounting to only 33,789,987 long tons, valued at $60,821,976, as against 52,955,070 long tons, valued at $117,560,265, in 1907. The total value for 1908 is figured on an average valuation of $1.80 per ton of ore delivered at lake ports from the Superior field, or f.o.b. in the other localities. Of the 1908 production 33,789,987 tons came from the Lake Superior region, 20,014,987 long tons from the South and 1,875,000 long tons from other States. All three districts produced less in 1908 than in the previous year, but the South fell off less than either the Lake Superior field or New York and the Central States section.

Pig iron is usually sold at gross tons of 2240 lb., though with a few furnaces the old computation of 2268 lb. per gross ton or "sand ton" still prevails. The gross ton also applies to ferro-alloys. Coke is figured at net tons of 2000 lb. always

Chronology of Mining, May, 1909

May 1—Sale of the Walsh & Seibert coal lands in Indiana for $1,500,000 to the Equitable Trust and Savings Company, Chicago.—Strike at St. Joseph Lead Company's mines, Bonne Terre, Mo. Mills closed.

May 3—Supreme Court of the United States declared the commodity clause of the Hepburn Railroad Rate Act as constitutional.—Fire broke out in the Forest Hill mine of the Pittsburg Coal Company, Smithdale, Penn.—Fire in North Mahanoy Colliery, Penn., under control.

May 4—Lake navigation opened at Houghton, Mich.

May 5—Pittsburg Coal Company, Westland, Penn., resumed operations after being closed 8 months.—Meeting of representatives of 70 independent coke plants at Uniontown, Penn., to plan consolidation.

May 6—Construction of 560 by-product coke ovens at Gary, Ind., begun by the United States Steel Corporation.

May 7—The Stockton Colliery, Penn., employing 800 men, suspended operations until the fall.—United States Steel Corporation announces the opening of the ore shipping season on the Lakes.

May 9—Fire in the United States Geological Survey's building at Washington, D. C.—Fire broke out in the Dos Estrellos Mines, El Oro, Mexico.

May 11—The directors of the Shannon Copper Company voted to finance the Shannon & Arizona Railroad.

May 12—The merging of the Consolidation, Fairmont, Somerset, Clarksburg, and the Pittsburg & Fairmont Coal companies, and their subsidiaries, controlling 200,000 acres of coal land.—The Ohio Coal Company, Evansville, Ind., resumed operations.—The Cullman Coal and Coke Company incorporated with headquarters at Cullman, Alabama.

May 14—Labor strike at New Idria quicksilver mines, San Benito, California.

May 17—Opening of navigation on Montreal river.

May 18—Murray plant of American Smelting and Refining Company resumed operations after a brief shut-down due to labor troubles.

May 19—Ohio Mining Commission met at Canton to formulate new laws suitable to operators and miners.—Death of Henry H. Rogers, president, Amalgamated Copper Company.—Frick Coke Company started 1000 additional ovens.

May 21—The $60,000,000 merger of coke plants was completed.

May 22—Largest week's zinc-lead shipment from Joplin district for more than one year.—Price of zinc ore reached $43.50.

May 23—A silver nugget weighing 3000 lb. was found at Cobalt, Ontario.

May 25—Six thousand miners go on strike in the Kanawha field.

May 28—A formal agreement made whereby the Standard Oil Company will control the Galician oil fields.—Hayden, Stone & Co., purchased control of Santa Rita Copper Company.

Mines as Investments

By George D. Stoxestreet*

To many laymen the idea of investing in mines seems to suggest gambling, and not legitimate business. Many conservative bankers and staid old business men politely and firmly show the mining promoter the door, and would never allow their names to be attached to any investment where mining is undertaken as a source of revenue. From their point of view such men are correct enough in pronouncing mining a gamble, and in the days before the advent of trained mining engineers they were justified in refusing to look upon mining as an investment. It was usual, 20 years ago, and even now to a smaller extent, to promote a mining property by specious advertisement, untrustworthy reports by alleged experts, and by the sale of stock many times below par value. While it is true that some mines so promoted have succeeded, they have done so in spite of their promotion and management, but 99 per cent. of such promotions usually fail and properly so.

The education of the public on mining matters is important from two viewpoints: (1) That gambling in mines may be stopped, and vast sums of money saved from going into the pockets of unscrupulous promoters; (2) that the public be instructed in careful uptodate methods of investigating prior to making investment. That such investment can really be called such is a well proved fact today. A mining engineer of standing in the financial world signing a report upon a mine in favorable terms, has the effect of engaging the attention of capital as an investment to the extent of any number of millions which may be required.

Should plain John Smith sign a good report upon a mine, his name, carrying no weight, would have no effect on this class of investors, and ranging between the engineer of international mining fame for skill and probity down to John Smith of unknown skill and doubtful honesty are many thousands of engineers more or less capable. All of the best of these will testify that mining can be made a legitimate investment and can prove their assertion.

Iron and coal mining are today well removed from the promoter's wily ways, and his attention is now usually directed to gold, silver, or copper mining. The following advice may be tendered to the public on mining promotion. When the promoter calls, ask him the following questions and note that in most cases he will be totally unable to answer them:

(1) Is this a mine or only a prospect?

(2) Should the promoter claim it to be a mine, then ask him how many tons of ore are in sight, who measured them, how the measurement was made, what is the value per ton of ore in sight, how is that value arrived at, and if he has plans of the mine showing its development and value.

(3) Who was the engineer who reported upon the mine, what are his qualifications, and who are his references?

(4) Who are the directors? Have any of them had experience in mining-company directing?

(5) What amount has been spent upon the mine to date, who vouches for this, and what did the property originally cost?

(6) What is the capital stock? How and to whom allotted, and why were they so allotted?

(7) What is going to be done with the money you are now seeking to get out of me, who is going to spend it, who says it will accomplish what you intend it for?

(8) Who is the manager of your mine and what experience has he had to justify his position?

(9) What are the metal contents of ore in the mine, their value, and what process of recovery do you intend to install to recover those metals? Who advises you on this process, and what has been his experience with this class of ores?

(10) What figures have been made to show the probable life of the mine and who made them; in other words, for how many years may I expect dividends, and at what rate?

(11) What title have you? In whose name does the property stand? Is it fully paid for?

He may say, "Your questions are good, but I am only dealing with a prospective mine," and if he says this, it is no investment, but has only a bare chance of becoming a mine. Exploration and development companies should do this prospecting work, for which they are properly equipped, and for which the ordinary promoter certainly is not. Should the promoter claim that he is selling shares only in a prospect then ply him with questions 3, 4, 5, 6, 7, 8, 9 and 11, and upon the answers being returned, use your best judgment, together with that of some reputable engineer. For just as you would consult your doctor, or your lawyer, so should you consult your engineer. Pay him for his advice and then take it.

In conclusion, a word should be said about a large class of men who put money into mining only for the chance it affords to unload on someone else at a higher figure. They do so without inquiry into the merits or demerits of the property, but these men will be eliminated by a natural process if the careful businessman will act on the advice tendered herewith.

*Mining engineer, 45 Broadway, New York.

Progress in Cyanidation*

By Alfred James†

It is rather interesting, if at first sight somewhat disappointing, to note that recent developments in cyanide work have been almost entirely mechanical. And yet that such should be the case is surely a tribute to the band of chemists, prominent among whom were MacArthur and Ellis, who over 20 years ago investigated so thoroughly the chemical side of the process that even today one is forced to acknowledge that chemically the cyanide process stands almost where it did at its introduction.

The use of oxidizers such as atmospheric air, ozone, sodium dioxide, and ferrocyanide of potassium, put forward or investigated by Montgomerie, Moldenhauer, Julian, Kendall and others; the application of alkalies; the use of lead salts now carried to such an extent in the treatment of the silver sulphide ores of Mexico; and even the addition of a granular coating of lead to the zinc shavings, were all recommended or patented in the early days of the process; the use or addition of the halogen salts of cyanogen, including the bromide, iodide and chloride, were all investigated and advocated by Doctor Gaze in New Zealand in the early '90s, and more fully later by Sulman and Teed.

From the earliest days the addition of hypochlorites was investigated in certain quarters (bleaching powder was in actual use on the Kalgoorlie field in 1901); but all these accelerators or "improvers," as well as mercuric cyanide (Doctor Keith), and alkaline persulphates including ammonium persulphate patented by Dr. G. A. Schmidt in 1895, have been generally discontinued in practice owing to the increased cost of the improved process without corresponding benefit. The bromocyanide process alone may claim to have shown definite and continuous commercial results in practice and it probably would have persisted but for the incidence of cheap roasting which has permitted of higher recoveries at lower cost.

Mechanical Developments

It is on the mechanical side, therefore, that we find most recent developments. And here we are confronted by a change in practice that amounts to a revolution. No longer does one aim generally at crushing an ore as coarsely as possible and with a minimum production of slimed products. On the contrary, the higher recovery obtained from the slimed products has resulted in the adoption of an entirely new method of crushing the ore, of dissolving out the gold and silver and of recovering the valuable solution from the pulp.

And so passing over the development of the roasting furnaces which now roast refractory telluride and sulphide ores down to as low as 0.01 per cent. of sulphur as sulphide at 2s. 6d. per ton roasted, one comes to the finer crushing of the ore and to that great development of the last few years, the tube mill, the use of which has been publicly stated to be the greatest development in gold-ore treatment since the introduction of the cyanide process. The higher extractions obtainable from the more finely crushed ore are claimed to result in an extra profit of 2s. per ton in South Africa, or say an additional £2,000,000 per annum for that field.

Agitation

But the finer crushing of ore has led to another development, and that is the circulation of cyanide solutions through the mill, instead of through the leaching plant only, as formerly. This practice is now widely followed in Australia, America and eastern Asia. From time to time, statements accompanied by charts appear in the technical press showing the extra extractions resulting from this practice. As the getting of the gold into solution by percolation in tanks, as of old, is out of the question for a large proportion of the finely slimed product, it has been necessary to effect solution by keeping the pulp in suspension in the cyanide liquor.

This is accomplished naturally during the crushing and transfer of the pulp where cyanide solution is circulated through the mill but the period of contact thus afforded is usually insufficient. Mechanical (paddle) agitators have, therefore, been employed as has also air under pressure—notably by Mr. Moss at the Kalgurli Gold mine—but in practice the latter has proved much too expensive a method and the former has not been entirely satisfactory whether from a mechanical or commercial point of view.

Recently an ingenious modification of the principle of the Pöhle air lift has been introduced in New Zealand where they use tall tanks in which the lessening of the specific gravity of the contents of an inner tube resulting from the introduction of bubbles of air tends to rapid and most energetic displacement of the pulp contained therein with consequent effective agitation of the mass of pulp contained in the outer tank and surrounding the inner tube. This apparatus has been found very efficient and to require much less power than the mechanical agitator and it has been adopted already in the various great goldfields of the world

Treatment of Silver Ores

These notes would be incomplete were i not to refer to the recent great development of the cyanide process in its application to the treatment of silver ores. The mechanical developments mentioned above are possibly mainly responsible for this. In the ordinary way, so long a period of agitation is required for the recovery of the silver content of a sulphide ore that the necessary mechanical agitation of the finely slimed ore for some days was found to be a very expensive matter. This time, however, has been very materially reduced by the use of the air-lift system of agitation above referred to and already a large proportion of the silver output of the world is now produced—particularly in Mexico—by the use of tube mills, air-lift agitators and vacuum filtration.

But with the growing tendency to finer crushing and the greater production of slimed pulp, the necessity became more pressing for the provision of a cheap and effective method of recovering the valuable solution from the slimed pulp. In the early days of the process, when confronted with a New Zealand ore which one could not leach in vats, we used filter presses for this purpose and later Ellis treated similar Chilean ore by decantation as the most convenient method available, and until the general adoption of tube mills the mining world was content to treat its slimed pulp by one of these two methods. In West Australia filter-pressing received its greatest development, recoveries of 97 to 98 per cent. of the dissolved gold being obtained at a pressing cost of 1s. 6d. per ton pressed. In South Africa, J. R. Williams worked out a practical method of applying decantation which resulted in some of the highest installations ever erected and possibly the highest recoveries ever obtained in practice by a displacement process.

Vacuum Filtration

But with the increased proportion of slimed pulp resulting from the use of tube mills, greater attention has been paid to providing an effective method of recovering a high percentage of the dissolved contents and one is now confronted with perhaps the greatest development in the cyanide process of recent years, the adoption of vacuum filtration. Acting on the basis of the adherence of a mass of filtered cake to a vertical or downward-facing filter until displaced by the discharge of the vacuum or by the application of back pressure, large equipments have been erected (some of them treating upward of 1000 tons of slime per day) for obtaining at a low cost the dissolved contents of the slimed pulp. Of the success of this latest development of the cyanide process one may judge from the increasing size of the equipments being erected, and from the published statements of a cost of from 3d. to 4d. per ton handled and of a recovery of 99.5 per cent. of the dissolved contents (average for the month of November at a plant treating over 500 tons per day) and from the fact of the

*A paper presented under the title, "Recent Developments of the Cyanide Process," at the International Congress of Applied Chemistry, London, May 28, 1909.

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treatment—if one may rely on published records and statements—of no less than 5,000,000 tons of slimed pulp by this process during the last 12 months.

Magnetic Oxide in Matte

By E. L. Larison*

For many years an intermittent controversy has gone on regarding a more or less important constituent of copper mattes, magnetic oxide of iron. Some observers go so far as to deny, or at least doubt, its existence.

Although the grounds for such an opinion are surely lacking in many cases, there is no doubt about the fact that a great many mattes when treated with nitric acid do not completely dissolve, but leave a residue of magnetic oxide. This residue often amounts to several per cent. of the quantity taken, and in such cases appreciable amounts can be obtained to work with, and no mistake as to the nature of the substance is credible. The fact of the existence of the residue and its certain identification being established, only one explanation can be put forth in support of the idea that magnetic oxide does not exist as such in the mattes. That is, that it is produced by the action of HNO_3 on the iron sulphide or metallic iron in the matte.

This theory was presented very clearly and with some supporting experimental data by Gibb and Philp.[1] The substance of their argument lay in two points: (1) They show that with increased quantities of oxidizing reagents [HNO_3 and $KClO_3$] increased quantities of the residue of Fe_3O_4 result on a given matte, showing that at least the amount and strength of the oxidizers have a quantitative influence. (2) The residue of Fe_3O_4 formed in their experiments was soluble in H_2SO_4, whereas Fe_3O_4 formed at the high temperature of a blast-furnace tuyere region should be very difficultly soluble in H_2SO_4.

Two Possible Sources

This theory is somewhat out of the ordinary, as Mr. Keller remarks in his criticism of the original paper. Without going into the theory of the oxidation reactions which might take place, two experimental facts will, nevertheless, have weight. Ordinary FeS which was made by melting together Fe and S and which contains excess Fe and is magnetic, leaves no residue of Fe_3O_4 on being treated with HNO_3 or $KClO_3$; also the Ducktown smelter mattes which are nearly pure Cu.Fe.S combinations, similar to those described by Gibb and Philp, give constant residues irrespective of the amounts of the oxidizing solvents used. This residual Fe_3O_4 is soluble with difficulty in H_2SO_4, which, however, does not prove that the Fe_3O_4 was formed in the furnace.

If we grant that Fe_3O_4 does exist as such, in the matte as it comes from the furnace, there are two ways of accounting for its presence. The first is that it is formed in the furnace by action of the blast on the iron sulphides; the second, that it was present in the charge as mineral magnetite and went through the furnace unchanged, in part, at least. The theory of formation in the furnace was brought out very strongly in Doctor Peters' "Modern Copper Smelting," being attributed to high-pressure blast acting on fused FeS. Doctor Peters at that time went so far as to suggest using low-pressure blast produced by fans, and enlarging the tuyeres to admit the necessary amount of oxygen. This theory was pretty well demolished when Mr. Keller pointed out that often reverberatory mattes, produced in furnaces using natural draught, contain large percentages of Fe_3O_4. Also that the blister copper and the slag from converters, in which exceedingly high blast pressures are found, often contain very little or no Fe_3O_4. Doctor Peters, in his later "Principles of Copper Smelting," does not speak so strongly as to the formation in the furnace, though he still says that it "may be formed under conditions as yet disputed in both reverberatory and blast furnaces."

Unaltered Magnetite

The alternative, i.e., that the magnetic oxide found in mattes is simply unaltered magnetite which existed in the ores seems a reasonable and natural explanation. It has long been observed that the mattes made by pyritic smelting of the Ducktown heavy sulphide ores always contain magnetic oxide. Recently in making "mineral analyses" of the ores it was found that these ores contain very appreciable percentages of magnetite, and it was this that brought the subject to mind. The evidence which could be obtained with very limited time follows:

There are two ores from mines three miles apart. Both are heavy sulphides, but they differ in some respects mineralogically. I will call them Nos. 1 and 2. No. 1, which produces the ore regularly smelted, contains from 2 to 3 per cent. of magnetite; No. 2 ore contains 12 to 14 per cent. magnetite. The first matte (about 20 per cent. Cu.), made from ore No. 1, contains approximately 3 per cent. Fe_3O_4, varying from 2 to 3.5 per cent., and apparently the higher percentages with the richer mattes. When this matte is concentrated by putting it through the furnace again, with only quartz and a small amount of coke, a matte ranging from 45 to 55 per cent. copper is produced. This matte carries on an average about 5 per cent. of magnetic oxide.

The ore which I have called No. 2 is not regularly smelted at present as it is rather low in copper. But some time ago a test run was made with it for about two weeks, and many matte samples were obtained, running from 5 to 30 per cent. copper. Many samples of different copper tenor were run for Fe_3O_4, and the amounts varied from 10 to 30 per cent. Only one sample tested, a 4.9-per cent. copper matte, contained less than 10 per cent. Fe_3O_4.

With these mattes the lower percentages of Fe_3O_4 in general were with the lower-grade mattes until the copper percentage reached about 25, when the Fe_3O_4 appeared to decrease. The mattes were all tested with a magnet. Those made from the No. 2 ore, which contained the high Fe_3O_4 percentages, were distinctly more magnetic than those from No. 1 ore. The corresponding slags were also tested, and again the slags of No. 2 ore were much more magnetic than those of No. 1 ore. I realize that this data is not as full and detailed as it should be to be used in comparison with that of other observers, but it pretends only to be incidental, and it is hoped that it can be made more complete when time allows. However, what little is here presented, I think justifies some generalization.

Conclusions

It seems clear that the charges which contain the greater amounts of magnetite produce mattes higher in Fe_3O_4 than those from the charges low in magnetite. The mattes, of course, do not account for anywhere near all the magnetite charged, but the fact that the slags in every case are distinctly magnetic, and that this property varies with the magnetite charged, partially at least, accounts for the difference. Also, it is probable that part of the original magnetite is lost by reduction, and combination with SiO_2. Knowing that there is magnetite in the charges, it is fairer to assume that it partly, at least, goes through the furnace unchanged, than to assume that it is mostly reduced and slagged, and new Fe_3O_4 formed by blast action.

It has been suggested that the difficult solubility of Fe_3O_4 from mattes in H_2SO_4 indicates that the Fe_3O_4 was formed in the furnace at a high temperature. This is offset in the present instance by the fact that the magnetite in these ores is also very hard to dissolve in H_2SO_4, or even HCl, and the passage through the furnace would not tend to make the solution easier. In the articles that have been published on this subject I have never seen any figures on the magnetite content of the ores from which the mattes quoted were produced. Figures on this point from various ores from different districts would, I think, be of much value in solving the question.

*Chemist, Ducktown Sulphur, Copper and Iron Company, Isabella, Tenn.

[1] *Trans.*, A. I. M. E. Vol. XXXVI, p. 665.

Colliery Notes

With proper equipment, a small peat-bog of from 50 to 70 acres will supply a moderate power plant for a good many years. Wet peat with 45 to 50 per cent. of water can be burned successfully in a gas producer; however, the air-dried material of about 25 per cent. water is much more desirable, if the producer process is to go on smoothly and turn out a rich gas.

Artificial wood manufactured from peat is being successfully introduced in Germany. In 1908, peat-wood blocks were used for paving a street at Dresden. Although this street has handled heavy traffic, the trial has showed good results, in spite of the frequent changes of temperature which occurred last winter in Germany. The advocates of this kind of paving claim that the peat-wood blocks are better than asphalt, and that they lessen the noise of carriage traffic equally as well as an asphalt pavement.

According to Arthur E. Taylor, a peat expert of Findlay, O., the peat deposits in Indiana cover about 200,000 acres, or 312 sq.m., and occur in the three northern tiers of counties. The peat beds appear in the sites of old glacial lake basins. Practically all of the workable deposits of Indiana are limited to the counties found in the Lake region, and most of the beds have had their development in these lakes. The filling of these lakes by vegetation undoubtedly began as soon as the ice receded, and is today going on in some degree.

The general idea that marsh gas, so common in coal seams, accumulates and remains in cavities in the roof and higher places of a coal bed, is considerably in error. It is true that this gas is lighter than air, and that as a consequence its presence may sometimes be first noticed in such cavities and high places; however, the accumulation of marsh gas in such places will be only temporary. From the moment the gas is liberated, it is largely governed by the natural law known as "the diffusion of gases," and it immediately begins to mix with the mine atmosphere. In order to prove the foregoing statement, it is only necessary to take two bottles, one filled with ordinary air and the other with methane; connect these bottles with each other by means of a tube passed through a cork inserted in the neck of each bottle; it will be found that after a short interval of time the two gases will have mixed uniformly, and this will occur even though the bottle containing methane is placed uppermost with its neck directed down ward toward the other bottle.

The question of watering mine roadways has given rise to much discussion. To ascertain the exact effect that sprinkling has on the roof and sides, interesting experiments were recently carried out at an English colliery. In three distinct seams, a pair of places were driven parallel, about 60 ft. apart; one of the places was watered each working day, that is, five days a week, for three months or more, while the other was left alone. The water was applied with an ordinary greenhouse syringe, about two buckets of water being used on 60 ft. of road; the width of the road was about 12 ft. In the first seam, the measurements showed that in the case of the watered place, the roof lowered, or the floor lifted as much as 14, 7, and 16 in. at three specially selected points; the unwatered place did not alter more than ½ in. In the second seam, the roof of the watered place broke up and fell, at some points, to a thickness of 2 ft.; the unwatered place lowered onto the packs, but did not break up. In the third seam, the roof of the wet place broke up to a hight of 20 in., while the dry place remained unaltered.

A careful investigation of the many recent experiments where calcium-chloride has been applied as a remedy for dust in dry mines, shows that this treatment is simple, rapid, inexpensive and efficient; it also facilitates the proper care of distant or inaccessible parts of a mine. In some instances, a solution of calcium-chloride was used, in other cases, a calcium-chloride powder was the agent. It was found that when the solution was applied to the sides or roof, the effect was just as damaging as though water was used. At one mine, 90 gal. of calcium chloride were used to treat 225 ft. of main road; the application kept this part of the road clear of dust for three months. There was no alteration in the hight of the road. At another property, 330 lb. of calcium chloride, previously ground to a fine powder, was sprinkled on the entry floor for a distance of 249 ft., no dust having been previously removed. On the following day, the road was wet and no dust arose. When the road was examined two months later, the effect was still visible. Judging from this experiment, one application every three months would be ample. The powdered calcium chloride was sown on dry by hand, 330 lb. being put on 2241 square feet.

A recent invention enables the manufacture of artificial wood from peat. The wet peat is washed without changing the natural fiber, after which the material is mixed with hydrate of lime (water-slaked lime) and with an albuminous combination, and, perhaps, argillaceous earth, the entire mixture being pressed in molds with a pressure of 6400 to 7100 lb. to the sq.ft., the excess of water being released by the pressure. After a short application of the pressure, the board can be taken out of the mold, when it is already very strong and needs only to be completely dried in the open air and worked to the necessary dimensions to be ready for use. The boards produced by this method can be worked as easily as natural wood, although their strength is much superior to the strength of the natural wood. They can be polished and painted, and according to the statement of the inventor, are 30 to 50 per cent. cheaper than articles made out of good oak wood. The artificial peat wood is suitable for: (1) flooring of every kind; (2) doors, fireproof stairs, ceilings, panels, and all other cabinet work; (3) sidewalks and roof coverings; (4) railroad ties; (5) pavements for streets and factories; (6) complete furniture from the simplest to the most elegant design. The artificial wood is not hygroscopic, and does not require painting or impregnation for use in the open air. The new peat wood is also fungus-proof and very little affected by heat.

Before useful suggestions can be made as to the treatment of coal dust, so as to render it innocuous, it is necessary to obtain some idea as to the rate at which dust is deposited on underground roadways. In this connection, Henry Hall, the English mine expert, recently made valuable experiments in an endeavor to solve this question. With this object in view, aspirators were fixed in a return-air road at intervals of about 75 ft. The action of the aspirator is by means of cotton-wool: the air is drawn through it, and the dust deposited in transit, the cotton-wool being carefully weighed before and after the operation. After collecting data from a number of such experiments, Mr. Hall found that something like 11½ lb. of coal dust were carried in 8 hours past the point where the measurements were taken. The velocity of the current of air carrying this dust was 95 cu.ft. per minute. The result also proved that there was a gradual diminution of the dust as it traveled out-bye; there was no traffic on the road on the out-bye side of the point where the aspirator was placed, while the experiments were being carried out. Still other measurements were made, with the object of arriving at the quantity of dust deposited on the floor, sides, etc., as it was being carried along by the ventilating current. In these latter experiments, flat porcelain dishes having an area of 1.12 sq.ft. were used. The time allowed for making the measurements varied from 8 to 10 hours on two separate days. The results of these experiments showed that at the shaft-bottom, where the area of the road is 150 sq.ft., 18 lb. of dust are deposited each working day of 12 hours. If it be assumed that this road averages 12 ft. in width and that ½ lb. of dust per lineal foot of such a road is required to make an explosive mixture of dust and air, starting with a clean sheet, it would require 83 ordinary working days to render this 3000 ft. of road at the bottom of the shaft absolutely dangerous. The deposits of dust, of course, will be thicker near the shaft than farther in

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Consumption of Spelter in the United States

We have previously, in the JOURNAL for Feb. 27, 1909, reported the production of spelter and zinc ore in the United States in 1908, and the deliveries of spelter for consumption, the figures then given including the production of virgin spelter only. We now reproduce those figures, together with our report for the production of reclaimed spelter, i.e., the metal derived from the resmelting of dross and other waste products.

DELIVERIES FOR CONSUMPTION.
(IN TONS OF 2000 LB.)

	1907.	1908.
Stock Jan. 1	4,550	32,883
Production(a)	249,612	210,511
Production(b)	18,000	12,150
Imports	1,778	881
Total supply .	273,940	256,425
Exports	563	2,640
Stock, Dec. 31. . .	32,883	25,000
Deliveries.	239,494	228,785

(a) Virgin spelter. (b) Reclaimed spelter.

According to the above figures it appears that the deliveries of spelter for consumption were 239,494 tons in 1907 and 228,785 tons in 1908. We have previously called attention to the probability that the reports from the consumers would fail to show so large a consumption in 1908 as the computed deliveries would indicate. It is impossible, for obvious reasons, to obtain reports from the consumers accounting for the entire consumption, there being so many small concerns which keep no records, or which it is impossible to reach However, the reports that we have received account for so large a proportion of the total that they afford an excellent indication of the status of the consuming industries, especially inasmuch as they can be compared with the reports of the same concerns for the previous year. Upon this basis we estimate the consumption in 1907 and 1908 as follows:

CONSUMPTION OF SPELTER.
(IN TONS OF 2000 LB.)

Purpose.	1907	1908.
Galvanizing	150,000	119,000
Brass-making	44,000	33,000
Sheet zinc	30,000	27,000
Lead desilverization.	2,600	2,500
Other purposes	12,894	10,000
Totals	239,494	191,500
	Per Cent.	Per Cent
Galvanizing	62 7	62 2
Brass making	18 4	17 2
Sheet zinc	12 4	14 1
Lead desilverization	1 1	1 3
Other purposes	5 4	5 2
Totals	100 0	100 0

It will be observed that we have revised the figures previously reported for 1907 in order to take up the consumption of reclaimed spelter. The change that we have made in the figures has been chiefly in the case of the consumption of spelter for "other purposes," later and more comprehensive information leading us to believe that the consumption of this metal for a great variety of miscellaneous purposes is considerably greater than what we previously estimated. It is especially these consumers from whom it is most difficult to obtain statistical reports.

The particularly noteworthy feature about the statistics of consumption in 1908 is the deficiency of the total as compared with the deliveries, the difference being 37,285 tons. At the end of 1908 there were large speculative holdings of spelter, but the amount of such metal remaining at the smelteries was included in the stocks reported by the smelters, the inquiry having been specific in that respect. The difference between deliveries and consumption is to be explained by stocks in second hands, and in manufacturers' yards. It is well known that some of the latter had overbought their immediate requirements, and indeed the last report of the United States Steel Corporation contains a statement that it had on hand at the end of 1908 an increased quantity of spelter as compared with the end of 1907. The deliveries of spelter in 1908 did not fall off very largely as compared with 1907, but the actual consumption was only about 80 per cent. of that of the previous year. There was actually a decrease in the accumulated stock at the smelteries, but there was a large increase in the invisible supply. This situation was, of course, the explanation of the sluggishness of the spelter market during the first quarter of 1909, at which time less than 70 per cent. of the retorts of the smelters of ore were in operation. Since that time there has been a healthy improvement in the demand.

Seismic Disturbances and Colliery Explosions

We have been criticized in the last issue of *Mines and Minerals* for publishing an article in the JOURNAL of Feb. 20, 1909, favoring the theory that seismic disturbances are often accompanied by outflows of gas into coal mines. We did not indorse this theory, but in presenting the article by Mr. Spalding, made some editorial remarks about it as follows:

"An argument on the basis of *post hoc*

ergo propter hoc is inconclusive. Nevertheless, it must be admitted that the coincidence between earthquakes and colliery explosions is such as to warrant careful study of the conditions. In this connection, full credit must be given to James T. Beard, who has for many years been drawing attention to the matter, as the readers of the JOURNAL are well aware. . . .

"This, together with the atmospheric theory, that we have previously discussed, continues to demand the careful attention of colliery engineers. Our propaganda as to the probable effect of atmospheric conditions has led many operators to install barometers at their mines and observe them carefully for warning of approaching low pressure. Such warnings are generally recognized in Europe as being of great practical benefit."

The fact that Mr. Spalding's article had previously been declined by our esteemed contemporary lends no force to the argument that we should not have accepted it. Indeed, we are free to confess that this circumstance did predispose us to the idea that the manuscript might contain something of modern interest. We were fully informed of the history of the manuscript by Mr. Spalding in his first letter, wherefore *Mines and Minerals* need not worry about its veto having been unknown to us. In justice to Mr. Spalding, we shall say now that a large part of his original manuscript was devoted to an elaborate thesis in support of his argument, in which he advanced an interesting hypothesis. We asked him to withhold this portion of his manuscript until further researches could be made and additional proofs presented; and we confined his article to the coincidences between the records of seismic disturbances and the occurrences of colliery explosions. We stated very plainly in our editorial remarks that any *post hoc* argument is inconclusive, but urged that the coincidences have been such as to warrant study of the conditions.

The criticisms of *Mines and Minerals* are not of a character to cause us to recede from this position, which has the endorsement of numerous engineers and scientists in Europe and America. Indeed, there are many who take a far more advanced stand. Thus, Mr. Beard, of Scranton, who needs no introduction to the readers of *Mines and Minerals*, and who is recognized as an expert on the subject of colliery explosions in his recently published treatise on "Mine Gases and Explosions" strongly advocates the earthquake theory; and at the recent meeting of the Meteorological Congress at St. Petersburg this subject was specifically under discussion, and several delegates suggested that a seismograph be installed at every mine to record earth movements and thereby warn engineers of the possibility of danger.

The JOURNAL aims to lead the way, and by bringing to the attention of its readers suggestive ideas seeks to develop profitable investigations that will elucidate the truth. The sooner we can discover whether barometric pressure, seismic disturbances and other natural phenomena have a direct bearing on the outflow of gases into mines, the fewer unsolved problems in connection with promoting safety in coal mining will there be. The journal that travels the beaten track will arrive only where others have been. Cristopher Columbus had difficulty in convincing the scientists of his day that the earth was round. Every town can produce its citizen who has been consistently opposed to every new idea—street cars, telephones, etc.—and Scranton is undoubtedly one of those towns. Fortunately the mining industry has in the ENGINEERING AND MINING JOURNAL a forum that is freely open to rational discussion.

Extension of Oil Production in California

Notwithstanding the large production—just now overproduction—of petroleum in California, there is plenty of exploration for oil going on. In May there were 462 wells being drilled in the State, and some of these are in new districts or extensions of old districts. Thus a syndicate organized by the head of the Santa Fé railway's oil department has taken over the lands of the Western Mineral Company, comprising 4000 acres of the flat southeast of Sunset. Under the agreement of purchase about $100,000 is to be spent at once in development. One corner of the ground reaches the Johnson holdings where a strong well was recently brought in. The Kramer Consolidated Oil Company at Kramer on the Mohave desert has met oil seepages at a depth of 2900 ft.; there is also an abundance of gas. This is a new territory.

In San Francisco and Los Angeles there is at present very little speculation in oil stocks, those owing shares in producing wells not caring to sell while dividends are being paid. When once the value of an oil well is established there is little uncertainty except as to the life of the well.

A Mining Code for Arizona

At the Territorial legislative session this year, several bills were introduced for the creation of the office of Territorial mine inspector. Out of this proposed legislation grew a proposition for a mining code commission, to be appointed by the Governor, to prepare and draft a code of laws regulating metalliferous mining. This commission has now been appointed, consisting of Will L. Clark, of the United Verde Copper Company, as chairman, together with Hon. Thomas Armstrong, Jr., an attorney-at-law of much experience, W. F. Staunton, general manager of the Development Company of America, and Messrs. Kipple and Kimball, who are thoroughly experienced underground miners. This commission expects to report at the next session of the legislature, and in the meanwhile will coöperate with the Committee on Prevention of Mine Accidents of the American Mining Congress. It is gratifying to observe that the seed sown by the latter is thus early beginning to bear fruit.

The Longest Pipe-line

Pipe-line connections have been completed by which it is possible to pipe oil from the Oklahoma wells to New York harbor. Oil has been started on the long journey of 1500 miles, but it had not reached the seaboard yet this week. This is the longest pipe-line in existence in the United States, and indeed in the world. It is not probable that much oil from the Mid-continent district will be brought to the seaboard at present, and the completion of the line seems to be more in the nature of a provision for the future, or for emergencies which may arise. Oklahoma has the most active oilfield in the country at present; moreover its production is increasing, while that of Pennsylvania and West Virginia is decreasing. It may not be long before the western wells will be called upon to supply the seaboard and export demand

Amalgamated Copper Company

The statement issued by this company for the year ended April 30, 1909, gives the general balance sheet at the end of the year as below:

Investment in securities, etc., representing ownership in copper mines, mining claims, mining plants, reduction works, refineries, coal mines, sawmills, standing timber, water rights, land, etc.	$156,481,847
Loan to Washoe Copper Co., for smelter construction	7,200,000
Cash and cash assets	3,593,102
Total assets	$167,274,949
Capital stock	$153,887,900
Accounts payable	22,565
Dividend No. 39, payable May 31	769,439
Surplus and reserve	12,595,045
Total liabilities	$167,274,949

The stock authorized is 1,550,000 shares of $100 each; of which 11,121 shares are unissued. The income statement, as deduced from the balance sheet, is as follows:

Net income for the year	$ 3,663,980
Dividends 36, 37, 38 and 39—2 per cent. in all	3,077,758
Surplus for the year	$ 586,222
Balance from previous year	12,008,823
Total surplus	$12,595,045

The statement says: "The producing companies controlled by the Amalgamated Copper Company, have been operated continuously throughout the fiscal year, with the exception of the Anaconda Copper Mining Company and the Boston & Montana Consolidated Copper and Silver Mining Company. The former was compelled to cease operations for a short period of time at the Washoe reduction works, due to the fact that the railroad companies were unable, on account of severe climatic conditions, to transport a sufficient supply of coke; and the reduction works of the Boston & Montana Mining Company at Great Falls were closed from early in June until the middle of September, on account of damage by flood to the power plant of the company and to the railroads, which transport the ore.

"The copper business, during the period covered by this report, has been dull and the ruling price of the metal has been low. During most of the year, the production ran in excess of consumption, but at the present time deliveries of the metal are about equal to the production. Sales have been made in sufficient amount to practically absorb the accumulated surplus, made in the early part of the year.

"All conditions in the Butte camp during the year, tending toward the successful operation of the different properties, have been quite satisfactory, and the cost per pound of copper produced has been materially lessened. The normal amount of development work has been carried on in all of the properties, and the officials of the different producing companies report that this has been done with very satisfactory results and that in several of the mines, new orebodies have been found at depth, which had never been encountered on the upper levels.

"The fire in the Anaconda mine, which has been burning for a period of 19 years, has occasioned some inconvenience from time to time, but has not interfered seriously with the operation of the property for any length of time.

"A new shaft on the Belmont claim, belonging to the Anaconda Copper Mining Company, has been put in condition and equipped, and will eventually be connected with the lower levels of the Anaconda mine. This when completed will be used as an auxiliary shaft for the operation of the Anaconda properties.

"The shaft at the Parrot mine has been sunk to a depth of 2000 ft. and cross-cuts to the vein have been made at the 1900- and 2000-ft. levels. While the vein at these depths shows ore of a concentrating grade, it is not equal to the average concentrating grade of the camp, and will not yield a profit at present prices for the metal.

"The Little Mina claim, owned by the Parrot company, has been developed by a shaft which has now attained a depth of 1200 ft., and a shoot of ore of good grade has been developed on the 1000-ft. level. Crosscuts are at present being extended toward the vein on both the 1100- and 1200-levels.

"The shaft at the Gagnon mine, owned by the Trenton Mining and Development Company, is now 2300 ft. deep, and the discovery of new orebodies on the lowest levels has increased the value of this mine.

"The improvements at the reduction works at Great Falls, consisting of a stack 560 ft. in hight, with flues and dust chambers, are practically completed, and will shortly be in full operation.

"The sawmills of the Big Blackfoot Milling Company have been operated to a greater extent than during the previous fiscal year, owing to the fact that the mines at Butte, on account of their constant operation, have required a larger amount of timber and the commercial demand, while still far below the average, is showing a gradual improvement.

"The coal mines at Belt, owned by the Anaconda Copper Mining Company, and the mines at Diamondville, owned by the Diamond Coal and Coke Company, have been operated continuously, with very satisfactory results, throughout the year.

"The developments at the Bear Creek coal mines, owned by the Washoe Copper Company, have also been most satisfactory, and a grade of coal is being produced, which compares most favorably with the best Wyoming coal.

"A considerable betterment has been made in the mining and reduction costs by the use of electric power. Electric pumps have been installed in the mines during the year and operated with good [illegible], and it is planned to do hereafter all [illegible] in the mines with this power. [illegible] are now being made to determine the feasibility and economy of operating all the hoisting plants of the different companies by compressed air, generated by electric power.

"The companies, owned solely or in part by the Amalgamated Copper Company, produced for the calendar year 1908, from their own and custom ores, about 234,000,000 lb. of refined copper, of which amount the Amalgamated Copper Company received the benefit from about 199,000,000 pounds.

Speculation in Copper

We have several times referred to the speculation in copper on the London Metal Exchange, emanating from this side of the water. This speculation is, of course, an old story with the metal houses having foreign connections, but during the last year it has been undertaken to a large extent by entirely outside interests. The latest development is the solicitation of such business by a well known firm of bankers and brokers. The following is part of a circular recently sent out by Hayden, Stone & Co.:

"We desire to call attention to the possibilities presented in the purchase of copper, the metal. Those who wish to buy copper, and do not care to be bothered with the details of handling it, will find it most convenient to buy copper warrants on the London Metal Exchange. Copper is dealt in there much as wheat and cotton are handled in this country. The metal is quoted in London in pounds per long ton, and the contracts call for delivery of what is known as 'G. M. B.' copper, a grade slightly lower than our electrolytic brand. The ordinary unit for trading is 25 tons. The usual contract is for three months, and the commission is ¾ per cent. for the round turn on the total amount of money involved. The contract may be renewed for a second three months on the payment of an additional commission of ½ per cent. The customary protection required is £5@6 per ton.

The stoping width on the South reef at the Roodepoort United mine has been reduced (*South African Min. Rev.*, March, 1909) from an average of 42 in. to under 30 in. The gold-bearing ore on this reef is only a few inches wide as a rule, and the company is now breaking about 25 per cent. less waste rock than it did formerly; also it is hoisting about 25 per cent. less, and, allowing for sorting, it is milling correspondingly less.

According to *Engineering-Contracting*, April 7, 1909, steam shovel No. 220, on March 2, working in the Empire Construction district, central division of the Isthmian Canal, removed 3941 cu.yd. of rock and earth in a working day of eight hours.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

The Smelter Smoke Question

For some years articles, more or less misleading, relating to alleged smelter-smoke damage, have appeared in various journals. No attempt has been made in the past to refute these statements, but with the conclusion of the Bliss suit, directed against the Anaconda smelter, in which the decision was sweepingly in favor of the company, it seems only just to call attention to misstatements of fact. The article appearing in the April number of the *Review of Reviews* is a case in point, and the astonishing position taken by the editor in refusing to correct errors makes it necessary to seek other channels of publicity. The correspondence submitted below requires no further comment:

EDITOR *Review of Reviews*:

Dear Sir:

In an article in the April number of your magazine, under the title, "Saving America's Plant Food," Guy Elliott Mitchell uses the following language:

"The Western phosphate beds may be considered of further importance by reason of their proximity to the great smelting works of the West at Butte, Anaconda, Great Falls and other points. These smelters give off poisonous gases, chiefly sulphurous, that are very injurious to vegetation, *absolutely killing all green things for miles around*. It is found, however, that they can be utilized to great advantage by conversion into sulphuric acid, which is the agent used in reducing rock phosphate to superphosphate fertilizer, or, as it is generally termed on the farm, acid phosphate. Thus not only would a substance injurious to vegetation be controlled, but it would be actually employed in fostering plant growth."

I have too great respect for Mr. Mitchell to believe that he would knowingly indorse such a misrepresentation of facts as is contained in the paragraph quoted, and am inclined to think that he has accepted the statement of a prejudiced government official as being true. The following quotation from the opinion of Judge William H. Hunt, of the Circuit Court of the United States, Ninth Circuit, District of Montana, in denying a petition to enjoin the operations of the immense plant of the Anaconda Copper Mining Company, at Anaconda, after one of the most extensive hearings on record, will, I think, conclusively settle the question of the extent of the damage around Anaconda and adjacent country:

"Fortunately, I have been helped to a better understanding of much of the testimony in the record, indeed, of the whole case, by a visit of two days to the valley, during which time I rode many miles in an automobile in various directions from the smelter. The trip was made in August, 1905, in company with the master in chancery, counsel for complainant and defendants herein, and one or more expert witnesses for the respective litigants. As I had asked the several counsel to call my attention to anything they thought worthy of particular notice, it is fair to say that I had an excellent opportunity to gain a general, though, of course, somewhat superficial, insight into conditions. Upon the first day, which was bright, the smoke from the big stack rose high into the air, and seemed to be carried far away so high that its diffusion would seem to have been too general to do injury to any land; but on the second day the weather was rainy and the clouds were lower. The smoke then was more dense and its stream was carried down toward the Bliss ranch and southerly and northerly for a few miles toward the center of the floor of the valley, and was there dissipated. The trip impressed one main thing very firmly upon me, that neither the eye nor the training of an experienced or scientific agriculturalist was required to ascertain. It was that the allegation of complainant's bill, to the effect that the Deer Lodge valley and the country adjacent to the smelter are barren and desertlike, is grossly inaccurate. It is true that the land and vegetation lying within, say, a quarter of a mile of the smelter, is visibly affected. But outside of this limited area there was the appearance of healthy natural conditions of successful cultivation and of such crop growths as are usually seen in the valleys of the State. The harvest was going on; we saw hundreds of healthy-looking shade and fruit trees about farm houses; the grainfields and pastures looked as others in Montana generally do during or just after harvest. We walked over a portion of complainant's place, noticed the foxtail and inferior quality of the grasses growing, and, except for the smoke on the second day, there was nothing in the physical appearance of the complainant's farm or of the valley that indicated unusual or abnormal conditions."[1]

With reference to the use of sulphuric acid for the manufacture of fertilizers, freight rates are so high as to prohibit any such use of the acid for many years to come. In time, undoubtedly, when the extremely rich soils of the arid West, adjacent to phosphate beds, or near the smelters, shall have become exhausted, a market will exist comparatively near at hand, but until this time there will be no demand for a product that would be gladly furnished if it were possible to dispose of it.

The men in charge of the great smelters of the West are men of keen business discernment who are constantly seeking means of increasing the value of their output and of utilizing waste products. The "wise men from the East" come with ready-made solutions of the problem, but soon learn to appreciate the obstacles confronting the men who have grappled with and overcome even greater difficulties in the past, and who may be counted upon at the earliest possible moment to make a source of profit of that which is now going to waste.

F. W. TRAPHAGEN.

Golden, Colo., April 22, 1909.

Prof. F. W. TRAPHAGEN,
Colorado School of Mines,
Golden, Colo.:

Dear Sir:

We have read with interest your letter of April 22 replying to a statement made by the writer of our article in the April *Review* on the Western phosphate beds. It does not prove possible, however, for us to print your letter, because there is no provision in any of the departments of the magazine for the printing of communications correcting or controverting statements made in previous issues. It is regrettable to have an erroneous statement made in any of our articles, but it is not quite feasible to devote any considerable space in a subsequent issue to a correction of such statement. We thank you very much, however, for allowing us to read your comments on the point in controversy, and would suggest that perhaps the author of the article in question might be interested in seeing what you say about the matter. Guy E. Mitchell may be addressed care of the Geological Survey, Washington, D. C. We return your letter herewith.

Yours very truly,
Editorial Dept., *The Review of Reviews*.

There has been a great deal of absurdity published with respect to the smelter-smoke question. There has been no suggestion more absurd than the proposed utilization of the sulphurous smoke of Anaconda and elsewhere for the manufacture of sulphuric acid. We have pre-

[1] Pages 26 and 27 of printed opinion.

viously referred to this in the JOURNAL. It is no matter for surprise that a non-technical journal should fall into the error of fathering such a recommendation, but it is indeed a source of regret that such a recommendation should have emanated from the U. S. Geological Survey, even if it be with respect to a matter that does not pertain directly to the geological studies of the Survey. Although the Government, evidently to "save its face," is now having this matter investigated by a chemical engineer who is qualified to express an intelligent opinion, we have no doubt that the latter will be substantially in accord with that of chemical engineers in general, although its phraseology may be tempered so as to pass delicately over some raw places. Amid the flood of absurdities and prejudice in connection with the smelter-smoke question, the work of Professor Traphagen has stood out eminently for its lucidity, rationality and scientific spirit.—EDITOR.]

The Quebec Mining Law

I beg to call your attention to page 1046 of your issue of May 22 in the article on the Quebec Mining Law, wherein you state that in order to obtain letters patent "an expenditure of $500 must be made for each acre purchased." The manner in which this phrase should read is as follows: "An expenditure of $500 must be made for every section of 40 or 100 acres purchased."

J. OBALSKI,
Superintendent of Mines.

Quebec, June 3, 1909.

A condensed statement of the terms of the new mining law of the Province of Quebec has been furnished us by Mr. Obalski, as follows:

THE QUEBEC MINING LAW AS IT STANDS

1. The mines are reserved by the Crown on all the Crown lands and on the lands sold or patented for farming or other purposes after July 24, 1880, the owner of the surface having no right whatever thereon except to the damages. The land needed for mining may be expropriated by arbitration process before the Department of Mines.

2. Gold and silver are reserved by the Crown on all the lands, whatever may be the date of the patent.

3. Surface and underground may form one property, but can be separated in order to form two distinct properties, according to the wish of the owner.

4. The whole Province, surveyed or unsurveyed, is open for prospecting, except on territory already alienated for mining.

5. The staking out of a claim can be done only and personally by a prospector holding a miner's certificate. The cost of such certificate is $10, good until Dec. 31 in each year.

6. The staking out can be done on claims having an area varying from 40 to 200 acres in unsurveyed territory and on specified lots, from one to two lots, forming a maximum of 200 acres. Within four months of the staking out a mining license must be taken: (*a*) On unsurveyed territory for the claim as staked out; (*b*) on surveyed territory for lots or fractions of lots, containing an area of from 1 to 200 acres.

7. In unsurveyed territory the claim must be rectangular in form, with north-south and east-west orientation; and in surveyed territory the mining license will be bounded by lines parallel to the outlines of the lots, and the description must be furnished to the satisfaction of the Minister.

8. No evidence of discovery, assessment works or surveying is required in order to secure a mining license, but a fee of $10 plus a rental of $1 per acre per year has to be paid in advance, and the same is renewable, so long as the necessary amount is paid to this department.

10. The mine may be purchased upon payment of $10 or $20 per acre, respectively, within or outside of 20 miles in a straight line from railroad in operation, the above being for a full claim or an entire 100-acre lot. The applicant must produce the proof of a mineral discovery, the concession has to be surveyed and an amount of $500 spent in mining work before the patent can be secured. On Crown land the surface is sold with the mine, and on private land only the underground property, part of the surface being liable to expropriation should same be necessary.

11. All applications and recording must be made through correspondence with the Department of Mines at Quebec until otherwise announced.

12. The prospecting license system has been abandoned, but the actual holders will keep the benefit of the same and will have the right to renew them until Jan. 1, 1910.

Guerrero and Its New Railroads

In the JOURNAL of April 24, 1909, I notice the following from the correspondent at Mexico City: "A notable state road has just been completed from the end of the central line at Balsas, Guerrero, to Chilpancingo."

It may be of interest to know that the road mentioned is to extend from Iguala on the Mexican Central Railroad in Guerrero to Chilpancingo, the capital of the State. The road is only about two-thirds completed but work is being rapidly pushed at several points and it is expected to be formally opened before the end of the year. I might add that the present administration of Guerrero, headed by Governor Don Ramon Flores, is one of the most progressive in the whole Republic. The above is but the beginning of a comprehensive system of roads, proposed by the administration, covering the entire state. It is probable that this road will be put through to the coast at Acapulco in the next few years.

A similar road from Iguala to the old mining center of Taxco, is nearly completed. These are not "roads" in the ordinarily accepted sense. The road from Iguala to Chilpancingo is 14 ft. wide, rolled with crushed stone, and having maximum grades of 4 to 4½ per cent. In the low country the road is protected by well constructed ditches and in the higher sections by masonry culverts. The construction throughout of the road is in accord with the latest scientific practice.

Guerrero is a state of vast possibilities in her undeveloped mineral resources, to the development of which the lack of transportation is the chief obstacle. The building of these roads, and the liberal attitude of Governor Flores and his administration toward foreigners is a direct invitation to foreign capital.

SUBSCRIBER.

Campo Morado, Guerrero, May 22, 1909.

The "Consulting Engineer" and a Question of Ethics

In the JOURNAL of May 29 a "Subscriber" inquires as to the ethics of a certain transaction involving a question of professional ethics, upon which the JOURNAL made some comments. The latter were quite right upon the basis of the facts as stated. Although no names were published, and there is but little by which to identify the occurrence about which "Subscriber" wrote, I think that I am able to connect it with certain transactions and am in a position to state that the actual facts were in no way as represented by "Subscriber."

X. Y. Z.

New York, June 4, 1909.

[Our comments in the issue of May 29 were based, of course, upon a certain statement of facts. It should be needless to say that they do not apply to any other condition of affairs.—EDITOR.]

According to figures collected for THE MINERAL INDUSTRY, based on reports of all producers, the 1908 domestic output of lead products was as follows: White lead, 116,628 short tons, worth $10,515,315, against 111,400 short tons, worth $12,254,000, in 1907; sublimed white lead, 9100 short tons, worth $1,156,282, against 8700 short tons, worth $1,026,600 in 1907; red lead, 11,358 short tons, worth $1,156,282, against 13,370 short tons, worth $1,778,717 in 1907; orange mineral, 393 short tons, worth $43,157, against 815 short tons, worth $123,917 in 1907; litharge, 12,254 short tons, worth $1,231,206 against 14,769 short tons, worth $1,624,553 in 1907.

Conservation of Natural Resources

Progress in Mining and Metallurgy of Iron and Copper. Greatest Waste Is in Use, Not in Production. Engineers and Corporations Defended

BY JAMES DOUGLAS*

In discussing the waste upon which hinges, or is supposed to hinge, so largely the preservation of our national resources, the conclusions reached would be more reliable if actual experience were consulted, and fewer deductions were drawn from general statements, which are often the product of the imagination.

It cannot be questioned that the value of by-products has not been sufficiently appreciated by us, and that our tardiness in recovering the useful ingredients of the escaping gas of our coke ovens is one of the most glaring instances of shortcoming in that direction. And yet even for that sin there is some palliation in the immature condition of affiliated industries. I presume that it is admitted, without argument, that, except under very exceptional conditions, all the elements cannot be recovered from most of the ores or natural products which we treat. While it is a shame that the by-products from our coke ovens should be dissipated, Edward W. Parker's report to the U. S. Geological Survey for 1906[1] supplies a fairly good excuse in justification of this appalling waste. He says (pp. 773 to 774):

"What has been already commented on in previous reports about the slowness of manufacturers to change from the better known but wasteful beehive practice to the by-product-recovery method of coke manufacture is particularly emphasized in the statistics presented in this chapter. For it would appear from the table following that the construction of by-product ovens had about come to a standstill, especially when the records for the preceding five years are taken into consideration. * * *

"One of the reasons that has been assigned for the comparatively retrogressive condition exhibited by the statistics for 1905 and 1906 * * * is the lack of a profitable market for coal tar, and yet the United States is importing coal-tar products to the value of several million dollars annually, while the development of the fuel briquetting industry has been held back because of the lack of assurance of a steady supply of coal-tar pitch for a binder, and users of creosoting oils for the preservation of timber complain of an insufficient domestic supply of this product of coal tar distillation."

The truth is that one branch of industry is so dependent upon another that there must be equal progress along the whole line of industrial life, if complete recovery of all the available elements of our natural resources is to be effected. The chemical industry must keep pace with the mining and metallurgical industry. We may be moving too slowly in that direction, but we can distinguish a steady movement toward this needful cooperation. It is encouraging, for instance, to find that the waste gases from the furnaces of the Tennessee Copper Company are being turned into sulphuric acid for the manufacture from Southern phosphates of the superphosphates which the fertilizers of the Southern cottonfields need. Failing this mutual relation between the metallurgist of Tennessee and the chemical manufacturer, the blame should not rest entirely upon the metallurgist for wasting that for which, heretofore, he has been unable to find a market. The same justification exists abroad as in this country for similar waste in other branches of industrial activity.

Recovery of By-products by Legal Compulsion

It is nevertheless true that legal compulsion alone has driven manufacturers to introduce improvements and economies which were demanded by public safety, and which have redounded to the benefit of the reluctant corporations. In Germany and England the disposal of noxious vapors and noxious liquors has been required of the manufacturers, but their compulsory removal from the atmosphere and the water has resulted in their conversion into useful products, and the building up of new technical industries. An agitation is springing up in the West against the fumes from smelting works being turned loose into the atmosphere. While in some cases the injury done to vegetation may have been falsely attributed to the smoke from metallurgical works, the agitation has been followed by some good results. For instance, the Mountain Copper Company, having been driven out of Shasta county, Cal., by the farmers, has erected chemical works as an annex to its smelter at Martinez, on San Francisco bay. Here, as elsewhere, manufacturers are reluctant to go to the heavy expense involved in abating such nuisances, even though they may know that in the end the abatement will be profitable. As far back as 1881 Mr Vivian admitted that in recovering 47 per cent of all the sulphurous acid emitted from his furnaces in Swansea, he condensed 3666 tons of oil of vitriol at a great profit. This valuable asset, though he does not so state, was secured in spite of bitter opposition on the part of those who were ultimately the most benefited by it. One looks with wonderment at the clouds of valuable fumes which float from the New Jersey shore over Staten island to the sea instead of flowing inland as acid to the chemical manufacturers in the neighborhood.

Our industrial development, however, has reached such a state of advancement, especially in the densely-populated portion of the country, that however averse some of us may be to expend a large share of our profits in improvements, designed primarily to relieve the public of nuisances, we must submit whether we will or not. And having obeyed the mandate of the law, not many years will elapse before we come to realize that what we do under compulsion is as much for our own good as for that of our neighbor.

Early Experience in Arizona

I promised, however, to confine myself in my remarks to matters of experience. I have been identified with the copper interests of the Southwest since 1881. Though the Southern Pacific railroad had only just traversed the territory, mining was immediately stimulated by railroad transportation, and the Copper Queen, at Bisbee, the Old Dominion, at Globe, and the Lezinskys (the predecessors of the Arizona Copper Company) as well as the Detroit Copper Company, were actively at work at Clifton. All three of the most productive districts, therefore, of southern Arizona were being explored, and, through the influence of the railroad, vigorously exploited, at that time. But none of them were situated on the main line, or were linked to the trans-continental road by branches. The Copper Queen was 60 miles from its nearest railroad station, Benson; the Old Dominion was 140 miles from either Wilcox or Bowie; and the mines of the Arizona Copper Company, and the Detroit Copper Company, were 80 miles from Lordsburg. Coke and supplies had to be hauled in and copper teamed out those long distances.

The ores in all three camps were thoroughly oxidized. At the time this was supposed to be a condition of the highest advantage, upon which the only possibility of economical treatment depended; and not without good grounds,

NOTE. From *Bull.*, A. I. M. E., May, 1909.
*President of Phelps, Dodge & Co., New York.
"Mineral Resources of the United States," 1906, U. S. Geological Survey, Washington, 1907.

for the tedious methods of treating sulphide ore, so expensive in labor and fuel, were still practiced. We all, therefore, imagined in our shortsightedness that the day of doom for the copper interests of southern Arizona would date from the transition from oxidized to sulphide ore. Of the three districts, the only prosperous one during the succeeding 15 years or so was the Warren, and for reasons which we now more clearly appreciate than we then did. The ores of the Copper Queen, or rather such of them as were then selected for treatment, were self fluxing. They contained about 10 per cent. of copper. The slags of that period, which we are now resmelting, contained about 2.5 per cent. of copper. Assuming the slags to represent 65 per cent. of the charge, about 16 per cent. of the total copper content was being stored away in them. Less favorable conditions, however, existed at both Globe and Clifton. The ores of both these districts were extremely silicious, and the furnace charge of ore had to be diluted with from 40 to 50 per cent. of limestone. The silicious ores as treated were probably of about 12 per cent. The furnace charge was reduced by fluxing to between 7 and 8 per cent. of copper. The old slags—65 per cent. of the total charge—yield at Globe about 3.5 per cent., and therefore must have carried from 30 to 32 per cent. of the total copper fed into the furnaces. We have re-treated all the old slags of the Detroit Copper Company, at Morenci, near Clifton, and know that they carried on an average 4.5 per cent. of copper, and must, therefore, have contained at least 40 per cent. of the copper in the ore. At neither Clifton nor Globe was the dust collected, which probably represented a loss of another 5 per cent. Considering the high cost of fuel and labor, it is not to be wondered that neither the Old Dominion, the Arizona Copper Company, nor the Detroit Copper Company, was financially successful for the first 15 or 16 years of their existence. It was not until all the richer carbonate ores had been wasted by being largely converted into slags that the companies recognized that their salvation depended upon securing sulphide ores; upon making metallic copper through the medium of matte, and throwing away less copper in their slags. So little, however, was this fact appreciated at first that we all envied the Arizona Copper Company, because it could turn the San Francisco river into its works and granulate and wash away this valuable refuse. And when the Old Dominion mine struck large volumes of water, the company committed the same act of folly, washing its 3.5 per cent. slags into Pinal creek.

Deficiency of Sulphide Ore

Had the companies realized the losses they were incurring and the only [illegible] applicable, they would have been obliged to close both mines and firms. [illegible] except at the Copper Queen, where sulphide ores were encountered within three or four years after the mine was opened and were considered a nuisance, heavy sulphides are elsewhere rare. Though the Old Dominion Company has explored its property to the 10th level, between 100 and 200 tons daily are imported from California and Bisbee, the company's own mines producing only about 60 per cent. of the sulphur required by the furnaces. And at least one of the Clifton smelting companies is obliged to draw from abroad by railroad about 160 tons daily of sulphides high in sulphur and low in copper. It follows, therefore, that there was no alternative in the early days between either suspending operations or making copper in the wasteful manner which the companies then pursued.

Looking at the situation from the standpoint of today, if we place the advantages and disadvantages side by side, we have on the side of the advantages:

1. The experience which was gained during that long period of adversity, which is now being turned to good account, not only by the original companies, but by the many other enterprises which have entered the same field and are profiting by the losses of the pioneers.

2. The southern portion of the Territory has increased in population and in wealth, mainly through the exertions of these copper companies, even while they were losing money on the copper produced. They not only employed thousands of men, but they made a market for the agricultural development of the small amount of arable land within reach of the mines. Had the mines of Globe and Clifton not been operated because pecuniarily unsuccessful, and had not the shareholders been willing to accept hopeful promises in lieu of dividends, Arizona would not today be making an unanswerable plea for admission to the Union as a State.

3. The ultimate success has been due to the advent of the railroad; for railroads are seldom built into unproductive regions in the expectation of creating traffic that does not exist.

Advantages of Progress

If we turn to the disadvantages, they are, of course, palpable. At the present time, when we are matting our copper ores instead of making black copper direct, the slags from those three groups of copper furnaces run from 0.4 to 0.5 per cent. of copper. Even when the slags are re-treated, copper in the slags resulting from the slag treatment runs higher than in slags from the treatment of ore, owing to the difficulty of reducing silicates. Thus, [illegible] slags are re-treated, there is [illegible] double waste of fuel and the double [illegible] of labor.

[illegible] that our economic sys[illegible] different, and that necessity did [illegible] corporations to utilize wastefully the resources they acquire, I think that the balance of advantage to the country at large, as well as to the district, would indicate that it is better to make progress and thereby gain experience, even at the expense of such waste as I above indicate, rather than stand still and do nothing, in the hope of more favorable conditions being brought about by Providence rather than by our own efforts.

Never Throw away Slag or Tailings

Certain lessons, however, the above recital of experience teaches. One of them is, never to throw away anything that contains material of any value, even though it may seem to be valueless. The time inevitably comes when, through improved conditions or better methods, what was waste to one generation becomes of value to another. Most of the filling of the old stopes in the Copper Queen mine and in the Old Dominion mine has already been re-treated. In the case, therefore, of sulphide ore, which is too lean to handle, it should be stored underground rather than exposed to the weather at the surface. I am not sure whether we are justified in ballasting our railroads with the slags which we are making now—lean as they are. One cannot see how 0.5 per cent. of copper and a little gold and silver can possibly be recovered to any advantage, and yet the future may reveal secrets which will convert such impossibilities into possibilities. The slags from the iron blast furnaces, which were deemed valueless a generation ago, are made into hydraulic cement today.

We all recognize the waste that has resulted in the past from washing away gold tailings, which often ran several dollars in gold to the ton. Had they been impounded, the minerals now, through weathering, would be in the fittest possible condition for cyaniding, and would give up to this process their residual values to within a trifle of their contents. The same rule of preservation should be applied to the tailings from copper works. The sulphides, no matter how small their percentage, slowly decay, and give off their copper as soluble sulphate, which can be precipitated on scrap iron at a very inconsiderable cost. If the locality be such that these waste materials can be stored, care, and some outlay, if necessary, should be expended in their preservation.

Waste in Domestic Life

There seems, however, to be a fascination in contemplating loss rather than saving, and while we cannot exaggerate the follies of waste, it is not fair to the profession to overlook the efforts that have been consistently made within the last three quarters of a century, and are still being made, to eliminate waste. One of the anomalies, however, of the problem is that the accused mining and technical engineers compose the only section of the

public which really appreciates the cost of waste and tries to save.

The recovery of heat units in our domestic fireplaces and furnaces is far less than the recovery of heat from coal burned under our best boilers, when measured as power generated in our steam engines. And the waste in our kitchens and at our tables involves a greater national loss than the waste in our coal mines. In the one case the people at large are making no effort to minimize it, while every technical man of repute is putting his best endeavors into devising means of getting the highest efficiency out of nature's forces, with a view to turn nature's resources indirectly to the greatest good for the greatest number.

If we look backward to what has happened within our own day and experience, we may justly feel some resentment at the harsh criticism which is now being so generally aimed by the press and the public at technical men. And this is partly true likewise of the strictures so indiscriminately passed upon the corporations which are instrumental in developing the country's natural wealth.

Advances in Iron Manufacture

In the middle of the last century, less than one-half of the iron made in this country was smelted with anthracite, and the balance with charcoal or charcoal and coke.[2] The devastation of the forests was awful. Pearse[3] gives the consumption of wood in Berks county, Penn., in making 19,000 tons of charcoal iron in 1828, 1829 and 1830 at 250,528 cords. To secure this amount about 8000 acres of the finest forest land in the country must have been stripped. In England, where most of the iron was made with coke as fuel, at the same date, and until 1875, there were consumed from 35 to 37 cwt. of coke per ton of pig iron. In 1875, when the Whitwell stove was introduced to heat the blast, the quantity of fuel consumed was reduced by 3 or 4 cwt. By improved mechanical and metallurgical appliances that consumption in the Middlesbrough district is now lowered to 22 cwt.[4]

This saving of fuel in the blast furnace has, in this country as well as in Europe, been effected through the sleepless activity of metallurgists and engineers, by modifying the size and shape of the great iron stacks, increasing and regulating the temperature and the pressure of the blast, and by the introduction of appliances for utilizing the waste heat. The difference between the 37 cwt. of coke formerly needed to make a ton of pig iron and the 22 cwt. now consumed, multiplied by the number of tons of pig iron made in the United States in 1906, represents a saving (assuming 1.75 tons of coal as required to make 1 ton of coke) of approximately 30,000,000 tons of coal.

Bessemer and Gayley

The progress along this line in blast-furnace practice has been steady and wonderful, and has culminated in the ingenious device of James Gayley, which still further economizes fuel, by freezing the blast before admitting it to the stove in order to eliminate moisture, and thus supply the stack with a gaseous element of as constant and reliable a composition as the solid elements of fuel and ore.

The advances in blast-furnace practice in the direction of fuel-saving have been great. But they are not as startling or as picturesque as the economies which followed the introduction of the pneumatic method as applied through the mechanical and metallurgical skill of Bessemer, and as developed in the United States through the genius of Holley. We can all recollect the distressing sight, especially in summer weather, of the puddler, stripped to his waist, toiling over his furnace, while burning up from 20 to 27 cwt. of coal, in converting 1 ton of pig iron into puddle bar. Leaving out of the question the fuel used in generating the power for operating the bessemer converters, which, however, is generally recovered from the waste heat of the blast furnace, the amount of coal saved in making bessemer steel instead of wrought iron during the same year of 1906 exceeded 22,000,000 tons.

The Metallurgy of Copper

The metallurgy of copper has benefited as acutely as the metallurgy of iron and steel from the combined science and skill of the mechanical and metallurgical engineers. One recollects distinctly how, in the old brick furnace, a campaign of 10 days, with a daily charge of 10 tons of ore, was looked upon as almost phenomenal; and that from the time we began roasting sulphide ore in heaps until the refined copper was turned out after endless handlings of the mattes, as they were worked up from lower to higher grades, about three months was occupied. Now, by means of mechanical roasting furnaces, large jacketed cupolas, electrical cranes, the bessemer converter and the Walker casting table, the ore is turned into metal in fewer hours than it formerly took weeks, and at the same time almost dispensing with hand labor.

While these industrial changes were going on in the mining and metallurgical fields, the electrical engineer was bringing under control that tremendous force which Faraday investigated as dynamic electricity; and we metallurgists have not been slow to apply it, both to the saving of fuel and other natural resources, and to the conservation of human labor. The modern rolling mill, in which a motor replaces the small engine and boiler that used to operate the rolls, and the modern electrolytic plant which turns out electrically pure copper, are only the more visible benefits that electricity is conferring. When some of us commenced our technical experience, the deduction in precious metals made by the refiner of copper before any contribution was made to the miner or the seller, was $60 worth per ton of ore or metal. Under such heavy charges comparatively small amounts of gold or silver were or could be saved. Today, through the application of electrolysis to the metallurgy of copper, about $8,000,000 in value, which was formerly lost, is now recovered annually and goes into commerce as a by-product; for the world's copper may be assumed to carry an average of $10 per ton in gold and silver.

Electrical Transmission of Power

The last aplication of this mysterious force, by transmitting from stationary engines electric current for the movement of trains, aims at reducing what is certainly one of the most wasteful uses of coal—its consumption in the locomotive for the generation of steam. In distributing our coal supply, the railroad burns from 20 to 25 per cent. of the total production of our coal mines. This will be notably reduced, though to what extent has not yet been determined. But before this desirable consummation is attained, if electrical engineers continue to extend the limits within which long-distance transmission can be applied economically, they will bring the latent, neglected forces of the whole continent to our doors, and the water powers 1000 miles away, as well as the winds and tides, will propel our railroad cars as well as heat our houses. The service which coal now performs will be fulfilled without the expenditure of human labor and the diffusion of so much obnoxious smoke and vapor. Long before our coal supplies are exhausted, even on the most pessimistic calculation, our children will gladly leave the balance in the ground, and charge off to profit and loss some of what we now consider our most valuable natural asset.

Destruction of Forests

There is no doubt whatever that the destruction of our forests is attended by a host of such terrible consequences that a halt must be called. In the early days at Bisbee, when we were at a distance from the railroad, we, of necessity, almost stripped the hills of their scanty clothing of stunted wood, for we were forced to use wood for the generation of steam. I find from one of the earliest statements that the company burnt about 2000 cords of wood for the year. The hills for miles around were completely denuded, with the result that disastrous floods have ever since almost annually de-

[2] In the *Iron Manufacturer's Guide* (1866), Lesley gives the total production in 1854 at 724,833 tons, of which 417,123 tons was charcoal or charcoal and coke iron.

[3] "Concise History of the Iron Manufacture," p. 150.

[4] "A Description of Messrs. Bell Brothers' Blast Furnaces from 1844 to 1908," and other papers. *Journal of the Iron and Steel Institute*, Vol. LXXVIII, No. III, 1908.

luged and damaged the town, which is built in the troughs of two converging valleys. As mining engineers we are sensible of the ruin which reckless lumbering involves, and we lower with regret every stick of timber that we bury underground. Nor are we satisfied to bemoan the fact without making some effort to remedy the evil. It has been suggested, and we are trying the experiment, to replace wood by iron. The forests can be restored in time by reforestration, but iron ores cannot be replaced. And, therefore, it is a false economy to attempt to save a reproductive material by substituting one which rusts and cannot be regenerated. Concrete is also being used more and more in mining operations, and against its substitution for wood there can be no objection; but the most notable economy will result from improved methods of mining, especially from the introduction of the caving and slicing systems.

The Caving System of Mining

These were introduced into the Cananea mines when Arthur S. Dwight was manager; and Doctor Ricketts and Mr. Kirk have extended the use of the methods and applied them so successfully that less than half the timber is used per ton of ore extracted today than was buried in the mine three years ago. The following table, kindly supplied by Doctor Ricketts, represents the saving which is going on at Cananea, and in many mines where the same method is applicable:

TIMBER CONSUMED PER TON (WET) OF ORE PRODUCED AT CANANEA, MEX.

Period.	Tons Ore Mined.	Feet Timber Used.	Feet per Ton.
Aug. 1, '05, to Jan. 31, '06	463,039	10,774,342	23.27
Feb. 1, '07, to July 31, '07	554,473	8,268,682	14 95
Aug. 1, '08, to Sept. 30, '08	97,510	1,091,837	11 30

While it would be presumptuous to pretend that, as a people, we are economical, and to deny that, under modern corporate control of large national resources, the temptation, under necessity of making large profits, is not betimes stronger than the appeals which conscience makes to subordinate personal gain to the national welfare, I am sure that neither our largest mining and metallurgical companies nor ourselves, as their working agents, are recklessly indifferent to the preservation of those very materials upon which the wealth of the corporations and our own salaries depend. No large corporation would today use an old boiler and slide valve engine with a consumption of 6 lb. of fuel per h.p. hr. in preference to a triple-expansion, cut-off engine which will do the same work with 1.5 lb. per h.p. hr., and so on through the whole gamut of operations which these large corporations conduct and which we, as their mining re advise them to adopt, because we help them to be the best and most economical methods.

Corporations Unjustly Blamed

While public policy may not be the prime motive for saving, every thinking man in a large institution, from the manager downward, takes a pride in knowing that he is saving, and feels a sense of shame when he is conscious of wasting. And in economic life—I do not speak of social and domestic life—the rules against waste are becoming more and more rigid and are better enforced. The public outcry, therefore, against the large corporations for wasting the natural resources of the nation is unjust in so far as it fails to recognize what they have done and are doing in the direction of conservation, and inasmuch as it gives the working staff of these great corporations so little credit for the marvelous progress the world has made through their instrumentality. They have saved where formerly, through ignorance and inexperience, their predecessors were wasting. With more profound knowledge, and better instruments for observation and investigation, they are patiently unraveling nature's secrets and learning how to turn her forces to human uses. I cited a case of the unavoidable waste of copper ore, of fuel and of human labor in the treatment of the oxidized copper ores of Arizona 20 years ago. The men who were wasting acted upon their knowledge and skill. So now it often happens that in response to the urgent call which modern society makes by fits and starts for enormously increased productiveness of various commodities, the demand can be met only at the expense of waste of nature's resources, of human energy, and even of human life. If a more stable balance could be maintained between supply and demand; if the current of domestic and economic life would run more smoothly; if wealth were not accumulated so easily and spent so lavishly; if those marvelous improvements to which we have referred were not periodically made, which give these irresistible impulses to world-wide human energy, thereby bringing about these oscillations between hard times and good times, between labor dearth and labor surplus; if all these disturbing elements were obliterated, certainly there would be less waste, and possibly there would be more happiness. But it is not our part nor within our power, as mining and metallurgical engineers, to reconstruct society or renovate the world. Yet it is our duty to continue using our best efforts—whether the world recognizes our merits or not—to get the utmost energy out of human life as well as out of the inert material we handle—with the least possible exhaustion of human tissue and the smallest possible waste of mineral or vegetable material.

According to *Stone*, all the marble used in Argentina's new government building in Buenos Aires will be cut with carborundum tools made here.

The Zinc Corporation

Special Correspondence

The report of the Zinc Corporation, Limited, for the 10 months ended Dec. 31, 1908, states that of the period under review, the first two months were employed in construction and the following three months in experimental mining and adjustment of the plant, during which time the working expenses were necessarily high and returns less than in the latter portion of the year.

The total revenue from the concentrates made and from sulphuric acid sales, etc., was £136,398. The prices at which the metals were sold were: Spelter, £20 3s. 2.6d.; lead, £13 6s. 7.8d. per ton; silver, 24.387d. per oz. The latest monthly results recorded are those of April, 1909, when 18,090 tons were treated yielding products valued at £19,065, taking spelter at £20. The month's expenditure was £8352; the cost of material treated, £4523, and the estimated profit, £6190.

The directors refer to a convention that has been arranged between the large smelters to limit production of spelter and hope that thereby improved prices will be obtained in the future. In the profit-and-loss account a profit on the year's operations of £25,504 is shown. There was, however, a debit balance from the previous year's accounts of £85,154, which is now reduced by the profit shown above to £59,650.

The report of the general manager gives statistics of the technical results obtained. A total of 131,965 tons of material (Broken Hill tailings) averaging 20.14 per cent. zinc, 5.69 per cent. lead and 8.47 oz. silver were treated for a yield of 47,312 tons of zinc concentrates, assaying 46.35 per cent. zinc, 7.3 per cent. lead and 15.55 oz. silver, and of 2503 tons lead concentrates, assaying 57.3 per cent. lead, 16.3 per cent. zinc and 38.66 oz. silver. The total extractions work out at 84 per cent. of the zinc, 65.3 per cent. of the lead and 74.4 per cent. of the silver.

The working costs from August to December averaged 9s. 4d. per ton. Further improvements in extraction and costs are expected as greater experience is gained.

The Elmore concentrates produced during the period had an average assay value of 43 per cent. zinc, 16 oz. silver and 10.1 per cent. lead. These concentrates, at the average metal prices ruling for the period, were worth 36s. per ton. After being passed through de-oiling furnaces this product was separated into zinc concentrates and lead concentrates. The value of these final concentrates was 49s. 4d. per ton of original Elmore concentrates, thus showing that these latter concentrates were enhanced in value to the extent of 13s. 4d. per ton by the separation. Photographs of the works accompany the report.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

E. Dedolph, of Nelson, B. C., has been visiting New York.

Herbert Haas, of San Francisco, has gone to London, on professional business.

S. S. Fowler, of Nelson, B. C., attended the commencement exercises at Columbia University last week.

George R. Stilwell, manager of the Hewitt mine, Silverton, Slocan, B. C., has returned from a trip to England.

Ernest Schmatolla, of London, sailed for New York, May 29. He expects to pass about three months in the United States.

A. E. Drucker, metallurgical engineer, of Aberdeen, Wash., is now in New Zealand, visiting some of the gold-mining districts there.

E. W. Brooks, of Los Angeles, Cal., is now in Seattle and intends to sail shortly for Alaska to examine copper prospects for Seattle people.

J. S. McCord, of Philadelphia, accompanied by a party of capitalists from that city, recently inspected several of the principal mines at Cobalt, Ontario.

James T. Dixon is now general manager of the Vezeeroff-Stanley mining concession, his headquarters being at Salairski Rudnik, in the government of Tomsk, Siberia.

Professor U. S. Grant, of the Northwestern University, has sailed from Seattle for Valdez to study glaciers and the gold and copper prospects on Prince William Sound.

D. G. Wilson, for several years superintendent of the Bankhead colliery, near Banff, Alberta, has been transferred to the Hosmer mines, British Columbia, in a similar capacity.

Herbert C. Hoover, who has been to Korea since leaving America last spring, is again in London. His recently published "Principles of Mining" is meeting with keen appreciation.

M. S. Davys, lessee and manager of several mining properties in the Slocan district of British Columbia, arrived in Nelson, B. C., recently from London, England, after an absence of two years.

Robert H. Shield, president of the Arcadia Copper Company, has been in Boston arranging the final details in the taking over of the old company by the recently organized Michigan company.

Joseph Hermon, formerly superintendent of the Rothschild, and recently manager of the Progress mine, Cobalt, Ont., has taken charge of mines owned by the Donaldson Brothers, on Bloom lake.

Lewis Stockett, general manager of the Hosmer Mines, Ltd., Crow's Nest Pass, B. C., will shortly make Bankhead, Alberta, his headquarters, he being also general manager of the Bankhead Mines, Ltd.

James Grant has resigned his position as chief engineer of the Nelson-Jenks Coal Company, at Sand Coulee, Mont., and has accepted a position on the engineering staff of the Amalgamated Copper Company, at Great Falls, Montana.

H. C. Cutler, who has been managing engineer for the Nixon & Wingfield interests for the past four years resigned April 1 on the dissolution of the firm, and has resumed professional practice with offices at Goldfield, Nevada.

E. W. Durfee has resigned his position as general superintendent of the Daly-Judge Mining Company, at Park City, Utah, and has been appointed general manager of the Alvarado Gold Mining Company at Congress Junction, Arizona.

George O. Argall, who has, for several years, been connected with the Iron Silver Mining Company at Leadville, Colo., was, at a meeting of the executive committee held June 3, appointed general manager of the company's properties in place of Waldemar Arens, deceased.

R. G. Drinnan, for years connected with coal mines in the Crow's Nest Pass district, of British Columbia, has resigned as superintendent of the Hosmer colliery to take charge of prospecting work on a large area of coal lands west of Edmonton, Alberta, recently acquired by a Toronto syndicate.

Karl M. Way, formerly with the fuel-testing branch of the United States Geological Survey, has been appointed assistant mining engineer to the Arthur D. Little laboratory of engineering chemistry, in Boston. Perry Barker has been appointed assistant chemical engineer to the same concern.

Allan Gibb, consulting metallurgist to the Tanganyika Concessions, Ltd., left London for Katanga on June 5, accompanied by W. G. Perkins and P. K. Horner, the engineers who will arrange for the immediate erection of the plant for treating 1000 tons of ore daily which has been purchased, and will be shipped to the site selected for the smelting works in Katanga. The plant purchased is intended for treating the ore from the Star of the Congo mine, which will be the first mine reached by the railway that is at present making rapid progress. Mr. Perkins is well known in this country as the builder of the Steptoe Valley reduction works.

Obituary

Zephyrin J. Pequignot, who died in Philadelphia, June 3, aged 63 years, was considered one of the foremost experts in precious stones in this country. He was frequently called in as consulting expert to appraise the value of gems for the Government and for others.

John F. Gibbons died in New York June 5, aged 60 years. He was born in Baltimore and spent much of his life there, removing to New York about 1890. He was prominently connected with the development of the Florida phosphate industry for 35 years, but retired from active business about a year ago on account of failing health. He was vice-president of the Peace River and the Pierce Phosphate companies, and for some years before his retirement was president of the American Agricultural Chemical Company.

Ernest L. Fraleck died at Cobalt, Ont., May 27, aged 33 years. He was born at Belleville, Ont., and graduated from the Kingston School of Mines. He was employed at several Canadian mines as assistant, and later had charge of pyrites mines in Hastings county. When the Cobalt district was opened he went there and took an active part in its development. He was connected with several mines, and for some time past had been superintendent of the Cobalt Lake mine. He was one of the more prominent and promising of the younger Canadian engineers, and his death at an early age is much regretted. He was an active member of the Canadian Mining Institute, and was elected a member of the council at the annual meeting in March last.

Societies and Technical Schools

Colorado School of Mines—At the commencement exercises at Golden, May 29, President Alderson stated that the Walsh research department is to be continued, and that it is not only possible but probable that radium will be produced in Colorado. John Hays Hammond made an address, and an honorary degree was conferred upon him.

Society for the Promotion of Engineering Education—It has been decided to hold the seventeenth annual convention at Columbia University and Pratt Institute, in New York and Brookyln, on June 24, 25 and 26. These dates immediately precede those of the meetings of the American Institute of Electrical Engineers, the Society for Testing Materials and the American Society of Civil Engineers. The program will include the reports of the Joint Committee of Engineering Societies on Engineering Education by Dugald C. Jackson; of the Committee on Technical Books for Libraries by Arthur H. Ford; of the Committee on Engineering Degrees by William F. M. Goss; of the Committee on Entrance Requirements by Robert Fletcher; besides contributed articles. In addition, a special session will be devoted to the discussion of Engineering Mathematics by the committee of fifteen, appointed at the Chicago meeting of the American Association for the Advancement of Science.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Salt Lake City, Goldfield, Colbalt, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

June 4—The interest of mining men still continues to be concentrated on the wonderful quartz discoveries at Alleghany, Sierra county, where each week some new rich strike is recorded. The strange thing is that all these strikes are in old mines, and are the result of active development work, mainly by tunnels. It is only of late that much notice has been taken of this old district. Some of the mines there, now becoming enormously productive were located as early as 1851 and 1852. The surface quartz was removed, and little deep development was undertaken by the owners. Many of these claims were patented nearly half a century ago. In one instance claims located in 1854 and worked but a few months, have recently been sold by the son of the original locator for a high price after all these years of idleness. They were patented so that not even assessment work had been done. In the Rainbow claim the ledge has been struck at a depth of 400 ft. below the old workings and is yielding phenomenally high-grade rock. The El Dorado mine is in the center of the group in which the rich strikes have been made. Mr. Wilson, owner of the Sixteen-to-One, thinks the strike in the El Dorado even more important than that in his own mine. The tunnel is in 500 ft. and the vein found is 2 ft. 6 in. wide.

Of the Morning Glory strike, little is known beyond that very rich ore is being taken out by Rohrig Brothers. In addition to these mines the Plumbago, Oriental, Bonanza King, Wonder and Ophir mines have enriched their owners. The latest strike of note is in the Red Star mine which has struck phenomenally rich ore, some of it being worth $50 per pound. The company has spent $50,000 in prospecting and has run a tunnel 2100 ft. This is a vein parallel to the famous Tightner. Mr. L. P. Woodbury is the manager of the company.

In a number of mines in California since the passage of the eight-hour law for mines and reduction works, the men expressed their willingness to continue on the old nine or 10-hour system with the same wages. It has been explained to them, however, that the operators had no more choice than the men in this matter and that they would be violating the law if they permitted the men to work over eight hours. So when the men had their wages cut to fit the eight hour schedule they had only the law itself to make complaint against. In cases where shovellers and others working 10 hours daily for $2 per day were concerned, no reduction was made in wages though they worked two hours less. But where miners were getting $3 for 10 hours and were cut 25c. or more per day to suit the eight-hour system, many of them quit work. Many of the shovellers and other $2 men quit in sympathy, though they got the same pay for two hours less work daily.

At Oroville last week, Judge Sexton granted the motion of the defendant for a non-suit in the action of Churchman vs. Steifer Brothers of the P. B. Steifer Mining Company. Churchman had alleged fraud in the sale of stock and in the management of the mine, saying that money had been misappropriated. The judge could see no testimony offered which warranted the charges. The suit has attracted great attention, there being many stockholders in the company.

Butte

June 2—At the annual stockholders' meeting of the Anaconda Copper Mining Company held at Anaconda last week the following were elected directors: John D. Ryan, F. P. Addicks, H. H. Rogers, Jr., George H. Church, William Rockefeller, U. H. Broughton and Percy J. McIntosh.

The demand of the men for an increase in wages of 50c. per day at the smelter of the American Smelting and Refining Company, at East Helena, was refused by the company last week and the matter of going out on a strike was put up to the men. By a large vote the union decided not to strike and thus averted the trouble which threatened to tie up the works.

H. H. Gerry, Jr., manager of the Missouri River Power Company, and in active management of the negotiations looking to the construction of the Butte & Helena electric railway, states that while arrangements are not fully completed for the construction of the road, work will be begun on it this summer without doubt. The Northern Pacific and the Chicago, Milwaukee & Puget Sound railways are now engaged in a race to secure the most favorable right of way from Missoula westward through the Lolo pass into Idaho. Agents for both companies are on the ground securing consent of the property owners and several condemnation suits have been filed in the district court at Missoula.

The latest development in the affairs of the Idaho Smelting and Refining Company, which formerly operated the Panhandle smelter at Sand Point, Idaho, is an adjudication by the United States district court that the company is bankrupt and the appointment of Bruce Blake as receiver of the company. With the assumption of control by the Federal court all other actions against the company are dismissed, and John Mocine, receiver of the company by appointment of the State court is ousted from the control of the company's affairs. This is a virtual victory for President Anderson, who has, from the first, contended that those behind the previous actions brought against the company were actuated by personal motives.

Annual statements of the East Butte and of the Pittsmont copper companies have recently been filed in the office of the county clerk of Silver Bow county. The East Butte report states that its paid-up capital stock is $2,150,000; assets, $3,171,036 and liabilities nil. The Pittsmont Company's report states that its paid-up capital is $30,000,000; assets, $33,966,595 and liabilities, $3,635,055.

What is probably the most far reaching suit with reference to land grants ever filed by the Federal Government in the State of Montana has recently been instituted against the Northern Pacific Railway Company. The suit involves about 1800 acres of land in the Missoula and Helena land districts. The complaint filed by the Government alleges that the land at the time it was classified by the commissioners was well known to be mineral in character, but that the commissioners, with intent to defraud the Government, falsely classified it and thus enabled the railway company to obtain patent. While the Government has recently won a case involving the same points in an action to recover certain coal lands, yet that case is now on appeal to the Circuit Court of Appeals in San Francisco and the law involved has not been definitely determined. Should the Government succeed in its latest case, numerous others of the same nature will doubtless be instituted.

Denver

June 4—The development of the coal mines of the State is being seriously hindered by the Government indictments against various companies and individuals for alleged fraudulent entries and other charges. In one instance, parties are charged with filing on 1500 acres of coal

land and then transfering it to a company, the Government officials charging that the former had the transfer in mind when they made the filings. The Yampa coalfield of 1200 square miles, which has just been reached by the Denver, Northwestern & Pacific railway, is but slightly affected, as most of these coal lands were taken up before there was any prospect of a railway. That there have been irregularities, is conceded, but no actual fraud has yet been shown, and it is the contention of mining men that the Government should have made its investigations before it took the people's money and granted them patents, and not waited for years until the coal was rendered available by the advent of a railroad.

The Western Petroleum Company has been formed to sink for oil near Trull, in Routt county, a few miles west of Steamboat Springs, the present western terminus of the Moffat road. Oil was struck near Trull eight years ago, but without a railroad it was useless and the well was capped. The prime mover and manager of this new company is ex-Gov. James H. Peabody, of Denver

For some months the Government has been removing the greater portion of the gold stored at San Francisco to Denver for safe keeping, and a shipment of $6,000,000 arrived this week, making a total, it is said, of $375,000,000 stored in the vaults of the Denver mint. The shipments were entrusted to Wells, Fargo & Co., and were made in steel boxes, guarded by heavily armed men night and day until arrival. The new Denver mint is fitted with all the very latest inventions and improvements for safety, and having in view the elements of possible earthquake, burglary and invasion, the Government evidently considers this city a more suitable point than San Francisco for the safe keeping of this enormous store of gold and silver bullion. The Denver mint was moved from the old to the new building in 1904, and coining was commenced in 1906.

The production of the Cripple Creek district for May is given at 57,835 tons of gold ore, of a gross value of $1,360,838, the average value per ton being $23.74. As compared with April this is a decrease of 2300 tons and $21,632 in value. The Iron Clad mill was closed and no figures were given out by Stratton's Independence mill, which ran at part capacity during the month.

The Leadville output for the month of May of all classes of ore reached 67,000 tons, being an increase of 10,000 tons over the corresponding month of last year. This is due to a number of new properties that started shipping during the month, and also to the increased production from the mines in South Evans gulch. It is reported that the Arkansas Valley plant will blow in two more furnaces during the month of June

Salt Lake City

June 4—The Conkling Mining Company and Nicholas Treweek have filed an amended reply to the amended answer of the Silver King Coalition Company in their suit in the Federal court over ore alleged to have been mined from the Conkling property. The suit involves more than $1,000,000 worth of ore from the famous Elephant stope and the right to mine in that territory. The Wabash company in Park City has made arrangements whereby it will connect its lowest level with the Ontario drain tunnel and work will shortly be resumed in the lower levels of the mine.

Tintic mines during the week ending May 28, produced 189 carloads of ore, as follows: In 50-ton cars, Ajax, 1; Bullion Beck, 3; Centennial-Eureka, 49; Eagle & Blue Bell, 1; Eureka Hill (leasers), 1; Grand Central, 5; Mammoth 12; May Day, 2; Sioux Consolidated, 14; Undine, 1; Victoria, 4; Yankee Consolidated, 2; in 20-ton cars, Beck Tunnel, 3; Brooklyn, 3; Colorado, 30; Dragon Iron, 25; Iron Blosson, 30; North Cliff, 1.

W. A. Kidney, who had charge of the planning of the Ohio Copper mill at Lark, visited the plant last week. He will probably remain until the mill is finished and put in commission, the date of which has been set for the first week in July. Preparations are being made about the property to handle the big tonnage which the mine management expects to produce as soon as the mill is in operation.

A company has been organized by Joseph R. Murdock, of Heber, Utah, to build an oil refinery near Salt Lake City to handle the product of the Pittsburg & Salt Lake Oil Company. The plant will have a capacity to handle about 100,000 gal. per week of the crude product. The plant will consist of refining stills, condensers, agitators, receiving and storing tanks, bleachers and filters. In addition to the refining of illuminating and lubricating oils, the company will manufacture as a by-product candles from paraffin wax.

Formal announcement has now been made of the proposed reorganization of the Newhouse Mines & Smelters as outlined in the JOURNAL of May 22, 1909 Charles A. Moore, of 111 Broadway, New York, together with Frank A Schirmer and Louis N Kramer compose the reorganization committee, and security holders who desire to participate in this plan are required to deposit their stock with the Hungarian American Bank, 32 Broadway, New York City, not later than July 1. The cash requirements of the plan are reported to have been fully underwritten.

Goldfield, Nevada

June 1—The town-site controversy, which has been agitated during the last year, involving the ownership of 500 acres of land occupied by the town of Goldfield has finally been settled, and town-site property claimants can now receive title to their ground provided the same has been improved. A payment will have to be made to the district Judge to cover the expenses of the land, which it is estimated will be at the rate of $20 for a lot 30 by 100 feet.

District Judge Peter J. Somers issued a communication to the grand jury last week instructing them to investigate the reports of several mining companies against whom suspicion points as attempting to evade the payment of bullion tax. According to the State bullion tax collector, the Florence Goldfield and the Pittsburg-Silver Peak mining companies are two of the chief offenders.

The Southern Pacific Railway Company filed in the land office at Carson, last week, a map of a projected branch line to extend from Twin Falls, Idaho, to a point on the main line of the Southern Pacific near Cobre, Nevada. The road if built will open up land rich in mineral and timber resources in both Idaho and Nevada.

Articles of incorporation of the Hawthorne & Bodie Railway Company were filed with the Secretary of State last week at Carson. Alonzo Tripp, G. W. Fletcher, J. G. Crumley and others are named as directors. The articles provide for a road operated either by steam or electric power between Hawthorne and Lucky Boy, Nevada, a distance of about 16 miles.

The quarterly meeting of the directors of the Goldfield Consolidated was held in New York May 27 when the regular quarterly dividend of $0.30 per share was declared which amounts to $1,050,711. Geo. Wingfield succeeds Sen. Geo. S. Nixon as president, Mr. Nixon retiring from the board as a result of the recent sale of his holdings in the company. W. C. Roelker succeeds Mr. Nixon as director and Mr. Wingfield's position of vice-president is now occupied by J D. Hubbard, of Chicago.

The Nevada-California Power Company has completed its line from Millers to Manhattan and that camp is now enjoying the benefits of electric light and power. The line is also being extended to Round Mountain.

Manager Mackenzie's report for the month of April shows a total production of 19,417 tons of ore containing $947,542, the net profit derived from which was $722,175; 385 tons of the above came from the Hampton stope and gave net returns of $287,941. The total cost of production was $6.49 per ton distributed as follows: Stoping, including part of office expense, $2.82 per ton; development, including portion of office expense, $1.10 per ton; transportation, 13.3c per ton; milling, $2.44 per ton; total, $6.493 per ton. The cost of operating at the new mill was $2.08 per ton. The increase in costs was largely due to the heavy ground encountered in the Clermont shaft where the stations and skip pockets were cut. A safety device to pre-

vent overwinding has recently been installed at the Clermont and Mohawk shafts.

Production of the Tonopah district for the week ending May 29 was: Tonopah Mining, 3400 tons; Montana Tonopah, 955 tons; Belmont, 850 tons; MacNamara, 250 tons; West End, 125 tons, and Midway, 100 tons; total estimated value, $140,000.

Cobalt

June 5—It is expected that the sale by the Provincial Government, of 800 acres of the Gillies Limit will not arouse as much interest, or bring in as much money, as it would have done two years ago. This section of the Limit surrounds the Provincial mine, and has been prospected by the Government for about three years with few encouraging results. The lack of interest is due largely to the poor showing of the Provincial mine, on which about $100,000 has been expended, while the return from the sale of ore is little more than a tenth of that amount.

Recent developments in the Keewatin formation have exploded many of the theories formerly held regarding its productiveness and depth. In the great majority of cases when the veins reach the Keewatin the values give out, and so convinced were the mining men of its unproductiveness that but little development work was done in this series. Some time ago the lower workings of the Crown Reserve entered the Keewatin, and the ore was found to be fully as good as in the overlying diabase. Last week one of the Nipissing workings went through the Keewatin into the diabase. As the mineral contents of the veins are generally conceded to have come up with the diabase this latter discovery is likely to have an important bearing on the future development of the camp.

On May 28 a new high-grade oreshoot was encountered in No. 5 vein of the King Edward mine, while drifting west on the 80-ft. level. The vein is about 4 in. in width and consists of calcite carrying native silver, while for about 1 ft. on each side, the wallrock is also well mineralized. This is the third discovery that has been made in this mine within a short period.

The Station Grounds Mining Company, which has been purchasing power for two drills, from the Cobalt lake, has decided to stop operation until the Hydraulic Power Company's air is ready for distribution. Prospecting will be carried on in the meantime with the aid of a diamond drill.

Following the discovery of ore in the Beaver mine, the plant, which was destroyed by fire some time ago, will be rebuilt.

For the past nine months the Coniagas Mining Company has been carrying on experiments in the smelter at Thorold, to improve the process for the reduction of Cobalt ores. The plant is now doing such satisfactory work that the company will enter the market for custom ores, in competition with the other smelters. The capacity will be about ten tons of high-grade ore or concentrates a day.

On May 24 another new vein was discovered on the Farah property, making the second discovery within two weeks. The shaft which is being sunk about the middle of the claim is now down 100 ft. When a depth of 125 ft. is reached a station will be cut, and crosscuts run to tap the veins.

The development of the Lawson property by La Rose, is being watched with great interest on account of the remarkable surface showing of the vein. Work is being carried on from an old shaft, sunk by the Silver Leaf, and which, through a mistake in the survey, is located on the Lawson claim. A drift is being run from the bottom of the shaft, and the management expects to encounter the main orebody shortly. The new vein discovered a short time ago, will also be developed from this working.

The framework for the new concentrator at the Colonial mine is being erected and the stamps are already in place. A 5x16-ft. tube mill, to be driven direct from a motor, has been ordered. The power to run the mill will be obtained from the Electric Power Company when its plant is installed, and it is expected that the mill will be ready by that time.

The rush up the Montreal river from Latchford is so great that the Upper Ontario Navigation Company is unable to accommodate all the people. In one week over 800 men made the trip on the company's boats. The transportation of heavy freight is out of the question for the present, owing to the high water, and there are now about 30 cars of freight, on the siding at Latchford, waiting to be unloaded.

Mexico

June 5—Numerous railroad projects in southern Mexico promise to greatly influence the future development of the mining industry of that portion of the Republic. A much needed and important line is projected from San Juan, near Toluca, to the Temescaltepec, Sultepec and Zacaulpan districts of the southern part of the State of Mexico. This line would probably be extended to furnish an outlet for the famous Taxco district, now six hours by trail from the Cuernavaca division of the Mexican Central. This road has been concessioned by the Federal and State authorities but the money has not been raised to construct it. The parties to whom the proposition was made contend that the road should be extended to the coast in order to insure profitable operation. This road is very much needed, and the government is desirous of having it built.

Another projected line runs from Puebla south to the Nochestlan coal district, then to an iron-bearing area, continuing to the Pacific at Port Angel. This is backed by European capital interested in the exploration of the coal and iron deposits of Oaxaca. It is assumed that construction on the first section will be commenced this year. The road will serve as an outlet for the extensive antimony deposits near Tlaxiaco, Oaxaca, controlled largely by the Cookson syndicate. There is also a new lead-silver district in northern Oaxaca, near Huajuapam, that would be benefited by the road. The Mexican Southern railway, an English company, has recently purchased the uncompleted line to the Taviche camp and the Oaxaca and Tlacolula line. The first is being rapidly completed to Taviche. The other line will be extended to Tula to serve the Magdalena district and ultimately connect with the Tehuantepec Isthmus line, affording an easy outlet to the Gulf or the Pacific for all of southern Oaxaca. This extension passes near the Tatolopam mining district, one of the richest in the Republic. Another concern held by St. Louis, Mo., parties covers a practical line from Oaxaca to the Pacific coast via the Rio Verde, tapping the Minas Santiago district where there are large deposits of copper and iron. This was originally projected by C. A. Hamilton and associates as an electric line, the power to be furnished from the numerous and ample falls in the Rio Verde.

A Salt Lake City syndicate has a concession for a line from Oaxaca to the coast, and along the coast to Acapulco and Manzanillo. This is in strong hands but its immediate realization can hardly be considered now. It would open up a rich agricultural and mining country. The Tehuantepec road, planned primarily for transcontinental business, is a factor in the opening up of several camps in southern Oaxaca, and has stimulated activity in prospecting in the Isthmus region. Likewise the Pan-American line, along the Pacific coast from the Tehuantepec road to Guatamala has made available several low-grade lead and copper properties, in the vicinity of Tonala and in Chiapas. The navigation of the Rio Balsas, now being undertaken as an experiment, promises to open up a very rich and extremely isolated mining region. All these projects are of vital importance to the mining of southern Mexico, and the realization of some of them will greatly improve the conditions in this rich mineral zone.

The mining law has passed the Chamber of Deputies in a form very favorable to the mining interests, and it is now before the Senate where it is expected that favorable action will be taken on the essential points of the measure. It is to become effective January 1, 1910.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

General Mining News

Amalgamated Copper Company—At the annual meeting, June 7, J. H. Harding and James Jourdan were elected directors to succeed the late A. R. Flower and the late H. H. Rogers. The other directors were reelected. A statement for the fiscal year was submitted which will be found on another page.

United States Smelting—All of the company's plants, with the exception of the Utah copper smelter, are operating at their full capacity. In California, the Mammoth smelter is now treating 1200 tons of ore per day, producing 3,500,000 lb. of copper per month, which is the highest rate of production ever obtained at the Mammoth smelter is now treating 1200 plant is treating 670 tons daily.

American Smelting and Refining Company—The earnings of the company are said to be at the rate of 8 per cent. per annum on the $50,000,000 common stock. This is largely the result of the recent recovery in the prices of copper, silver and lead. While the advance in price is small, it has been sufficient to cause an increase in metal production in Mexico, and as a result the plants at Chihuahua, Torreon, Monterrey and Aguascalientes are now operating on an 80 per cent. basis, whereas 60 days ago they were operating only 60 per cent. capacity. El Paso smelter is now operating at 80 per cent. of its capacity, which is the highest of any plant of the company in the United States.

Alaska

JUNEAU

Alaska Treadwell—April: 240-stamp mill 30¾ days crushed 37,100 tons of ore; estimated value of bullion, $58,602. Saved 465 tons of sulphurets; estimated value, $38,647. Working expenses, $81,133.

Alaska Mexican—April: 120-stamp mill 30½ days, crushed 18,385 tons; estimated value of bullion, $44,952. Saved 414 tons of sulphurets; estimated value, $34,300 Working expenses, $30,057.

Alaska United—April: Ready Bullion claim, 120-stamp mill 30 days; 700-ft. claim, 100 stamp mill 30½ days; crushed 36,297 tons; estimated value of bullion, $40,0[illegible] Saved 575 tons of sulphurets, estimated value, $33,220 Working expenses, $60,238

KUSKOKWIN

The gasolene schooner, "P. J. Alber," of Seattle, is expected here with miner's supplies for 47 different points, indicating renewed activity for this important section.

NOME

T. H. Thatcher, manager of the Alaska Banking and Safe Deposit Company of Nome, predicts a greater output for this season than in 1908. Extensive dredging operations at Nome, Kougarok and other points in that vicinity give great promise.

VALDEZ

It is reported that the Guggenheims have acquired a lease on a quartz claim in the Hope mining district, near Cook's Inlet. The property is on the peninsula near the mouth of Palmer creek. Vaulable ore deposits are said to exist.

Arizona

PINAL COUNTY

Ray Consolidated—The report issued by the executive committee shows that 21,077,241 tons of ore have been developed on 60 acres, the copper content of which is 46 lb. per ton. About 500 acres display the same character of rock and surface indications as the areas already developed. Transportation facilities are all that could be desired. An excellent site for a mill has been provided near the Gila river.

California

AMADOR COUNTY

Ione Copper—Superintendent Tarrtau recently installed new machinery, put up new buildings and started mining work. Some of the ore carries gold and silver as well as copper.

Bunker Hill—After paying its usual monthly dividend this company has about $65,000 in its treasury. The main shaft will be straightened and repaired.

Garibaldi Placer—This hydraulic mine at Volcano will hereafter be worked by drifting. The clean-up for this season was nearly $20,000.

BUTTE COUNTY

Shakspeare—This group at Forbestown, has been acquired by M. J. Cooney and B. F. Forbes, of Oroville, and Mrs. H. E. Vail.

Magdalia—Matt Bader has sold to A. E. Smith, for $20,000 on deferred payments, the mineral on 160 acres of land near Magdalia. Many claims are being opened on the Magdalia ridge.

CALAVERAS COUNTY

Calaveras Engineering Company—This company has been organized at San Andreas by S. R. Fox, T. W. Downer, F. E. Tiscornia and others, and will work the Eastland-Gray mining properties on the Calaveras river, near Donellan's bridge. Arrangements are being made to install a dredge.

INYO COUNTY

Ruby Silver—J. H. Oliver, of Goldfield, Nev., has made a discovery of ruby-silver ore near Cottonwood Springs, in Death Valley. A number of prospectors have gone to the camp.

Casa Diablo—Forty men are now employed. Much new machinery has recently been installed and the mine has become productive. Clarence Beale is superintendent. The mine is 20 miles north of Bishop.

Greenwater Copper—The shaft is down 1400 ft. and will be continued to the 1500-ft. level in hopes of finding a paying grade of ore.

SHASTA COUNTY

Washington Gold—This company has incorporated at Redding to work the old Washington mine, at French gulch. The incorporators are C. C. Fox, C. L. Watson, Charles Gilzean, Joseph Porter and F. Stabel.

Consolidated Gold Dredging Company—The dredge belonging to this company is being moved up the Sacramento river from Clear creek to Middle creek, where it is supposed better ground exists.

Friday-Lowden Copper Company—This company has been incorporated to operate the Friday Lowden group of claims between the Mammoth and Trinity copper mines. T. H. Benton and John R. Lowdon, of Redding, are the principal owners, Mr. Benton being the president of the new company which controls 15 acres of mineral ground.

SIERRA COUNTY

West Point—This mine near Downieville has been bonded by Peckwith & Spalding to a San Francisco company represented by F. M. Phelps. It adjoins the White Bear.

Kate Hardy—Tyler Dudley, who has recently begun working this property at Forest, has broken into the old works, closed 40 years ago, and found excellent ore.

Minnie D.—L. A. Wagner has bonded this mine and the Gold Cañon at Alleghany and set crews of men at work.

Alleghany—Numerous rich strikes continue to be recorded at this place in addition to those of the Sixteen-to-One, El Dorado, Tightner and Rainbow mines

Large numbers of men have gone to that section, which is, however, not a good place for poor men, as most of the discoveries have been made in tunnels which have taken some years to cut.

TUOLUMNE COUNTY

Big Casino—Lee & French, who have a lease on the Two Brothers and Little Sister claims of this company, have put in a hoist and other machinery and the mill is being put in order to crush the ore. The mine is near Groveland.

Colorado

LAKE COUNTY—LEADVILLE

Lillian—The lessees working in both the upper and lower levels of this Iowa gulch property are doing well, and are shipping a fair tonnage of ore running well in gold.

Houston—A tunnel is being driven by lessees on this claim to catch the main orebody. Several pockets of rich gold ore have already been taken out.

Long & Derry—A tunnel is being driven from the foot of the hill to open the oreshoot worked from the surface in the early days. About 150 ft. is yet to be driven before it is beneath the orebody.

Carbonate Gypsy—The shaft on this claim is now down 450 ft. and is to be sunk 50 ft. farther. The shaft passed through 200 ft. of porphyry and is now in the limestone.

Mikado—A lease has been taken on this Graham park property by local men. The shaft is being retimbered and the machinery overhauled.

Tribune—The vein recently encountered in this Breece hill property has been opened for a distance of 85 ft. and is reported to be of higher grade than when the strike was first made. Preparations are being made for a 50-ton shipment.

Yak Tunnel—A lateral from the tunnel has been started to connect it with the Resurrection No. 1 mine, which has been drained. It is stated that when the connection is made with the Resurrection property the company will probably lease the ground in blocks.

Horseshoe District—Snow is still so deep in this section that active mining cannot be resumed for several weeks. The Hilltop, Last Chance and Belvidere tunnel is working a small force of men, which will be increased as soon as the roads are open.

SAN MIGUEL COUNTY

Tomboy—Reports from London show an estimated production of $62,900 in gold, with $36,500 working expenses, leaving an estimated profit for the month of $26,400.

TELLER COUNTY

Kimball—A concentrating plant for the treatment of the tailings on the site of the old El Paso reduction works near Gillette is being installed by George K. Kimball, of Idaho Springs, who has secured a lease and will clean up the dumps. The tailings accumulated in the early days of the district when the saving effected by the chlorination process was much lower than by the cyanide process now in use. The dumps have been carefully sampled and the average value per ton is said to approximate $2.50.

Idaho

IDAHO COUNTY—GRANGEVILLE

Owing ot the cold weather in the mountains the snow is melting very slowly. The water supply is low, necessitating the placers closing down.

IDAHO COUNTY—ROOSEVELT

A heavy landslide is reported from this region. The slide started at the Caswell & Curran placer on Thunder mountain and dammed Mule creek.

SHOSHONE COUNTY

Snowstorm—This mine is reported to be increasing its shipments. On June 1 twenty 40-ton cars were ordered to be loaded.

Standard—Reports indicate that a rich orebody has been encontered in the shaft at the 1650-ft. level; the ore is said to be even better than that on the 1450 level.

Gold Cliff—Good ore is reported to have been found on this property east of the Mother Lode company's holdings. The owners of the company are A. B. Rhude, of Murray, and Dr. W. B. Richardson, of Spokane.

Indiana

GREENE COUNTY

Shirley Hill No. 1—This mine has been reopened, and operation commenced after being closed for nearly two years. The mine works nearly 200 men.

SULLIVAN COUNTY

Hymera No. 33—This mine, of the Indiana Consolidated Coal Company, is boasting of having made the best record of any mine in this field since March 1, having been idle only two days in that time, and one of these days was a holiday. Other mines in this county are not experiencing the lull that usually comes the first two weeks in May, and the season so far is the best ever known for this time of the year.

Bellevue Coal Company—This Delaware corporation has been admitted to do business in Indiana under the foreign corporation act. This company proposes to mine and ship coal from this county. The resident office will be in Carlisle with William H. Arnold in charge.

Michigan

COPPER

Keweenaw—A series of drill holes is being put down throughout the tract and in this manner the Kearsarge and Osceola lodes are to be exposed. Operations at the Medora shaft continue on a limited scale to further open the west fissure vein at depth on what is known as the north lode.

Isle Royale—The A shaft, on the Baltic lode, has reached a depth of 425 ft. Copper has been revealed from time to time in the shaft. The shaft is nearing the depth that the lode was cut by the drill core and will probably enter the formation within a very short time.

Quincy—At a depth of about 400 ft. in the No. 9 shaft the formation has deflected and the shaft is going down in the footwall. The copper-bearing portion of the lode passed out of the shaft at a depth of about 210 ft. Drifting in the direction of this shaft from No. 8 shaft is opening good grade of ground.

Franklin—Drifting continues at the 23d, 24th and 25th level of this company's No. 1 shaft on the Pewabic lode with a good grade of copper rock opened throughout. The north drifts are approaching the Rhode Island tract, and indications are that this land carries the underlay and it will be but necessary to sink deeper.

Cliff—Work has been suspended on the Cliff property which is controlled by the Tamarack. The diamond drill near the Ojibway line is under way to expost the Kearsarge lode and this work will be continued.

Montana

BROADWATER COUNTY

Ohio-Keating Gold Mining Company—A gasolene plant has been installed at the property, near Radersburg, with a view to saving on fuel cost until arrangements can be made to use electric power. Water rights have been secured, which will later be utilized for the generation of electricity. John H. Cowan, of Salt Lake City, is general manager of the company and Charles S. Shoemaker, formerly State mine inspector of Montana, is in charge of operations at the mine.

CARBON COUNTY

Butcher Creek Oil Fields—Thomas Cruse, of Helena, has recently acquired all outstanding interests in the district, and is now making preparations for a thorough exploration of the fields. Machinery for drilling has been on the property for some time, but until now conflicting interests have made it impossible to work the property.

CASCADE COUNTY

Great Falls Gas Company—The company has recently purchased from the Northern Montana Coal Company and E. R. Clingan, 2040 acres of coal land, near Belt. It is the purpose of the company to use the lands for obtaining coal to be used in the company's new gas plant now being constructed at Great Falls.

Nevada

Churchill County—Boyer

It is reported that capitalists from Wilmington, Del., have made a first payment on the Boyer copper property comprising 27 claims located at this point, the sale price being announced as $250,000. The deposit consists of a porphyry intrusion, mineralized from 30 to 1000 ft. in width. The company will be known as the Boyer Nevada Copper Company; the provisional directors are: Dr. F. R. Carpenter, of Denver, president; H. R. Durkee, of Chicago, vice-president, and Arthur H. Carpenter, of Denver, secretary and treasurer.

Esmeralda County—Goldfield

Jumbo Wonder—This lease on the Poleverde claim of the Jumbo Extension Company was forfeited some time ago and has been secured by a group of Philadelphia men, among whom are W. D. Hickman and W. F. Rose. A contract has been let for sinking the shaft 200 ft. from its present depth of 250 feet.

Esmeralda County—Hawthorne

Spencer Lease—A strike of exceedingly rich ore is reported as having been made in this property at a depth of 300 feet.

Elgin, Randall and Cardew Lease—J. C. MacCormack, of Goldfield, purchased this lease on the Lucky Boy No. 1 lode last week. The former leasers worked about 60 days and sank their shaft to a depth of 90 ft. through pay ore a greater part of the distance. In the bottom of the shaft there is now exposed 2½ ft. of ore which runs in excess of $100 per ton.

Esmeralda County—Mina

Lucky Man Mine—A strike was made last week on this property situated two miles north of Mina. The vein, 18 in. wide, was encountered in a crosscut from the main tunnel and assay returns run high in gold, silver and lead.

Esmeralda County—Rawhide

King-Heisner—A large portion of the frame work for the new mill is in place. The telephone line from the water-works to the mill and town is completed.

Grutt Mining—Work has been started at the 100 and 200-ft. levels of the Wild West claim. It is 90 ft. to the shoot of high-grade ore which is being developed so extensively in the Marigold property.

Queen Bethania—A 4-ft. vein of gold-bearing quartz has been encountered. A shaft is to be started and development work carried on extensively.

Steinheimer—Fifty tons of ore from the McMann claim was shipped recently to the Selby smelter. The ore is said to contain approximately $85 gold per ton.

Lander County—Austin

Patriot—This property located north of Austin has been acquired by the Maricopa Mines Company, of Arizona. The company is a close corporation, and is composed of men from Cleveland Ohio, principal owners being L. F. McGrath, A. J. Rogers, J. F. McGraw and E. A. Richardson. The shaft will be repaired, a new hoisting and compressor plant installed, and operations pursued on a large scale.

Nye County—Bellehelen

Sciota Nevada—It is reported that a steam hoist and ten-stamp mill have been ordered by this company. The property is opened by a 200-ft. shaft, from which laterals have been run, also by a tunnel 600 ft. in length.

Nye County—Bullfrog

Tramp Consolidated—A fair sized body of ore has been blocked out on the Clothier & Jingles lease. Four hundred sacks of ore averaging $100 per ton are now ready for shipment. On the Kuliacka-Vucovitch lease work is being pursued on the lode at two different points; the vein varies from 10 to 15 in. in width, the ore ranging from $60 to $175 per ton in value. A shipment is now being prepared, to be sent out in June.

Montgomery Shoshone—This property is now producing an average of 200 tons daily. A shipment of bullion was made last week, having a valuation of approximately $18,000 which was the result of the semi-monthly cleanup.

Nye County—Manhattan

Placers—About 150 men are now operating on various placer deposits in the gulch between Manhattan and the Smoky valley. The daily cleanup is estimated at $1000. Nuggets worth from $5 to $15 have been found, the largest recorded being worth $22.50. The average yield of the gravel is in the neighborhood of $10 per yd. The Pneumatic Dredger Company, of Sacramento, Cal., has a machine *en route* to Manhattan which is expected to handle 500 yd. per day.

Nye County—Pioneer

Puritan Savage—A strike was reported last week on this property, which is situated about a mile northeast of town. The shaft, which is 85 ft. deep, has encountered a vein of good ore from 4 to 6 ft. in width.

Bullfrog Pioneer Lease—Ore of a high grade has been encountered in the bottom of the winze from the 210-ft. level. Electric power was turned on last week. The production for the week was in excess of $30,000. About 60 men are now employed at the mine.

Rickard-Garburg—Ore was disclosed in the tunnel level of this lease last week which assays up to $40 per ton. Three shifts are now employed and the ore is being sacked for a trial shipment.

Nye County—Round Mountain

Round Mountain Mining—The production of this company for the first 15 days of May, amounted to nearly $17,000. Electric power will be furnished the property this month.

Nye County—Tonopah

Tonopah Mining—The Mizpah shaft is now down to a depth of 1386 ft. A crosscut is being run at the 1380-ft. level and a sump will be cut about 20 ft. from the shaft, and the water from above will be collected at this level. The compressor has been found inadequate for the demands made upon it, and another has been ordered. The 150-h.p. hoist at the Mizpah shaft has been replaced by a 300-h.p. electric hoist which handles the load easily. The mill report for week ending May 22, shows 3225 tons of ore crushed; average value of $20 per ton; 63 bars of bullion, valued at $850 per bar, and 27 tons of concentrates at $425 per ton were shipped.

White Pine County

Cumberland-Ely—According to a circular issued by a New York brokerage house, the investment of this company in the Steptoe reduction works is $3,000,000, on which it has a guarantee of 8 per cent. In addition, Cumberland-Ely is said to be receiving $300,000 per annum as its half share of the net earnings of the Nevada Northern Railroad. The circular concludes as follows: "More than half of the 1,300,000 shares of Cumberland-Ely are owned by the Guggenheims and their associates. The rest of the stock is very widely distributed, the books of the company registering 1600 share holders. We believe that in the near future Nevada Consolidated and Cumberland-Ely will be joined in one great company. This coalition will insure Cumberland-Ely share holders *an attractive proportion of the profits of its steam shovel neighbor.*" The italics are our own. The stockholders of the Nevada Consolidated are yet to be heard from.

New Mexico

Grant County

Chino Copper Company—This is a new company organized by Hayden, Stone & Co. to operate the Santa Rita mine. Of the authorized issue of 700,000 shares, 375,000 shares are being delivered in exchange for an equal par value of the entire capital stock of the Santa Rita Mining Company. Of the balance of 325,000 shares, a portion is now being sold for cash at $5 (par value) per share, and the balance is under option at the same price. Active operations at the property in the development of the porphyry deposits have already been begun under the direction of A. Chester Beatty, who is engineer for the new company. John M. Sully has been put in charge of the property. D. C. Jackling will be chairman of the board of directors.

Socorro County

Socorro Mines—The company has secured control of the Little Fannie, Champion and Consolidated groups at Mogollon. The mill at present is treating 60

tons per day with an extraction of 89 per cent. A new 150-ton mill is being built, also a 600-kw. hydroelectric plant.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—The statement for April and the 10 months of the fiscal year from July 1 to April 30 is as follows:

	April.	Ten Mos.
Earnings	$4,633,804	$30,292,772
Expenses	4,375,821	28,609,975
Net earnings	$ 257,983	$1,682,797

For the 10 months there were decreases of $2,568,700 in earnings; of $1,990,903 in expenses, and of $577,896 in net earnings.

Delaware, Lackawanna & Western—The old wooden breaker at the Taylor colliery, near Scranton, is to be replaced by a reinforced concrete structure. In this the company is following its recent policy of using concrete wherever possible. Wooden breakers are comparatively short-lived; but the most serious objection to them is their liability to take fire, involving not only the destruction of the building, but the loss of valuable machinery. The plans for the breaker have been drawn by Bradford Sampson, Lackwanna superintendent of construction.

BITUMINOUS COAL

Monongahela River Consolidated—The financial statement for the half-year ended April 30 gives the net earnings at $978,511, a decrease of $373,078 from last year. Charges were: Royalty, $199,542; depreciation, $212,098; taxes, insurance and interest, $447,575; total, $859,215. This left a surplus of $119,296, which is a decrease of $291,193 from last year.

South Dakota

LAWRENCE COUNTY

A severe flood has caused a suspension of most of the mines in the Bald Mountain district. Few of the mines were flooded, as electric power was available and in almost every case the pumps were kept going. Railroad connection with the mills, most of which are at a distance from the mines, has been broken. All those treating Bald Mountain ore have temporarily suspended.

Utah

BEAVER COUNTY

Cedar-Talisman—A large cave has been opened and on its floor is a layer of 3 or 4 ft. of lead carbonate ore with evidence of higher silver content than in the other ores of the mine. S. S. Pond, manager, Beaver, Utah.

JUAB COUNTY

Chief Consolidated—This company has purchased the Granite claim and one-half interest in the American Star and Blackbird claims. This new ground, together with the Little Chief holdings, gives the company a desirable territory in the Tintic district.

Montana—Orders have been placed for buildings and equipment for this property. The purchase includes a 125-h.p. compressor, an 8x10 air hoisting engine capable of operating to a depth of 750 ft., power drills, and ventilating and lighting systems.

Iron Blossom—The management is opening an orebody in a drift from the south shaft that promises to become an important source of revenue. President Jesse Knight said: "We are drifting on a full face of ore which contains no lead, but of uniform content of silver and gold which makes it of shipping grade. We have followed a streak of copper ore to considerable depth in this shaft, and this leads me to believe that with depth we will find plenty of copper ore in this part of the property."

Tintic Standard—The big fissure which has just been crosscut on the 400-ft. level is proven to be 87 ft. wide. The grading for the headframe for the new shaft has been completed. The hoist is to have a capacity for sinking 1000 ft. E. J. Raddatz, general manager, Eureka, Utah.

UTAH COUNTY

Mountain Dell—A streak of high-grade silver ore, described as "almost native," has been found in the raise which is being driven to connect the 800-ft. tunnel with the inclined shaft in American Fork cañon. The tunnel will completed in 30 days and it is then expected to develop the high-grade streak. Considerable ore of shipping grade has been developed in the shaft. R. N. Baskin, general manager, University Club, Salt Lake City.

Burgess Consolidated—This property, immediately south of Miller hill, in American Fork cañon, will resume work.

Virginia

BUCKINGHAM COUNTY

Fernciff Slate Company—This company, with office at Rochester, N. Y., proposes to develop slate properties at Arvoria; also proposes manufacturing structural and roofing slate, slate acid vats, slate insulators for electrical wires, etc. E. E. Crook is general manager.

Washington

JEFFERSON COUNTY

Construction on James A. Moore's steel plant at Irondale continues steadily.

KING COUNTY

Grand Ridge—C. J. Smith, A. S. Kerry and Andy Reynolds, of Seattle, have purchased the Grand Ridge coal properties at Issaquah under the name of the Central Coal Company, and will mine coal within 90 days from a portion of the 400 acres acquired.

West Virginia

MONONGALIA COUNTY

Franci Rock and associates, of Uniontown, Penn., have purchased 3000 acres of coal lands in Monongalia and Marion counties. It is proposed to construct 1000 ovens, to have a daily production of 2500 tons of coke. L. A. Phillips, of Grays Landing, Penn., is the engineer in charge of construction.

Philippine Islands

BENGUET

Benguet Consolidated Mining Company—The output for the month of March was 235 oz. gold.

CAMARINES

San Mauricio—The equipment has arrived and is now being installed. It is the largest shipment of mining machinery ever brought to the Philippines. It includes a complete mill of 20 stamps, concentrators, an electric-light plant complete and power machinery. President Heise states that the installation will be complete and the plant operating by the end of 1909.

PARACALE

Paracale Gold Dredging Company—This company reports 644 oz. gold saved in March from its dredging work in the Paracale river.

Canada

BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

Awaya Ikeda & Co.—Ore shipments in May to the Tyee smelter at Ladysmith totaled about 1000 tons, making nearly 9500 tons since shipments were commenced. Output for April was 884 tons, averaging 7 per cent. copper and about $3.50 per ton in gold and silver. Total footage in four tunnels driven is 1500 ft. Lowest tunnel is in 800 ft. in ore practically all the way. Recently a 6-ft. dike was encountered and after going through this the tunnel entered an orebody proved to be 26 ft. wide with a footwall not yet reached. The manager, A. Ikeda, of Vancouver, B. C., is arranging to install additional power equipment. Recent developments at this mine are regarded as the most important that have taken place since the commencement of mining operations on the islands about two years ago.

BRITISH COLUMBIA—VANCOUVER ISLAND

Tyee Copper Company—Of several properties the company is developing, results from one or two indicate early profitable production on a considerable scale. The smelter at Ladysmith had a full month's run in April with one furnace, smelting about 7000 tons of ore. Much work is being done at mines from which the smelter derives its ore supply, so that directly market values improve there will be ample ore to keep two furnaces going. The second furnace is being installed. W. H. Trewartha-James, of Victoria, B. C., general manager, W. J. Watson, smelter manager, and J. W. Bryant, mining en-

gineer, have returned from their recent trip to Queen Charlotte islands.

NOVA SCOTIA

Dominion Coal Company—The coal output for May was 306,888 tons, as against 335,829 tons for May, 1908. The total for the five months ended May 31 was 1,263,458 tons, as against 1,578,923 tons for the corresponding period last year.

Nova Scotia Steel and Coal Company—R. E. Chambers, the company's iron-ore expert, has gone to Newfoundland to arrange for a larger output this season from the ore deposits at Wabana. Contracts for 310,000 tons for shipment abroad have already been made, of which about 100,000 tons will go to Germany, 150,000 to the United States and 60,000 tons to Great Britain. Thomas Cantley, general manager, estimates the coal output of the season at 800,000 tons, the company having a present coal-producing capacity of about 1,000,000 tons yearly.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 29, were as follows: Buffalo, 43,574 lb.; Crown Reserve, 161,680; Chambers-Ferland, 60,000; La Rose, 195,680; McKinley-Darragh, 46,780; Nipissing, 194,146; Nancy Helen, 43,400; O'Brien, 128,190; Right-of-Way, 81,228; Temiskaming, 59,000; Trethewey, 65,300; total, 1,078,978 pounds.

Beaver—A new powerhouse, 35x50 ft., is being erected. A headframe will be built over the main shafthouse. New machinery is on the ground for installation when the buildings are completed. The first shipment will shortly be made, 235 bags of high-grade ore being already sacked.

Crown Reserve—Six drills are working on development operations and two on stoping. From the drift under the lake at the 100-ft. level a crosscut has been finished for 530 ft., and from No. 1 vein a crosscut has been run 87 ft., and has penetrated a diabase formation.

Hargrave—The main shaft on the Jacobs vein is down 270 ft., and will be sunk 30 ft. further, when a crosscut will be made to intersect the vein at the 300-ft. level and a drift run to the Kerr lake line.

King Edward—A discovery has been made in drifting at the 80-ft. level of No. 5 vein where a vein was struck 11 in. wide, running over 3000 oz. silver to the ton. The wallrock also carries silver.

Little Nipissing—A 12-in. vein of calcite running about 3000 oz. to the ton in native silver was struck on June 1 on the Peterson lake leasehold of the Little Nipissing, on a raise between the 100- and 100 ft. levels.

Silver Leaf—The diabase formation will be explored in the expectation of finding Huronian underneath it. A shaft on the north end of the property is down 40 ft., and will be put down to 300 ft. with the object of reading the Huronian. Forty men are at work trenching.

Cobalt Gem—A massive nugget 5 ft. 6 in. in length, 2 ft. 5 in. wide, and 16 in. thick, 75 per cent. pure silver and valued at $16,000, has been found near the surface at the foot of a cliff 60 ft. high on this property. It will be forwarded to Philadelphia, the company being controlled by people in that city.

La Rose—This company has obtained permission from the Right-of-way to run a crosscut under the railway so that it can work its holdings on the town side of the track, which will be developed from the first level of the La Rose. The work on the crosscut has been begun.

ONTARIO—MONTREAL RIVER DISTRICT

Otisse-Currie—Another shaft is being put down on the northeast corner of the property. At the depth of 6 ft. the vein shows about 7 in. of decomposed calcite, cobalt, galena and silver. At No. 1 shaft 71 ft. of sinking, 161 ft. of crosscutting and 133 ft. of drifting have been accomplished, and the vein continues to hold its value.

Mexico

CHIHUAHUA

Calabacillas—A 50-ton cyanide plant is being erected at this mine, not far from the Sinaloa and Durango State line. The plant is for handling the accumulated tailings, as well as a large tonnage of low-grade ore. The property is owned and operated by W. H. Brevoort, of New York and Paris. The mine is reached from Fuerte, Sinaloa.

Lluvio de Oro—Burt filters are being installed at the cyanide plant. The small plant has proven so successful that plans are being made for the early erection of a larger one. A small amount of bullion is being produced from working over the old tailings.

Tepochique Gold and Silver Mining Company—The mine is situated in the vicinity of Barranca de Cobre and is preparing for the early resumption of work under the direction of Dr. C. F. V. Caracristi.

Moris Camp—A number of mining properties in this district have recently been purchased by Canadian capitalists, among whom is the owner of the O'Brien mine at Cobalt.

Santa Elena and Bot—J. D. McKenzie and J. D. Harbottle, of Chihuahua, have acquired these properties, owned by R. Anderson in the Terrazas district. Development work is under way and a good showing of ore has been found in a 120 ft. shaft.

Durazno Mines Company—H. B. Pope and other Pittsburg people have recently made another payment of 25,000 pesos on this property in western Chihuahua. It is reported that the reduction works, consisting of amalgamation and cyanidation plants will be placed in commission shortly.

International Gold Mines Company—A Kansas City concern, managed by J. W. Pender, will discontinue cyanidation and return to concentration of its ores. The property is west of Ocampo in El Socorro district.

American Smelting and Refining Company—Two additional furnaces are being added to the Chihuahua plant, making five in all. This will give the smelter a capacity of 750 tons per day.

MEXICO

Esperanza—Report for April: The mill operated 27 days, crushing 14,451 tons of ore. Estimated value of bullion produced, $127,785; estimated value of concentrates, $49,848; receipts from rents and other sources, $748; total, $178,381. Less all working expenses and treatment charges on concentrates shipped to smelters, $112,258. Net proceeds, $66,123.

Mexico Mines of El Oro—Report for April: The 40-stamp mill ran 24 days, crushing 7240 tons of ore. Estimated value, $110,120; working expenses, $38,750; development expenses, $6800; net proceeds, $64,570. In addition to this 23 tons of high-grade ore were shipped to smelters, yielding net proceeds of $6750. Total profit for the month, $71,320.

SONORA

El Tigre—The adjourned annual meeting of the stockholders was held recently at Douglas, Ariz. The capital stock was increased from $650,000 to $8,000,000. Seven directors only were elected to take the place of 13 which have heretofore served. The new directors are T. C. Fooy, C. S. Jobes, John B. Seitz, W. A. Moses, John Kelley, E. J. Street, and C. M. Evans, all of Kansas City. Of the $8,000,000 of new stock voted, $1,000,000 is placed in the treasury for further improvement at the mines. Six million, three hundred and fifty thousand dollars was declared as stock dividends.

Greene-Cananea—The May output was 3,010,000 lb. of copper, containing 84,600 oz. of silver and 500 oz. gold. This is slightly less than the April production.

Africa

RHODESIA

The gold output in April is reported at 5,000 oz. fine, being 4876 oz. more than in March, and making a total for the four months ended April 30 of 105,301 oz. By values, the total production for the four months was $3,015,550 in 1908, and $4,000,407 in 1909; an increase of $84,047, or 2.2 per cent.

Other production reported in April was 21,495 oz. silver, 4 tons copper, 82 tons lead, 1748 tons chrome ore and 28 tons asbestos. Coal production from the Wankie mines was 13,498 tons.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 9—Reports from the West continue to be encouraging. An increased business is being done in steam coal at nearly all the large centers. Mines are running on better time and making larger outputs, and there is decidedly a more hopeful feeling in the trade. Car supply throughout the West is generally good and coal is moved promptly.

In the East the bituminous trade is improving, though much more slowly than in Western territory. Still, there is an improvement and indications are that it will continue.

The anthracite trade is quiet and steady. Production has been cut down in April and during the present month, and in consequence accumulated stocks are being gradually worked off.

Lake Coal Trade—The question of rates to Lake Erie ports on coal for shipment to the Northwest is still unsettled. It is understood that the West Virginia operators will continue to fight against the proposed differential rates before the Interstate Commerce Commission and in the courts.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 29 short tons:

	1908.	1909.	Changes.
Anthracite	2,278,735	2,198,543	D. 80,192
Bituminous	13,154,336	14,352,766	I. 1,198,430
Coke	2,818,885	4,065,142	I. 1,246,257
Total	18,251,956	20,616,451	I. 2,364,495

Increase for the week, 181,498 tons. Total increase this year to date was 13 per cent.

The coal mined by the Monongahela River Consolidated Coal and Coke Company for the six months of its fiscal year ended April 30 was 3,254,055 tons in 1907-8, and 2,869,134 in 1908-9; decrease, 384,921 tons, or 11.8 per cent.

Anthracite coal shipments in May were 5,063,873 long tons, being 827,303 tons less than in April, and 1,268,501 tons less than in March. For the five months ended May 31 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	5,173,553	5,396,756	I. 223,203
Lehigh Valley	4,351,018	4,397,739	D. 153,279
N. J. Central	3,609,195	3,365,138	D. 244,057
Lackawanna	4,115,355	3,942,193	D. 173,162
Del. & Hudson	2,784,864	2,870,585	I. 85,721
Pennsylvania	2,619,655	2,566,269	D. 53,386
Erie	2,958,190	3,359,100	I. 400,910
N. Y., Ont. & West	1,151,717	1,148,983	D. 2,734
Total	26,963,527	27,046,763	I. 83,236

Three companies showed increases and five decreases. The total gain this year was 0.3 per cent.

Coal tonnage originating on the Southern railway, three months ended March 31: Alabama district, 564,936; Tennessee district, 336,244; total, 901,280 short tons, an increase of 320,580 tons over last year.

New York

Anthracite

June 9—The anthracite trade is quiet and steady. Sales are about as usual at this time of the year. The collieries are beginning to run on a little better time as the stocks are being worked off.

There is no change in prices which are for prepared sizes, $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

Bituminous

The Seaboard bituminous trade is beginning to wake up and show some activity after its long rest. Mills and factories which have been scraping the boards in their coal bins are feeling the necessity of putting in more stocks. It is noticeable that many of the orders now received come with the request to ship as soon as possible.

The far East is doing best in the trade. The Sound is rather quiet. In New York harbor business is slow and the harbor is coming to be looked on as a dumping ground for cheap coal. The lower grades are selling at $2.40@2.50 per ton, f.o.b. shipping port, and better grades $2.50@2.60 and upward. The harbor docks are generally clear and there is no demurrage coal on the market.

All-rail trade is still improving and has now reached a fair basis. Car supply is good, but transportation is rather slow, dropping a little behind the schedule in many cases.

In the Coastwise trade small vessels are rather scarce, but large boats are plenty, and on the whole it is a shipper's market for tonnage and freights are low. For large vessels from Philadelphia quotations are 75@80c. to Lynn and Newburyport; 60@65c. to Boston, Saco and Portland; 45@50c. to Providence and the Sound. From New York rates are 60@65c. to points around Cape Cod.

There has been some inquiry for outside coal for the West Indies, but sailing vessels are reluctant to take business at this time of the year, being afraid of bad weather and hurricanes.

Birmingham

June 7—The coal trade in Alabama is dragging along. There is not much being done at the mines. The coming convention of the United Mine Workers of America, Alabama district No. 20, to start on June 14, is to be watched closely by the operators in this section. Reports have it that the officials of the union have been making an effort to reorganize the men and bring about more trouble. From the headquarters of the operators it is learned that there will never be any more recognition of the union miners in this State, so far as the larger operators go.

Coke is in steady demand with the production being held up well. A. Dempster, of Pittsburg, was re-elected president of the Corona Coal and Iron Company at a meeting held here last week. The Corona company has had a prosperous season, despite the dullness of the coal trade.

Chicago

June 7—Coal consumption is down to its normal summer level, to all appearances. There is a fair demand for fine steam coals; lump suffers from the drift of the market, the trade centering about Illinois and Indiana screenings. For steam lump and general domestic coals there is practically no market. Contract business has obtained most of the big consuming interests, at low figures. Run-of-mine is hard to sell.

Illinois and Indiana coals bring in car lots $1.55@2.25 for lump or egg; $1.65@1.75 for run-of-mine; $1.35@1.65 for screenings.

Eastern coals are slack. Smokeless run-of-mine is in too large supply and sells for $2.95@3.05, with lump at $3.20@3.25. Hocking is still too abundant, bringing 10c. or 25c. under the $3.15 list price. Youghiogheny continues even at $3.15 for ¾-in. coal and Pittsburg No. 8 is quiet at $2.65 for ¾-in. lump, the demand for both being light.

Anthracite sales are light, in both city and country.

Cleveland

June 8—Lake coal is moving more freely, the docks and yards being less crowded. The railroads, however, want

to see more improvement before they take coal for the Lake trade from the mines.

Local business shows improvement, and steam coal is being taken readily in quarters where buyers have been holding back. Slack is in best demand. No. 8 district brings $1.95@2.05 for lump; $1.70@1.80 for run-of-mine; $1.40 for slack, all f.o.b., Cleveland. Middle district runs about 10c. under these prices.

Indianapolis

June 7—In a general way the coal situation presents additional favorable features, but there is still room for a larger advance both in output and price. There is less heard of empty coal cars on the sidings, of the timidity of buyers, of the strike on the Lakes. Blast furnaces and mills continue to increase operations and these are regarded as hopeful signs and Indiana mines are beginning to profit by the increasing consumption for these and other purposes. There were more mines in operation during the past week than since last March and more men were employed. Two or three mines resumed operation after months of idleness and work is progressing on several shafts in new territory.

Pittsburg

June 8—The heavy rains of last week brought a good stage in the rivers, and about 5,000,000 bu. of coal have gone down this week. The coal market remains rather quiet. Nominal prices are continued at $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at mines, these prices being shaded 5 to 10c. per ton. Slack is quoted at 60 to 65 cents.

Connellsville Coke—The positive statement is made on behalf of the promoters of the Connellsville coke merger that the parties back of the movement are interested in the consumption of coke and have business reasons for desiring to acquire the properties; but no direct statement can yet be obtained as to who are back of the purchase. The appraisers are at work. There are four options involving prices of $5000 an acre or higher, but these cover a relatively small acreage, and the promoters expect to be able to scale them down 20 per cent. The remainder of the options on Connellsville coal are claimed to run from $2200 to $2700 an acre. There are about 90,000 acres in the Connellsville region, of which the United States Steel Corporation controls 60,000 acres. Of the remaining 30,000 acres it is expected 20,000 acres will be purchased, while about 15,000 acres of Greene county coal will be taken, making 35,000 acres altogether to go into the merger, which will be capitalized at $60,000,000. The stock has all been underwritten, and while some of the sellers will be urged to take some stock in the new company it is represented that it is desired to have them in for the purpose of having practical coke operators interested.

The report is confirmed that the three-year contract between the Jones & Laughlin Steel Company and the Thompson-Connellsville Coke Company was at $2 per ton at ovens. A steel company has just taken 50,000 tons of coke for second half, at $1.60 at ovens, this being to supplement its own production. The market for Connellsville furnace coke remains at $1.50@1.60 for prompt and $1.60@1.80 for contract, according to grade. Foundry coke is $1.80@2 for prompt and $1.90@2.25 for contract, depending on grade.

The *Courier* reports production in the Connellsville regions for the week ended May 29 at 284,866 tons, a gain of 6000 tons. Shipments are: 3637 cars to Pittsburg district; 5595 cars to points west of Pittsburg; 739 cars to points east of Connellsville; total of 9971 cars, or 500 more than the preceding week.

Foreign Coal Trade

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 29: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, June 9—The iron and steel markets continue generally active. New business just now is coming in perhaps in rather less volume than in May, but still in sufficient quantity to keep the mills active with fair prospects of remaining so for some time to come.

In pig iron, foundries generally are placing orders quite freely for the third quarter, and to some extent for the fourth quarter also. Buyers seem to be no longer feeling their way, but are ready to take on considerable stocks, evidently believing that they will be able to use them to advantage. Furnaces generally are firmer in their views and are asking at least 25c. more per ton than last month, generally with an advance of 50c. for fourth-quarter deliveries. Basic iron has been in strong demand and large sales have been made. Parallel with this is a call for heavy steel melting scrap, which is getting to be rather scarce and bringing good prices.

In finished material, structural steel continues in demand; while few large contracts have been placed, there have been many small orders making up a good volume of business. Bars have also been selling freely. In plates demand has improved owing to the placing in the East of several contracts for new ships for the coasting trade. The shipyard activity on the Atlantic coast promises to be greater during the coming season than for some years past.

Railroads have been ordering freely for new equipment. A recent estimate is that 950 locomotives and 21,500 cars have been ordered in the five months ending May 31. Rail orders are still light so far as standard sections are concerned, but light rails have sold quite freely and there is a good deal of trolley-rail business in sight. Some good contracts have already been placed.

Tinplate Wages—It is stated that the American Sheet and Tin Plate Company will make no agreement with the Amalgamated Association this year, but will run all its plants on the open-shop plan after the present agreement with the association expires.

Baltimore

June 7—Exports for the week included 3,271,760 lb. steel billets to Liverpool; 1396 tons steel rails to Bahia Blanca and 5137 tons to Guaymas, Mexico; 849,223 lb. pipe to Panama; 81,800 lb. tin scrap to Antwerp. Imports included 700 tons manganese ore from Germany and 350 tons from Cuba; 11,350 tons iron ore from Cuba; 4239 tons cupreous pyrites from Spain.

Birmingham

June 7—The month of June started off well with the Southern pig-iron manufacturers. There has been a steady inquiry for iron and the sales so far this month more than equal the make. No. 2 foundry is being held for $11.50 per ton, minimum, while $12 is being asked for third-quarter delivery and some sales being made. Three furnaces went out of blast during the past fortnight and one more will be cold within a few days. However, every preparation has been made for a resumption at two furnaces and two others will soon be in condition to resume operation. The home consumption continues to show improvement, the cast-iron pipe makers having large orders on hand and the machine shops and foundries receiving business right along. During the month of May the iron producers in Alabama sold more than their make. The make so far this month has been covered. The Ensley steel plant is still idle.

Chicago

June 7—Conditions in the iron and steel market remain indicative of a bright future but with business in pig iron still sluggish. The ordinary consumer is not yet buying for the future; he is awaiting developments of tariff, general market conditions and a host of other things. His purchases are small and for the next three months, as a rule. When he contracts into the last quarter it is also for small amounts. The large consumer—he who

buys in lots of 1000 tons or more—is equally cautious. Both sides—the selling and the buying—are awaiting developments.

Southern iron hovers about $11.50 Birmingham ($15.85 Chicago). Sales probably have been made—those most favorable to the seller—at 50c. below this price. On the other hand, some have been made at $12 Birmingham. What price a large order would bring is questionable. Northern iron holds to $16.50 base price for No. 2, with furnaces reported close to demands and producers still conservative. Lake Superior charcoal, with a tight market, brings $19.50.

Iron and steel products continue active. Coke finds a steady market at $4.70 (or $2.05 at the ovens) and the supply well regulated to the demand.

Cleveland

June 8—There has been more buying of iron ore, now that the price is established. The quotations are $4.50 for Old Range and $4.25 for Mesabi bessemers; $3.70 for Old Range and $3.50 for Mesabi non-bessemers, all f.o.b. Lake Erie ports. Guarantees are 55 per cent. iron on bessemer and 51.5 on non-bessemer ores. The strike is making some trouble still, but there are plenty of vessels moving.

Pig Iron—A good business is being done, with prices 25c. higher, the base being $15.25@$15.50 for No. 2 foundry.

Finished Material—New sales are a little slower, but deliveries on contracts are being urged. Plates are more in request, but business in bars is lively, and structural steel orders are still coming to the mills.

Philadelphia

June 9—The sum total of sales in eastern Pennsylvania for the past week falls below that of some previous like periods. The lack in sales was made up in inquiries. Prices quoted show a hardening, especially for basic, which promises to be called for in considerable quantities owing to recent favorable developments in the steel industry. Inquiries for low grades of pig iron are under consideration by one or two furnace companies. Electrical equipment manufacturers are in the market for special brands, the stocks of which are practically exhausted. The most significant feature of the situation is the practical absence of stocks of desirable irons. Forge iron continues to drag. Foundry is strong even in the absence of large sales. No. 2X is quoted at $16.50, forge, $15; basic, $15.50, with an upward tendency.

Steel Billets—Billets are decidedly stronger under heavy buying. Negotiations now in progress for large quantities

Bars.—There is a larger demand for bars. $14.75 Valley can be done, some further common iron especially. Mill owners are snatching up all the business they can get and are quoting 1.30c. delivered.

Sheets—Still further improvement is noticed in mill orders. The industry as a whole is gaining ground, though full capacity is not reported.

Pipes and Tubes—Liberal buying is in progress and prices are hardening.

Plates—A marked improvement in demand was developed within a few days. It is said an advance in early-delivery plates will be made.

Structural Material—A large volume of business has been placed at the mills and the daily receipt of inquiries is encouraging manufacturers. Prices are not advanced but a change is looked for in quotations.

Scrap—Heavy steel scrap is pretty well cleaned up and yardmen are on the warpath trying to fill new orders for steel mills. Light scrap is dull, except No. 1 yard. The large dealers are scurrying after stock and stronger prices will be the outcome.

Pittsburg

June 8—The iron and steel trade is in a healthy and prosperous condition. While the full capacity is not engaged, production is at a higher rate than at any time since October, 1907. Outside of railroad material, the shipments of the mills are fully up to the rate prevailing before the panic, and in some cases at a greater rate.

Production of pig iron has shown a steady gain since about the middle of April, but the gain is furnished altogether by the steel-works furnaces, the merchant furnaces not gaining any, but improving their position by ceasing the accumulation of stocks. Production of steel has shown a material increase. Many of the works are operating at absolutely full capacity.

Prices of finished steel products are substantially unchanged. There is a possibility of an early advance in wire products, possibly of $2 a ton, while a similar advance in merchant pipe about July 1 is not altogether improbable.

Pig Iron—The tone of the local market is still stronger, and there have been fairly large sales in basic, with moderate sales in bessemer, while foundry and forge grades have been relatively quiet. Bessemer is held at a minimum of $15, Valley, for prompt delivery, while most sellers are quoting $15.25 for extended delivery, and sales have been made at this price. The minimum of the market on recent sales was $14.50, Valley, this price being done both on prompt and on third quarter delivery. Sales of basic aggregating [illegible]bly 10,000 tons have been made in the local market in the past week, at $14.[illegible], $14.35 and $14.50, Valley, the market showing a sharply advancing tendency, the present position being that nothing below $14.50 Valley can be done, some furnaces quoting $14.75 and some as high as $15. The latter have practically withdrawn from the market for the present. The bessemer and basic averages, compiled from actual sales, have been as follows, Valley furnace: January, $16.44 and $15.50; February, $15.88 and 15.19; March, $15.44 and $14.94; April, $14.90 and $14.15; May, $14.58 and $14.12. The May average on bessemer corresponds with the low point of last year, made in October. April and May made new low prices on basic.

Steel—The several sales of sheet-bars made lately at $24@25, delivered, for both prompt and second-half delivery, have attracted considerable attention, the official market being $25.50. It is evident that the outside steel mills are willing to support the independent sheet mills in their contest for business with the leading interest. Billets remain firm at $23, Pittsburg. The regular market on plates remains at 1.3c., especially attractive business being sometimes taken at 1.25 cents

Sheets—Shading continues in sheets. The regular market is 2.20c. on black and 3.20c. on galvanized, 28 gage, Pittsburg, but these prices are sometimes shaded $1 a ton. Corrugated roofing is nominally $1.55 for painted and $2.80 for galvanized, per square, but these prices are shaded $2 a ton.

Ferromanganese—The market remains weak, $40.50 to $41, Baltimore, being quoted, equal to $42.45 to $42.05, Pittsburg.

Foreign Iron

Canadian Steel—The production of steel and of finished iron and steel in Canada for two years past was, in long tons:

	1907.	1908.	Changes.
Steel ingots	646,754	509,957	D. 136,797
Finished Material:			
Wrought iron	81,093	65,505	D. 15,588
Steel	519,086	431,012	D. 88,074
Total	600,179	496,517	D. 103,662

Of the steel made in 1908 there was 108,433 tons bessemer and 401,119 tons open-hearth steel. The ingots included 9657 tons direct castings. The largest item of finished material was 268,602 tons rails.

German Iron and Iron-ore Trade—Exports and imports of iron and steel, and of ores, in Germany, three months ended March 31, metric tons:

	Exports.	Imports.	Excess.
Pig iron	83,210	26,663	Exp. 57,547
Pig, 1908	66,221	60,983	Exp. 5,240
Other iron and steel	824,229	64,220	Exp. 760,009
Other iron, '08	807,880	78,474	Exp. 729,406
Iron ore	641,784	1,764,323	Imp. 1,122,539
Iron ore, 1908	921,985	1,348,103	Imp. 426,118
Manganese ore	691	77,910	Imp. 77,309
Manganese, '08	440	91,735	Imp. 91,295
Slag and slag products	16,675	99,442	Imp. 82,767
Slag, 1908	16,373	118,278	Imp. 101,905

Iron ore includes pyrites residues, cinder and similar material

Metal Markets

New York, June 9—The metal markets continue to show some improvement in demand and prices; also some speculative activity, especially in copper.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver:			
April 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,467,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298,582	" 2,750,269

Exports from the port of New York, week ended June 5: Gold, $2,120,440, chiefly to Paris and Buenos Aires; silver, $916,507, chiefly to London. Imports: Gold, $128,426; silver, $214,878, both principally from the West Indies and South America.

Gold—The demand for gold on the open market in London was not active and the Bank of England took most of the metal arriving.

Platinum—The market is rather weak and lower prices are not unexpected. Present quotations are $22.50@$23 per oz. for refined platinum, $25 for hard metal and $18@$20 for good scrap.

Our special correspondent writes from St. Petersburg, Russia, under date of May 27, that the markets are a little better, and the demand sensibly increases. Recently an offer to buy 20 poods of platinum at 18,000 rubles per pood was refused here by the Platinum Company, one of the great producers. Generally prices remain unchanged and the crude metal, 83 per cent., is quoted at Ekaterinburg 4.50 @5 rubles per zolotnik; in St. Petersburg, 18,000@19,000 rubles per pood—equal to an average of $17.86 and $18.13 per oz., respectively. These prices are nominal and subject to negotiation.

Silver—The market has settled into very narrow channels. Absorption of silver continues, but there does not seem to be much prospect of a rise of any material consequence soon.

SILVER AND STERLING EXCHANGE

June.	3	4	5	7	8	9
New York....	52¾	53	53⅛	53	52¾	52⅞
London.....	24¼	24⅜	24⅜	24⅜	24⅛	24⅛
Sterling Ex..	4.8785	4.8785	4.8790	4.8780	4.8775	4.8770

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to May 27:

	1908.	1909.	Changes.
India.....	£ 3,172,218	£2,161,200	D. £1,011,018
China.	516,400	1,075,100	I. 558,700
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,778,818	£3,319,100	D. £ 459,718

Receipts for the week, £112,000 from New York, exports, £222,500 to India

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
3	13½ @13⅝	13¼ @13½	60⅞	29¼	4.35	4.25 @4.30	5.12½ @5.15
4	13½ @13⅝	13¼ @13½	61¼	29¼	4.35	4.25 @4.30	5.15 @5.17½
5	13¼ @13⅜	13⅜ @13½	....	29¼	4.35	4.25 @4.30	5.17½ @5.20
7	13⅜ @13¾	13⅜ @13½	61⅜	29¼	4.35	4.25 @4.30	5.20 @5.22½
8	13⅜ @13¾	13⅜ @13⅝	61	29	4.35	4.25 @4.30	5.20 @5.25
9	13⅜ @13¾	13⅜ @13⅝	60⅞	29⅝	4.35	4.25 @4.30	5.20 @5.25

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—An outburst of speculative buying in all the European markets helped to carry the market forward further during the week. The business placed by consumers was of relatively small proportions. Toward the end of the week there was a realization of speculative holdings on a large scale, which tended to discourage new buying from that quarter, and the market closes barely steady at 13⅝@13¾c. for Lake copper; 13⅜@13⅝c. for electrolytic in ingots, cakes and wirebars; 13⅛@13⅜ for casting copper. The average of the week for casting copper has been 13⅛@13⅜ cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire has been again advanced ¼c. to 15c. base, carload lots at mill.

The standard market in London, in which speculative activity centered, had advanced by Monday morning to the highest prices reached on this movement, and closing quotations of the first call on that day were cabled at £61 12s. 6d. for spot and £62 10s. for three months. Ever since there have been heavy realizing sales, which brought about a decline to £60 7s. 6d. for spot and £61 5s. for three months in the closing market of Wednesday.

For refined and manufactured sorts we quote: English tough, £65; best selected, £64@65; strong sheets, £76@78

Tin—In sympathy with the advance in copper, the London market for tin has shown substantial strength throughout the week under review. Transactions increased considerably in volume on Wednesday, and reports are current that the bull party is engineering an advance. The market closes firm at £134 for spot and £135 7s. 6d. for three months.

The domestic market has been dull, the only exception being on Tuesday when some spot material was thrown on the market at somewhat below import prices. Future deliveries, however, were held at a premium, and the market closes at about 29⅝ cents.

Lead—The market is unchanged at 4.25 @4.30c. St. Louis, and 4.35c. New York.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 9, that lead is strong at the latest advance, and is salable at 4.32½@4.35c. for Missouri brands.

The London market has been holding its own, and closes steady at £13 3s. 9d. for Spanish and £13 6s. 3d. for English.

Spelter—In spite of the higher prices which have ruled of late, the production of this metal has not increased and it is generally recognized that the current output is not equal to the demand. Stocks are decreasing steadily on the one hand, while the consumption is expanding. During the week, heavy orders were again placed, particularly by the galvanizing industry, and the market advanced from day to day reaching at the close 5.20@5.25c. St. Louis, 5.35@5.40c. New York.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 9, that spelter is firm and active. The latest sales are on a basis of 5.30@5.32½ cents.

New York quotations for spelter June 3 were 5.27½@5.30c.; June 4, 5.30@5.32½c.; June 5, 5.32½@5.35c.; June 7, 5.35@5.37½c.; June 8 and 9, 5.35@5.40 cents.

The London market is unchanged at £22 2s. 6d. for good ordinaries, £22 7s. 6d. for specials.

Base price of sheet zinc is 6¼c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—Business is waiting for some decision on the tariff. In the absence of sales quotations are nominally unchanged at 8⅛c. per lb. for Cookson's; 7⅞c. for U. S.; 7⅜@7⅝c. for outside brands.

Aluminum—Prices remain at 22@24c. base for No. 1 ingots; 31@32c. base for wire; 33@34c. base for sheets. Business is not especially active.

Cadmium—Current quotations 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Paul Speier writes us from Breslau, Germany, under date of May 20, that the price of cadmium, which in 1907 was 1500 marks per 100 kg., fell in 1908 to 575 marks. This year there has been a further drop, prices for metal guaranteed 99.5 per cent., being 450@475 marks per 100 lb—average, 50c. per lb. These are the lowest prices ever made

Quicksilver—New York prices are still unchanged at $44.50 per flask of 75 lb. Sales have been light. San Francisco quotations are $44 for domestic orders and $42 for export. The London quotation is £8 7s. 0d. per flask, but as low as £8 2s. 6d. is named by second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots, The price for electrolytic is 5c. higher.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

German Metal Imports and Exports

Imports and exports of metals—other than iron—in Germany, quarter ended March 31, in metric tons:

	Imports.	Exports.	Excess.	
Copper	39,131	15,298	Imp.	23,833
Copper, 1908	48,773	18,516	Imp.	30,258
Tin	3,301	1,610	Imp.	1,691
Tin, 1908	3,917	1,363	Imp.	2,554
Lead	16,930	7,677	Imp.	9,253
Lead, 1908	15,844	10,575	Imp.	5,269
Zinc	7,310	23,549	Exp.	16,239
Zinc, 1908	7,255	18,612	Exp.	11,357
Nickel	380	504	Exp.	124
Nickel, 1908	651	524	Imp.	127
Aluminum	410	1,388	Exp.	978
Aluminum, '08	267	613	Exp.	346
Miscellaneous	337	2,398	Exp.	2,061
Miscellan's, '08	263	2,465	Exp.	2,202

The figures include alloys and manufactures of the several metals. Imports and exports of ores—other than iron—for the three months, were, in metric tons:

	Imports.	Exports.	Excess.	
Gold ore	23	.....	Imp.	23
Gold ore, 1908	7	.....	Imp.	7
Silver ore	372	.....	Imp.	372
Silver ore, '08	469	.....	Imp.	469
Copper ore	3,757	1,819	Imp.	1,938
Copp'r ore, '08	4,397	7,680	Exp.	3,283
Tin ore	2,779	4	Imp.	2,775
Tin ore, 1908.	2,307	21	Imp.	2,286
Lead ore	25,424	430	Imp.	24,994
Lead ore, '08	30,559	186	Imp.	30,373
Zinc ore	36,855	6,702	Imp.	30,153
Zinc ore, 1908	40,384	5,330	Imp.	35,054
Nickel ore	2,027	.....	Imp.	2,027
Nickel ore, '08	4,875	.....	Imp.	4,875
Miscellaneous.	1,038	103	Imp.	935
Mis., 1908	1,470	109	Imp.	1,361

Imports of chrome ore was 6474 tons, an increase of 4097 tons. Imports of pyrites were 143,357 tons in 1908, and 108,123 tons in 1909; exports 3924 and 2396 tons for the respective years. Miscellaneous ores include uranium, molybdenum, tungsten and other minor metals, with some mixed or complex ores.

Zinc and Lead Ore Markets

Joplin, Mo., June 5—The highest price paid was $46 per ton, the assay base price ranged from $43.50 down to $42 base for heads and as low as $40 base for slimes of zinc sulphide. The average price, all grades, was $39.56. An effort early in the week to lower the level of prices was met by an almost unanimous refusal to sell, and on Thursday the market was restored to a level of the previous week, for the higher base, while the low base was advanced. The highest price paid for lead was $60 per ton for 250 tons. As much more was sold at $59, but the bulk of the shipment was at $58 per ton, with a considerable tonnage of ore off grade selling at a price which lowered the average to $57.20, all grades.

SHIPMENTS, WEEK ENDED JUNE 5.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,453,100	1,008,690	$99,676
Joplin	2,247,530	162,260	52,088
Galena	747,400	57,280	16,982
Prosperity	255,470	276,390	13,277
Alba-Neck	481,140	57,930	11,782
Duenweg	475,640	95,760	11,438
Miami	359,120	169,950	10,335
Granby	566,320	13,300	8,676
Aurora	509,310	.....	7,732
Carthage	341,700	.....	7,175
Badger-Peacock	268,270	.....	5,633
Spurgeon	208,700	79,440	6,606
Oronogo	206,850	3,020	4,725
Sarcoxie	169,930	.....	3,483
Quapaw	146,650	2,280	2,926
Zincite	94,140	.....	1,936
Totals	10,531,570	1,926,300	$263,472
23 weeks	259,893,330	42,023,810	$5,854,712

Zinc value, the week, $208,368; 23 weeks, $4,736,374
Lead value, the week, 55,104; 23 weeks, 1,118,338

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	Zinc Ore. All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 5—The highest price paid this week for zinc ore was $42.50; the base price of 60 per cent. zinc was $42 per ton. The highest price paid for lead ore was $58.50; the base price of 80 per cent. lead was $56@57 per ton.

SHIPMENTS, WEEK ENDED JUNE 5.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Strawbridge	960,000	.....	.....
Platteville	633,940	.....	227,500
Hazel Green	533,300	.....	.....
Benton	488,860	56,340	.....
Cuba City	347,240	94,955	.....
Linden	127,530	57,470	.....
Rewey	120,800	.....	.....
Harker	100,860	.....	.....
Galena	88,000	.....	.....
Livingston	80,000	.....	.....
Total	3,480,530	208,765	227,500
Year to June 5	61,280,809	2,316,480	4,145,500

In addition to the above there was shipped to the American Zinc Ore Separating Company—from Platteville 216,000 lb.; Linden 50,070 lb.; Rewey, 50,000 lb.—325,070 lb. and to the Joplin Separator Works, 153,000 lb. zinc concentrates.

There was shipped last week, not then reported, from Highland 192,400 lb.; from Linden, 125,400 lb.; from Harker, 228,660 lb. zinc ore. From Highland, 106,080 lb.; and from Harker, 51,600 lb. lead ore.

Chemicals

New York, June 9—The principal activity is in contract deliveries. New orders are not coming in freely in most lines.

Copper Sulphate—Quotations remain at $4.25 per 100 lb. in carload lots and $4.50 per 100 lb. in smaller parcels. Business is quiet.

Arsenic—A fair amount of trading has been recorded. Prices are 2⅞@3c. per lb. for white arsenic.

Nitrate of Soda—The market is firm and sales good at last quoted prices, 2.25c. for spot nitrate and 2.12½c. for futures.

Mining Stocks

New York, June 9—The general stock market has faltered a little in its upward course. The bull movement which was started last week has been interrupted by one or two days of reaction and in some stocks there was a good deal of liquidation and consequent lower prices. The indications are that this is only a temporary condition, and most operators are looking for higher prices again. At the close the tendency is rather uncertain.

A good deal of interest is being shown in the arrangement for listing Steel Corporation stocks on the Paris Bourse. There is much curiosity to see how this attempt to give Steel securities a wider market will succeed. On this market they remain very strong.

There was one sale of Homestake of South Dakota during the week at $91.50 per share for a small lot.

On the Curb the copper stocks were active but rather irregular in price. The Curb had its reaction also which carried down some shares, but left others untouched. The Nevada gold stocks are holding their own better. Cobalt stocks are in demand, and interest in them is being worked up in every possible way.

Boston, June 8—Outside of a sensational drop in Mass mining stock there have been no alarming developments in the local market. This stock was bulled to $18.25 a week ago and had a rapid decline to $8.50, the interval between these extreme prices being only three days. The finding of a new orebody some months ago was the cause for bulling the stock from around $6 to the high price mentioned above. A mill run of about 600 lb. of rock from this new vein yielded considerably less than 1 per cent. copper, which was disappointing and the cause of the subsequent break. A rally to $10 followed, but the price today was close to $9.

Sentiment on copper shares is very optimistic, and today's market showed a material broadening tendency.

North Butte had a $5 bulge today to above $61.75. The bear selling seems to

be at an end. Copper Range displayed good rallying power, advancing to above $83. Old Dominion rose $2 to $57.50, and Shannon touched $17. Stockholders of this company have authorized the directors to guarantee the principal and interest on $000,000 in 6-per cent. 10-year bonds to be issued by the Shannon-Arizona railway, convertible into Shannon Copper stock at $20 per share. They have also authorized an increase of 30,000 shares of Shannon stock for the exchange. These bonds are being offered to Shannon stockholders, of record June 15, in the proportion of one $1000 bond for 500 shares of stock. Shannon rights sold up to 30c. today.

North Lake mining attracted considerable attention by its $1.75 advance to $10.75. Advices state that the drill at No. 3 hole encountered copper.

The declaration of the regular quarterly dividend of 50c. by the Utah Consolidated had a stimulating effect, causing the stock to stiffen to $44.

Curb trading has been in the better class of stocks. Outside of sharp breaks in Davis-Daly and Ohio Copper there were no particular features.

Salt Lake City, June 24—During the month of May, 3,045,395 shares of stock sold for $2,123,162 on the Salt Lake Mining and Stock Exchange. The market was a broad one and holders of stock had no trouble in making sales. The feature of the month's trading was a slump in Iron Blossom, which declined after many heavy sales.

STOCK QUOTATIONS

NEW YORK	June 9	BOSTON	June 9
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.50	Adventure	8½
Amalgamated	86¼	Allouez	42⅝
Anaconda	50⅞	Am. Zinc	26⅞
Balaklala	‡2⅛	Arcadian	5
British Col. Cop.	8	Arizona Com	42⅛
Buffalo Mines	‡3½	Atlantic	9⅝
Butte Coalition	27¼	Boston Con	16
Colonial Silver	⅛	Calumet & Ariz*	109
Cum. Ely Mining	8½	Calumet & Hecla	675
Davis-Daly	5⅝	Centennial	34
Dominion Cop.	‡.07	Copper Range*	82½
Douglas Copper	3¾	Daly-West	27½
El Rayo	2	East Butte	14
Florence	3¾	Franklin	16¼
Foster Cobalt	.32	Greene-Can	10¾
Furnace Creek	.10	Hancock	‡12
Giroux	7⅜	Isle Royal	28¼
Gold Hill	⅛	Keweenaw	5
Goldfield Con	7⅜	La Salle	13¾
Granby	106½	Mass	9¼
Greene Gold	⅛	Michigan	10¼
Greene G. & S.	9	Mohawk	67½
Guanajuato	1½	Nevada	22½
Guggen. Exp.	200	North Butte	56½
Hanapah	.15	Ojibway	12¼
Kerr Lake	7⅞	Old Colony	‡.60
McKinley Dar	.98	Old Dominion*	56¾
Miami Copper	15	Osceola	140
Mizmac	¾	Parrot	36
Mines Co. of Am.	⅛	Quincy	93
Mitchell Mining	7⅝	Rhode Island	14¾
Mont. Sho. C.	‡1½	Shannon	17
Nev. Utah M. & S.	2½	Superior	41½
Newhouse M. & S.	2	Superior & Bost.	16¾
Nipissing Mines	10¼	Superior & Pitts.	14⅝
Old Hundred	1⅛	Tamarack	‡72
Silver Queen	.37	Trinity	13
Stewart	⅛	U. S. Smg. & Ref.	50¼
Tennessee Cop'r	41⅛	U.S. Sm. & Re., pd.	49¾
Tri-Bullion	¾	Utah Con	43½
Union Copper	1	Victoria	6
Utah Apex	6⅛	Winona	6
Utah Copper	52	Wolverine	‡148
Yukon Gold	4⅞	Wyandotte	3¼

*Ex. Div. †Ex. Rights ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agril. Chem.	43¾
Am. Smelt. & Ref.	96
Am. Sm. & Ref., pf.	112½
Colo. Fuel & Iron	43⅛
Federal M. & S., pf.	90
National Lead	19½
National Lead, pf.	106½
Pittsburg Coal	‡12⅝
Republic I. & S.	32⅞
Republic I. & S., pf.	106¾
Sloss-Sheffield	83½
Standard Oil	676
U. S. Steel	67¾
U. S. Steel, pf.	125¼
Va. Car. Chem.	51⅛

BOSTON CURB	Low.
Ahmeek	169
Black Mt.	1
Chemung	16⅞
Globe Con	4⅜
Helvetia	5⅛
North Lake	27½
Ray Contral	3⅛
Ray Con	17
San Antonio	11

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	June 5	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	1.85	1.50
Cent.C.& C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	6.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.35	.30
St. Joe	12.00	11.00

LONDON	June 9		
Name of Com.	Clg.		
Dolores	£1	6s	0d
Stratton's ld.	0	3	1½
Camp Bird	1	5	3
Esperanza	2	18	9
Tomboy	1	2	6
El Oro	1	6	3
Oroville	0	13	6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. June 9.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.12
Belcher	.50	St. Ives	.10
Best & Belcher	.35	Triangle	.01½
Caledonia	.09	BULLFROG STOCKS	
Chollar	.06	Gibraltar	03
Comstock	.31	Homestake King.	.01
Con. Cal. & Va.	.66	Mont. Shoshone C.	1.62½
Crown Point	.50	Tramp Cons	.05
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.08	Bonnie Clare	...
Hale & Norcross	.20	Lee Gold Grotto	...
Mexican	.79	Nevada Hills	.87½
Ophir	1.20	Nevada Smelting	1.00
Overman	.14	Nevada Wonder	.50
Potosi	13	Nevada-Utah	2 37½
Savage	.19	Penn-Wyoming	04
Sierra Nevada	.28	Pittsburgh S. Pk.	.50
Union	.31	Rawhide Caol't'n.	..
Utah	.04	Round Mt. Sphinx	10
Yellow Jacket	56		
TONOPAH STOCKS			
Belmont	.78		
Extension	.46		
Golden Anchor	...		
Jim Butler	.13		
MacNamara	.22		
Midway	.22		
Montana	.67		
North Star	.02		
Tono'h Mine of N.	7.12½		
West End Con	.27		
GOLDFI'D STOCKS			
Adams	.01		
Atlanta	.14		
Blue Bell	.03		
Booth	.13		
Columbia Mt.	.10		
Comb. Frac.	.59		
Con. Red Top	.01		
Cracker Jack	.02		
Dia'dfield B. B. C.	.04		
Goldfield Belmont	.04		
Goldfield Daisy	.32		
Great Bend	.08		
Jumbo Extension	.10		
Kendall	.05		
Lone Star	.04		
May Queen	.04		
Oro	.07		
Red Hill	.08		
Reanoke	...		
Sandstorm	.08		

COLO. SPRINGS	June 4
Name of Comp.	Clg.
Acacia	.07
Black Bell	....
C. C. Con	‡ .03½
Dante	.06½
Doctor	.08
Elkton	.63
El Paso	.50
Findlay	‡.15
Gold Dollar	‡.11½
Gold Sovereign	.03½
Isabella	.22
Jack Pot	.06¾
Jennie Sample	‡.07
Jerry Johnson	.06¼
Mary McKinney	.39½
Pharmacist	.03½
Portland	.90
Un. Gold Mines	.05½
Vindicator	.60
Work	.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida	May 8	June 5	$0.005
Bullion, Nev	June 14	July 13	0.05
Challenge Con., Nev	June 22	July 13	0.05
Chollar, Nev	June 8	June 30	0.10
Confidence, Nev	May 18	June 8	0.20
Con. Imperial, Nev	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 26	0.00½
Echo, Ida	May 1	June 1	0.002
Exchequer, Nev	May 5	May 26	0.05
Gould & Curry, Nev	June 8	June 26	0.10
Hecla M. & M., Utah	May 15	June 14	0.05
Julia Con., Nev	May 24	June 17	0.03
Mexican, Nev	June 28	July 14	0.10
Nev. Superior	Apr. 10	May 1	0.075
Palmyra G. & C., Utah	June 11	June 30	0.001
Paymaster, Utah	June 12	June 30	0.001
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Scorpion, Nev	June 14	July 6	0.02
Sierra Nevada, Nev	May 4	May 28	0.10
Uintah Trens. Hill, Utah	May 20	June 9	0.01
Union Con., Nev	June 28	July 19	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.595	50.468	25.570	23.227
April	55.505	51.428	25.133	23.768
May	52.795	52.905	24.377	24.343
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.876	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93¾	58.331	57.363
May	12.598	12.893	12.788	13.228	57.387	59.338
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	.....	.....	12.600	....
July	4.744	.....	.....	13.000	....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York 1908.	New York 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.876	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.978
June	4.543	.....	4.393	.....	19.000	....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

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The Lorraine Deposits of Oolitic Iron Ore

A District with Extensive Reserves of Nearly Self-fluxing Ores, Admirably Adapted to the Basic Steel Processes by their Phosphorus Content

BY TONY CALLOT*

The iron mines of Lorraine are of great interest to the miner, the metallurgist and the economist. The miner will consider the importance of the deposits, the various methods of working the seams and the special difficulties that were encountered in shaft sinking. The metallurgist will recognize the importance of finding an ore directly suitable to the Thomas basic converter process, and the economist will appreciate the many problems that may arise from an iron field spreading over four different European countries and constituting the largest iron deposit in the world. The reserve is estimated at 4,000,000,000 metric tons.

GENERAL VIEW OF SURFACE EQUIPMENT AT THE MOUTIERS IRON MINE—BRIEY DISTRICT

To realize the importance of this iron field the reserves of the most important fields of the world must be quoted; they are as follows, according to various authors: Great Lakes (U. S. A.), 1,000,000,000 metric tons; Bilbao (Spain), 25,000,000; Sweden, 800,000,000; Ural (Russia), 800,000,000.

The well known Bilbao district never contained more than 100,000,000 tons. The new Ouenza mines (Algeria) that are to be worked soon are situated in a wild country; they will not yield more than 60,000,000 tons and will necessitate the construction of a special railway 140 km long, while the mines of Lorraine with their enormous tonnage are situated close to existing railway systems, not far from the German collieries and in a rich and well developed part of the world. In addition coal seams have been discovered recently at deep levels under the iron seams, and although they present great difficulties in working they may be considered of importance for the future.

As will be seen on the accompanying map, which shows only the more important portion of the iron field, the mines extend over territory mainly in French and German Lorraine, and over a limited portion of Luxemburg and Belgium. These deposits have been known for more than a century and until the war of 1870-71 belonged almost entirely to France. When the new boundary between France and Germany was marked on the ground, the German representatives were accompanied by the chief engineer of mines of their Government with a view of getting most of the mines known at that time.

Influence of Basic Steel Processes

Since 1871 the development of the iron mines has been considerable, particularly since the invention of the Thomas basic converter process in 1880 which made possible the treatment of the phosphoric ores known in Lorraine as *minettes*. The discovery of the deep levels of the Briey district has given a new impulse to the output which in 1906 was about 27,000,000 tons. The relative importance of this deposit in the three leading countries is shown by the following statement of their reserves: Luxemburg, 300,000,000 tons from an area of 3600 hectares; Germany, 1,100,000,000 tons from an area of 43,000 hectares; France, 2,500,000,000 tons from an area of 43,186 hectares; giving a grand total of about 4,000,000,000 tons and an area of 89,786 hectares. Mr. Bailly, engineer of the French government, has estimated the probable development of the mines in these three countries and has graphically represented these reserves in an accompanying diagram.

The output is increasing every year in Germany and France and remains stationary in Luxemburg. The official statistics give Luxemburg an annual production of 6,000,000 tons; Germany's production in 1906 was 14,000,000 tons as against 7,500,000 in 1900. In 1900, France mined in this field only 4,500,000 tons, 7,800,000 in 1906 and 8,738,000 tons in 1907. Belgium produces only 70,000 tons yearly. Though the French output is the lowest, its ore reserves are probably the largest. This is due to the fact that the ferruginous deposit outcrops mainly in Luxemburg and Germany. In France the principal mines are "deep levels" which were only opened after carefully prospecting the Briey district during the years 1894 to 1899. How-

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ever, from a French point of view it is notable that these mines take every year a larger place in the general output of iron ores. The Lorraine production now constitutes over 85 per cent. of the French iron-ore output and about 70 per cent. of the total production of pig iron.

Description of the Deposits

As will be seen from the accompanying map, these deposits are located in the eastern part of France and western part of Germany. The country is hilly and consists of uplands divided by the valleys of several tributaries of the Meuse and Moselle rivers. They are in the "Basin of Paris," a large basin where the ancient seas have deposited sediments from the lowest Jurassic up to the upper Tertiary, all the ore seams being inclined toward the center of the basin.

The iron seams of Lorraine are at the upper level of the Toarcian and rest upon green pyritic marls and sandstone. Just above them are micaceous marls belonging to the Bajocian. The ferruginous deposits comprise a number of seams separated by more or less sterile marls or limestones. A drilling made at Villeroy (France) encountered these various seams and their analysis and thickness are given in the accompanying table.

DRILL CORE OF LORRAINE IRON DEPOSIT.

Description of the Seam.	Thickness in Meters.	Fe Per Cent.	CaO Per Cent.	SiO^2 Per Cent.
Micaceous marls. . . .	18.80	5 72	3 65	58 8
Poor limestone	2.10	13.78	33.39	11.02
Ferruginous limestone (I)	2 00	24.24	16 84	14 21
Poor limestone.	4.00	10 60	34 35	11 97
Poor red seam. . . . (II)	2.75	18.70	23.73	15.50
Ferruginous gray and blue marl.	4 60	19 28	18 01	26 18
Yellow seam. . . . . (III)	1 20	33 69	14 31	7.29
Gray seam . . . . . (IV)	4.20	39.10	6.95	6.97
Brown silicious seam (V)	1.95	30 86	8 78	20.27
Ferruginous marl. . .	8 25	21 10	12.75	27.58
Black vein . . . . . (VI)	1 15	32 58	12 47	4 95
Gray vein.	3 62	23 54	5 64	29 34
Upper Lias sandstone (wall of the deposit).	0 40	11 84	9.37	48.92

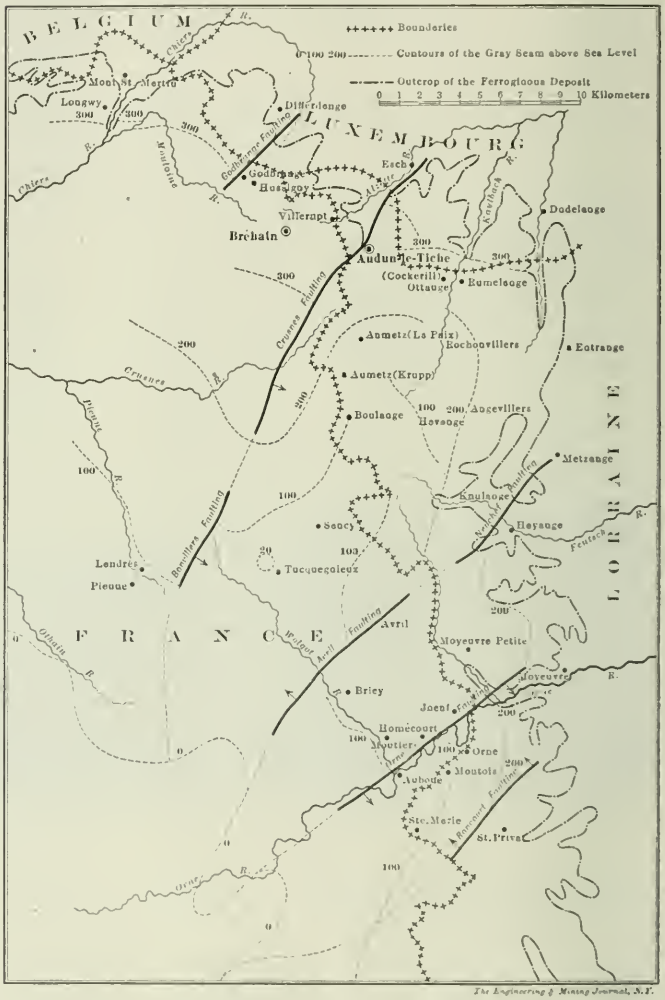
The percentages and thicknesses of the seams vary greatly with the locality where the sample is taken and the line of separation of the seams is not always precise. In the Briey district, the miners call the veins I and II the upper level, veins III and IV the middle level, and the veins V, VI and VII the lower level. It is difficult to say *a priori* which seam will be payable as this depends chiefly on the local conditions and management. Usually not more than three veins are worked at the same time in the deep mines. For example, at Micheville the output is about 1000 tons per day, divided as follows: Ferruginous limestone (I), 650; red seam (II), 250; gray seam (IV), 100 tons. The ore from vein I averages 29 per cent. iron; from vein II, 38 per cent., and 40 per cent. in the gray seam.

In general the total thickness of the whole of the ferruginous deposit varies from 25 to 50 m., being smaller near the ends of the formation. For example, the thickness never exceeds 10 m. at the south, near Nancy, while the exploitable portion is about 50 per cent. in quarries, and decreases to 15 and even 10 per cent. in the deep mines. The average inclination of the seams is 1 to 2 per cent. toward the west. They outcrop all along the Jurassic hills of Lorraine, and are divided by the geologists into several basins, as follows: In France, in the basins of Nancy and Longwy; in Luxemburg, in the basins of Differdange and Esch-Rumelange; in Germany, in the basin of Moyeuvre-Hayange.

The Basin of Briey

The basin of Briey in France is of much importance to the iron works of the region and is the continuation of all the above basins under 100 to 200 m. of barren limestone. The researches in this basin were the result of the absence of lime in the silicious and poor iron ores of Longwy. The numerous companies which own iron and steel works in French Lorraine close to the German boundary, knew there were many calcareous iron ores mined in Germany, and started drilling in the early '80s. They found the seams at varying depths and requested concessions, the first of which was granted in August, 1884.

The difficulties of sinking the shafts



SKETCH MAP OF THE LORRAINE IRON FIELD

were great as large quantities of water were encountered, as much as 3 cu.m. per min. having to be pumped out. These difficulties joined with an industrial crisis after 1888 caused the abandoning of all the attempts to sink shafts. Three years later de Wendel & Co. resumed their work at Joeuf, and after a second unsuccessful attempt, succeeded in 1896 in sinking the first shaft of the region to a depth of 70 m. The first ore was hoisted in 1898. The other companies profited by this first success and the Société des Hauts Fourneaux, Forges et Aciéries de Pont à Mousson in 1897 started a shaft by freezing the ground and completed it with success in 1900. This was the only shaft sunk by the Poetsch freezing process in this region. The other companies were able to sink their shafts by pumping out about 3 cu.m. per min. Some companies met with still larger quantities of water. For example, at Moyeuvre (German Lorraine) they pumped out an average of 12 cu.m of water per min., the maximum being 30 cu.m. per min. in the wet season. All these shafts range between 100 and 250 m. deep.

The basin of Briey has been divided by geologists into four subsidiary basins, this separation being based on the numerous faultings which are encountered and which are of considerable importance from two points of view: that of geology, and of hydrology. The main faults are shown on the accompanying map, as well as the outcrop of the ferruginous deposits, and in dotted lines the contours of the gray seam. These faults are the boundaries of the basins, which are named Bassin de l'Orne, de Moutiers-Avril, d'Aumetz-Tucquegnieux and de Landres.

The geologists who have studied the basin of Briey attach much importance to these faults in explaining some of the peculiarities of the deposits, and especially the fact that the veins are richer along the valleys than under the uplands. It should be noticed that the main faults are almost parallel to the valleys of the region. There are, however, two systems of faults at right angles, the main one being southwest-northeast and the others southeast-northwest. As the zones of richness of the ore have the same setting, Mr. Villain, mining engineer of the French government, presented in 1902 a theory in which he considers these faults as feeders through which the thermal waters, saturated with carbonate of iron, welled up under the Toarcian, the carbonate decomposing into a pulverulent oxide of iron. Thus the iron oxide would be situated along these faults and close to them. The accompanying section through Luxemburg will show the importance of these faultings and explain why the ferruginous seams are in the same locality sometimes worked by quarries, by galleries on hillsides, and by shafts.

Hydrology of Lorraine

The hydrology of Lorraine is of importance to the mineowners by reason of the quantities of water that are met with both in sinking shafts and in developing the mines. The presence of water is due to three causes: (1) The rivers, mainly the Orne and its tributary, the Woigot; (2) an underground sheet in the Jurassic limestone; (3) a deeper sheet in the ferruginous formation. The latter two are insulated, one from the other, by the micaceous marls of lower Bajocian, but are put into communication by means of the faults.

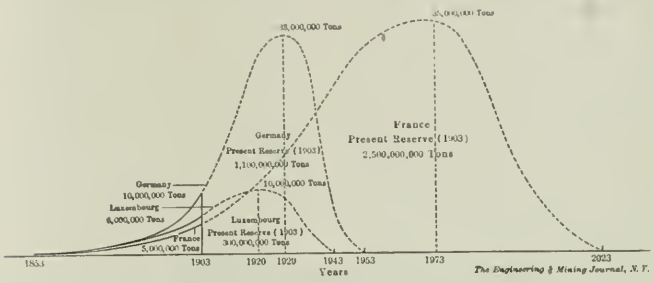
The varying conditions throughout the Basin of Briey, due to the various inclinations of the faults and positions of the rivers, cause great differences in the quantities of water that are to be pumped out in the four secondary basins. The average quantities of water in cubic meters per minute that are encountered in sinking shafts in the various basins are: Orne, 2.75; Aumetz-Tucquegnieux, 6.66; Landres, 1.75; Moutiers-Avril, 1.33. In development work less water is encountered; the Orne basin is an exception, however, the average flow there being about 4.75 cu.m. per minute.

The Phosphorus Content

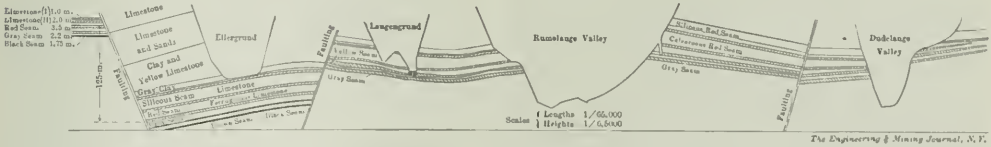
The main feature of this ore is the constant presence of phosphorus. The ore is a hydrated oxide of iron, Fe_2O_3, with a clayey, calcareous, or silicious gangue. It is an oolitic ore, varying in color from yellow brown to red brown. Under the microscope the concentric seams of hydrated oxide are seen surrounding a small earthy grain. An average complete analysis of the Lorraine ore would show: Loss by ignition, 18.37 per cent.; SiO_2, 5.60; Al_2O_3, 4.61; Fe_2O_3, 39.77, FeO, 10 to 16 (Fe = 31 to 40); P_2O_5, 1.85 (P = 0.8); MnO, 0.42 (Mn = 0.32); CaO, 12 to 18; MgO, 1.22; H_2SO_4, 0.22 (S = 0.08).

Phosphorus is present as phosphate of lime and phosphate of iron. It is in close relation with the iron and its percentage varies with that of iron in the oolitic ore. However, in the poor ores its proportion increases, owing to a larger quantity of phosphate of lime. In the gray seam, which is the favored one in Lorraine, the proportion of phosphorus to iron is practically constant, the average analysis being: Fe, 33.62 per cent.; P, 0.73; or a phosphorus content of about 2.15 per cent. per unit of iron.

This proportion is so constant that the blast-furnace men rarely determine phosphorus in the smelting charges. They know that in a charge containing 30 per cent. iron there is approximately 2 per cent. of phosphorus per unit of iron, and that the pig iron will run about 1.8 per cent. phosphorus. Notwithstanding this constancy in the ore, the presence of silicon in the pig, varying from 0.3 to 0.8 per cent., causes variation in the percentage of phosphorus in the basic bessemer slags. These slags will usually average as follows: P_2O_5, 16.19; CaO, 47.05; MgO, 3.75; FeO, 11.35; MnO, 6.46; Al_2O_3, 7.60; SiO_2, 7. These slags are sold to manufacturers of fertilizers at a profit of about $5 per metric ton, corresponding to



GRAPHICAL REPRESENTATION OF THE ORE RESERVES IN THE LORRAINE FIELD



CROSS SECTION THROUGH LUXEMBURG—NORTHEASTERN SECTION OF THE LORRAINE IRON FIELD

about 33c. per ton of ore smelted. As the cost of a ton of ore is in some cases in the neighborhood of this amount, it will be seen that the sale of the slags nearly pays for the mining of the ore in the most favorable instances.

Open-cut and Hillside Exploitation

The ferruginous veins are worked either by open cut, by galleries in the hillside, or by shafts. According to the French mining law of 1810, all the metallic mines, including coal, belong to the State, and concessions are granted by the government after the demandor has proved the existence of the mine, his financial capabilities, and also when the government engineers are satisfied the enterprise can be profitable. The owner of the ground above the mine has no right of preference on the mine except that where the iron ore can be worked by open cut it belongs to the owner of the ground down to the depth where the work is no longer on a paying basis. Below this point the mine is the property of the State and can be granted to another man than the owner of the ground. Similar arrangements exist in the laws of Germany and Luxemburg, so that, in practice, the quarries of Lorraine iron ore are not deeper than 10 to 17 m. Quarry properties are extensively worked in Luxemburg, and in France, near Longwy.

The hillside mines are numerous in Luxemburg, also in France, in the valleys of Alzette, Orne, and Moselle, and in the Orne valley in Germany. Some of the mines are worked from very long main galleries, such as that of the mine d'Hayange at Knutange, which is 2 km. long and has a cross-section 3 m. high by 2.5 m. wide; that of the Société Stumm Frères from Entrange to Rochonvillers is 5.5 km. long, and that of the Société Roechling & Cie., from Beuvrange to Angevillers is 5.5 km long with a section 2.5 m. high by 3.20 m. wide. In the latter electrically driven rope haulage is used. The Roechling tunnel is to be extended to a total length of 10 km. It has advanced at the rate of 1 km. per year and at a cost of 350 fr. per m. The cost of haulage is 2 centimes per ton per kilometer.

Secondary galleries, shown as *R* in the accompanying sketch, are driven from the main haulage gallery. These secondary galleries are from 2 to 3 m. wide. At intervals of from 8 to 15 m., large galleries *V* are mined with a width of 3 to 7 m. The angle between galleries *V* and *R* is determined by the inclination of the seam and the direction of the cleavage. The pillars thus formed are 5 to 8 m. wide and from 50 to 100 m. long, according to the conditions obtaining at the particular mine. They are mined in coming back toward the gallery *R*, the farthest pillars being cut down first. The rooms *C*, which are formed, are soon filled up by the caving of the roof, the rule being that every room is protected on two sides by ore *in situ*. As long as the gallery *R* is used for haulage, protective pillars *P* are maintained and are broken down later.

The size of the face of the pillars is determined by the solidity of the roof, and also by the greater efficiency of the workmen on large faces. It was found that the greatest efficiency was obtained with a width of 8 to 10 m., but the character of the roof does not always allow even a width of 6 m. In some mines, such as that of Val-de-Fer, in the Bassin de Nancy, and that of Mont St. Martin, in the Bassin de Longwy, where regular and almost horizontal seams are met with, electric ore cutters and electric drills are used. The cutters are of the Morgan-Gardner type fitted with chains. The power required is from 20 to 40 h.p., according to the hardness of the ore and the speed. In a 2-m. seam they gave a monthly output of 6000 tons per machine at a lower cost than by hand. Several seams in a mine are worked at the same time and in some cases hand picking of the ore is necesary. Electric locomotives and electric pumps are used in many mines and the galleries are usually lighted by electricity. The miners, however, have individual acetylene lamps. Ventilation is effected without fans by shafts connecting the different levels.

MINES IN THE BRIEY DISTRICT.

Names of the Mines.	Area of Property, Hectares[a]	Tons Hoisted at the End of 1908, Metric Tons.	Depth: Of Shafts at Work, Meters.	Depth: Attained at the End of 1908, Meters.	Water Pumped per Minute, Liters[b]
Homécourt.	894	5,854,315	122 193	.....	2,100
Auboué-Moineville.	1,437	4,313,838	128	.....	5,700
Moutiers.	696	2,603,482	100	.....	910
Joeuf	1,744	2,745,740	69	.....	300
Tucquegnieux-Bettainvillers.	1,659	913,480	240	.....	4,850
Landres	553	833,485	214	.....	4,718
Pienne.	862	480,851	220	.....	1,300
Sancy	735	217,930	240	.....	1,200
Ammermont-Dommary.	1,021	3,600	245	.....	1,333
Jondreville	501		234	.....	140
Jarny	812		.....	174	900
La Mourière	474		.....	133	50
Murville	496		.....	111	500
St. Pierremont	917		.....	114	84
Valleroy	886		.....	.....	
Drostaumont	1,170		.....	.....	
Andernay-Chevillon	916		.....	10	

[a]One hectare = 2.47 acres.
[b]One liter = 0.264 gal.

HAND DRILLING IN THE MOUTIERS MINE, BRIEY DISTRICT

ELECTRIC DRILLING AT THE MOUTIERS MINE

Shaft Mines

The deep mines are located in the Bassin de Briey and furnish the excellent iron ore of that district. The advantages of this ore may be summarized as follows: (1) The ore is hard and compact and may be delivered to the blast furnace in lumps. (2) The percentage in phosphorus is always the same and is the very proportion convenient for producing basic bessemer pig iron, allowing the production of that quality without any analysis or mixture with other ores. (3) It gives valuable phosphorus slags as a by-product of the basic bessemer process. (4) Its richness

permits a smelting charge carrying 33 to 35 per cent. iron, instead of 28 to 30 per cent., as with other Lorraine ores, and a coke consumption 12 per cent. lower than the usual quantity. The corresponding economy is about 5.50 fr. per ton of ore, or 15 fr. per ton of pig iron for works situated close to the ore and buying its coke at 27 fr. per ton.

For a plant situated near the coal deposits in the North and buying the ore, the economy is 6.5 fr. per ton of ore. The ore of Briey is sold at a premium of 3 fr. over the other iron ores of the region. Its qualities, increased by its calcareous character, give it a wide market not only in France, but also in Belgium, Luxemburg and in Germany as far north as Westphalia. Some of the German steel producers are interested in these mines and special railway tariffs were introduced in Germany for the importation of the Briey ores.

The output in 1906 was over 3,000,000 metric tons with only four mines (Joeuf, Homécourt, Auboué, Moutiers) in operation. At present 10 mines are at work and others are preparing for production. There will soon be 19 mines at work in this district which will make a large increase in the output. All these mines belong to iron and steel producers and, up to 1909, 43 mines have been granted to 32 companies. Through the courtesy of Georges Rolland, president of the Aciéries de Longwy, the accompanying table is given, presenting some particulars about these deep mines at the end of 1908. The concessions granted by the government have an average area of 900 hectares (about 2223 acres). They are usually worked by means of one shaft for hoisting and one for the proper ventilation of the mine. As usual in France these shafts are circular with a diameter of 5m. generally.

Handling the Water

As explained above, the main difficulty that was met with in sinking the shafts was the presence of water. To keep the pit dry while sinking a "deep-well pump" is installed. It consists of a number of pumps placed at different levels, the power being applied by a vertical rod as in Cornish pumps. Each pump feeds the pump placed above it. The first one is fed by a centrifugal sinking pump suspended in the pit and driven by a 3-phase motor. As the work advances the shaft is lined either with bricks or often with cast-iron panels, behind which a layer of cement is deposited to fill the space between it and the ground.

As soon as the ferruginous seams are reached the permanent pumps are installed. As the life of the mine depends upon the reliabilty of these pumps, only first-class machinery is installed. They are steam-driven and usually have a capacity of about 10 cu.m. per min. However, a plant of 28-cu.m. capacity per minute has been installed in one mine at a cost of $200,000. The working cost is low, being 3 to 4 centimes (0.6 to 0.8c.) per cu.m. when pumping against a head of 100 meters.

As the quantity of water to be pumped out may double in the wet season, a second pump of same capacity but of cheaper type is always installed. It is usually a multi-stage centrifugal pump, electrically driven. In addition the set of sinking pumps is kept for use in case of breakage of one of the other pumps.

The shaft used for ventilation is not sunk until the first one is completely fitted up with all the pumping machinery. A drill hole is then made in the center of the proposed shaft and a gallery is driven to connect the main shaft with the bottom of the bore hole. Thus all the water that is met with in sinking the second shaft goes down through the bore hole and gallery to the bottom of the main shaft whence it is pumped out by the existing machinery.

Mine Equipment and Costs

The main shaft is equipped with the usual machinery, the cages contain two ore cars having a capacity of about 2 metric tons of ore; the daily output is usually about 2000 tons in 20 hours. The method of working the seams is the same as in the case of hillside mines.

The sinking of the two shafts to 200 m. and their complete equipment with the necessary machines, buildings, workmen's houses, general expenses, etc., cost as a rule about $1,000,000. To prevent damage to the buildings on the surface, large pillars are left in the mine to avoid as far as possible the effects of the caving of the roof. The installation of hydraulic filling plants has been carefully considered by the mine owners and the problem has been solved at the Auboué mine by using granulated slags and a marlish limestone which can be got cheaply in the country. The cost amounts to 10c. per ton of ore.

At some of the mines large electric power plants have been installed for supplying power to the various parts of the

UNDERGROUND ELECTRIC HAULAGE IN THE BRIEY DISTRICT

UNDERGROUND LAVATORY AT THE MOUTIERS IRON MINE

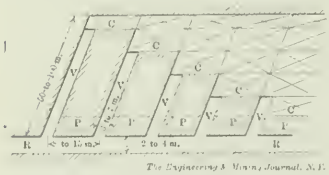
MINING COSTS UNDER VARIOUS CONDITIONS.

	Shaft mine, 100-m. deep, no pumping, 1-m. seam, excellent roof, annual output, 300,000 tons.	Shaft mine, 100-m.; pumping 3 cu.m.; 3.5-m. seam; 65 per cent. left in pillars; annual output, 40,000 tons.	Hillside mine, 3-m. seam, excellent roof; annual output, 300,000 tons.	Hillside mine, 1.8-m. seam, bad roof, annual output, 800,000 tons.	Hillside mine, 1.2-m. seam, bad roof; annual output, 80,000 tons.
	cents	cents.	cents.	cents.	cents.
Mining and underground transport	24	34	30	43	53
Various upkeeps	5	8	1	12	10
Hoisting and pumping	2	8			[illegible]
Outside transport	2	2	2	1	..
General expense	4	4	4	4	10
Total	37	56	40	60	73

property. As all the mine owners are iron smelters most of the power plants are driven from power obtained by gas engines utilizing the gas from the blast furnaces, with an economy of 50 per cent. over steam power. There were in 1906, 5500 workmen employed in the mines. The laborers are paid 3 fr. and the best miners 10 to 12 fr. The average is 5 fr. The efficiency of a miner is calculated to be about 1000 tons of ore per year. All the mines are connected with the lines of the Eastern Railway Company by private tracks, the longest of which does not exceed 3 kilometers.

In the accompanying table are some details of the cost of one metric ton of iron ore delivered on car on the nearest lines of the Eastern Railway Company under various conditions in France, according to Mr. Bailly.

Other mines 180 m. deep with an annual output of 550,000 tons from a 3-m. calcareous seam, and pumping 12 cm. m. per min., get a cost of 60c. per ton, of which 15c. is due to pumping by steam. It is estimated that at 200 m. with an annual output of 600,000 tons and pumping of 10 cm. m. per min., the cost will be as follows: Mining, transport and maintenance, 35c.; general expenses, 3; pumping (steam), 14; depreciation on plant in 20 years, 13; total, 65 cents.



PLAN OF THE GALLERIES

In France the iron and steel works, treating the ore of this district in 1907, embraced 21 reduction plants belonging to 19 companies. Ten of these companies produce only pig iron. The number of blast furnaces was 76, of which 68 were running, producing 2,500,000 metric tons of pig iron. The steel works comprised 30 Thomas converters, 8 open hearth furnaces, 31 steam hammers and 43 rolling mills, giving an output of 1,212,500 tons of steel, or 51 per cent of the French steel production.

Figures collected for THE MINERAL INDUSTRY show that the output of carborundum in the United States in 1908 was 4,907,170 lb., valued at $294,430. In 1907 the production was 7,532,670 lb., valued at $451,960.

The Chinese government proposes to develop the oilfields of Shensi. Foreign capital is not wanted. If Chinese capital is not to be had, the government will undertake the work.

The Broken Hill Proprietary Company

The report of this New South Wales company for the half-year ended Nov. 30 1908, and the chairman's address to the shareholders discuss the labor troubles that occurred at the commencement of the year and which led to a stoppage of operations. At the close of 1906, owing to the high price then ruling for lead, the directors granted a general advance of wages, averaging about 12½ per cent. The agreement made with the men was for two years and was to expire Dec. 31, 1908. During 1908 prices fell, and the directors decided that a return to the old scale of wages paid in 1906 was necessary, in order to make the company's business remunerative.

The Mineowner's Union was not unanimous about reducing the scale of wages and the other Broken Hill companies, with the exception of Block 10 Company, agreed to continue the advance given under the previous two years' agreement. The Proprietary Company and the Block 10 Company made, however, an offer to the men to pay on the previous basis with a sliding scale based on the price of lead, which offer was declined by the miners. The dispute was then taken to the Arbitration Court, after an offer had been made by the directors to abide by the award of that Court and had been refused by the miners' union. The Arbitration Court decided in favor of the higher wages as paid by the other mining companies. Against this decision the directors have appealed to the High Court, being advised by their counsel that the judge had gone beyond his jurisdiction in his award. The decision of the High Court is being awaited. The scale of wages acceptable to the union depends on an assumed "living wage." On this point the chairman makes the following remarks. "The term 'living wage,' as referred to by Mr. Justice Higgins, is no doubt a most pleasant sounding term in theory, but in practice it is quite impracticable. The factor that guides in this matter must be what can the worker give in labor for the value he receives, and if the industry cannot pay the rate fixed by the worker, then the industry must be discontinued and the worker be without employment. No legislation or arbitration court can artificially set aside for any length of time the natural law governing such matters, and all attempts in this direction must ultimately end in failure and disaster; as what is the value of an award on paper with no employment.?"

Before the Arbitration Court sat, an undertaking was given by the miners' union to accept the award of the court, but the company merely undertook to resume operations, in accordance with the courts' award, as far as regards the production of zinc concentrates and so far as regards the smelting and treatment of lead concentrates purchased from other companies. These latter contracts will expire with the present year, except one which expires in March next year. The company would not assure the court that it would resume full operations as before. The life of the mine as an ore-producing concern is estimated at five years, and only 2½ years at the present rate of extraction. A continuation of operations on a reduced scale appears, however, to have been promised, and on this understanding the court considered the case; and its main object being to decide what was a proper wage for human labor under the conditions prevailing and not to dictate to the company what work should be carried on. The award of the court, as stated above, was not accepted by the company, on the plea that the judge had exceeded his powers and an appeal to the High Court was lodged.

With regard to the operations of the company the first unit of the spelter plant at Port Pirie was completed during the half-year and an addition of nine furnaces decided on. The smelters put through an increased quantity of material, treating 132,979 tons as against 115,266 tons for the preceding half-year. The refinery turned out from the bullion treated 47,833 tons of soft lead, 2,589,416 oz. fine silver and 1054 oz. gold. The disposal of the lead for the six months ending Nov. 30, 1908, has been as follows: To Europe, 38,852 tons; to India China and Japan, 7508; to Australia and New Zealand, 3750; total, 50,110 tons. Trade with the Far East has been well maintained.

In the mine development work in the lower levels has not proved as satisfactory as was anticipated, but at the 900-ft. level good ore, though of no great extent, is being found.

The average prices received during the six months were for lead £13 4s. 7d. per ton; for silver (standard) 23.93d. The gross profit amounted to £34,430, and the net profit to £25,701 The fire in Block 11 is not giving any anxiety and is not likely to do so in the future. The ore reserves, which on May 31, 1908, were shown as 3,000,000 tons have been reduced to 2,735,153 tons by the mining during the six months of 264,847 tons. During the half year no considerable new orebodies have been found. The average cost of mining, inclusive of development work, etc., has been 15s per ton or about 1s. 8d. per ton less than in the preceding half-year

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According to *The Iron Age*, May 6, 1909, the largest ore freighter, the "Shenango," was launched at Detroit, Mich., May 1. The boat is 607 ft. long, 58-ft. beam and 32 ft. deep. Capacity, 13,000 tons of ore or coal, or 488,000 bushels of wheat.

The Zacatecas District and Its Relation to Guanajuato and Other Camps

By C. W. Botsford*

This is not an article on the Zacatecas district in its entirety, but merely some notes on the geology near the city of Zacatecas, and its relation to that of Guanajuato and other parts of Mexico. The similarity between many of these districts in Central Mexico is very pronounced especially in the succession of the formations and the faulting and vein-systems.

Topographically, the Zacatecas area is situated in a rather low range of mountains that rise about 1000 ft. above the central plateau of Mexico. These are well rounded and smoothed by the action of the elements and fade gradually away into the smooth low foothills, and these gradually into the surrounding plains. Extensive faulting has occurred here, but it is not perceptible in the present topography.

Succession of Formations

Cretaceous shales have been exposed by erosion both to the east and west of the city. This is the oldest formation exposed in the district. They are the same black, calcareous, thinly-bedded shales that are found to such extent at Guanajuato. They have been much folded and bent, and sericitization and silicification has been extensive in some parts of the district. These shales underlie the whole country but have only been exposed near the borders of the mineralized area. They were followed by much erosion before the volcanic activity began.

The first volcanic activity produced great quantities of andesitic breccias. These consolidated breccias are precisely similar in appearance and composition to the rock at Guanajuato, called the Guanajuato conglomerate. At Zacatecas, these breccias are on the average a little finer and contain greater percentages of ash and tuff than the average agglomerate at Guanajuato. There is also, I think, more perfect evidence of water action.

At Zacatecas, the series of rhyolitic and andestic breccias present at Guanajuato do not occur. These formations, I think, are always local and are the indications of an intermediate and comparatively quiescent stage when only a few local volcanic districts were in eruption.

The diorite intrusion followed the andesitic breccias probably at a lapse of considerable time. Near the city, this intrusion seems to have forced its way in between the shales and the conglomerate and to have penetrated irregularly upward. There has been much contact metamorphism, producing many varieties of changes from the red agglomerates into greenish, indurated rocks similar to the La Luz schists of Guanajuato. This change is well exposed in the streets at the eastern end of the city and along the road to Guadalupe.

Following the diorite intrusion came the folding, followed by extensive erosion. At this time Zacatecas probably assumed approximately its present topography.

The later rhyolites mark the resumption of volcanic activity. They are a very extensive series of rhyolitic breccias and tuffs, the latter called *cantera* in many parts of Mexico. This formation from Zacatecas to the north has only been left by the erosion on the top of the Bufa. South of the town the whole country is still capped by this material. This formation was also present at Guanajuato but has been largely removed by erosion except in a few areas on the tops of the mountains.

In tabular form the succession of formations at both Zacatecas and Guanajuato, from the youngest down, are as shown in the accompanying table.

SUCCESSION OF FORMATIONS AT ZACATECAS AND GUANAJUATO.

Zacatecas.	Guanajuato.	
Later rhyolites	Later rhyolites	Miocene (?)
Unconformity.		
Diorite intrusi'n	Granite intrusion Diorite intrusion	
Missing formations	Andesite breccias Pinguico rhyolites Bufa sandstone	Eocene
Guanajuato conglomerate	Guanajuato conglomerate	
Unconformity.		
Cretaceous shales	Cretaceous shales	Cretaceous

Two Stages of Vulcanism

There seems to have been two well defined stages of volcanic activity in Central Mexico, each of which is traceable over extensive areas. The older was the long series of andesitic eruptions which have resulted in the Guanajuato agglomerate and similar formations in various parts of Mexico. These rocks are widespread and persistent in large areas of Central Mexico from the State of Jalisco northward to Durango.

Following these came a comparatively quiet period when the volanic activity only occurred in local districts. This was the time of the series of eruptions at Guanajuato, the Pinguico rhyolites and andesites, which are missing at Zacatecas. The last effort of this first stage of vulcanism was, I think, the intrusion of the granites and diorites. These have evidently been the cause of many of the ore deposits.

After this final effort of the intrusions, the country seems to have had a long rest from volcanic disturbances. Then came the principal faulting caused by the settlement and adjustment of the strains resulting from the long period of vulcanism. During this long rest extensive erosion took place.

The second period or vulcanism gave the later rhyolites. Their extent was enormous, nearly the whole of the western part of Mexico having been covered by these eruptives. From Guerrero on the south, far into Chihuahua on the north, and from the eastern parts of the States of San Luis Potosi and Guanajuato to the Pacific Slope on the west, the whole country has been generally covered.

CANTERA VEIN AND SURROUNDING FORMATIONS

The principal development of these rhyolites was along the western axis of the Sierra Madre. Known thicknesses of 5000 ft. are common for this formation. Very recent basaltic flows have followed these rhyolites but are of only local interest.

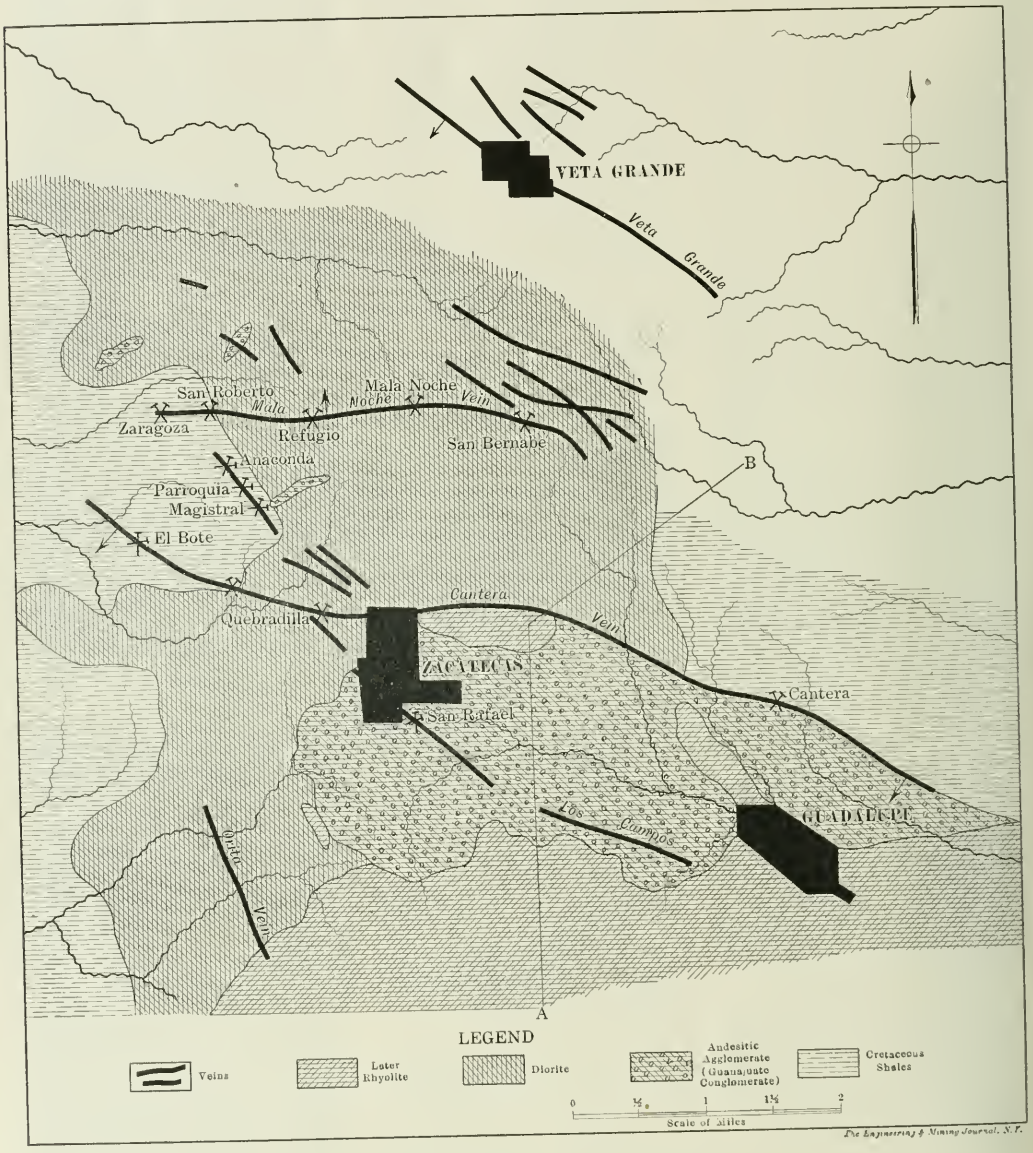
Faulting and Vein-formation

The principal faults of both Zacatecas and Guanajuato are those striking northwest-southeast, and dipping westwardly. These are always normal faults. This system of faults is persistent and extensive through all the central portion of Mexico. At Zacatecas this system is illustrated by the Cantera and Veta Grande veins. The Mala Noche vein dips in the opposite direction, and is more in the nature of a cross-vein and was probably caused by relieving a twisted strain. As at Guanajuato, the ore deposits are replacements along these fault planes. At Zacatecas, unlike Guanajuato, the ores

*Mining engineer, Springville, N. Y.

tend to run into base-metals. The Veta Grande and the west end of the Cantera vein carry only silver and a small content of gold. The Magistral and Mala Noche veins run into copper and iron bases; at the eastern end of the Cantera vein the ore runs base with lead and zinc.

The accompanying sketch map and cross-section gives a general idea of the geology of the district. This is taken partly from a map published in the JOURNAL of Aug. 29, 1908, and partly from my own notes.



GEOLOGICAL SKETCH MAP OF THE ZACATECAS DISTRICT

Statistics collected for THE MINERAL INDUSTRY show that the production of coal in the United States during 1908 amounted to 414,454,064 short tons ($541,692,127), as compared with 480,033,945 short tons ($640,803,723) in 1907. Of the 1908 production 80,329,578 short tons were anthracite, with an average value of $1.98 per ton at the pit mouth, and 334,124,486 short tons bituminous coal, worth $1.14 at the mines. The price of the anthracite in 1907 was $1.99, and of the bituminous coal $1.19 per short ton, the production being 86,341,832 short tons of the former variety and 393,692,113 short tons of the latter.

Goldfield and the Goldfield District of Nevada

Since Discovery of Goldfield Approximately 50 Per Cent. of the State's Output of Gold Has Come from This Camp; Dividends Paid, $12,000,000

BY JOHN TYSSOWSKI

During recent years mining developments in Nevada have attracted widespread attention. The State has once more been through a boom and this time has weathered the storm. In the late spring of 1903 Goldfield was discovered, and by the end of that year had already begun to produce precious metals. Since 1904 this one camp has far outdistanced all the remainder of the State as a producer of gold.

The accompanying tables show, for the years 1902-1908, inclusive, the commercial value of the gold, silver, and total gold-silver production of Nevada, and of Goldfield alone; also the percentage that Goldfield has contributed to the total output of the State. It may be noted that Goldfield has produced $27,000,000 in the last five years (1904-1908), or 48 per cent. of Nevada's total gold yield for that period. As a producer of silver, it is seen that Goldfield is inconsequential, contributing only 0.52 per cent. of the total output of the State.

The growth of the mines of Goldfield has been vigorous and constant. Only in 1905 and again in 1908 did the production fail to increase over that of former years. However, the cause for this is plainly apparent. In 1905, the year after the first wild rush into the district, people began to put in permanent equipment and to develop their properties; leasing was also less active, and companies began to store low-grade ore to await completion of reduction works on the ground. In 1908 the setback was due to the financial depression. At the same time when we consider that the year's production from Goldfield represented only nine months' work, it is evident that even in hard times the camp continued to grow. During the first three months of 1908, Goldfield suffered from a bitter labor controversy, and it was at this time that General Funston took the regulars into Goldfield in order to maintain order. The dispute was at last satisfactorily arranged for both sides.

Visitors to southern Nevada formerly came away with the impression that Goldfield was merely a temporary camp. Comparison was often made with Tonopah, bringing out the permanent and solid appearance of the older camps as compared with the makeshift conditions found in Goldfield. This was true at first, when most of the properties were being worked on leases, but it does not apply at present.

The present population of Goldfield is estimated at 6000 and is of a much more permanent character than it was during the rush days when it was supposed to amount to about 10,000. The completion of the proposed railroad to connect Goldfield with Ely, will, no doubt, add materially to Goldfield's prosperity.

The Goldfield mills, when those under construction are completed, will be capable of treating 1000 tons of ore per day. The Nevada Reduction has a capacity of 100 tons; the Combination, 80 tons; the new Goldfield Consolidated, 500 tons; and the Florence, 200 tons. The new Goldfield Consolidated and Florence mills are of the latest type; they have been described in the JOURNAL.[1] The accompanying map and index sheet show the location of the greater part of the mining claims in the Goldfield district. The area included in the map is about 10½x7¼ miles, and 437 claims are shown. On the index sheet several of the companies have no number in the column designating the claims on the map. This is accounted for by the fact that the claims are not located within the area shown by the map, or else the company has been merged into some other one, under the name of which it is to be found.

The best indication, and to the public the only satisfactory one, of a mining camp's permanency, is its record as a dividend payer. Already this year one company, the Goldfield Consolidated, has paid a dividend of $1,063,803.90, and has declared another of equal amount (3 per cent.), payable July 31. The dividends paid by Goldfield companies in 1908, a year in which many companies all over the world discontinued dividends, totaled $1,578,500, made up as follows: Florence Goldfield, $420,000; Engineer's Lease, $570,000; Rogers' Syndicate, $300,000; Mohawk Jumbo, $78,000; Frances Mohawk, $45,500; Florence Annex, $50,000; Red Top Consolidated, $20,000; Little Florence, $30,000; Mohawk Combination, $65,000. Other dividends, of which I have no record, may have been paid. This is a splendid record when it is considered that the two largest properties in the camp, the Goldfield Consolidated and the Florence companies, were building new mills and did not pay dividends.

The dividends declared in 1907 amounted to nearly $1,500,000. Previous to 1908 almost $8,000,000 had been paid to the investing public by Goldfield companies. Thus, to date the mines have paid dividends, amounting to approximately $12,000,000.

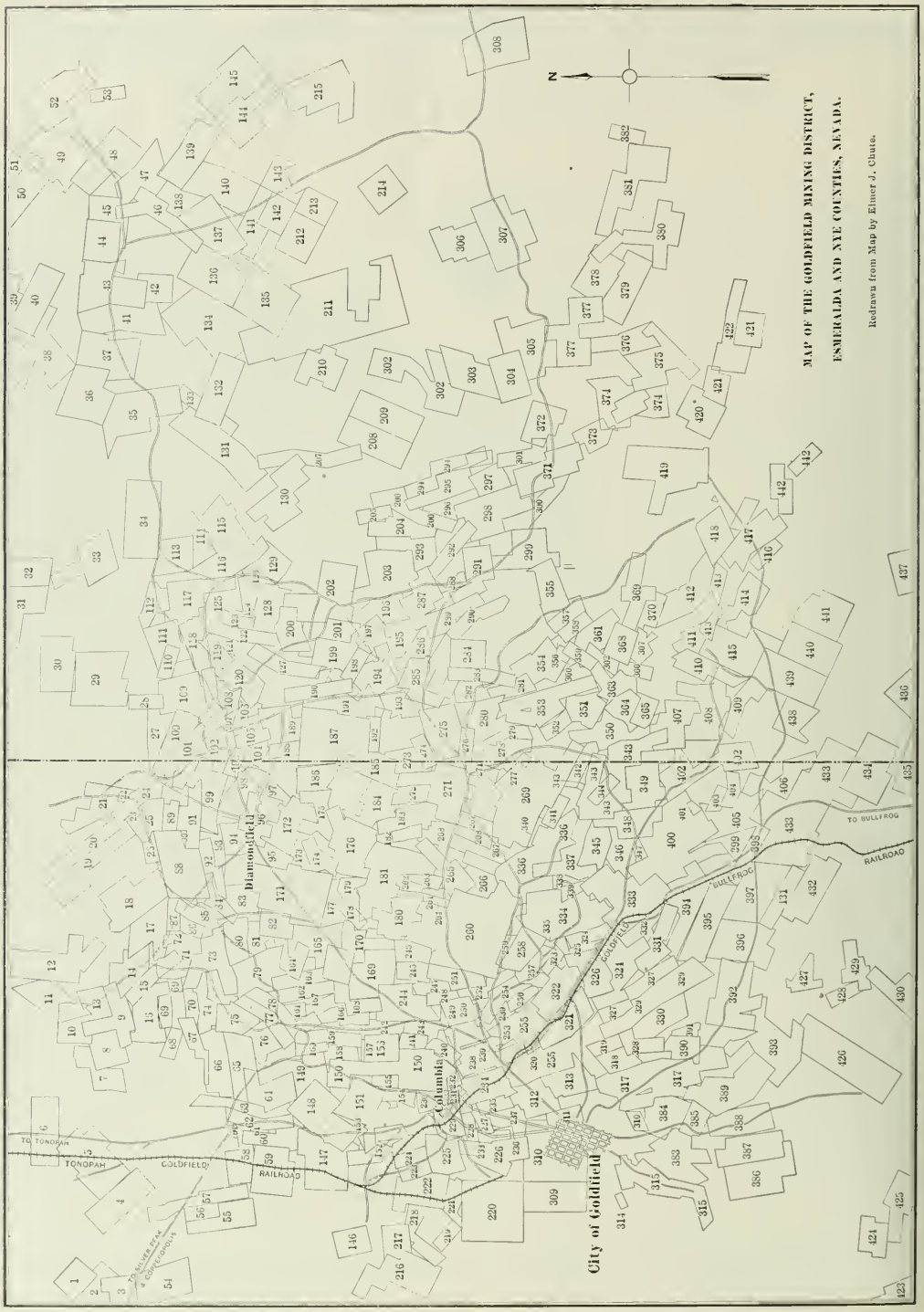
It is early to form an idea of what the 1909 production of Goldfield will be; judging from the returns to date, however, this year will be a record breaker. The output for four weeks selected at random is as follows: Week ending March 13, $220,000; March 20, $332,000; April 13, $507,850; April 27, $600,650. These figures, which are possibly a little high, show a steadily increasing output; even taking $300,000 as an average week's production, the year's total will amount to $15,600,000, or over 200 per cent. of the total for 1908. At present the Goldfield Consolidated and Florence are the largest producers in the camp.

GOLD AND SILVER PRODUCTION OF NEVADA AND GOLDFIELD COMPARED.

Year.	Gold.		Percentage from Goldfield.	Silver.		Percentage from Goldfield.	Total Value.		Percentage from Goldfield.
	Nevada. (a)	Goldfield.		Nevada. (a)	Goldfield.		Nevada.	Goldfield.	
1902	$2,895,300	.....	..	$1,985,486	.....	.....	$4,880,786	.....	..
1903.	3,070,350	$70,670	2	2,098,912	$155	0.007	5,169,262		
1904.	5,060,494	2,341,979	46	2,432,830	11,374	0.47	7,493,324	2,353,353	40
1905	5,269,819	1,882,951	36	3,915,177	5,188	0.13	9,184,996	1,888,139	21
1906.	10,470,704	7,026,154	62	4,536,310	10,484	0.23	15,007,014	7,036,638	55
1907	15,411,000	8,408,396	54	5,465,100	47,329	0.86	20,876,100	8,455,725	40
1908(c).	15,500,000	7,458,000	48	4,500,000	42,000	0.93	20,000,000	7,500,000	40
Totals(c) . .	$51,712,017	$27,117,480	(b)48	$20,849,417	$116,375	(b)0.52	$72,561,434	$27,233,855	(b)39

(a) Figures used represent mine reports as agreed upon by Director of the Mint and the U. S. Geological Survey. (b) Average percentage for last five years. (c) Only years 1904-1908 inclusive are included in totals.

[1]Sept. 5, 1908.



MAP OF THE GOLDFIELD MINING DISTRICT,
ESMERALDA AND NYE COUNTIES, NEVADA.

Redrawn from Map by Elmer J. Chute.

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A Matte-Separating Forehearth

By E. Jacobs*

The settler in use at the Tyee Copper Company's smelting works at Ladysmith, Vancouver Island, B. C., is so constructed as to provide for a continuous flow of matte as well as slag; consequently the removal of the matte by tapping at intervals is obviated. This provision is simply an adaptation of the old Orford style of separator to a water-jacketed receiver, the receiver being of a much larger size than those formerly used. It is, further, an improvement on the Orford separator in that the matte compartment is placed outside the main receiver, so that in case of accident it is practicable to remove this part without interfering with the working of the furnace, since the receiver is also fitted with the ordinary tapping jackets, one on each side, for use in such an emergency until the necessary repairs shall have been made to the matte-separator compartment mentioned.

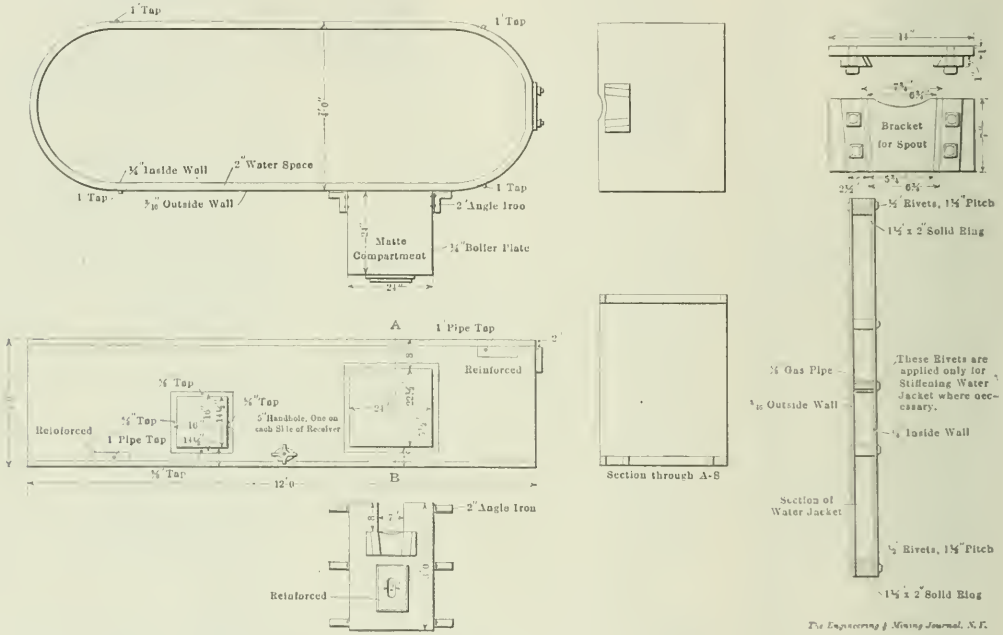
The matte compartment, the position of which is shown in an accompanying illustration, is 24 in. square and is lined with 8 in. of brick. The opening between the settler and this outside compartment is 24x22 in., but with the exception of a connecting channel 6 in. square, at the bottom, this space is filled in with chrome brick.

The level of the matte is controlled by regulating the hight of the slag outlet. For instance, if it be desired to increase the flow of matte, a ball of clay is pressed into the slag spout; or to reduce it, this outlet is opened up. As nearly as practicable a depth of 10 in. of matte is maintained in the settler.

The size of settler ordinarily used at the Tyee company's works is 4 ft. wide by 12 ft. long, but the construction of a much larger one is contemplated. This matte-separating arrangement has been in use here for three years, and so far as known to the manager of the smelter, W. J. Watson, he was the first to use it in this way. It has been found to work very satisfactorily, so much so that during the three years the matte compartment has been frozen up only two or three times, and then because of the high zinc content of the matte, which sometimes was as much as 23 per cent. ZnS.

Among the advantages afforded by the use of this matte separator are the elimination of danger of men being burned when tapping, the much cleaner slag made (this causing a saving which in one month more than pays for the cost of installation), the economy effected in the services of a tapper being dispensed with in all of the three shifts, the reduction in the wear and tear of matte pots (the stream of matte not striking the side of the pot as in the ordinary tapping operation) and in the saving of tapping clay.

*Victoria, B. C.



DETAILS OF MATTE SEPARATING FOREHEARTH IN USE AT SMELTERY OF TYEE COPPER COMPANY, VANCOUVER ISLAND, B. C.

Platinum in Borax

J. G. Rose (*Chem. News*, Aug. 1908) in assaying various samples found traces of platinum, where such results were rather unexpected and he then proceeded to investigate the reagents used in the assays. The sodium bicarbonate having previously been examined for platinum, the borax and litharge were tested. The litharge was soon proved to be platinum free but not so with the borax. Further tests showed the borax to contain 0.00013 per cent. platinum. Tests were then made to ascertain if this amount of platinum could be introduced into the borax through the fusing of the same in platinum vessels. These tests conclusively proved that fused borax has a very distinct action on platinum ware and platinum determinations made with borax prepared in platinum vessels should be viewed with suspicion.

Statistics compiled for The Mineral Industry show that there was an increase in the output of copperas in the United States during 1908 over that of 1907, amounting to 8503 short tons, worth $94,103. The total 1908 production was 35,334 short tons, valued at $388,674.

California Oil and Asphalt Lands

SPECIAL CORRESPONDENCE

In the House of Representatives at Washington, Mr. Smith, of California, has introduced a bill (H. R. 9904) to provide for the disposal of lands chiefly valuable for oil and asphaltum. This has been referred to the Committee on Public Lands, and it is understood will be pushed next winter.

The bill provides that the public lands of the United States in the State of California chiefly valuable for mineral oil or asphaltum may be acquired under the provisions of the proposed act and may not henceforward be located as placer-mining claims. The bill then goes on to specify that any citizen, actual or intending, of the United States may file a declaration with the register and receiver of the land district, wherein is situated the land that he intends to claim, that he intends to improve the land for oil or asphaltum, describing the land in a tract not exceeding 160 acres. In no case shall a claim be more than one mile in length. Upon filing the declaration the declarant shall pay the receiver a fee equal to 25c. per acre. Nothing, however, is to abridge the right to enter the lands subsequently for the purpose of discovery and development of metalliferous minerals, or the assertion of a mineral claim thereto. Neither shall the proceedings give to the claimant before patent the right to the surface of the land for agricultural, grazing, or any other purpose, nor the right to take wood from the surface of the land. At any time within three years the claimant may make application for patent and the application shall show that drillings have been made to produce oil or asphaltum in commercial quantities, etc.; but it is further provided, "that if there are any veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposits known to exist at date of filing such application for patent, title thereto shall not pass under any aplication, entry, or patent under the provisions of this act, but are hereby expressly declared to be reserved therefrom, and such known veins or lodes shall be subject to location and entry by any qualified person or persons under the provisions of the existing United States mining laws aplicable thereto; provided, however, that any declarant who discovers any vein or lode bearing asphaltum, gilsonite, elaterite, or other like substances within the limits of the land included in his declaration or entry under this act shall have the preferential right for a period of 90 days after discovery of such vein or lode within which to locate the same under the provisions of the general mining laws of the United States and must file with the register and receiver of the land district where the land is located a copy of the location notice."

MATTE-SEPARATING FOREHEARTH IN USE AT TYEE COPPER COMPANY'S SMELTERY AT LADYSMITH, VANCOUVER ISLAND, B. C.

Mexican Oilfields

SPECIAL CORRESPONDENCE

In response to a resolution offered some days ago by Senator Cummins, of Iowa, and subsequently passed by the Senate, the Geological Survey has sent to the Senate through the Secretary of the Interior a digest of the conclusions arrived at by C. W. Hayes, chief geologist, in a tour of the Mexican oilfields. The Cummins resolution made request for the full report of Mr. Hayes with, however, the usual proviso, "if not incompatible with the public interest." In replying to the resolution, Secretary Ballinger, however, finds that it is incompatible with the public interest to make known the whole report, and he therefore, transmits, as noted, merely the conclusions. The reasons which have led him to hold back the bulk of the report are that the investigation was undertaken largely with a view to the better planning of the work of the Geological Survey in this country. With this in mind it was intended that the data should be held confidential, and assurances to that effect were given to the owners of the Mexican oil wells. Mr. Ballinger points out that at present mines and other natural resources in private ownership are open to inspection by Government agents, and that it is extremely desirable they should continue to be so. This, however, cannot be the case unless the good will and confidence of the miners in the intentions of the Government are maintained, barring, of course, the possibility of legislation compulsorily opening the mines to government examination.

In presenting the conclusions arrived at by Mr. Hayes, Mr. Ballinger says that while the Mexican fields promise to yield a large quantity of crude oil, its quality is such that it cannot compete under present conditions in the markets of the United States or Europe with the higher-grade petroleum of the Appalachian, Illinois, or Mid-Continent fields. Further, the conditions are such that the demand for fuel oil and refined products in Mexico exceeds the supply available at present, or in sight. There is little coal in Mexico, and the railroads, now dependent chiefly on Texas, Oklahoma and English coal, could consume several times the present production of oil if it were generally adopted as fuel. The increased production in the Mexican fields, therefore, will affect the United States by reducing the demand for coal, by reducing the demand for high-grade crude oil in refining to supply the local market, and to some extent by competing in the European market with American refined products. Finally, the conditions in the Mexican fields are found to be unfavorable to the small operator, and it is regarded as highly probable that production as well as refining will remain in the hands of a few strong companies. The geological conditions under which the oil occurs are such as to increase the hazards and uncertainties encountered in the development of an oilfield, and it is probable that both the difficulty of securing a steady supply of oil and the average cost of production will be correspondingly increased.

In 1908 the production of chrome ore in the United States, as shown by figures collected for THE MINERAL INDUSTRY, was 280 long tons valued at $5600. This was a decrease from the 1907 production of 335 long tons valued at $5620.

Mining for Gems in Brazil

By A. S. Atkinson*

In the past few years several American companies have been organized for mining operations in Brazil with the chief object in view of working some of the old abandoned mines and opening up new ones that yield gems suitable for the jewelry trade. These gems are profitable for that large trade in cheap jewelry which has steadily expanded in recent years in this country, and Brazil offers a fertile field for obtaining the raw material. The trade is naturally influenced materially by the caprices of fashion, but generally speaking the demand is fairly constant for tourmaline, garnets, agates, rock crystal, amethysts and topazes.

The superficial deposits of most of these gems have been exhausted in this country, and the difficulty of mining for them at greater depths has increased their value. In most of the mining regions of Brazil the stones are still near the surface, and in many parts they can be extracted without great work or difficulty. Another difficulty in mining for American gems of this nature is that most of the perfect stones have been mined, and those remaining are for the most part either small or marked with some flaws; also the perfectly colored stones are getting rarer every day, even those most suitable for the ordinary jewelry trade.

These conditions of the market supply determined the American companies to turn their attention to Brazil as a wide field offering profitable returns. The results of this investment have not been without good returns and some excellent experience which may lead to more important developments in the future. Mining in Brazil by the natives is still in a primitive condition, and it is only outside capital and brains that develop the mines to any important extent. Brazil has for years been exporting these gems, but they were obtained chiefly through desultory work in picking them up from the surface. Yet in the mining regions good stones can be found a short distance below the surface by expert miners.

Tourmaline Mining

Mining for tourmaline is one of the most important industries of Brazil. In reality, however, the deposits have only been superficially worked. The tourmaline zone is quite extensive, extending from Itamarandiba and running northeast as far as the Piauhy river, a branch of the Arassuahy, and thence west and northwest as far as Boqueirão, and San Antonio das Salinas. In the municipal districts of the Theophilo Ottoni and Arassuahy there are about 800 persons engaged in mining for tourmaline alone. The stones are found throughout the lower basin of the Arassuahy and in the valley of Rio Doce, also along the rivers Itambacury, Urubú, Setúbal and Caihao. The gems are found in the veins of granite, quartz, pegmatite and gneiss along the river banks and are washed out and picked up by the miners in considerable quantities.

At Theophilo Ottoni an active mine is in operation, and systematic work is done to extract the gems. The deposits occur in a forest under a layer of earth several feet deep. The layer of earth is removed, and the stones are then found in a bed of gravel. The stones found here are of an ordinary bottle green, and hence are not very valuable, but the quantities in which they are found makes the work profitable.

Much better tourmalines are extracted from the big mine of Larangeiras at Arassuahy in the district of Itinga. This mine has been successfully operated for about nine years, and the supply of stones continues good. Perfectly transparent green tourmalines are found here, and they command good prices. At San Miguel not far from this mine the blue and red varieties of tourmaline have more recently been unearthed. Unfortunately few of these are found to be perfect. The red ones invariably show flaws and the blue ones are not transparent. Most of these stones are traversed by cracks which practically spoil them for the best jewelry purposes. Some of these stones are of unusual size, and in spite of the flaws they can be cut advantageously into a number of smaller ones.

Good red tourmalines are in fair demand in this country at prices which make their mining profitable. A mining company composed of natives and Americans has been in operation on the Piauhy river for the past two years, and some very fair specimens of red tourmalines have been received from them. The coloring of a tourmaline determines its price, as much as its flawlessness. Clear rich transparency and beautiful coloring makes a small-sized tourmaline more valuable than one twice the size but lacking in color and transparency.

Aquamarines

Some fine aquamarines have been mined in various parts of Brazil, and one a few years ago was taken from a mine near Arassuahy that weighed nearly six pounds. The record, however, was one that weighed 15 pounds. It was of the green variety and was mined as far back as 1814. This stone was eventually cut up and dispersed. We have the authority of Eschwege that it weighed 15 pounds, but that is all. If the stone was of such a size and correspondingly perfect and well colored it is a pity that it was not preserved intact. Some very large and handsome aquamarines are obtained today from the Brazilian mines, and one American company has exhibited several specimens of remarkable coloring ranging from half a pound to several times this weight. The best aquamarines, however, come from the island of Alegre. Beautifully colored aquamarines are found there in crystals of great lustre. These are exhibited at the different ports of Brazil to visitors to show them the richness of the gem deposits of the country. Frequently prospectors are deceived as to their origin, and they are induced to make extensive searches for similar stones in the tourmaline districts.

Many American prospectors are today going into Brazil with the idea of locating gem mines, and the need of accurate information is essential. Like all other mining countries, wonderful stories may be heard about picking up priceless Brazilian diamonds, topazes, and amethysts. But like all such stories they generally simmer down to only a very small grain of truth. On the other hand the government of Brazil has so little accurate knowledge of its own mining resources that the prospector must often follow ordinary rumors to get anywhere.

As fashion dictates the value of stones to a large extent, the miner for gems must consider the vagaries of a fickle market; but most of the stones of commerce sooner or later come into fashion again after having passed through a temporary eclipse. Amethysts have not been in as active demand as tourmalines and aquamarines for some time, but they are pretty sure to return to a fair state of popularity. The mining of amethysts has suffered a decline in Brazil as a result of this change in fashion, but good ones are always in demand. Similarly mining for topazes is conducted on a small scale in Brazil, but a revival of interest has been manifested in the mines in the last year.

Topaz Mines

The old mines of Boa Vista and Seramenhain in the basin of the Arassuahy river, have been reopened by a new company, and some beautiful topazes are being obtained. The old open-cut method of mining has been abandoned, and deep mining is carried on with success here and at Jose Correa and Caxambu. The gems are extracted from a gravel bed about 20 ft. deep. The topazes show a great variation in coloring and size. Some are small and full of flaws, and others changing from a pale yellow to a deep rose shade and so large and transparent that they are of the greatest value. There is exhibited at the national museum at Rio Janeiro a topaz mined at Ouro Preto in the basin of the Jequitinhonha river that weighs almost 2000 grams. But its size is not more significant than its beautiful color, perfect transparency, and absolutely flawless condition. It was

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one of the handsomest gems ever mined in Brazil or any other country.

There is a yellow quartz which comes from the state of Goyaz which resembles the topaz and is largely exported to meet the demands of the cheap jewelry trade. Thousands of stones in use which pass as topazes are only yellow quartz. It is mined on a large scale in Brazil and has really hurt the topaz miners. There is another gem occasionally found in the topaz mines. It is a hydrous silicate of aluminum and glucinum, and known as euclase. This is of a pale blue or green color and of vitreous lustre. It is a stone of considerable rarity and value, and its presence is always welcomed by miners. There is a special demand for good specimens for museums, as well as for the better class jewelry trade. The best specimens of euclase have been mined at Boa Vista and Capao do Lana.

Agates and Other Gem Minerals

Agates, garnets and rock crystal are obtained in considerable quantities from many parts of Brazil, but the size and quality of the gems are not always satisfactory. The garnets are obtained chiefly in the valley of Santa Maria, a branch of the Calhao river, and along the shores of the tributaries of the Urubú river. They are rather small and belong to the varieties known as pyrope and almandine. The stones are of a dark red, and if larger they would have more general demand.

The agates of Brazil run from chalcedony to onyx and are quite abundant in Rio Grande do Sul and several other districts of the country. In the neighborhood of Uruguayana there are some of the richest beds of agates in the world. The beds stretch over a large area and the supply of gem stones is abundant, but it is the coloring and size of the stones which make them so attractive. They come in wonderful carnelians of a deep red color, and some of them are of unusual size and flawless beauty. Large quantities of these agates are sent to Germany; thence they find their way into this country in jewelry.

The best rock crystal and quartz are found in the famous mountain Cristaes in the State of Goyaz. The rare specimens extracted and cut for the trade indicate the output of these mines. In spite of the fact that the mines have been worked for many decades, the output is large today and many deposits, not located or worked, still await the prospector.

The chrysolites in spite of their beautiful yellowish green color are not of much value as gems today but these minerals are found in the valley of the Gravata river in the most wonderful abundance. They are really decomposed chrysolite and called by the miners *cambalaxo*. The stones are found in gravel deposits along the river and were formed by the decomposition of the quartz veins that traverse the gneiss rocks. The stones are beautiful and should be of use in certain branches of the jewlery trade.

General Conditions

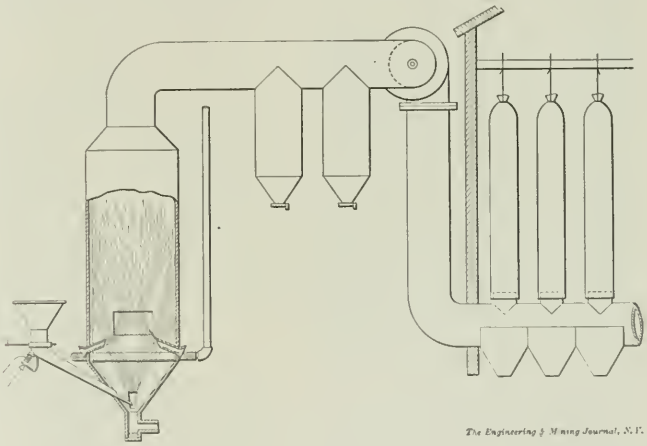
Unfortunately most of the gems found in Brazil are subject to an export tax which makes their marketing outside of the country less profitable. This tax varies with the stones, but it is not usually of a prohibitive nature. Very fine specimens could be shipped away with great profit, but the common stones would hardly pay. Gem mining has in the past decade become a profitable industry in many parts of the world, and the enormous demand by the cheaper jewelry trade for stones which can be utilized for ornament at no great expense has stimulated prospectors to study carefully profitable fields of exploitation of such stones as those mentioned.

Diamonds, rubies and the more precious gems are not considered in this paper, for they are of comparatively rare occurrence, but tourmaline, aquamarines, topazes, amethysts, garnets, agates and rock crystal can be mined systematically in restricted areas at a good profit. They form the basis of the cheap jewelry trade and must continue to improve in value as new methods of using them are invented. Mines that will yield an abundance of such stones regularly cannot fail to prove profitable in the long run, much more so in many respects than a mine where only the more precious gems are occasionally found.

Brazil offers a field for gem mining that is only partly understood, and, one might say, only half explored. Within its great mountainous stretches of mining land there must be wrapped up treasures in the form of precious and semi-precious stones. The native population is slow to realize and slower to adopt modern methods of mining for these products. For the most part they are content to scratch the surface of the land or dig a few inches into the gravel beds for the stones and if not uncovered, they pass on to new regions.

Oxidizing Furnace for Pulverized Ores

L. S. Hughes, of Joplin, Mo., describes (British Pat. 16,521 of 1908) a furnace for oxidizing pulverized ores which are carried through the furnace chamber by an air blast and maintained at a comparatively low temperature preventing their fusion, or the decomposition of substances in the ore that would injuriously affect the product. The accompanying illustration shows a sectional elevation of the furnace, with the cooling flues and screen system indicated diagrammatically. The furnace chamber is preferably upright with an inverted conical bottom, and is of unlined sheet iron. In the bottom near the apex are openings for air to enter and for extracting unburned and inert particles of the ore, while at the apex is an air pipe for supplying compressed air to the furnace.



OXIDIZING FURNACE FOR PULVERIZED ORES

Around the lower part of the furnace chamber is a gas-burner ring provided with nozzles which are inclined upward so that the flame issuing from them will not impinge upon oppositely disposed tubes. The pulverized ore is fed into the hopper at the side and then passes into a chute with a trough-like end projecting nearly to the center of the furnace, so as to deliver the ore directly into the air jet. Below the hopper is a gate for regulating the feeding of the ore, and on the outside of the chute is a rapping or vibrating device for keeping the hopper and chute in a state of vibration.

A Novel Coal and Stone-Cutting Process

A System Based on the Use of Driven Cables Carrying Tempered Steel Cutting Points, Whereby a 50 Per Cent. Saving Is Possible

BY ALFRED GRADENWITZ*

The coal- and stone-cutting process here described, was invented by Messrs. Neukirch and Freytag, and is being rapidly adopted by German and foreign mining concerns, on account of its low-working expenses and simplicity of operation. It is true that the lower officials entrusted with the immediate superintendence of the process have to undergo a thorough training to account for the local conditions of the mine, but no skilled labor is required for the process itself.

The system is based on the use of cables carrying tempered-steel cutting points, the cables being driven by either one or two machines. The cutting machine represented in the accompanying illustrations is 36 in. in hight, 40 in. in width and 8 ft. 4 in. in length, its capacity being 11.5 h.p. It is designed for electrical operation, but is readily adapted to compressed-air operation by some slight altertions in its construction.

The arrangement used in the case of electrical operation is represented in Figs. 1 and 2, and the one adapted to compressed-air operation in Figs. 3 and 4; general views of the electrically-operated machine are given in Figs. 5 and 6. These machines are from 1000 to 1500 lb. in weight, according to their size and type.

The Cutting Machine

The cutting machine mainly consists of a double-groove winch with automatic tightening gear. The wooden sheaves, which are generally arranged vertically, may also be installed in a horizontal direction below the machine, if this be more in agreement with local conditions. The tightening gear will carry the machine forward while forcing the cutting cable against the coal seam, but the pulling power of the machine is never exceeded. When the cable reaches any harder coal or rock, the speed of the tightening gear is slackened in proportion.

The machine comprises a base frame, on which are mounted the motor, toothed-wheel gearing and shafts of the wooden cable sheaves. The driving sheave is provided with two grooves and is about 32 in. in diameter, while the opposite wooden sheave, which has only one groove, is not driven.

The cutting cable, after passing over one of the grooves of the double sheave, goes on to the opposite single sheave and back again to the second groove of the driving sheave. The cable travels at a speed of 5 ft. 8 in. per sec., or about 340 ft. per minute.

Design of Cable

As regards the cutting cable itself (Fig. 7), this, in the case of small-size machines, is ⅜ in. in thickness. The following varieties of cable, selected after several years' experiments, are used:

1. Cables made of triangular steel wire or wound with a sheath of such material. As this wire is braided, it obviously cannot be of hard steel. Such cables are of relatively high cost and are used only in the case of soft coal.

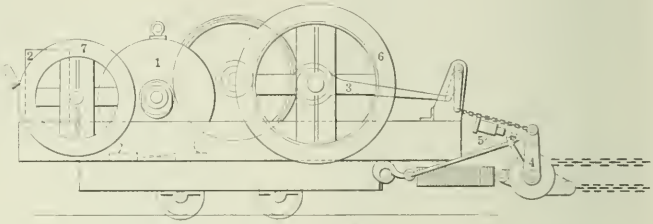


FIG. 1. ELECTRIC DRIVING MACHINE

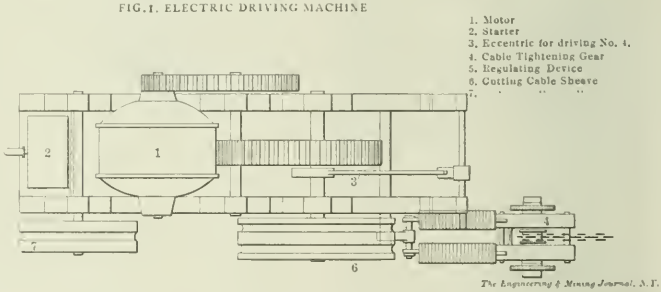


FIG. 2. TOP VIEW OF ELECTRIC CUTTING MACHINE

2. Another type of cable is fitted with two steel caps ⅛ in. thick and about 2½ in. long. Each cap has eight holes, into which triangular points of high-class tempered tool steel are inserted. These cutting points are prevented from falling through the holes or getting forced into the cable by a thin piece of steel sheet, which is placed between them and the cable (Fig. 7). The two caps are fastened to the cable by two rivets, which part the strands of the latter. There is said to be absolutely no slipping of these cutting parts, which are placed on the cable at about 2-ft. intervals.

In another type of cutting cable these caps have slots, the edges of which are bent up and tempered. However, a disadvantage of this design is that the edges are too easily bent down again. These caps can also be designed as files, and another process consists in braiding the steel points with the wire, according to the spiral lines of the latter, so as to work from all sides of the cut as they advance. The type of cutting tool represented in Fig. 7 is the one preferably used.

Next as regards the cutting process itself, three varieties should be distinguished:

1. *The revolving cable process,* according to which the cable, lined throughout its length with knives or other cutting tools, is made to turn around the pillar of coal.

2. *The reciprocating cable process.* The same machine, as above described, can be used in connection with this process, but there is a special switching device which has to be regularly adjusted. This adjustment can, of course, be made automatic. In the case of this process, only a small portion of the cutting cable, viz., that coming into contact with the coal seam, need be lined with cutting tools.

3. *A process consisting in making two separate cuts* (at the top and bottom of the pillar, respectively). This double process will be necessary only in the event of the coal being particularly hard, so that it does not break loose and fall down of

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its own accord if a cut is made only at the bottom, or if the hole swells. Two small machines, arranged in each of the parallel passages, respectively, are preferably used in connection with this process. While Jeffrey machines can be converted with a view to their being used in this connection, this conversion will be worth while only in order not to shut them down entirely. However, the original Neukirch-Freytag machine has been found far more practical and economical in operation.

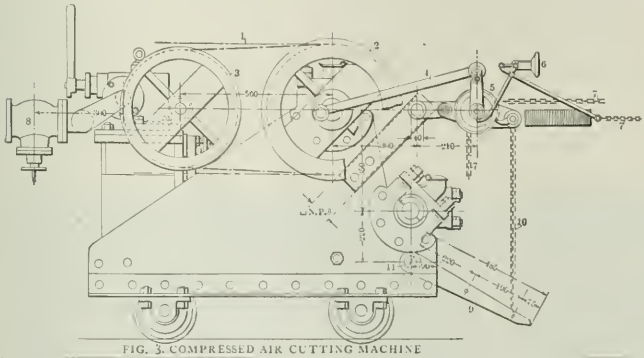


FIG. 3. COMPRESSED AIR CUTTING MACHINE

Legend

1	Cutting Cable	7	Tightening Chain
2	Driving Sheave	8	Safety Valve
3	Guiding Sheave	9	Cams, to prevent Backrun on Rupture of Cable
4	Driving Bar for Cable Tightening Gear	10	Suspension Chain
5	Cable Tightening Gear	11	Cam Rod
6	Hand Wheel for Controlling Cable Tension	12	

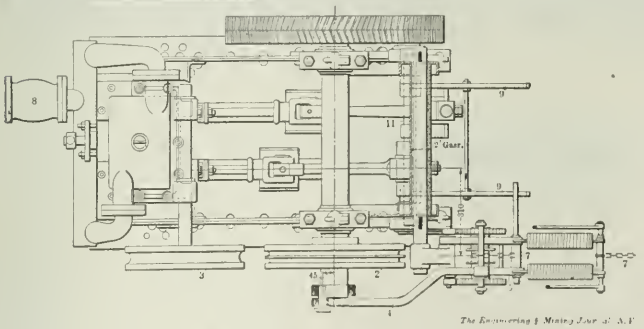


FIG. 4. TOP VIEW OF COMPRESSED-AIR CUTTING MACHINE

The machine should be installed in a side passage where no winding is done. It runs on a track of rails. The tightening gear should be firmly attached at a proper distance, and, as above stated, serves to draw the machine along with it, as the cable penetrates more and more into the seam of coal.

The cutting cable, according to the above, should be applied to the grooved sheaves, and according as it is either revolving or reciprocating, should be arranged to fit the conditions of each case.

In order to provide for an adequate guiding of the cable, it is well to break its cut a little at the corners where the cable or cables run, that is, at the top and bottom. On the other sides of the pillar, guide rollers should be provided. In connection with revolving cables, wooden rollers are preferable, but for reciprocating cables iron rollers are found more suitable.

In the case of the revolving-cable process, the machine should be adjusted toward the lower part, so that the cable may have a tendency to remain near the ground, if the bed of coal be inclined at an angle. If, on the contrary, the machine be placed high, the cutting cable will be apt to climb.

Advantages of the System

As regards the advantages claimed for this process, it should be stated that the machine, being installed out of the way of the haulers, never interferes with their work, nor is it ever exposed to any risk of being damaged or crushed by falling coal.

The amount of energy required to work the machine is far less than in the case of any other system, and the machine is far simpler in construction and cheaper in operation. Furthermore, it does not produce any noise nor raise any dust, while all blasting work is dispensed with. The wear and tear of the machine is far less than in the case of other constructions, the revolving parts of it being free from any coal-fragment impurities. Before proceeding to the final stroke, any other work can be carried out without interfering with the cutting process. Again, there is no interruption in the cutting work during the removal of the coal, and finally, the process allows any hard rock to be rapidly cut through.

Capacity of Machine

As regards the capacity of the machine, 172 sq.ft. of coal have been cut, according to testimonials of the Deutscher Kaiser mine, at Hamborn, in Germany, under rather unfavorable conditions. The coal there is of moderate hardness and a triangular cable was used in cutting. The type of cable lined with two steel points would obviously have given still better results.

Supposing the case of a quadrangular wall, 30 ft. in width and 90 ft. in length, a cutting cable of $2 \times 30 + 2 \times 90 = 240$ ft. in length would be required.

The output of the machine above described is 300 ft. per min., or 18,000 ft. per hour. The width of the 30-ft. wall to be cut would accordingly be dealt with by the cutting points 600 times within its width. Supposing the cable to penetrate only ¼ in. on passing over moderately hard coal, it would have penetrated to a depth of 6 ft. 3 in. in one hour, which, in the case of a 30-ft. width, would mean an area of about 187 square feet.

It may be said that these figures are by no means exaggerated, outputs of the same area of magnitude having also been obtained in the Zwickau district. However, on the basis of only 172 sq.ft. per hour, as in the case of the Deutscher Kaiser, a cut of about 1080 sq.ft. would still be obtained for each shift, even in the most unfavorable of cases and allowing for any possible stoppage.

If the coal wall be 4 ft. 10 in. in thickness, a coal volume of 5300 cu.ft. would be obtained, which, supposing 1 cu.ft. to correspond to a weight of 60 lb., would result in 159 English tons per shift.

A maximum of three men is required to operate the machine. In order to utilize the machine to the best advantage, it would have to be installed in such a way as to allow one wall to its right, and a similar one to its left, to be prepared and to be surrounded with a cutting cable. If, then, the working of the right-hand wall for some reason or other should have to be temporarily discontinued, the cable of the other hand) wall will be applied in a minimum of time, thus immediately continuing the hewing work.

Cable Cutting is Less Expensive than by Chain Machine

The wear and tear of cutting cables

lined with two steel tapes is far less than that of triangular cables, and the cost of wear for each ton of worked coal is thus quite immaterial. In fact, this item will be far smaller than the wear of wheel and chain machines, whose teeth, owing to the greater hight of their cut, have to perform a far greater amount of work. For a similar reason, the power consumption in the case of cable cutting will be far less than when using wheel and chain machines.

According to the American practice in the working of walls, pillars are partly left. Now, the cutting process above described will also be found of excellent use in the case of this special method, which, of course, differs from the German practice.

The following data are derived from an original estimate in meters and in round figures, which, in order to avoid any complication, have not been converted into their English equivalents.

The Cost of Cutting

Supposing the "room" to be hewn is 30 m. in length and 10 m. in width, the coal reaching to a hight of 1.5 m.; one hole (from one way to the other) would have to be bored at each of the four corners, and these holes will presumably be completed by two men in two shifts. However, for this operation, allowing a time twice as long, that is, $2 \times 4 = 8$ shifts at $4 each, this will figure up to a total cost of $32. Some workmen should be trained for the special work of boring such holes, and these men will always have to be in advance with their work.

The process of cutting these "rooms" will then be as follows:

After passing the cable through the upper and lower holes, the coal should at first be cut in a vertical direction, after which the bottom of the foot-wall, and eventually the other side, should be cut vertically. The two vertical cuts will result in $2 \times 30 \times 1.50 = 90$ sq.m., and the cut on the foot-wall is $30 \times 10 = 300$ sq.m., working out at an aggregate of 390 sq.m. If this machine be able to cut 100 sq.m. per shift (as it is, it will yield 30 to 40 per cent. more in the case of an adequate use), four shifts of three men each will be required for this treble hewing, amounting to 12 shifts at $4 each, or a total cost of $48. The wages to be paid in working the rooms (above described) will, accordingly, amount to $80. Even in case the foot-wall had to be cut, the outlay will never exceed $100.

According to present coal-cutting methods, using other types of machines, wages would work out as follows: Each room contains $30 \times 10 \times 1.50 = 450$ cu.m. of minable coal at 1.5 tons each, that is, 675 tons. According to American data, the performance of each workman would be 6 to 10 tons, or an average of 8 tons each. An aggregate of 84 shifts $\left(\frac{675}{8}\right)$ at $4 each would, accordingly, be required, amounting to $336 in wages, that is, to $200 in excess of the amount corresponding to the novel method here described.

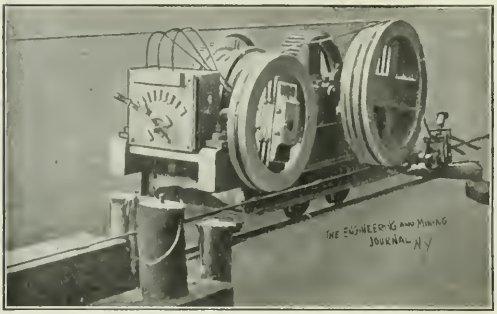


FIG. 5. GENERAL VIEW OF ELECTRICALLY-OPERATED MACHINE

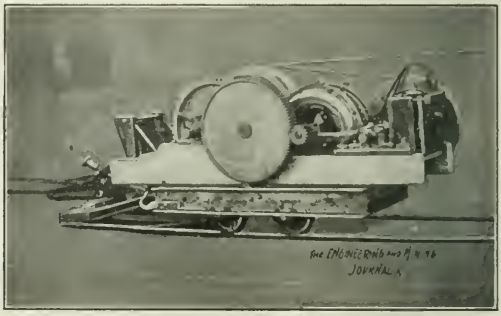


FIG. 6. SIDE VIEW OF MACHINE WEIGHING LESS THAN 1500 POUNDS

FIG. 7. GENERAL VIEW OF CUTTING CABLE

Calcium chloride is a grayish-white substance, which has the power of strongly attracting moisture from the atmosphere, and of holding same. When used to dampen dust on coal-mine roads, it contains nothing that can be injurious to the miner, roadways, haulage-ropes, etc. It does not give off any smell or gas. Comparing its hygroscopic property with salt, salt of itself has not the power of attracting moisture, but owes what little power it does possess to a small amount of impurity which it contains in the form of magnesium chloride, and cannot be for one moment compared with calcium chloride, as a moisture-attracting substance.

Proceedings of the Mine Inspectors' Institute

Special Correspondence

The second annual convention of the Mine Inspectors' Institute opened on Tuesday afternoon in Scranton, Penn., there being about 50 mine inspectors from various parts of the country present, many of them having come long distances at their own expense to attend the convention, and one at least coming 2000 miles.

The president of the convention, George Harrison, chief mine inspector of Ohio, in his opening address to the convention explained the object for which the institute was founded a year ago. He said that while the mine inspectors were without an organization, anything like concerted action was impossible. The loss of life, the speaker said, had increased and was increasing in the mines, in many instances, at least, without justifiable cause. This was so not in one mining State or two, but throughout all the States in which coal measures were found. Now the object which the Mine Inspectors' Institute had placed before them, and which they would try to realize, was to minimize the loss of life in the mines by minimizing the dangers of mining as far as they could effect it. How was that to be accomplished? According to the speaker, this could in a considerable degree at least be effected by an interchange of ideas among the mine inspectors. This interchange of ideas could be conducted only through an organization such as they had founded 12 months ago at Indianapolis. At that convention there were 45 mine inspectors, but since that time the membership of the Institute had considerably increased, and with the increase of numbers came an increase of influence in each State and throughout the United States.

One of the results of their Indianapolis convention was the foundation of the testing station at Pittsburg, established by the United States Government at a cost of

$150,000. They must strive to make not only the Federal Government interested in the safety of life in the mines, but they must try and make the State governments interested also. None of the State governments had so far erected experimental or testing stations, such as were common in the mining centers of Europe. They must also, he said, interest the large operators in these matters to a greater extent than is the case now. That was their mission, and in brief, this was the manner in which they hoped to carry it out. He was disappointed at the failure of the bill in Congress to establish a bureau of mines and testing stations.

After the president's address, the convention went into session, and for the greater part of the evening was occupied with the selection of committees and other routine matters.

The following committees were appointed: Executive committee, H. D. Johnson, Pennsylvania; Peter Honragy, Oklahoma; Albert A. Sams, Indiana. Committee on constitution, John Verner, Iowa; W. H. Turner, Ohio; Thomas Moses, Illinois. Committee on resolutions, Thomas K. Adams, Pennsylvania; P. A. Grady, West Virginia; Thomas Hudson, Illinois. Membership committee, Clarence Hall, District of Columbia; J. T. Beard, Pennsylvania; J. L. McDonald, Ohio.

In the evening a social and smoker was given, but so far from the affair being preoccupied with merely musical or social functions, on the contrary, it was technically most interesting, four important addresses on mining matters being delivered, as well as an address of welcome by Judge H. M. Edwards, of Lackawanna county, in the absence of the Mayor of Scranton.

President Harrison delivered a second address, in which, after reiterating the purpose for which the meeting was called, the purpose for which the Institute was formed, and a few allusions to the welcome which the city of Scranton had extended to the delegates, he plunged into the duties of mine inspectors and the conditions that lead to the loss of life in the mines. He declared that the time had come when miners and operators must lay aside their bickerings and disagreements and work in concert for the good of all who were employed in the mines, or who drew a revenue from them. He asserted that 55 years ago when he first became a working miner, the miner took pride in his employment; that he kept his chamber clean; that he never blasted coal unless he had first cut each side of the block of coal that he intended to bring down and made a clean cut underneath. "But mining at the present day," said the speaker, "is a lost art." Take any "Tom, Dick, or Harry," place a keg of powder under one arm and a large auger under the other, and let him become a member of the United Mine Workers' Union, and you have a full-fledged miner, and a dangerous one to himself and all his fellow workers.

A Current of 500 Volts is Dangerous

The speaker called attention to blasting, and particularly to the new conditions involved in working the mines with electricity. He deprecated the use of high-voltage electrical currents, and declared that many of the fatal accidents in the mines were due to this cause. A voltage of 250 was said to be fairly safe, but when it was raised to 500 there was no such safety, and furthermore, the amount of coal that could be cut by doubling the voltage was only 10 per cent. more, as a general rule. The operators were indifferent, Mr. Harrison said, because they thought that by higher voltage there was more expedition, and the coal cut was as good. Mr. Harrison said that he did not believe in insulated wires; owing to the minerals in the water, dampness and one thing or another, the insulation became both defective and deceptive. When a miner took hold of a wire that was supposed to be insulated, but which was not so in fact, a fatal accident occurred. He also said that more care should be taken in installing electric wires, which were sometimes strung anywhere and anyhow as if they were so many hemp ropes.

J. H. Taylor, of Illinois, in the course of a somewhat lengthy and discursive address, warned the inspectors to beware of what he called the "theoretical fellow;" he also advocated the employment of the acetylene lamp in the mines, which, he declared, burned clearly and brightly when the ventilation of the mine itself was dangerous to human life, and that oxygen was not so essential to the illumination of the acetylene lamp.

J. H. Holmes, of the United States Geological Survey, in the opening of his address said that he had heard that morning that there was an undertakers' convention also being held in Scranton, and that he hoped, although the undertakers of the country had about 1000 fewer mineworkers last year to lay underground than they had during the preceding year, that the conventions would not be the less friendly, as both were underground diggers. Reverting to the warning given by Inspector Taylor to beware of the "theoretical fellow," Doctor Holmes said that theory and practice in any effective undertaking usually went together. For instance, in the Government testing station at Pittsburg, those in charge had invited the manufacturers of explosives to send in samples of their products which would be tested, secretly, under their own eyes, without fuss or feathers. If the explosive survived the Government test, the name of the manufacturer would be published; that is, the name would be printed in the circulars distributed by the testing station. If the product did not come up to the standard, nothing would be said about it, the name of the manufacturer would not be printed, but he would be requested to withdraw the product from sale, or to bring it up to the standard of safety. The same course was pursued in regard to electrical appliances used in the mines. These, too, were tested under similar conditions.

Doctor Holmes also said that a report had obtained circulation among mine inspectors that the Federal Government was about to undertake the inspection of mines. There was not a word of truth in this. The Government had no such intention. The only object of the Government in establishing the testing station was to aid the State mining inspectors in every way it could. Doctor Holmes, in conclusion, deprecated the present cutthroat competition among operators, and thought that the conditions at the mines would never be improved as they should be until the mineowners charged an adequate price for the coal at the mouth of the mine, as they do in England, where the operators receive $1.60 per ton, on an average, instead of 60c. paid here.

A New Potash Salt

Although it has long been admitted that the red color of carnallite is due to iron oxide from the decomposition of some earlier ferruginous potash salt, it is only quite recently that a salt of this kind has been discovered. This discovery was made by Mr. Boeke in the mines of the Nordhäuser Kaliwerke, at a depth of 547 m., where the hard salt rests on the carnallite, in association with sylvine. The new salt, according to *Vulkan*, April 21, 1909, is of a pale pink or violet color in the bed, but turns yellow within a very few minutes after removal. It is very hard, with splintery fracture, the splinters being hard enough to wound the finger; it exhibits a characteristic inky taste. On exposure to the air it crumbles down to a sandy powder, the presence of which in the salt has led to shipments being rejected as "adulterated with sand," although the "sand" contains 50 per cent. of potassium chloride. In composition it consists of one part ferrous chloride, three parts potassium chloride, and one part sodium chloride, chemically combined, and is anhydrous. It has been named rinneite, after Professor Rinne, formerly of the Hanover Technical High School.

The 1908 production of alum and aluminum sulphate decreased from the figures for 1907. As shown by statistics of the U. S. Geological Survey, the output for the respective years was: 1907, alum, 10,404 short tons, valued at $34.78 per ton; aluminum sulphate, 106,821 short tons valued at $18.80 per ton; 1908, alum, 7700 short tons at $39.74 per ton and aluminum sulphate 97,255 short tons at $18.87 per ton.

Time Recorder for Furnace Operations

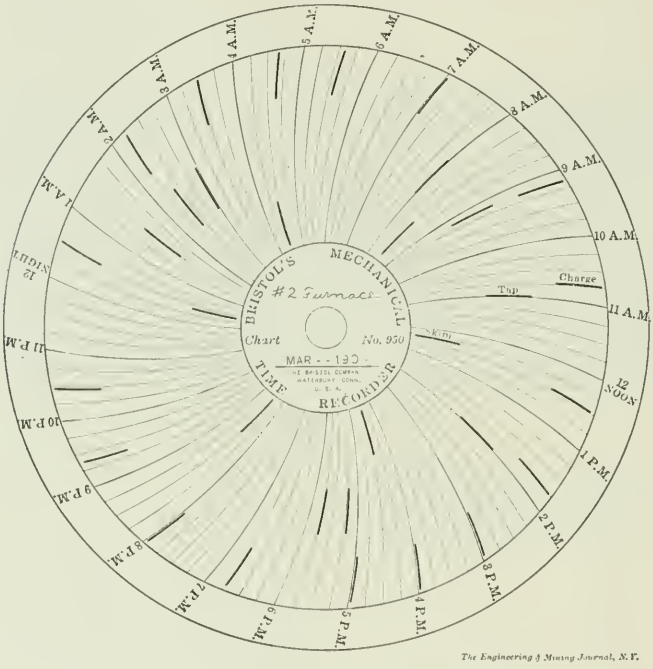
By O. E. Jager*

For the successful running of reverberatory furnaces it is sometimes necessary to keep track of the times of charging, tapping and skimming. If this is left to the furnaceman's memory it is liable to be reported wrongly or forgotten altogether. To overcome this difficulty I have devised the following arrangement of a Bristol recording gage:

Take any Bristol recording gage (the kind is immaterial as it becomes merely a time recorder in this instance), remove the front glass and turn the pen away to one side. Take a sheet of stout tinplate and cut it to the same size as the glass (8 5/16 in. in diameter for a gage taking 8-in. charts). Mark three slots, as shown on the record, on the same radius as the time lines on the chart. As the glass sets away from the chart about ¼ in., the slots must be made with all sides sloping inward toward the chart, leaving about 1/16 in. clearance between the tin and the chart, so as to insure the correct marking of time by the scriber. This job having been done in the tinshop, the words, "skim," "tap" and "charge" are painted above their respective slots. In the accompanying illustration the marks nearest the center of the chart represent skimming, those in the middle, tapping, and the outside mark, the time of charging. The duration of the operations is not recorded.

Fit the tinplate over the chart in the place of the glass, and the apparatus is complete. The scriber can be made of a hardwood-pen handle tapered down to a long fine point. Use a No. 350 Bristol patent-smoked chart, which can be "fixed," after using, by immersion in a very weak solution of shellac in wood alcohol, thus constituting a record of operations for the day ready for filing.

The gage is put up in any convenient place near the furnace, and the scriber hung to it by a piece of string. Set the chart with the correct time directly under the slot. After skimming, tapping or charging, the furnaceman simply takes the scriber and marks in the corresponding slot. The fact of the gage being there is a reminder to him to do this. At the end of each shift the foreman opens the gage and copies off the times of the respective operations on his report. The chart can be easily modified to suit other operations.



RECORDING REVERBERATORY-FURNACE OPERATIONS AT THE STEPTOE SMELTER

*McGill, Nev.

South African Diamond Mines

Special Correspondence

At the recent annual meeting of the Premier Diamond Mining Company, managing director, Ross Frames, delivered a vigorous, fighting speech which thoroughly upheld the "traditions" of this young concern. The boldness of his views and the bitterness of his criticism of the De Beer's policy would have made more satisfactory reading to shareholders and public if the point of the question calling for solution were only the relation between the Premier's actual or prospective production and that of De Beers; for the managing director made out a good case for the Transvaal mine's claim to contribute a high proportion of the total yield. But the relation between its production and the market demand was discussed with less assurance and detail. The tone adopted in regard to this important point was one of unexpected confidence. Mr. Frames could not, of course, deny the reality of the market's collapse, but he contended that it had been greatly exaggerated.

The speeches of W. F. Frames and of Mr. Cullinan (chairman) were largely composed of criticisms in reply to the recent pronouncements of the chairman of De Beers. Apart from the points of debate, a great deal of valuable information was given as to mining conditions and results. The opinion was expressed with conviction that the Premier mine has now reached its "permanent" grade—that the present yield of about 25 to 26 carats per 100 loads (of 16 cub. ft. each) will probably see small variations in the future. Extensive tests of blue ground have shown average contents of 26 carats. It is reported that a layer of comparatively soft blue ground has been proved below the present workings, and that 45,000,000 loads of this material can be considered to be "in sight." It is well known that the Premier turns out a large quantity of inferior diamonds. Mr. Cullinan gave some interesting figures in evidence of this fact by stating that 33 per cent. in weight of the output represented 70 per cent. of the value. While the yield per 100 loads has been steadily decreasing to the present figure of 25.5 carats, the increasing scale and efficiency of operations has enabled working costs to be reduced to nearly 36c. per load. In the first year of high yields, the cost per carat was $1.72; later on, when the whole mine was worked and yields fell, it went up to $3.22 per carat. Now the cost has again dropped to $1.72 per carat.

The directors appear to have bound themselves resolutely to a policy of expansion, in spite of all dangers of overproduction. The Premier produced 2,078,825 carats of diamonds last year. When the new No. 4 gear is completed, the

company will be treating 50,000 loads per day or, say, 16,000,000 loads per year. This, at 25 carats per 100 loads, is equivalent to 4,000,000 carats per annum. As announced by Mr. Cullinan, 67 per cent. of the yield by weight represents only 30 per cent. of the value. He further declared that only 12½ per cent. of the output in money value (presumably 30 or 40 per cent. by weight) need be regarded as in the least difficult of sale, when larger quantities are produced than at present.

The chairman gave some interesting statistics regarding the records of the Premier from the commencement of operations in 1902. Excluding the Cullinan diamond, the yield to date is valued at £6,500,000, of which £3,700,000 represents profit. On equipment £1,413,666 has been spent, £1,009,076 has been paid to the Government in profit tax and £880,000 distributed in dividends.

Useful Formulas

By F. Close*

In the course of my experience, I have encountered or worked out, for my own convenience, various useful formulas calculated to save time, and have embodied the most useful of them in this paper in the hope that it will be added to from the experience of others. Most metallurgists and engineers have their own particular methods of working out problems which occur constantly in chemistry, surveying, etc., and a collection of the experiences thus gained should prove valuable.

One of the most useful formulas is that for the calculation of extractions.

Let assay of original $= Oa$.
Weight of original $= Ow$.
Assay of tailings $= Ta$.
Weight of tailings $= Tw$.
Assay of concentrates $= Ca$.
Weight of concentrates $= Cw$.

Then the percentage extraction may be calculated from the weight and assay of concentrates: thus "concentrates products accounted for" or

$$recovery = \frac{Ca \times Cw}{Oa \times Ow} \times 100.$$

Similarly, "tailings products accounted for" or

$$loss = \frac{Ta \times Tw}{Oa \times Ow} \times 100.$$

Obviously the "extraction calculated from tailings" is 100 minus the above result. Examples of calculation of recovery by these formulas follow.

Let.

$Oa = 15$ per cent. Zn and 12 oz. Ag per ton.
$Ow = 120$ ton.
$Ta = 7.5$ per cent. Zn and 3 oz. Ag per ton.
$Tw = 96$ tons.
$Ca = 45$ per cent. Zn and 48 oz. Ag per ton.
$Cw = 24$ tons.

Extraction of zinc calculated from weight and assay of concentrates would be

$$\frac{45 \times 24}{15 \times 120} \times 100 = 60$$

per cent. recovery.

Extraction of silver calculated from weight and assay of concentrates is

$$\frac{24 \times 48}{120 \times 12} \times 100 = 80$$

per cent. recovery.

Zinc tailings products accounted for:

$$\frac{7.5 \times 96}{15 \times 120} \times 100 = 40$$

per cent.

The extraction calculated from tailings is 100 — 40, or 60 per cent. recovered in concentrates, by difference.

The silver tailings products accounted for are:

$$\frac{3 \times 96}{12 \times 120} \times 100 = 20$$

per cent.

The extraction calculated from tailings is 100 — 20, or 80 per cent. recovery in concentrates.

A formula may now easily be derived for the calculation of extractions when only the assays of the products are known, the weights being unknown. The weight of the concentrates in terms of percentage by weight of the original may be expressed thus:

$$\textit{Percentage weight of concentrates} = \frac{Oa - Ta}{Ca - Ta} \times 100.$$

$$\textit{Extraction} = \frac{Ca}{Oa} \times \textit{percentage weight of concentrates.}$$

Combining these last two formulas, the full formula for calculating the extraction is

$$\frac{Ca}{Oa} \times \frac{Oa - Ta}{Ca - Ta} \times 100.$$

Working out the above example from this formula, we have for the zinc extraction

$$\frac{45}{15} \times \frac{15 - 7.5}{45 - 7.5} \times 100 = 60$$

per cent

The silver recovery would be

$$\frac{48}{12} \times \frac{12 - 3}{48 - 3} \times 100 = 80$$

per cent

The method of arriving at the final formula may be readily reviewed at any time by examining the formulas which have been combined to obtain the extraction formula. It will be noted that the extraction thus calculated without the weights works out the same as the extraction calculated from weight and assay, namely 60 per cent. for Zn, and 80 per cent. for Ag. Owing to errors in sampling or assaying, the extractions and weights worked out by formula will seldom check as closely in actual practice as in the above examples. A combination of errors may be either cumulative or neutralizing in effect. It should be noted that a + error, causing a + deviation from the correct result calculated by weight and assay, causes a — deviation calculated from the formula using assays only, and *vice versa*. This is apparently contradictory, but in the case of a + error in tails, calculated from weight and assay, the error must be added to the "tailings products accounted for," and the result subtracted from 100 to get the "extraction calculated from tailings," thus lowering the extraction. When calculating by the assay formula the same + error in tails assay will cause a — deviation from the correct result and this — quantity must be subtracted to get the correct extraction.

The following formulas for the rapid calculation of the quantity of water contained in pipes may be found useful:

$$\frac{(\textit{Diameter in inches})^2}{5} =$$

Imp. gallons in 6 ft. of pipe, or

$$(\textit{Diameter in inches})^2 \times 2 =$$

pounds of water in 6 ft. of pipe.

As an example, suppose one desires to know roughly how much water is contained in a 6-in. pipe, 12 ft. long.

$$\frac{36}{5} \times 2 = 14.4$$

Imp. gallons, or

$$36 \times 2 \times 2 = 144$$

pounds.

This is an approximation only, the correct figure being 147 lb. The 2 per cent. error can, however, in most cases, be neglected. Given the diameter of the plunger and the stroke, the amount of water delivered by a plunger pump per stroke can be quickly calculated from this formula.

The annual report of the German ammonia trust (*Chem. Trade Journ.*, April 17, 1909) gives the European and American production of sulphate of ammonia as follows: Great Britain, about 314,000 tons; Germany, 313,000; United States, 82,000; France, 54,000; Belgium and Holland, 35,000; Austria, Spain and other countries, 80,000 tons.

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Pensions for Iron Miners

The Cleveland Cliffs Iron Company, of Michigan, has established a system for pensioning its employees who have been disabled by accident or through age and long service. Besides allowing pensions for retired employes, the widows and orphans of workmen killed while discharging their duty are also to be benefited. One provision is that the widow and children of the workman meeting death must be residents of the United States at the time of the fatality. If a man accidently killed while at work for the company leaves a widow without children, or a widow with children under the age of 16 years who are dependent upon their own efforts for support, or if he leaves children under the age of 16 who are without other means of support, but leaves no widow, the company will contribute $12 per month to her or their support for a period of five years. If the widow should marry or become self supporting within that time the pension will cease. For each child under 16 years of age left with a widowed mother, $1 per month in addition to the $12 allowed her will be paid for a period of five years. If there is no widow the children under 16 years of age will receive their allowance through an administrator. In the event that all children of employees meeting death at the company's properties are under 10 years of age the pension board will have the power to extend payments beyond the five-year period.

Under the rules to govern the payment of pensions no assignments of money due widows or orphans will be accepted, nor will the company recognize such assignments in any way. No money due, or about to become due, a pensioner will be liable to attachment, levy or seizure by or under any legal process whatever, whether the same remains with the company or an agent thereof. Should a creditor attempt to collect moneys due a pensioner, such pension allowance shall be forfeited to the company and shall belong to it absolutely, to be dealt with as the pension board shall deem proper.

All pension allowances will be paid monthly during the life of the beneficiary, but the company may withhold its stipend in case of gross misconduct.

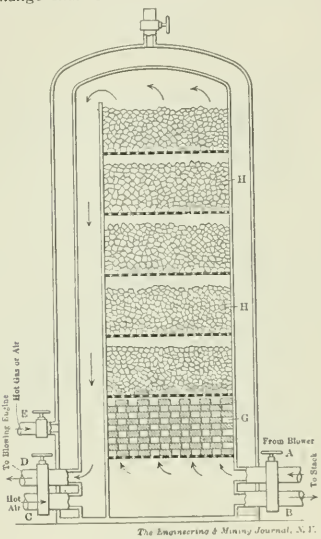
All employees who have attained the age of 70 years and have been in the service of the company for 20 years or more, the last 10 of which shall have been continuous, shall be retired and pensioned.

Any employee who has attained the age of 60 to 69, and who has been in the service of the company 25 years or more, the last 10 of which shall have been continuous, may at his own request be retired from active service and become eligible to a pension.

The monthly allowance paid each person shall be on the following basis:

For each year of service 1 per cent. of the average monthly pay for the 10 years next preceding retirement, provided that the annual pension disbursements for all persons shall not exceed the amount available from the pension fund, set aside by the pension board.

Should the aggregate pension allowance for two successive years exceed the amount added for those two years to the pension fund through apportionment and interest, in the absence of action by the board of directors a new rate shall be established by the pension board proportionally reducing all allowances. Notice of change of rate shall be given employees who are on the pension roll before the beginning of the fiscal year in which the change shall become effective.



AIR DRYING APPARATUS

The amount of pensions will depend, as above stated, upon two conditions: the number of years an employee has served the company, and the amount of his average wages per month, for the 10 years preceding retirement. If the average earnings, as above, should exceed $100 per month, the pension payment will be based on $10, this being the maximum wage on which pension allowance will be computed; but no pension shall be less than $15 per month.

The pension board will be composed of W. G. Mather, M. M. Duncan, Austin Farrell, C. V. R. Townsend, W. P. Belden and W. H. Moulton. Mr. Mather is president and Mr Moulton is the board's secretary.

In 1908 the United States produced 15 tons of molybdenum ore worth approximately $6000 according to statistics of THE MINERAL INDUSTRY

Drying Air for Blast Furnaces

F. W. Harbord describes (British Pat. 4424 of 1908) an apparatus for removing moisture from the air before it enters blast furnaces used for the manufacture of iron. In his specification 25,112 of 1906 various materials, as salts in connection with absorbing agents such as coke, kieselguhr, etc., were suggested and in his later specification, dried peat. With the latter the use of two or more chambers alternately was proposed, but now the hydrated material is not only first dried, but it is also cooled prior to being hydrated again.

In the accompanying illustration is shown a sectional elevation of a chamber in which are bricks of peat *G* and lumps *H*, all of which have been saturated with calcium and ferric chloride and afterward dried. The valves *B*, *C* and *E* being closed the air from the subsidiary blower enters *A*, and passes through the dehydrating chamber, the dry air leaving the chamber through the valve *D*.

When the dehydrating material is so saturated with moisture that it fails to work effectively, valves *A* and *D* are closed while valves *B* and *C* are opened and hot air at about 210 deg. C., is drawn or forced through the material to dry it, and through valve *E* hot air or gas enters the surrounding jacket. Meantime the moist air from the blower passes through the second cooled chamber, and then through the third chamber in which the material has just been dried and which it is desired to cool.

Mercury in Italy

According to a report by Mr. Nicou, the columnar deposits of cinnabar in the Monte Amiata district contain 1 per cent. mineral (60 per cent. mercury) (*La Metallurgie*, April 21, 1909). The ore is screened, and all the small fragments less than 1½ in. are roasted in Cermak furnaces. The chief mine is that of Abbadia San Salvatore, which turns out about 25,000 tons of 1-per cent. ore yearly. Altogether, the number of furnaces running is 28, among which are seven Cermak furnaces with a capacity of 24 to 30 tons, four of 12 to 15 tons' capacity, four of 2 to 8 tons' capacity, and 13 ordinary 6-ton furnaces. The average recovery from a large furnace is 95.2 per cent. of the total mercury contained in the ore. The latter costs 13s. 6d. to 22s. 6d. per ton at the mine, and the cost of classification, conveyance, and treatment is 3s. 3d. per ton, making the total cost 16s. 9d. to 25s. 9d. for the 12¾ lb. of mercury recovered, or 1s. 4d. to 2s. per lb. Although the quality of the ore is diminishing, the use of improved appliances enables the output of mercury to be maintained, and even increased, so that Italy contributes nearly 400 tons out of a total of about 3600 tons produced throughout the world.

Crucible Assays

By A. A. Steel*

When first teaching a class in assaying, I was impressed by the vague and unscientific discussions of crucible charges as given in all the older text books. Most of these simply give tables of charges for various pure gangues, and it is difficult from these to flux mixtures of minerals. A method of figuring crucible charges was therefore worked out so as to eliminate all uncertainties except the exact percentage composition of the gangue.

Professor Fulton's recent book[1] has a good discussion of the nature of assay slags but it gives no simple method of figuring charges. It may be of interest therefore to present the following directions for crucible assaying, which are given to the students of the University of Arkansas after they have figured a few slags by metallurgical methods:

Directions for Fluxing Charges

(1) Examine the material submitted for assay and estimate its approximate mineralogical composition. Then write down the corresponding weight of each mineral in the quantity to be melted (usually 0.5 A.T., called 15 grams.)

(2) *Silica.* Add, if necessary, enough silica to make with that already present in the ore 2 grams of SiO_2 for each gram of $CaCO_3$, $MgCO_3$ or $BaSO_4$ (calcite, dolomite or barite) present, and 1½ grams for each gram of Fe_2O_3, ZnO, clay or other infusible silicate (hematite, zinc mineral, kaolin, etc. Limonite is equivalent to ⅞ its weight Fe_2O_3 and pyrite to ⅔.) Consider 1¼ grams of powdered glass equivalent to one gram of silica.

(3) *Borax.* Add ⅓ of a gram of borax glass for each gram of silica or infusible silicate (clay or talc) present in the ore and the fluxes. For cupel assays add four grams of borax for each gram of bone ash.

(4) *Soda.* Add 1⅓ grams of sodium bicarbonate for each gram of SiO_2 present in the ore or fluxes. Consider fusible silicates as glass, etc., equivalent to 50 per cent. silica. For pure lead ores add at least ⅔ the weight of the ore. For clay, talc, etc., use a mixture of soda and potash.

(5) *Litharge.* Add enough litharge (0—20 grams) to make with the lead already in the ore an 18-gram button and in addition for the slag, 2 grams of PbO for each gram of silica or infusible silicate in the ore. (Consider glass as equivalent to 50 per cent. silica). For cupels add 2 grams of PbO for each gram of bone ash. Increase the amount of PbO largely to keep copper, zinc, antimony, arsenic, and tellurium out of the button if they are present in the ore. For ease in correction for silver in the PbO use litharge in even multiples of 10 grams only.

(6) *Argol or niter.* Add enough argol or niter to make an 18-gram button. One gram of Fe_2O_3 may be assumed to prevent the reduction of about 1½ grams of lead, but the reducing power of sulphides should be determined by a preliminary assay if they are present. When more niter than the weight of the ore is required do not use this method. Roast ores containing much pyrite, antimony or arsenic adding charcoal for antimony and arsenic. If but little niter is required use the niter method in preference to roasting. For galena, etc., nails may be used with charges in which the PbO for the slag is replaced by $NaHCO_3$ in excess. When niter is added in the nail method, be careful to form no FeO which will not fuse in the soda slag.

(7) Buttons brittle from antimony or zinc or showing scales of copper must be scorified.

This system of fluxing forms a bisilicate of Na_2O and PbO or $Na_2Pb(SiO_3)_2$. This is ample flux for a pure quartz gangue and in it the other bases dissolve forming, of course, slags of lower silicate degree. As given, the charge for pure limestone yields a slag of oxygen ratio of 1 in the base to 1.54 in the acid not counting borax. $BaSO_4$ gives a ratio of 1 to 1.7; $MgCO_3$, 1 to 1.47; Fe_2O_3 (as FeO), 1 to 1.33; clay, 1 to 1.42; etc.

Effect of the Borax

Since borax is added to form a borosilicate it is reasonable to figure it according to the amount of SiO_2 present in the slag. The proportion given has not been finally settled upon as the best. It is sufficient to greatly lower the temperature of slag formation, to make the slag viscous during the reduction period, and to lower the temperature of final complete fluidity. It is also sufficient to serve as a general safeguard to flux a slight excess of either acid or base. On the other hand it is expensive and makes the buttons more difficult to clean.

Our charges are a little higher in PbO than usual and for some basic ores it will be more economical to substitute soda for litharge but this makes the charge more bulky. For ease in remembering it was thought better to have a constant ratio of soda and litharge to silica rather than to use the form 1 to 1½ grams of soda and 1.5 to 2 grams of PbO for each gram of silica, which is more nearly what would be used by an experienced assayer.

The amount of fluxes as given by this table are ample and without any great excess. In estimating weights to be fluxed even grams are taken, using care to see that the weight of refractory mineral is over-estimated rather than under-estimated. The minimum amount of the sodium lead silicate required to dissolve the various bases has not yet been accurately determined. If I ever conduct a class in assaying again, this will be worked out for the more common minerals by making up charges of the pure oxides, etc. It is also desired to work out the amount of excess litharge needed for each gram of copper, antimony, etc., in the charge to make clean buttons. This PbO method has been found to work well with up to 25 per cent. of antimony and 60 per cent. of zinc as sulphides but is not so successful for copper.

Dissolving Action of Litharge

A large excess of PbO severely attacks the crucibles and the risk of ruining the muffle by spilled charges becomes important. Therefore it is thought best to scorify the coppery buttons as is done with the buttons obtained in the standard scorification method for copper mattes.

On account of this dissolving action of litharge upon the crucibles more litharge, as given in the directions, is of advantage in assaying clay and talc ores. The charges without excess litharge have very little effect upon Denver crucibles and attack the Battersea crucibles but slightly. The borax seems to protect the crucibles from being drilled by PbO probably by coating them with a viscous aluminum borosilicate.

We have found that by long fusion cupels can be entirely dissolved to a fairly fluid slag by much borax with some PbO and no soda or silica. This forms calcium borate and sodium phosphate as in the tests on platinum wire. The amount of bone ash in the charge is determined by weighing the cupel with the litharge and subtracting the standard weight of that size cupel when new, to give the PbO to be deducted from the weight of the stained part of the cupel. Apology is asked for the incomplete state of these data, but I thought it better to publish this now, rather than postpone it indefinitely in awaiting complete data.

*Associate professor of geology and mining, University of Arkansas, Fayetteville, Ark.

[1] "A Manual of Fire Assaying." McGraw Publishing Company, New York, 1907.

Probably the best time ever made in loading iron ore in the Lake Superior region was made by the "W. E. Corey," a Steel Corporation boat, at Ashland, Wis., on June 8. The vessel sailed with 10,234 tons of iron ore on board in 83 minutes from the time she tied up at the dock light. The actual loading time was 63 minutes, making an average of 159 tons per minute

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Discoveries of copper, gold and silver are reported to have been made on the Fiji islands, and western Australian mining men are at Suva, Viti Levu, awaiting the gazettal by the local government of regulations under which mining may be carried on, after which the new finds will be thoroughly exploited. No mining on a commercial scale has ever been done on these islands

Colliery Notes

The Ruhr coalfield in Germany is the largest and most important coalfield in that country. It covers an area of approximately 1080 sq.m. The estimated amount of available coal in Germany is 140,000,000,000 tons.

An average sample of Pictou (Nova Scotia) coal shows the following composition: Fixed carbon, 61.95; volatile matter, 25.87; moisture, 1.75; ash, 10.42. From this variety of coal 8000 cu.ft. of 15 c.-p. gas can be produced.

Many mining engineers are advising against the use of electrical coal cutters at the faces of gaseous workings. They claim it is better to install compressors in places where electricity may be taken with comparative safety, and then work the cutters with compressed air.

Accidents in coal mines often result from unexpected causes. One such case recently occurred in an English mine where a stone fell from the roof and an armored cable was cut. The mine was gaseous and a spark from the cut cable fired the explosive mixture with fatal results.

England and the United States are the only two countries that produce such quantities of good fuel for all purposes as to render the importation of any further supply unnecessary. Germany, France, Belgium and Austria raise enormous quantities of fuel, but the coal measures of these latter countries are deficient in some varieties that are required for specific purposes.

It is usually true, except where conditions are modified by the percolation of water, that the quantity of firedamp given off in a mine, as well as the temperature and dryness of the underground workings, increases proportionately with depth. It will generally be found that workings at a depth of from 500 to 700 ft. are damp in hot weather and dry in cold weather. Workings at a greater depth than 700 ft. are nearly always dry, and the deeper the drier.

When considering an electrical underground installation, the mine manager or superintendent should remember that although the danger of shock is a matter to be carefully considered, the greater problem should be to try and eliminate the dangers from fire and explosions of gas that may result from the use of electricity. One serious explosion is likely to cause a greater loss of life than would result from electric shocks during the period of a year.

Professor Galloway recently stated as his belief that the damping of the dust for a certain distance in front of blasting shots about to be fired should be compulsory. He does not approve of shirking this precaution on the plea that permitted explosives are used. He regards it as obvious that if the deposition of coal dust in the roadways of mines could be altogether prevented, or failing that, if after being deposited it could be rendered innocuous, great explosions would become impossible.

In preventing the deposition of coal dust in the roadways of mines, Professor Galloway says that the only means of effecting this result is to make use of dust-tight mine cars, filled to the level of their upper edges with coal; then to convey these cars along the roadway at such a speed that the shaking to which their contents are subjected during transit, is insufficient to cause dust to arise from them; and to carefully gather up and remove all traces of coal from the floor when a car happens to be accidentally overturned.

It it difficult to estimate proportionately the classes of work to which coal is put, therefore the following figures of an English statistician are most interesting. This writer extended his research over a period of years and gives the percentages of the main applications of coal in the United Kingdom as follows: Railways, 8.19; coasting steamers, 4.81; collieries, 7.22; factories, 24.07; blast furnaces, 11.44; steel and malleable iron works, 7.85; other metallurgical works, 1.20; chemical works, potteries, glass works, 3.61; gas works, 9.63; domestic, 21.08.

It is still a debated question as to whether as good results in the blast furnace can be obtained with by-product as with beehive coke. After examining this problem, Charles Bell stated that with the same ore, the consumption of coke per ton of pig iron showed a saving of 2.29 cwt. in favor of the by-product article. Opinion is still divided, however, as to the relative merits of the two cokes for smelting purposes. With the improved type of modern by-product ovens the superiority, if any, of the beehive cokes is very slight, and is not sufficient to justify the wastage incidental to coking in the beehive oven.

Dry powdered calcium chloride, similar to the product used for damping dust in coal mines, is a rather expensive article, costing about $12 a ton. As compared with the cost of sprinkling with plain water, the use of the powder shows a saving in labor, and does not require any capital outlay for pipes, barrels, hoses, sprinklers, etc. One mine manager estimates that the cost of sprinkling an entry, 9 ft. wide and 300 ft. long, with powdered calcium chloride, would average about $3.12; the water would have to be applied daily, whereas the calcium chloride would apparently be effective for three months.

Professor Meyer, of Germany, who conducted a number of experiments to determine the nature and quantity of the gases occluded in various coals, placed pieces of coal of the size of a nut in a flask and boiled them in water which had previously been made air-free by boiling; the flask was provided with an india-rubber stopper, through which a glass tube led the escaping gases. The latter were collected over boiling water. Professor Meyer obtained from British and Westphalian samples, heated to 100 deg. C., from 4 to 238 c.c. of gas per 100 grams of coal. The gases varied in composition, but all contained carburetted hydrogen, carbon dioxide, oxygen and nitrogen.

A large metal safety barrier was recently built for the Heinitz colliery, Upper Silesia. The barrier is constructed in three sections, and is designed to stand a pressure of 750 lb., and is provided with three doors; two of these doors measure 6 ft. in hight by 3½ ft. wide, and are used for the passage of the cars in the haulage road; the middle door is for foot passengers, being 6 ft. high and 31 in. wide. The total weight of the barrier is 35 tons. The metal used in making the casting consisted of pig iron with an addition of steel, the resulting material being stronger and tougher than gray cast iron, and midway between the latter and cast steel in point of tensile strength, while cheaper than cast steel.

The total exposed area of the seven important coalfields of England and Wales, is 2786 sq.m. There are in the various fields 190 seams of coal of more than 2 ft. in thickness at a less depth than 4000 ft. These beds represent a total thickness of 666 ft., an average of about 3 ft. 6 in. per seam. According to a recent report by the Royal Coal Commission, the amount of fuel still available in the above areas, excluding all seams of less than 2 ft. in thickness and more than 4000 ft. deep, is 79,000,000,000 tons. The thinner and deeper seams are estimated to contain an additional 70,000,000,000 tons. According to this estimate, and basing calculations on the present annual rate of extraction, the combined coal resources of Great Britain should last about 600 years.

China is rich in coal, which is widely distributed throughout the vast empire. The coal measures are of an age more recent than the Carboniferous, probably Jurassic. There are probably larger deposits of anthracite in China than in any other country. The Shan-si coalfield covers an area of 55,000 sq.m.; one bituminous seam in this field is 20 ft. thick. In Hu-nan, anthracite coal, having a conchoidal fracture and comparable with the best known varieties is found. The strata in this district are greatly broken up, and the inclinations are often great. The total area of the coal measures in this district is estimated at 21,000 sq.m. An average sample of Manchurian coal gives the following analysis: Fixed carbon, 62; volatile matter, 26; ash, 10; moisture, 2; sulphur, traces.

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The Copper Statistics for May

The report of the Copper Producers' Association for May was received generally in an optimistic way, but analysis of the figures does not seem to us to afford any substantial basis for joy. The accumulated stock was reduced by about 13,500,000 lb., but it does not by any means follow from this that the production of copper is now being used up faster than it is being turned out. On the contrary, the reduction of the accumulation in the hands of the refiners implies chiefly a transferal of the metal from one place to another. The exports in May were upward of 70,000,000 lb., a high figure. What was happening is reflected by the European statistics for May, which showed an increase of about 12,200,000 lb. in the visible supply.

Deducting the exports from the deliveries, there remains upward of 60,000,000 lb. that must have gone into second hands on this side, or was to some extent on lighters awaiting export. It is, of course, utterly incredible that domestic consumption has yet reached the figure of 60,000,000 lb. per month, which would be higher than the best on record. Undoubtedly some large manufacturers took a great deal of copper into their yards during May, providing for requirements for some time ahead. This is another way of transferring stocks.

The ominous feature about the statistics for May is the continued increase in the production, which averaged 3,818,000 lb. per day, against 3,785,810 lb. in April. The ratio of increase was larger in May than it was in April. It is well known that some large consumers of copper have taken in their requirements for many months ahead. The actual consumption of the world will have to make further strides in order to take care of the steadily increasing production and bring about a real diminution of stocks.

The real condition of affairs is reflected in the weakness of the market this week. Consumers have been well supplied and producers have much copper yet to sell. The visible supply at the middle of June, as cabled from abroad, shows a large increase, and the statistics at the end of the month will doubtless show a further augmentation.

The World's Production of Gold and Silver

According to our latest compilation of the official statistics so far as reported, with estimates for the minor countries from which official reports have not yet been received, the production of gold in the world in 1908 was 444,382,312, compared to $411,294,458. The production in 1908 not only was the largest on record but also it showed a larger increase compared with the previous year than for any time since 1898. Large increases in the production were shown by the United States, Canada, Mexico, Russia, Rhodesia and the Transvaal. The production of British India was about the same as in 1907. The only important gold-producing country to show a decrease was Australasia.

In spite of the lower price for silver there was an important increase in the production of that metal, which amounted to 200,655,383 oz. in 1908, against 183,386,250 oz. in 1907. There was a large decrease in the production of the United States and a small decrease in that of Australasia, but there were very large increases in the production of Mexico and Canada and small increases in several of the South American countries. The decreases in the United States and Australasia are explained by the reduced outputs of some of the base-metal mines which yield silver as a by-product of copper and lead. The large increases in Mexico and Canada are explained by the extension of the application of the cyanide process to the treatment of silver ore in the former country, and to the larger production of the remarkable Cobalt district in the latter country.

Santa Rita and Chino

A lady saint and a Chinaman, whereby hangs a tale. Some time ago our friend, Thomas W. Lawson, favored us with a handsomely engraved communication to the effect that he would soon present to us, together with other selected persons, an important literary production. In due course of time, the latter appeared and turned out to be a book dealing with a new process and the Santa Rita mine, to which we have previously referred. In the natural order of events, the materialization of this publication should have been followed by a loud blowing of the

bazoo. Strange to say there was silence, and stranger still, the Santa Rita mine was brought out a few days later, under the name of the Chino Copper Company, by a well known house of bankers and brokers, without one mention of Mr. Lawson. Our readers are interested in having an explanation of this sudden shift.

Mr. Lawson intended to promote the Santa Rita company. He owned an interest in it and had options upon the other interests. He published his book before he had exercised his options. Just then certain unexpected events occurred that led Mr. Lawson to refrain from exercising his options and transfer them to the house that brought out the Chino Copper Company.

The Santa Rita mine has a large deposit of oxidized ore of very low grade, below which there is low-grade, disseminated sulphide ore, that has not yet been extensively developed. Mr. Lawson contemplated treating the oxidized ore by a new hydrometallurgical process. The new owners are directing their attention to the sulphide ore in the conventional way.

The Wage Question at Broken Hill

As has been heretofore noted in the JOURNAL, the miners at most of the large silver-lead mines in the Broken Hill district of New South Wales have been on strike for some time past, and there is no immediate prospect of a settlement. The strike and the subsequent proceedings present some peculiarities, which are of interest. Some of these are due to the Australian law of arbitration, which is generally considered to be favorable to the unions, whose political influence has been very strong.

To go back to the origin of the trouble, the Broken Hill Proprietary Company—the principal company in the field—which had been paying its men on a stipulated scale, settled by arbitration in 1903, agreed about the end of 1906 to make a general advance of about 12½ per cent. This advance was granted without any contest, in view of the high prices for lead and silver then prevailing, which made the increase possible. The example of the Proprietary Company was followed by the other companies in the field. The advanced rate was to hold for two years. At the close of that time, in August of last year, the company decided to withdraw the advance, owing to the fall in the prices of metal. At the same time it offered the men, not simply a return to the wages of 1903, but a sliding scale, based on the price of lead, so that any advance in the metal would carry with it an increase in wages. This was not accepted by the men, who appealed to the Arbitration Court provided by Australian law, and who also decided to stop work, although the company offered to guarantee payment at the higher rate, if the Court should decide against it.

The action of the Broken Hill Proprietary Company was followed by the Broken Hill Block 10 Company, but after the men had struck the minor companies in the field generally gave way, and paid the higher schedule. When the case came before the Arbitration Court the two companies represented that a continuation of the 1906 schedule at present prices for lead and silver would force them to work without any profit, or at a loss, and that they would be compelled, under such circumstances, to close down altogether.

The Court, however, decided against the companies, not on the basis of their argument, but apparently entirely on the ground that the rate of 1906 represented the lowest point which could be regarded as a "living wage" in the district. It may be noted here that the rate for unskilled labor, under the award of 1903 was the same which had been paid for 10 years previously, and was 7s. 6d. ($1.80) per day. The increase in 1906 brought it up to 8s. 7½d. ($2.07) per day. This was the rate in controversy; miners in the district generally work on contract, and in 1908 averaged from $2.76 to $2.90 per day.

The Proprietary Company believed that the Arbitration Court had exceeded its powers in basing a decision, not upon the facts in the case, but upon its theory of the amount of a "living wage." Accordingly it appealed to the higher court. Some propositions for a compromise have been made, but not accepted. The latest reports state that the Appellate Court has approved the decision of the Arbitration Court, but solely on the ground that it had not exceeded its powers; the higher court not going at all into the merits of the case.

The Broken Hill laborers have accordingly gained a victory in one sense; but they do not seem likely to derive much benefit therefrom. The Proprietary Company has decided to continue work at its Port Pirie smelter to carry out certain contracts, but at the mines only to a limited extent. A large number of its former employees will be out of work altogether, as all of them have been for some months past.

Apparently the theory of the "living wage" is legally established in New South Wales; but in a way, probably not expected by the strikers, it will have a practical application to owners and employers as well as to employees. There is no legal way to compel owners to work their property at a loss. The price of such products as lead and silver depends on conditions beyond their control. If the men are unwilling to work except at a price which will make it impossible to produce the metals at some profit, the production must cease in time. A graduation of prices to wages would be possible only in the case of a producer who held an absolute monopoly.

The proper division of profits between owners and workmen is a complex question which, in all probability, will never be completely settled. The controversy at Broken Hill, apparently, has done little toward advancing that settlement.

The Broken Hill Proprietary mine of New South Wales is admittedly nearing the end of its life. At the last semi-annual meeting of the company, the chairman of the directors stated that at the end of August, 1908, the ore reserves amounted to 3,000,000 tons. During the following six months 264,847 tons of ore were raised, leaving 2,735,153 tons. No considerable orebodies have been encountered during the last year, and the immediate prospects are confessedly disappointing. At the present rate of production the life of the mine will be about five years more. If no new orebodies are discovered in the meanwhile, this will be the end of a glorious career.

THE MINERAL INDUSTRY, Vol. XVII, is now on the press and should be ready for distribution before the middle of July. It will be a volume of about 1100 pages. The printing is being done directly from the type, no plates being made, wherefore there will be no reprinting. The edition being thus limited, subscribers are advised to send in their orders early. There will be no complimentary list and no copies will be sent to the press for review.

The California Eight-hour Law

The new eight-hour law for miners in underground mines and men in reduction works, is to be tested at once before the Supreme Court. Fred J. Martin, superintendent of the Utica Mining Company at Angeles in Calaveras county, was arrested for keeping a miner in the 603-ft. level of the mine for 8½ hours, which is a longer time than the new law permits. He was arrested and imprisoned, Judge McSorley, of the Superior Court, of Calaveras county holding that the law was constitutional. A petition for a writ of *habeas corpus* has now been filed in Mr. Martin's behalf, which brings the matter at once before the Supreme Court. The law is attacked on allegations that it is special legislation and that the title embraces more than one subject. The attorneys for Martin contend that the regulation of labor in "smelters and other institutions for the reduction or refining of ores or metals" can in no sense be germane to labor in "underground mines," so as to be included within the general scope of an act " to regulate the hours of labor in mines." It is contended that the title of the act is in conflict with the State constitution, which provides that every act shall embrace but one subject, which subject shall be expressed in its title. But if any subject shall be embraced in an act which shall not be expressed in its title, the act shall be void as to so much thereof as shall not be expressed in its title.

The expression of two incongruous and disconnected subjects in the title of the act can only have the effect of rendering the whole void for uncertainty. If the title had been left as it originally stood, only such parts as were not expressed in the title would have been void, but the title was amended, and this, the lawyers think, destroyed the entire act.

The title of the law as amended is "an act regulating the hours of employment in underground mines and in smelting and reduction works." It does not take in all kinds of mines, and is thus considered special legislation. Men can work, or be worked, in placers, hydraulic and river-bed mines and gold dredges for any length of time without restriction, but if they get the gold in underground mining they cannot work more than eight hours even if they wish; and if the superintendent permits them to do so he is subject to fine and imprisonment, as in the case of Mr. Martin, of the Utica. As predicted in one of these letters the matter has been brought to issue very promptly by the mineowners and operators of the State, who will jointly press the suit now commenced to test the constitutionality of the law. Frank J. Solinsky and Paul C. Morf of San Francisco, both well known mining lawyers represent the California Miner's Association and Mr. Martin.

The Psychology of a "Bull Market"

In America, a "bull market" in stocks is an event which supersedes all other considerations of the day, says *The Evening Post*. Up to a certain point in its history, popular comment on it is pretty much limited among people out of Wall Street, to remarks by business men and their clerks that "I see stocks are picking up," with the inference that "things ought to be better with us, after a while." The Stock Exchange is then regarded as an indicator which is watching general business and trying to get the correct gage of it. The rise goes on; one hears less about business conditions and more of the market itself as the primary consideration. Quiet readers of the afternoon paper at the club, men to whom Wall Street is a picturesque idea and nothing else, stroll up to the latest arrival from an office south of Pine street, to inquire, curiously, "What are you doing with things down there?" Inquiries from widows and orphans next begin to arrive, as to whether they had not better sell the bonds that were left to them in the will, and put the money into Tin preferred or Amalgamated Nickel. This is preliminary, if the ticker keeps at its duty, to those profound conferences on the ferryboats and around the lunch counters, over the "inside pointer," which John or Henry got from a first-rate source, and which means ten points on the narrowest figuring. If the episode goes still further, it sometimes supersedes not only horse racing, but the standing of baseball teams, as the nearest topic of common interest.

It is the business of our high financiers to encourage and promote this pleasant pastime, and the way of doing it has been fairly well marked out by experience. If there are "new deals" under way in the finances of companies whose shares are listed on the Stock Exchange, they must be announced at judicious intervals, according as stimulus is needed for the "bull movement" and each of them must be held back until the psychological moment—which, naturally, means until the stock has been accumulated by the people with "inside information," has been bid up to very much higher prices, and is ripe for transfer in exchange for the outside public's cash. This is what Wall Street calls "distribution"—a term which, since it remotely suggests benevolence, is more favored than the term, "unloading," whose associations are more harsh. The rest of the history of the episode depends on circumstances; it is these which provide the gambling element which, after all has been said, is as dear to high as to low finance.

According to THE MINERAL INDUSTRY, 1908 was the first year in which magnesium was produced in the United States. The output amounted to 500 lb. worth $500.

Mineral Production of Virginia

By THOMAS LEONARD WATSON*

The statistics of production and value of minerals in Virginia for 1908—not including metals—collected by the Virginia Geological Survey in coöperation with the Division of Mineral Resources of the U. S. Geological Survey, clearly indicates the effect of the recent business depression arising from the monetary troubles. The decrease is especially noticeable in the larger industries, such as coal and coke, clay products, iron ores, stone, talc and soapstone, etc., but some of the smaller ones, of which there are many, show a marked increase. The total value for the year 1908 is $12,059,310, or about 70 per cent. of the production for 1907.

The quantities and values of the principal mineral products were:

		Quantities.	Values.
Coal	Sh. tons	4,224,821	$3,881,448
Coke	"	1,158,517	2,093,474
Iron ore	Lg. tons	645,460	1,372,802
Pyrite and pyrrhotite	"	117,440	389,808
Manganese ore	"	6,144	62,779
Miscellaneous minerals	Sh. tons	27,404	114,572
Mica, sheet	Lb.	13,427	7,346
Mica, scrap	Sh. tons	464	
Talc and soapstone	"	18,623	335,068
Mineral waters	Gal.	2,316,619	434,742
Total			$8,692,039
Add clay and stone			3,367,271
Total values			$12,059,310

Miscellaneous minerals include barytes, gypsum, feldspar and mineral paint. The quantities and values of the building materials produced were as follows:

		Quantities.	Values.
Granite			$321,530
Limestone	Lg. tons	442,094	272,306
Slate	Squares	41,678	194,356
Millstones and sandstone			8,554
Sand and gravel			226,782
Clay	Sh. tons	585	3,619
Brick and tile	M.	196,054	1,525,191
Sand-lime brick	M.	7,074	40,534
Lime and cement	Bbl.	1,472,564	774,399
Total values			$3,367,271

There was no production of arsenic, asbestos, fluorspar, graphite, quartz, rutile, nickel, or phosphate in Virginia, in 1908. Considerable development work was in progress during the year in the Nelson county rutile area. The results were encouraging and it is expected that the area will again be a producer in 1909.

Statistics of THE MINERAL INDUSTRY show that in 1908 the United States produced 32,000 short tons of calcium chloride valued at $224,000. In 1907 45,000 short tons valued at $450,000 were produced.

The 1908 production of zinc ore in the United States was 838,377 short tons against 902,923 short tons in 1907. These are the figures obtained for THE MINERAL INDUSTRY.

*State geologist, University of Virginia.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Electric Mine Signaling

The arrangement of electric signals at the Grand Hornu mine, described in the JOURNAL of April 24, 1909, is similar in many respects to that which has been in use in a number of collieries in the United Kingdom, for nearly thirty years. As far as there is any difference between the arrangements at the Grand Hornu mine and those in use at British collieries, the arrangements at Grand Hornu appear to me to be not so good. The use of the current from an electric-power service, in place of batteries, is a natural development but to my mind the use of alternating currents for signals is hardly wise, and the use of a live wire in the shaft is also unwise.

In the early days of electric signaling, we had a great deal of difficulty with shaft signals, principally owing to the wires in the shaft getting eaten away. If the insulating envelope of the wire was damaged even slightly, the water that is always present in mine shafts found its way through to the copper and quickly ate it in two, with the result that it not only stopped the signals but it was difficult to find. With long experience, one got pretty expert at finding these faults but anyone coming fresh to the work, might go over the place again and again, and not see it.

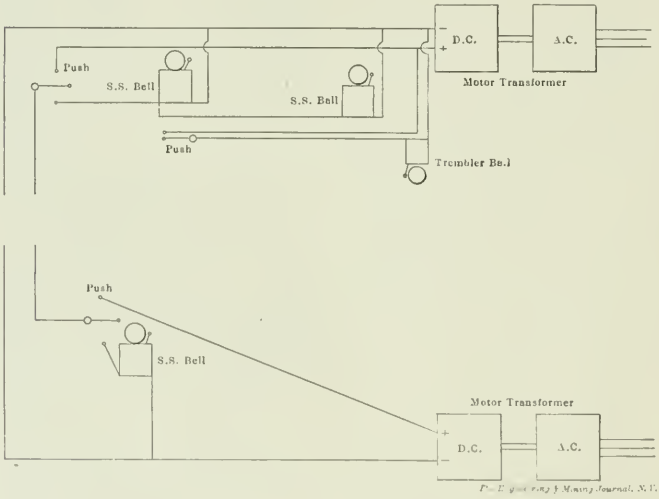
We found in those days and the matter has not altered since, that a wire in which the current was always present, if fixed in the shaft, was much more liable to be eaten in two than the wires in which currents were only passing when the signal was being given. I found the best method was to have a battery at the top to work the down signal and that between bank and engine house, and another battery at the bottom to work the up signal.

The modern equivalent of this would be a connection from a small motor generator at the top, to work the down signals, and the signals between pit top and engine house, and the current from another motor generator at the bottom to work the up signals. It is a simple matter to arrange a motor generator, taking current from a three-phase supply service, and generating continuous currents for the signals, and possibly for other work, both at the top and bottom of the pit and in any intermediate seams.

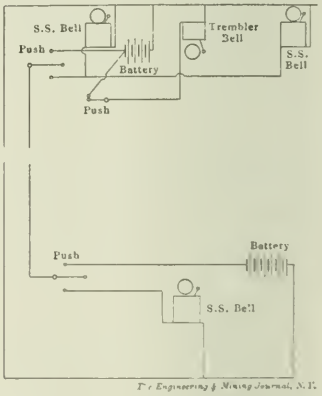
One disadvantage of the use of alternating currents for signaling is that it is absolutely necessary to have the signaling wires in one cable, twisted round each other, or to place them very close together. It would not do to have separately armored or lead covered cables for the different signal wires, and the tendency is to use armored cables in the shaft for everything now. I do not see, either, the advantage of using alternating currents as far as the working of the bells is concerned. A bell to work with alternating currents is a more complicated affair than one to work with continuous current. A familiar instance of a bell working with alternating currents is the call bell of the telephone apparatus.

It also appears to me not to be quite sound for the home bell to ring at the same time as the distant bell. According to the description of the signals at the Grand Hornu mine, the onsetter at the pit bottom would ring his own bell, at the same time as he rang the bells on the bank and in the engine house. One of the most important conditions that were given to me, when I was working out the shaft signal thirty years ago, was that nothing of the kind must take place. The reason I think is obvious, viz., that confusion may be caused by it.

The special rules for colliery working in the United Kingdom state very clearly that a certain number of raps on a bell, or the equivalent, must be given and a certain number of raps received in reply. It might happen that the onsetter was signaling at the same time as the bankman, though that would not often occur, and the results might be disastrous. I may mention that while engine plane signals have been almost universally adopted in every colliery in the United Kingdom, shaft signals have only been taken up at comparatively few. The ac-



SHAFT SIGNALS WORKED BY CURRENT FROM MOTOR GENERATORS AT TOP AND BOTTOM



SHAFT SIGNALS WORKED BY BATTERIES

companying diagrams show the connections of the signals as they are fixed in British collieries, with batteries, and as they would be arranged for taking current from motor generators.

SYDNEY F. WALKER.

Bath, England, May 12, 1909.

Filing System For Techincal Papers

A mining engineer in the practice of his profession is called upon to move from place to place a great deal and he soon finds that he cannot afford to pack a large library around with him. A standard work on milling, one on smelting and another on ore deposits will probably form the extent of his library especially during the earlier years of struggling to the top. During these years a man must depend almost wholly on the magazines and journals of his profession to keep him posted. Text-books are necessarily a year or more behind the progress. The articles in the technical press are written by the men in the field, and are alive and uptodate. Therefore a man who supplements his few standard works on mining and metallurgy with a filing system by means of which important articles from current literature can be filed for future reference is sure to be uptodate in his reference library.

I have such a file which contains all the important articles bearing on methods of mining, milling and smelting, costs at different plants, financial and other company reports, geological data, discussions, etc., which have appeared in several American and Canadian journals during the past four or five years. This collection contains about 7000 pages, yet the whole file can be carried in one end of a suit case. There is probably nothing new in the method of making up this file and its index, yet it requires so little work in comparison to its great value that a short description may be of interest to readers of the JOURNAL.

The indexing is done in a small loose leaf pocket-book. This book is leather covered and has three steel rings which can be opened or closed by means of a sliding lever in the cover of the book. Such books are carried by all stationers. The one I use is 5x7 in. in size and has indexing letters from *A* to *Z*. Under each letter several pages can be inserted and each one alphabetically marked at the top as Aa, Ab, etc.

Should an article be devoted to one subject, as for instance a description of the Shannon concentrator, it would be entered in the index under

Mi—Mills, description of
Shannon Cu. Co. 325.

Also, under *Ar*,—Arizona—Shannon Cu. Co. 325. I would also cross-index this to *Co*—Copper in Arizona, Shannon Cu. Co. If the article also described the smelting plant and mining methods, under "*Sm*—Smelting" would be entered the page describing that operation and under "*Mi*—Mining at Shannon Cu. Co." the page on which is the description of that operation. Then under *Sh*—would be a heading, Shannon Cu. Co., and page numbers of all articles relating to that company or plant would be entered. In this way each article is divided into several heads and each one is indexed under its proper letter. Should I want general information on the Shannon Copper Company, I would refer to index letter *S*, turn to page *Sh* and the page numbers of all articles of every kind referring to that company would be together on one line thus:

Shannon Cu. Co. 318-577-618-1141.

However, should I wish to know only cost of production at that plant I would refer to index letter *C*, and find such items under

Co—Cost of
Shannon, milling at, 318
mining at, 618
producing Cu. at, 1141.

The pages are torn out of the journals and numbered in the center of the bottom margin. These are then placed in manilla envelopes large enough to hold two hundred pages without folding. The envelope is marked to show what pages are included within. In order to keep the pages together two holes are punched in the top margin and copper fasteners put through and clinched, thereby binding together the two hundred pages. An extra envelope can be used for unindexed sheets yet even the busiest man if he finds time to read the articles can do the indexing as he goes over the articles and with but little loss of time.

Any number of pages can be placed in the index book up to its capacity. I have over 7000 pages of articles indexed yet the small book is not one-quarter full and can easily be carried in the pocket. While the file of articles can be carried in the suit case and still leave room for other necessary articles; yet what a live comprehensive reference library it is.

D. F. HALEY.

West Gore, Nova Scotia, May 20, 1909.

Prevention of Mine Accidents

The Committee on Prevention of Accidents in Metalliferous Mines, appointed by the American Mining Congress, expects to make a report at the forthcoming meeting of the American Mining Congress at Goldfield, Nev. This report will take the form of the presentation of a code covering provisions that are deemed necessary to promote safety in mining. Much importance is attached to this report, inasmuch as it is likely to be the basis for legislation by several States. Already a commission to draft a mining law for Arizona has been appointed, and that commission is awaiting the report of this committee.

In the first report of this committee, published in the ENGINEERING AND MINING JOURNAL of Dec. 5, 1908, and republished in pamphlet form by the American Mining Congress, summaries of the existing mining laws of several States were presented. The hope was expressed that these publications would have led to suggestions as to provisions that ought to be included in, or excluded from, a composite and improved mining law.

The committee now urges particularly that anyone having suggestions to offer respecting the workings of the existing laws of Colorado, Montana, Idaho, Missouri, and other States, or features in those laws that should be excised, or new provisions that should be incorporated, communicate promptly with the unsigned, in order that the committee in its deliberations may have the benefit of such suggestions.

W. R. INGALLS,
Chairman.

505 Pearl street, New York, June 11, 1909.

Michigan Gypsum

BY JAMES L. NANKERVIS*

Gypsum is found in remarkable abundance and purity at Grand Rapids and Alabaster, and in moderate quantities at various other places. This mineral is very properly classed among the useful products of the State and its production and manufacture form an important and a growing industry. The output of gypsum in Michigan in 1908 was 250,000 tons, valued at over $700,000. While the growth of the industry has been somewhat slow, yet it has been steady, wholesome and continuous. The stratum of gypsum at Grand Rapids is 18 to 20 ft. in thickness, and is found from 1 ft. to 16 or 18 ft. below the surface; it is fully 1000 ft. in extent, affording a very large supply to draw upon.

The development of the gypsum industry in Michigan is practically confined to Grand Rapids where the mineral is produced in considerable quantities and is ground and prepared as a basis for wall tintings, wall decoration, stucco work, plasters, fertilizers and other uses. For wall tintings and decorations alabastine and allied gypsum products are among the best things made. On account of the excellent sanitary properties of the articles and the ease with which the different preparations may be applied, they are becoming popular in the United States and in many parts of Europe.

*Ex commissioner of mineral statistics, Calumet, Mich.

Production of Various Minerals in Kentucky During 1908

By Charles J. Norwood*

Statistics are now available of the production of commercial coal, fluorspar and barytes in Kentucky for the calendar year of 1908. I have no hesitation in saying that these statistics are as complete as it is possible to collect. Data relating to the production of commercial coal are gathered monthly by the mine-inspection office and are checked and rechecked throughout the year, while the data for fluorspar and barytes are gathered by the Kentucky Geological Survey through personal visits made by F. Julius Fohs, of the Survey, and are checked in various efficient ways.

Output of Coal

The production of commercial coal amounted to 9,805,777 short tons, a decrease of 630,284 tons, as compared with 1907. The losses occurred in the western and southeastern districts, the loss in the former being 526,186 tons, and in the latter 184,687 tons. The northeastern district gained 80,589 tons. The output for 1908 by counties, arranged according to districts, is given in the accompanying table.

KENTUCKY COAL PRODUCTION IN 1908.

Western District. County.	Tons.
Butler	4,968
Christian	33,191
Daviess	52,658
Henderson	226,152
Hopkins	1,772,253
McLean	97,287
Muhlenberg	1,774,314
Ohio	602,316
Union	513,015
Webster	558,442
Total	5,634,596

Southeastern District. County.	Tons.
Bell	1,434,742
Knox	520,089
Laurel	212,585
Pulaski	69,634
Whitley	813,541
Total	3,050,591

Northeastern District. County.	Tons.
Boyd	79,763
Breathitt	24,043
Carter	78,509
Floyd	52,857
Johnson	154,159
Lawrence	24,751
Lee	92,533
Morgan	62,290
Pike	551,385
Total	1,120,590

The disposition of the product was as follows: Sold locally, 301,283 tons; used at the mines, 261,273; converted into coke, 85,449; shipped to market, 9,157,772. Of the total output, 70,413 tons were of cannel coal. The average selling value of the latter, at the mines, was $2.439 per ton. With cannel included, the average selling value of all coal was $0.997 per ton, but dealing with the bituminous alone, the average selling price per ton for the various districts was as follows: Western, $0.9081; southeastern, $1.1414; northeastern, $0.9580; general average, $0.9856; total value, $9,605,025. When comparing figures issued by the U. S. Geological Survey with those given by this office, it should be remembered that the former organization undertakes to report the production of all "banks," whether large or small, while this office reports only commercial coal.

Of the coal shipped from the mines, 57.74 per cent. was sent to other States, the western district and northeastern district being the largest shippers to outside markets. A fraction more than 56 per cent. of the total product was mined by machine, the proportion in each district being as follows: Western, 70.52 per cent.; southeastern, 32.56 per cent.; northeastern, 49.52 per cent. In the production of coal, 18,611 persons were employed of which 14,522 were engaged under ground and 4089 employed at surface works, including coke ovens. But little coke was made during the year. The St. Bernard ovens, in Hopkins county, turned out 36,416 tons; the ovens of the Ohio Valley Coal and Mining Company, in Union county, produced 1837 tons; the ovens of the Straight Creek Coal and Coke Company, in Bell county, were idle nearly all the year, producing only 100 tons.

There were 39 fatal accidents, as follows: Inside mine, 35; in shaft, 1; on surface, 3. This was an increase of 7 over the number for 1907. Considering accidents inside the mine only, the increase was 10. This was due to two explosions caused by blown-out shots and to an increase of 5 in the number of deaths due to falls of top. It is not improbable that the increase of fatal falls of top was in some measure due to the crippled condition of the mine-inspection bureau for a good part of the year; the increases occurred in districts that were without inspectors for some time, whereas in the districts having inspectors there was a decrease. In one of the explosions a blown-out shot caused the explosion of a keg of powder, killing 3 men; in the other, a blown-out shot set fire to coal dust and 9 men died from the effects of the afterdamp. In this State, blown-out shots seldom occur except where coal is shot on the solid. Mining on the solid should be explicitly prohibited by law; there seem to be difficulties in the way of many of the operators who may attempt to make a "rule" against it.

Production of Fluorspar in 1908

The statistics of the production of fluorspar were gathered with especial pains to obtain correct returns. As in 1907, the production was confined to Crittenden and Livingston counties. The tonnage mined was 25 per cent. less than in 1907, though greater than in 1906, and the shipments fell below those of any year since 1899. The tonnage held in stock at the beginning of 1909 was greater by almost 3000 tons than for any previous year. The amount of lump shipped was small, being almost entirely replaced by gravel. The production came from nine mines, the bulk, in fact, from five, whereas more than twice that number were necessary to yield about the same amount in 1906 and 1907, showing that with a certain amount of devlopment any of the good fluorspar mines can become much larger producers. The statistics of production, shipments, etc., for 1907 and 1908 are arranged for comparison in the accompanying table.

In 1908 the prices in Kentucky ranged from $4.35 to $6 for gravel, $5.50 to $7 for second- and third-grade lump, and $9 to $15 per short ton for ground fluorspar. The average price for all grades was $7.69. The first six months of 1908 proved the dullest for the fluorspar industry that had been experienced for a number of years. The companies report a falling off in business of from 35 to 80 per cent., averaging less than half as compared with the same period in 1907. This, however, was in accord with the general depression in the business of the country, the chief factor affecting the fluorspar industry being the slack demand that followed the shutting down of iron and steel plants. Since the larger number of shutdowns were in the South, the reduced demand for fluorspar from that section was especially felt by Kentucky operators. The demand for fluorspar in other industries, especially glass, was also less. The resumption of work at many of the iron and steel plants, and the blowing-in of new furnaces during June, especially in the South, caused a better demand for the remainder of the year.

But when the demand from steel plants increased, there were still two factors which prevented Kentucky from getting its share of the business, namely, undersellling by one of the large Illinois producers, and the severe competition offered by the imported English fluorspar. The greater factor is the annual importation of 100,000 tons of gravel fluorspar, duty free.

FLUORSPAR PRODUCTION 1907 AND 1908.

Mined.		Marketed.								In Stock Dec. 31.
Year.	Tons.	Gravel.		Lump.		Ground.		Totals.		
		Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.
1907	15,918	6,433	.....	1,033	.....	6,030	.....	13,496	.....	8,876
1908	12,010	2,840	$14,226	307	$1,828	3,176	$32,588	6,323	$48,642	12,899

*State geologist and chief inspector of mines, Lexington, Ky.

from English waste dumps. The cost of this product, according to excellent authority, is $2.19 to $2.59 per long ton laid down at Partington and Liverpool. The ocean freight rate is $1.22, making a total of $3.41 to $3.87 per long ton at Atlantic ports. The freight rate from Baltimore to Pittsburg is $1.50, making a total cost of $4.91 to $5.37 per long ton, or $4.38 to $4.74 per short ton, at Pittsburg. The sale price at Pittsburg is said to be such as yields the English shippers a fine profit.

On the other hand, the cost of producing gravel fluorspar in western Kentucky (not allowing for mine depreciation, etc.) is reported by one company at $4.48 per short ton. The average selling price in 1908 was $5.01. Another company gives as the average cost of all grades $6.22 per ton, the average selling price for 1908 being $7.60. The freight rate from western Kentucky to Pittsburg is $2.50 per ton. Manifestly, it is impossible to compete with the duty-free foreign fluorspar, and unless a countervailing duty is laid on gravel fluorspar one of the promising young industries of this State must suffer greatly. Since the average maximum amount of fluorspar used per ton of open-hearth steel does not exceed 15 lb., an equalizing tariff laid on gravel spar would not materially affect the cost of steel production.

Kentucky producers, and some of the Illinois producers as well, have refused to sell fluorspar unless a living price can be obtained and have, therefore, either curtailed production or piled up large stocks. In the discussion of the fluorspar and tariff question it has been asserted by some that in this country, as in England, the spar is a by-product from lead mining. That this is entirely erroneous, however, is shown by the fact that in the Kentucky-Illinois district, whence comes practically all the American spar, the lead production is small; there were only 107 tons of lead concentrates produced from more than 12,000 tons of Kentucky fluorspar in 1908.

silver probably came from some lead concentrates made at a Kentucky mill from Rosiclare, Ill., ore.

The following companies mined or marketed fluorspar from Kentucky mines during 1908: Albany Mining and Investment Company, Marion; Blue Grass Fluorspar Company, Princeton; Great Northern Mining and Development Company, Marion; Indiana & Kentucky Fluorspar and Lead Mining Company, Marion; Kentucky Fluorspar Company, Marion; Sunnybrook Lead and Fluorspar Company, Marion; and R. L. Moore & Co., Marion. The following did development work: James M. Pearsons, Marion; Pope Mining Company, Salem; and the Kentucky & Indiana Mining Company, Francis.

Barytes in 1908

Notwithstanding that in "Mineral Resources" for 1906 and 1907 Kentucky was assigned to a very minor position as a producer of barytes, and that in articles on barytes by various "experts" this State is not even named, Kentucky is really a very respectable producer of that mineral, and it is the belief of the State Geological Survey, as the result of field work that has been in progress for some months, that the Central Kentucky district is, all things being considered, the greatest barytes district in this country.

The production for 1906 amounted to 3375 short tons, valued at $15,187; for 1907 it was 9435 tons, valued at $44,059. In 1908 the amount mined was 11,051 tons. Of this a certain amount was used for making blanc fixe, concerning which we may not publish details, since the one concern making it does not authorize such publication. During the year 5233 tons of crude, valued at $21,504, and 3300 tons of ground, valued at $39,600, were shipped and a certain amount was stocked. At the close of 1908, 5904 tons were reported in stock. The average value of crude barytes was $4.11 per ton, and that of ground, $12. The average prices for both crude

samine, Lincoln, Owen, Scott and Woodford. Boyle, Fayette and Garrard were the largest producers, in the order named. Excellent deposits also occur in Henry, Mercer and Russell counties, especially in the first two, but there was no production in 1908.

The Dix River Barytes Company intends to erect a mill for grinding and bleaching barytes at Danville, Boyle county, and the Kentucky Barytes Company contemplates the erection of a plant for the production of blanc fixe and barium by-products; the company now has a grinding plant at Nicholasville, Jessamine county. The Mutual Mining Company is enlarging its blanc-fixe and lead-fume plant, and is adding equipment for the manufacture of paint. No lead or zinc shipments were made from the Central Kentucky district in 1908. About 60 tons of lead concentrates were produced. The Mutual Mining Company manufactured blanc fixe, sodium sulphide, and depilatory throughout the year.

The field study of our barytes deposits is in the hands of F. Julius Fohs, by whom the statistical data were gathered. As the work of the Survey proceeds a large number of veins have been brought to light, some of them extending four to five miles in length. In Fayette county alone 32 veins have been investigated, two-thirds of which Mr. Fohs considers profitably workable. The average width of the veins is 3 ft., but enlargements occur measuring over 10 ft. in width. The barytes is known to extend downward, nearly vertically, to a depth of 250 to 300 feet.

Annual Report on Production of Butte Mining Companies

The annual reports of the mining companies, required by law to be filed with the country assessor, were made public last week and show the earnings for 1908.

REPORT OF BUTTE MINES FOR 1908.

	Anaconda.	Boston & Montana.	Butte & Boston.	North Butte.	Washoe.	Butte Coal.	Trenton.	Parrot.
Tons of ore extracted	1,316,893	1,185,142	355,702	191,951	208,675	424,752	168,818	147,858
Gross proceeds	$11,963,134	$12,087,072	$3,212,726	$4,948,329	$1,543,062	$3,722,322	$1,242,725	$1,057,385
Cost of mining	5,460,937	4,730,533	1,322,887	1,636,167	759,938	1,623,980	614,045	608,138
Freight on ore	162,441	763,288	78,079	59,118	25,524	70,691	20,275	21,733
Cost of reduction	2,946,242	1,285,768	835,923	1,413,600	604,154	1,568,488	350,376	439,734
Cost of marketing	1,313,642	902,698	329,637				121,129	
Total cost	9,883,263	10,682,289	2,566,528	3,108,886	1,389,618	3,263,161	1,105,826	1,069,606
Net earnings (1908)	2,079,871	1,404,783	646,198	1,839,442	153,444	459,160	136,898	def. 12,221
Net earnings (1907)	1,132,875	1,561,061	295,605	1,113,647	246,096	71,810	67,259	def. 139,372

None of the 107 tons of lead concentrates was sold owing to the low price of lead in 1908. No zinc was mined, but 56 tons of zinc carbonate were shipped from the Crittenden Springs and Keyes mines. Perhaps it will be well to state here that the returns of 2 oz. of silver per ton from some "Kentucky" lead reported by Mr Siebenthal in "Mineral Resources" for 1907 was an error; no Kentucky lead has yet shown commercial silver returns The

and ground mineral were less than for 1907, and the indications are that the prices for 1909 will be still less.

Although there are deposits of barytes in Caldwell, Crittenden, and Livingston counties, in western Kentucky, the barytes industry is still confined to the Central Kentucky district, and in 1908 work was carried on in thirteen counties, namely: Anderson, Bourbon, Boyle, Clark, Fayette, Franklin Garrard, Harrison, Jes-

In view of the low price of copper and the general business depression prevailing during the year, the companies, as a group, have made a good showing. The total net earnings for the year were $6,732,015 as compared with $4,648,254 for the year 1907. The accompanying table embodies the reports of eight of the large companies, also the net earnings of the various companies for 1907 by way of comparison.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Henry F. Lefevre has returned to New York from Nicaragua.

Julius W. Hegeler, of Hegeler Brothers, Danville, Ill., has been visiting New York.

T. H. Leggett has returned from a sojourn of several months in Sonora, Mexico.

W. C. Thomas, of Salt Lake City, Utah, has gone to Wales for a vacation of four months.

J. Parke Channing has returned to New York and will be here until the end of this week.

Elton W. Walker has returned to Detroit, Mich., from a trip to the silver districts of northern Ontario.

Ernst Schmatolla, of London, has established an office as consulting engineer at 150 Nassau street, New York.

H. C. Wilmot has opened an office as consulting mining engineer in the Newhouse building, Salt Lake City, Utah.

Jay P. Graves, of Spokane, Wash., managing director of the Granby Consolidated Company, is recovering from a serious illness.

Dr. Wilbur A. Hendryx, manager of Hendryx Cyanide Machinery Company, of Denver, Colo., is in New York on professional business.

George Alexander, manager of the Ferguson Mines, Ltd., and the Kootenay Ore Company, has returned to Kaslo, B. C., having spent the winter in Europe.

Charles H. Gitsch, recently of Park City, Utah, has been appointed superintendent of the Antelope Spring and Nevada Superior mines in Humboldt county, Nevada.

C. S. Herzig, who has been in Nicaragua for a number of months examining mines on behalf of the Oroya Brownhill Company, Ltd., of London, is expected in New York soon.

Lester W. Strauss is on his way to the western part of the department of Ayacucho, Peru, to examine a partially developed gold prospect. He expects to return to Lima, Peru, in June.

James McEvoy, formerly with the Geological Survey of Canada, has gone into the big coal district lying between Banff and Edmonton, Alberta, for the German Development Company, of Ottawa.

John Fritz, the veteran ironmaster—well called "the father of the American iron trade"—has presented $50,000 to Lehigh University at Bethlehem, Penn., to be used to build and equip a metallurgical laboratory.

J. C. Gwillim, professor of mining at the School of Mines, Kingston, Ont., is spending a week or two at the St. Eugene mine East Kootenay, B. C. Last month he did some geological work near Hosmer, Crow's Nest Pass.

James Hargreaves has resigned as mine manager for the Canada West Coal Company, Ltd., Taber, Alberta, to become superintendent of the Alberta Consolidated Coal Company, operating about four miles west of Taber.

George W. Schleuderberg, who has had charge of the mining department of the Pittsburg Coal Company since its organization, will retire from that position July 1. He is one of the oldest operators in the Pittsburg district.

K. C. Parrish sailed recently from New York to resume his duties as manager of the Andes Mining and Development Company in the district of Guamoco, Colombia. Part of his time will be spent in making mine examinations for other interests.

Louis A. Wright has been appointed consulting engineer in the Southwest and Mexico to the General Development Company; also consulting engineer to the Miami Copper Company. His headquarters will be at Globe, Arizona, for at least a year.

John D. Ryan succeeds the late H. H. Rogers as president of the Amalgamated Copper Company. B. B. Thayer takes Mr. Ryan's place as president of the Anaconda Copper Company. F. P. Addicks, vice-president of the Amalgamated is now vice-president of the Anaconda also.

Dr. Alfred C. Lane has resigned his position as State geologist of Michigan, to take effect Sept. 1 next. He expects then to take a position at Tufts College, and also to be able to concentrate his attention on the study of certain geological problems having a direct bearing upon mining.

H. A. Prosser resigned, on June 1, his position as metallurgical director of the United States Smelting, Refining and Mining Company, a concern with which he had been connected practically from its beginning, during which time he supervised the construction of the smeltery and refinery at Chrome, the refinery at Grasselli, the smeltery at Kennett, Cal., and the enlargement of the smeltery near Salt Lake City. Mr. Prosser has associated himself with Arthur L. Walker, and the firm, under the name of Prosser & Walker, has opened an office at 42 Broadway, New York, as consulting metallurgical engineers.

Obituary

Frank A. Lucy was killed June 7 by falling down the main shaft at the Florence mine in Goldfield, Nev. He had been prominent in the district and in other parts of Nevada for several years, and had recently been appointed superintendent of the Florence.

Louis G. Laureau died at Yonkers, N. Y., June 6, aged 68 years. He was long associated with the late Alexander L. Holley, as his chief assistant, was for a while a member of the firm of Gordon, Strobel & Laureau, and for many years acted as a metallurgical expert in patent causes. He possessed an accurate knowledge of the steel industry of this country, and of Belgium and France.

Societies and Technical Schools

Georgia School of Technology—The latest catalog of this school at Atlanta shows courses in chemistry and chemical engineering; also in geology and metallurgy, especially the metallurgy of iron. The course in chemistry especially appears to be thorough and comprehensive.

University of Utah—The junior class in mining engineering is making a geological examination of the Pioche district under the direction of the Department of Geology. The class expects to spend six weeks in the district in surface and underground mine surveying and examination. The senior class recently returned from a month's trip throughout the West, visiting important mining districts.

Wisconsin State Mining Trade School—Three students graduate from this school, at Platteville, Wis., this year. This is the first class to graduate from the institution. These men will enter the employ of mining companies in the Wisconsin zinc district. All the other members of the student body will be engaged for the summer by some of the mines of the district.

Missouri School of Mines—A mining experiment station is to be established at Rolla. The legislature appropriated $10,000 at the last session for this purpose, and the executive committee of the board of curators, has decided to begin work on the new station immediately and have it ready for work by Sept. 1. The experiment station will be in charge of the assistant professor of mining. An assistant for the experiment station will also be appointed.

The graduating exercises at Rolla were held June 9, when 37 men received degrees.

Chemical, Metallurgical and Mining Society of South Africa—At the general meeting in Johannesburg, Transvaal, May 15, the following new papers were read: "Stope Measurements," by O. S. Tonnesen (illustrated). "The Influence of Moist Air on Quicklime," by James Gray. "The Telluride Gold Ores of Cripple Creek, Colo., by Thos. B. Crowe. The following papers came up for final discussion: "Precipitation of Cyanide Solutions by Zinc; a Comparison of Results and Costs," by Allan J. Clark. "Unskilled White Labor in Mining," by Tom Johnson. A number of other papers were ready for discussion.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Salt Lake City, Goldfield, Colbalt, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

June 11—The State president of the Western Federation of Miners is at present very actively engaged in organizing miners' unions, more particularly in Sierra county and northern Nevada county. The attempt to do this in Amador county was not at all successful. The president expects to unionize all camps where a membership of 20 can be obtained, that number being requisite to obtain a charter.

The largest gold dredge yet constructed in the Yuba field has just been completed at Marigold, at a cost of about $200,000. The machinery, now being installed in the hull was built at Marysville in the shops belonging to the dredging company. This dredge is expected to dig 45 ft. below pond level and to stack 45 feet.

Chas. S. Warren, of Butte, Mont., R. E. Bannan, W. W. Warren, of Gold Circle, and Frank G. Mitchell, of Cleveland, O., have bonded several mining properties in Yuba county for $70,000 and work will soon begin on a large scale. Included in the bond are the Red Cross mine near Indiana ranch, owned by Krupp & Quinlan; the Good Templar, 30 miles east of Marysville, owned by Wiilliams Brothers: and the Merriam property. There are small mills on both the Red Cross and Good Templar.

The dispute between the city of Oroville and the Indiana Gold Dredging Company, which has lasted a long time, has finally been settled. The injunction against the dredging company for interfering with the free flow of the water in the Feather river, has been removed. The dredge company agrees to level all the cobble piles it makes with its stacker as it goes along, not leaving them to form a barrier in the river bed. The company will also reimburse the city for the money spent in prosecuting the case, and will in return be permitted to continue operations until its land is dredged out. This is one of the two dredging companies in the State working ground where the cobble piles had to be left in the direct river bed. Most of the dredges are operating some distance from the rivers proper.

At the same place the Pennsylvania Dredging Company has settled its difficulties and agreed to reduce its cobble piles by leveling them off. No other dredges there are working in the river bed.

The local mint has just made a record run on gold coinage. This week it finished a 50-day run on gold, amounting altogether to $52,062,500 or $1,070,000 daily for the 50 days. On the last day the coinage was $1,520,000 gold. A large amount of gold had collected and large quantities have been coming in lately, but it has now been pretty well cleaned up. The Alaska and Klondike gold will now be coming in for the season as well as much California and Nevada gold, so there will still be plenty to do.

Lieutenant Chas. L. Leeds of the Corps of Engineers, U. S. A., has been appointed a member of the California Débris Commission which, under the Caminetti law, has charge of the conduct of hydraulic mining in certain portions of the State of California. Since the retirement of Col. W. H. Heuer, the miners have had rather a hard time of it as the new members hold rigidly to the strict letter of the law and have not, thus far, evinced any special friendship toward the miners, or encouraged the hydraulic mining industry in any manner. There has been much complaint on the part of miners, but the operation of the law has been in the hands of the Commission entirely, they having the final decision on all questions relating to hydraulic mining. There is a hope now that the new member will take an interest in the hydraulic mining question, look after details, and have some little sympathy with the cause of the miners.

The new find in the Old Cape mine four miles east of Humbug, Siskiyou county, is in one of the old tunnels. In addition to the gold and silver there is a good percentage of copper so that the ore will have to be shipped to a smelter. The property is now owned by Bulis & May. In former days there were no smelters near by and the "base" ore could not be worked, the owners being satisfied to take out what gold they could and let the balance go.

The old camp of Challenge Mills, Yuba county, is again showing activity after many years of idleness. A great deal of prospecting is being done by men from Nevada. The old placers are now yielding from $500 to $1000 per day during the water season.

The Supreme Court has reversed the decision of the lower court of San Diego county giving judgment for $116 against H. H. Markham and Geo. Coffin, president and secretary of the American Boy Mining Company, charged by a stockholder with having misappropriated that sum from the company. The American Boy company some time since bought the adjoining American Girl claim and formed a new corporation. It was stated in the complaint that Markham and Coffin had given shares in the company to friends without compensation. It was shown to the court, however, that the money had been utilized in promoting the development of the mines.

Butte

June 10—President Anderson, of the Idaho Smelting and Refining Company, states that he hopes to effect an agreement among the company's creditors whereby operations may be resumed at the smelter. The control of the company's affairs is now in the hands of Temporary Receiver Bruce Blake, appointed by the Federal bankruptcy court. Mr. Anderson believes that the creditors will agree to an arrangement for the settlement of all claims and thus avoid the heavy costs attendant upon the completion of bankruptcy proceedings.

In March of this year, E. W. Beattie, of Boston, secured a judgment against the Bald Butte Mining Company for the sum of $20,145. A petition asking for leave to intervene in the suit has been recently filed by Frank J. Edwards, of Helena, a stockholder of the company, who asks that the case be reopened and that he be allowed to come in and defend. The petition alleges that the company was never indebted to Beattie in any sum, and that the two notes on which the Beattie action was based were given without any consideration whatever. It is further alleged that the total indebtedness of the company does not exceed the sum of $12,000 as shown by its annual report of 1908, which was signed by Mr. Beattie as a director of the company.

The annual report of the Butte Coalition Company for the year 1908 has recently been made public. There were produced, during the year, 264,031 tons of ore, 18,521,282 pounds of copper, 300,192 oz. of silver, and 1831 oz. of gold. A total of 900 men are employed by the company.

The Great Northern Railway has recently issued a new tariff on ore rates between the principal shipping points in the State. The tariff is made retroactive and dates from April 27, so that all ore shipments made since that time are subject to rebates. A change is made in the basis of ore valuation, the new schedule classifying all ores exceeding $100 valuation at the $100 rate, instead of adding 20 per cent to the rate for each $50 increase. It is expected that the re-

sult will be a material benefit to the shipper.

At the annual meeting of stockholders of the Reins Copper Company held in this city a few days since the following directors were elected: J. M. Guffey, T. N. Barnsdall, John H. Gailey, William P. De Armitt, F. W. Marland, W. F. Johnson, George D. Prentice, A. P. Childs, Augustus Hartje, all of Pittsburg; John P. Reins and Glenn L. Thompson, of Butte.

Denver

June 11—The monthly measurement of the work performed under the Carlton contract at the Roosevelt deep drainage tunnel in the Cripple Creek district shows a total distance driven during May of 954 ft. At the north heading from the intermediate shaft 290 ft. were driven and at the south heading 262 ft. The portal heading was driven 402 ft., bringing the total distance from portal to breast up to 6288 ft., and the total distance covered in all three headings to date is 9378 ft. On June 1 there remained 227 ft. between the south heading of the intermediate shaft and the portal heading and it was expected that the connection will be made about the middle of June. During the last 15 days of May the picked crew in the portal heading drove the tunnel 246 ft. or at the rate of over 16.4 ft. per day. In this work there was used a new model machine, in which three Leyner drills were set up on a bar at the breast of the tunnel.

At the recent annual meeting of the Gold Dollar Consolidated Gold Mining Company at Cheyenne, the present management was sustained and H. L. Shepherd, of Cripple Creek, was re-elected president, with other officers and directors as follows: A. E. Carlton, treasurer; J. R. Young, secretary; E. E. Quentin and J. W. Hughes, directors. Of the 2,068,000 shares represented at the meeting, it is stated that the opposing faction controlled only 308,000, notwithstanding the fact that circular letters had been issued some time since making violent attacks upon the Carlton management. Announcement was made that the company will continue the regular payment of quarterly dividends of ½c. per share.

According to reports from London, the April production of Stratton's Independence mine was 2263 tons of an average value of $22.75. There were treated at the company's dump mill during the same period 3100 tons. No figures, however, are given of the average value of this dump rock, but the profits accruing to the company from "both mining and milling departments" was $11,300.

Ore shipments from Silverton for May aggregated 4525 tons, 150 tons being high-grade crude ore and the balance concentrates. The total would have been close to 6000 tons, if it had not been for the fire at the Gold King mine. The mine buildings which were burned about the middle of May will be replaced by modern steel structures. Repairs are being made on the aérial tram and when these are finished, temporary quarters will be provided for the men and work resumed in the mine. It is stated that the mine was in excellent condition at the time of the fire.

At a meeting of the Portland Gold Mining Company on June 9, it was announced that construction of a 300-ton cyanide mill at the mine near Victor will be commenced at once, and it is hoped will be ready for operation by the end of the year. The low-grade ore from the mine and the immense dumps will be treated, and it is stated that the experimental tests have shown that $2 ore can be treated at a profit. At the Isabella, which also has its cyanide mill at the mine, it is also stated that $2 ore is being treated successfully, and that during the past month they treated daily 125 tons of the above value, and that the bar sent to the Denver mint was worth $7500.

The Moose mine which produced half a million in the early days of Cripple Creek, and has been practically abandoned for years owing to the gas in the workings, is now going to be made capable of exploration for new orebodies. A connection will be made with the 1000-ft. level of the Cresson company, which has taken a bond and lease on it.

Indianapolis

June 14—There was, during the past week, greater buying for both manufacturing and storing purposes. It is understood that the requirements of the railroads were such as to put into service nearly all of the empty cars. Orders for later delivery are being placed more freely and numerous inquiries are received as to prices and facilities for immediate and future shipments. Operators say the reports from leading industries are favorable.

The retail coal dealers of Indiana are stocking up more than usual. The prices at the mines have not been increased, but there are indications of a raise July 1. The retail dealers have announced a strictly cash basis on which prices have been cut 15 to 20 per cent. in order to induce consumers to lay fuel.

Oklahoma

June 12—Secretary of the Interior Ballinger has prepared new regulations governing oil and gas-pipe lines in Oklahoma, and will make them public soon. Meantime he announces that the point of the changes consists in eliminating from the regulations the "common-carrier clause" and the so-called "confiscatory clause." These changes have undoubtedly been under consideration at the department for some time, but they were not made until a public hearing was given to representatives of all of the pipe-line companies operating in Oklahoma, to the Mid-Continent Oil Producers' Association and others. The "common-carrier" clause in the old regulations seemed to be no longer necessary because of the fact that the new State of Oklahoma has passed an act fully covering the subject, and because more than 70 per cent. of the oil-producing land in Oklahoma has been taken out of the control of the Department by the act which removed restrictions from the Indian lands, and which went into effect July 27 last. The so-called confiscatory clause in the old regulations permitted the Secretary to cancel a grant to a pipe-line company if it violated any of the regulations of the Department. With this clause out, the question of the pipe-line's violation of regulations and law and a forfeiture of its franchise will be left to the courts to determine. The capacity of pipe lines operating in Oklahoma has proved wholly inadequate to handle the product, and this condition has existed for some years. Only about 50 or 60 per cent. of the production is handled by the present pipe-line companies. As a consequence more than 55,000,000 bbl. of oil have been stored in the field and much oil is going to waste. No new companies have recently ventured in the field on account of the two clauses in the regulations.

Salt Lake City

June 10—The production of coal is becoming one of Utah's most important industries. The report of E. W Parker, of the U. S. Geological Survey, shows the total production for 1908 to be 1,848,792 short tons, having a value of $3,119,338. Although the coal production decreased in sympathy with the general business depression throughout the country, an increase is reported in the value of the product. The report shows that 2664 men are employed in the mines. The areas in Utah known to contain workable beds of coal are estimated by M. R. Campbell, of the Survey to aggregate 13,130 sq.m., and there are in addition 2000 sq.m. of which little is known, but which may contain workable coal beds. The original contents of these fields are estimated by Mr. Campbell to have been 196,458,000,000 short tons of coal. The total production since mining began in 1870 to the close of 1908 has amounted to 20,683,974 short tons. On the basis of one-half ton wasted for every ton of coal mined and marketed, the exhaustion during this period has amounted approximately to 31,000,000 short tons, or 0.016 per cent. of the original supply.

The new Tooele Valley railroad, the line that connects the International Smelting and Refining Company's smelter site at the mouth of Pine cañon, was opened to traffic on June 10, the first train consisting of five cars of cement, lumber and other material for the new plant. Now that this road is opened the work on the smelter will progress rapidly.

The shipments from the Tintic district

during the week ending June 4 amounted to 219 cars of ore, and of this number 96 cars were of 50-ton capacity. The other cars were of 20-ton capacity. The output follows: In small cars, Iron Blossom, 38; Brooklyn, 1; Colorado, 31; Beck Tunnel, 6; Dragon Iron, 33; Black Jack, 2; Swansea, 2. Large cars, Ajax, 1; Grand Central, 6; Lower Mammoth, 1; Victor Consolidated, 1; Sioux Consolidated, 14; Iron Blossom, 2; Yankee Consolidated, 2; Bullion Beck, 3; May Day (crude ore), 6; May Day (concentrates), 2; Centennial Eureka, 42; Eureka hill, 4; Mammoth, 10.

Goldfield, Nevada

June 8—Figures compiled by the Goldfield Mine Owners Association regarding the number of men working in the mines of the district, show 1065 men employed, exclusive of salaried employes of the various companies, which would increase the number about 250. In addition there are a number of properties being worked by the individual owners who would not appear in the total as given above.

State Mine Inspector Stuart and Deputy Inspector Ryan have completed their inspection of the Goldfield mines and report favorably on the methods employed, both on surface and underground, for the protection and safety of employees. Particular comment is made concerning the Consolidated and Florence properties, where the unusually large stopes are extremely well timbered and every precaution taken for the avoidance of accidents.

H. P. Henderson, superintendent, gives the following estimate of production of the Goldfield Consolidated for the month of May: Total tons extracted, 21,305; total extraction, $767,000; total cost, $145,000; estimated profits, $622,000. The Mohawk and Jumbo claims are producing about 8000 tons per month of $35 average value. The Red Top and Lucky Boy claims from 6000 to 7000 tons per month, averaging $37 and the Combination about the same amount averaging $45 per ton.

Cobalt

June 12—The Coniagas Mines, Ltd., are going to prospect more thoroughly the southeast corner of the property underground. Work is being started in the old shaft in the center of the town, and it is being pumped out preparatory to sinking. It is now down 18 ft. on a calcite stringer giving low values in silver.

A 25-h.p. plant has been installed at the Eastborne mine. This will be used to carry on development. The shaft, which is now down 40 ft., will be sunk an additional 75 ft. and crosscuts run to prospect the property. There are two small veins showing in the bottom of the shaft, but no values have been found as yet. The Silver Lode mine, adjoining the King Edward, has started up again.

In an upraise 45 ft. above the 150-ft. level of the King Edward mine, No. 7 vein widened from a mere stringer to between 2 and 4 in. of high-grade ore. No. 7 vein runs parallel to No. 5 vein 200 ft. to the west on which a strike was made a few days ago. A prospecting tunnel is being driven into the hill from the side of Cross lake, but nothing of value has as yet been found. The mill is treating 20 tons per day.

No. 4 shaft of the Pan Silver is down 215 ft., and at the 200-ft. level a crosscut is being driven to strike No. 4 vein.

At the present time the Silver Cliff is doing development work on Nos. 1 and 2 veins only, and it is expected that these workings will be connected within the month. The company will not undertake any extensive work until the air from the Hydraulic company is ready for distribution.

In the crosscut at the 65-ft. level of the Silver Cross mine, 57 ft. to the north of No. 2 shaft a vein of calcite carrying small values in silver has been discovered.

At the 87-ft. level of the main shaft of the Michigan Cobalt a station is being cut, and a crosscut will be run to tap the vein on which the shaft was started.

The Gifford Extension is running a drift on the vein 100 ft. west of the main shaft at the 80-ft. level, but no silver values have been found as yet. The shaft will be continued to the 125-ft. level.

The Cobalt Hydraulic Compressed Air Company, which is putting in a 5000-h.p. plant at Ragged Chutes, on the Montreal river, to supply air to the mines of the Cobalt district, expects to have the power ready for distribution about Aug. 1. Considering the amount of work still to be done, however, it is doubtful if this will be possible. The pressure at the mines is to be 100 lb. For the larger consumers when six or more drills are used, the air will be supplied by meter; the smaller consumers using five drills or under will pay a flat rate depending on the number of drills in use. The following rates have been fixed by the Hydraulic company. For the large consumers buying by meter, 25c. per 1000 cu.ft. of air at 100 lb. pressure. For the smaller consumers, for one drill per 10-hour shift, $5; 2 drills, $4; 3 drills, $3.50; 4 drills, $3.13; 5 drills, $2.80. This leaves a wide margin in favor of consumption by meter, and it is probable that before the contracts are finally signed, the mine managers will get together to compel the company to supply the power at a uniform rate.

A matter of great interest is at present before the shareholders of the Temiskaming & Hudson Bay mine. Many offers have been made for this property and, although none of these has been accepted, there is a general feeling among the shareholders that something should be done in order that they may have stock that is readily negotiable. At present the number of shares is so limited, there being only 7701 issued, and their value is so high, that they cannot be placed on the market and anything like their true value realized. A general meeting was called June 4 to discuss a proposition made by a broker. His idea is to form a new company to acquire the holdings of the Temiskaming & Hudson Bay, the capitalization to be from 3,500,000 to 5,000,000 shares of a par value of $1. This stock is then to be handed over to the original company and sold through the brokers at about 75c. on the dollar. The matter was taken up at the general meeting and, although nothing definite was arrived at, it would not be surprising if some action were taken in the near future. The company will pay another dividend at an early date.

The Nancy Helen mine has closed down, but prospecting will be continued with the aid of a diamond drill. It is understood that an offer by a New York firm of $4,000,000 for the O'Brien mine has been turned down. The Hargraves mine is running two drills in the shaft and one in the drift. The shaft has reached a depth of 275 ft.; at this point a station will be cut and a crosscut started. Some work has been done at the 70- and 175-ft. levels, but so far ore has not been struck.

The new vein recently found at the Beaver has turned at an angle with its general direction and the ore has disappeared. This is a common occurrence, however, in this locality and the management confidently expects to get the ore again in a short time.

Mexico

The new freight rates on coal and coke on Mexican railroads went into effect on June 1. It is claimed that these rates will keep at home fully $5,000,000 annually that has heretofore gone out of the country.

The coal mines of the state of Coahuila, by new methods of cleaning and washing coal and the development of new coal measures, are now prepared to furnish coal and coke over the republic. Several years ago when Mexico could not supply the demand for those two important fuel staples the railroads adopted coal and coke rates which greatly favored the foreign product. During the last six years a wonderful development of the coal resources of Mexico has been steadily in progress, and now the coalmen can justly claim they are prepared to supply the trade. The railroads have been brought to a realization of the fact that the rates on the foreign coals which have prevailed on the roads for years have discriminated against the native product. The new rates equalize the matter. There is no favoritism of rates shown now to ports of entry as against rates from internal points. Mexico has no important duty on coal and coke

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Tennessee Coal, Iron and Railroad Company—Four of the open-hearth steel furnaces at Ensley have been started, and the rail mill has also been put in operation. There is sufficient pig iron on hand to run the furnaces for three or four weeks. Two blast furnaces are ready and will be blown in before that time if conditions warrant.

Williamson Iron Company—The blast furnace at Birmingham has blown out for repairs. It is a small furnace.

Arizona

COCHISE COUNTY

Tombstone Consolidated—The shaft is flooded as a result of an accident to the boilers. The management expects to control the water within a few days. It is reported that a duplicate set of pumps will be installed.

Denn-Arizona—Ore has been encountered on the 1250-ft. level. It is native copper in limestone.

Bisbee Coalition—The Bisbee Coalition Mining Company has been organized to absorb the North Bisbee Development Company, by buying the North Bisbee stock at the rate of one share of Coalition for one share of North Bisbee. The new company is capitalized at 1,000,000 shares at $2 each, and it has been arranged that 150,000 shares are to be sold on the New York market at par.

GILA COUNTY

Miami—About 13,500,000 tons of ore have been developed since the beginning of actual work. A large body of ore is now being blocked out above the 370-ft. level preparatory to mining.

GRAHAM COUNTY

Arizona Copper—The output for the month of May was 2,854,000 lb. of copper.

Shannon—The May production of copper was 1,556,000, lb. being an increase of 98,000 lb. for the corresponding month last year. The total for five months this year is 7,988,000 pounds.

MARICOPA COUNTY

Vulture—At the annual meeting of stockholders of the Vulture Mines Company, the entire board of directors was re-elected as follows: Frank P. Estabrook, Joseph B. Locke, I. M. Taylor, Frederick W. Rockwell, Edward T. Frishie, Robert Mackay and J. Winslow Pierce.

PINAL COUNTY

Gila Copper—Authorized capital stock, 1,000,000 shares; outstanding, 550,000 shares; treasury, 450,000; par value, $10. Of the treasury stock 55,000 shares have been offered to the present stockholders at $2.50 per share, most of which has been taken. Cash in treasury $75,000; no debts. The property has been developed by 3000 ft. of underground workings, and 6350 ft. of churn drilling. S. W. Mudd is chairman of the executive committee, and Philip Wiseman is manager. The property is seven miles from Kelvin.

California

ALAMEDA COUNTY

American Magnesite—A large gasolene-engine truck has been provided for hauling magnesite from the mines at Red Mountain to Livermore, for shipment to the Cummings factory at San Leandro.

BUTTE COUNTY

Gold Bank—Henry Descant, of San Francisco, has bonded the Gold Bank and Gold Queen quartz mines, at Forbestown, and will work them through the Gold Bank tunnel.

Indiana Gold Dredging—The dredge, wrecked during high waters of last winter, has been righted and pumped out and the machinery repaired.

Steifer—Litigation over this property having ended, construction and development will begin at once.

KERN COUNTY

Desert—Several strong veins have been opened, and it is expected that a 20-stamp mill will soon be erected. M. J. Monette, of Goldfield, Nev., and several Los Angeles people are owners.

Soledad—Litigation has been settled and the mine is now producing ore.

Queen Esther—This company, at Mohave, has bonded the Double Standard mine and good ore is being taken out.

MONO COUNTY

Golden Gate—Jos. A. Brown has sold this property to Mr. Edwards and associates of Bridgeport, $40,000 to be paid July 4 for working purposes.

NEVADA COUNTY

Lecompton—This mine, at Nevada City, is almost unwatered. The bottom of the 630-ft. shaft has been nearly reached.

Last of the Mohicans—James Morrison has purchased the controlling interest in this Grass valley mine from A. and George Atterbury.

Ridge Tunnel—Williamson & Cole have discovered a rich ore shoot. The mine is near Washington.

Allison Ranch—This old and once productive mine may be again reopened, being under examination by Goldfield, Nev., men.

Pittsburg—Joseph Weisbein, president, is putting up an extensive surface plant. As soon as the water is all out, 10 machine drills will be put at work. Mark B. Kerr, Nevada City, is general manager.

PLUMAS COUNTY

California-Nevada Consolidated—A 6-ft. vein has been found. Anthony Lowe, of Prattville, is manager.

SAN BENITO COUNTY

Gold—Daniel Burg, of Pinoche valley, has discovered a ledge of gold-bearing quartz in that section. A small amount of silver is with the gold.

SAN BERNARDINO COUNTY

San Bernardino Borax Company—S. Riddel, James M. Kane and Isaac N. Thorne, of San Srancisco, and J. W. Searles and Charles Gressard, of San Bernardino, have formed this company to mine for borax.

Borax Consolidated Company—This company has recently completed a borax-refining plant at Otis.

Colorado

BOULDER COUNTY

Alton Tunnel—Manager J. Burke, of Cardinal, Colo., announces that the company intends building a concentrating plant during the year.

London Gold and Copper—Kansas people are interested in this organization, to operate the London and the London Extension mines, near Gold lake, east of Ward, and a 250-ft. tunnel contract has been let.

CLEAR CREEK COUNTY

Atlantic and Daily Districts—E. M. Moscript and associates, of Idaho Springs, are building a mill to handle their own and custom ores from these districts. It is stated that the Atlantic Mining and Milling Company contemplates driving a 5000-ft. adit. C. B. Ireland, Georgetown, Colo., is manager. Ore has been opened in the Coffin mine on Young mountain.

It carries gold, silver and lead, and is of smelting grade.

Vidler Tunnel—Work is to be resumed on the big bore as soon as the electric line for the operation of the compressor plant is finished. The tunnel is in 4300 ft., and about 2200 ft. farther will connect with the tunnel from the western side, near Argentine.

Dives-Pelicon—Louisville people interested in these mines at Silver Plume have appointed J. H. Robeson as manager, and active developments will be carried out under him.

Gilpin County

Gilpin-Boulder Consolidated—A gasolene hoisting plant is being installed, an addition being built to the shaft building, and arrangements made for sinking the Poole shaft several hundred feet deeper; machine drills and compressor may be installed. W. H. Crabtree, Central City, Colo., is superintendent.

Argosy—Denver and Philadelphia people, interested in the Maud S. mine of this company in the Russell district, will install machinery and erect a new shaft building. Joseph Hesselbine, Central City, Colo., manager.

Union Glanders—George S. Petteway, of Florida, has taken a four years' lease and bond on this property in Russell and Lower Fall River districts.

Medora—Arrangements have been made with the Penobscot company to drive a lateral from its tunnel, and more equipment is to be installed by Manager J. W. Koons, Rollinsville, Colorado.

Free Gold—F. A. Burnell, of Denver, has opened up a 5-ft. vein of milling ore, and will treat the same at the Daisy mill, which he has leased. Machinery is to be installed at the shaft, and a new engine and boiler has been installed in the Daisy mill. J. Bechtold, Rollinsville, Colo., is superintendent.

Town Topics—A *lis pendens* has been brought in the Circuit court asking that the sale of the East Notaway property of this company by public trustee to Rufus J. Foster for $24,272 to be declared null and void; also asking for a receivership during the proceedings. Eastern stockholders are the applicants.

Perigo—Smelting ore is being shipped to the sampling works and mill concentrates are also being regularly produced. D. C. Earl, Rollinsville, Colo., is superintendent.

Lake County

Progressive—The Cady Mining Company has leased this property on North Fryer hill to Al. Gans and associates. The shaft will be repaired and new machinery installed, including heavier pumps. The shaft is 300 ft. deep, and from this point exploration will be carried on by drifting. The work is in charge of C. W. Rogers.

Castle View—An output of 25 tons daily is being sent from this Carbonate hill property to the local smelter. Preparations are being made to operate the Evelyn, Giant, etc., from the Castle View shaft, these claims being under lease to the same people.

Lou Dillon—The tunnel started a few months ago is now in 200 ft., and the breast shows several streaks of lead ore. A shaft is also being sunk farther south.

Tribune—The vein of gold ore recently discovered on this property has been drifted on for a distance of about 40 ft., and a shipment will soon be sent to the smelter.

Jennie June—With the disappearance of snow in the Tennessee district this mine will resume active operations. Work is to be carried on at the 250-ft. level, from which high-grade gold ore was obtained last season.

Yak Tunnel—The breast of the main tunnel is now nearly opposite the New Monarch shaft and is nearing the 4-mile mark. Good progress is being made in driving the lateral to the Resurrection No. 1 property.

Sunday Tunnel—Shipments are being sent regularly from this property to the local smelter, the output being about 30 tons daily.

Routt County

Snake River Consolidated—This company is reported to have opened up milling ores in its property, near Three Forks, and is considering the erection of a mill. Lewis A. Pease, Steamboat Springs, Colo., is manager.

Idaho

Shoshone County

Standard—A large body of rich ore was encountered recently on the 1650-ft. level. It is reported as being better than on the upper levels.

Skookum—W. M. Bacon has been given judgment in the District court against Kennedy Hanley and his wife for $49,659 with costs and interest amounting to $51,856. In the Superior court of Spokane county, Wash., Aug. 24, 1908, suit was instituted against Mr. Hanley and judgment of $55,695 granted against him in March, 1909. Of this sum $6000 is alleged to have been paid. The defendants are owners of property in Shoshone county, including one-eighth interest in the Skookum mining claim. The removal of ore from this claim was the cause of the suit.

Indiana

Hudson Mine Company—The Terre Haute Trust Company has brought suit for the appointment of a receiver for this company, on behalf of Chicago men, who hold $40,000 in bonds issued by the company when it bought the mine. The new company had not long been owners when a strike began, which continued for a long time and ultimately involved President Lewis, of the Mine Workers, in a serious controversy with the Indiana officials. The Operators' Association backed up the mineowners in the exacting of fines against idle men under provisions of the yearly agreement. Suits were brought to recover these fines and other wages, and were successful. Other financial difficulties arose and a receivership was decided upon. It is expected that an early adjudication of the company's affairs will be made and perhaps a change in ownership of the mine will also occur.

Blackford County

More oil wells are being drilled than ever before. In one week recently nine new wells were brought in and two dry holes reported. The seven producers turned out 280 bbl. per day, the heaviest well producing 70 bbl. One heavy-pressure gas well was completed.

Gibson County

District Vice-President Rollins, of the miners' union, spent a portion of last week in this county endeavoring to settle differences between local miners and the Princeton Coal Mining Company over the shot-firing question. This question seems to be a difficult one to settle. Formerly the miners employed their own shot-firers. Then the employment of them was turned over to the company, and now, it is said, the men again want to employ their own shot-firers while the company wishes to continue.

Vigo County

A fire started June 3 in the Fairview mine belonging to the Carlisle Coal Company, a few miles north of Carlisle. The fire is said to have been started by a windy shot.

Kentucky

Johnson County

Consolidation Coal Company—This company is preparing to develop its property in the Miller's Creek coalfield. A large mining plant will be installed, mines opened and a railroad built to connect with the Chesapeake & Ohio. The new work is under charge of L. L. Malone, of Fairmont, W. Va., as manager.

Louisiana

The production of petroleum in May was 265,230 bbl., an increase of 866 bbl. over April. The shipments were by rail, 90,652 bbl; by Butte la Rose pipe-line, 23,973; total, 114,625 bbl., or 103,868 bbl. less than in April. Refinery consumption is estimated at 50,000 bbl.; field consumption at 15,000 bbl. There were 20 wells completed in May, of which 13 were oil producers, 2 gas producers and 5 dry. On May 31 there were 49 wells under the drill.

Michigan

Copper

The estimated output of copper for the Lake Superior district during the month of May is 19,917,500 lb., as compared with 19,675,500 lb. for May, 1907. The total for first five months of this year is 95,342,800 pounds.

Calumet & Hecla—About July 1, the offices of all the subsidiary companies will be transferred to the main office at Ashburton Place, Boston. The transfer will include the Osceola, Tamarack, Ahmeek, Isle Royale, Seneca and Larium, the offices of which have been in the Sears building. The offices of the Centennial and Allouez will be transferred from State street to Ashburton Place, also. It is reported that the office forces of these companies will be retained.

North Lake—This company has encountered ore in its No. 3 drill hole at a depth of about 1800 ft., which is the approximated position of the Lake lode.

New Baltic Exploration—No. 2 drill hole has been started to the west of the first one. No. 1 hole was put down vertically to tap the various formations opened by the trench; but, evidently due to a faulting of the formation, the expected results were not revealed.

Mass—The first mill run on the new lode has been completed. The rock came from the opening of the drifts at the 17th level and consisted of about 600 tons, which yielded about 20 lb. mineral to the ton.

Iron—Marquette Range

Empire—This mine, in the Cascade district, is being actively worked and the force has recently been increased. It is owned by M. A. Hanna & Co., of Cleveland.

Empire—Oglebay, Norton & Co. have added to the working force, and expect to make good shipments this season.

Volunteer—This property is being tested with diamond drills.

Iron—Menominee Range

Crystal Falls District—It is stated that Corrigan, McKinney & Co. are preparing to ship the big stock piles accumulated at the Dunn, Great Western and Tobin mines.

Iron River District—Active exploration work and shaft sinking are going on north of Iron river, on the James, the Konwinsky, the Hector, the Hall and the Barnette tracts.

Montana

Butte District

Davis-Daly—The Colorado shaft has reached a depth of 1485 ft. Preparations are now being made to sink to the 2000-ft. level. One hundred men are employed.

Broadwater County

Ohio-Keating—At the recent meeting of stockholders the following directors were elected for the ensuing year: R. M. Calkins, W. H. Penfield, C. H. Smith, George M. Bourquin and John F. Cowan. At the directors' meeting held afterward, R. M. Calkins was elected president, and C. H. Smith, secretary and treasurer.

Fergus County

West Kendall Gold Mining Company—The company has recently been incorporated by F. J. Robinon, C. A. Drinkard and J. H. Connely. The capitalization is $1,000,000; par value of shares is $1 each. The company will develop what is known as the McClure group of claims on the west side of North Mocasin mountain. The ore is free milling.

Gallatin County

Washer Copper—The coal washer of the company, situated at Stoors and valued at $200,000, was recently destroyed by fire, presumably of incendiary origin. Edwin G. Bartel and Dr. J. P. Reins, of Butte, had recently secured a lease on the property from the Washoe company. Previous to that time the plant had been idle for some time.

Jefferson County

Corbin-Clancy Creek Mining Company—The company has recently been organized by Jack O'Neil, D. W. Rodgers and Meyer Gansberger, of Butte. Its capital stock is $100,000; par value of shares is $1. The company owns the Ariadana and Bee quartz claims, situated at Gregory gulch, west of the Corbin & Calumet property. Men have recently been put to work cleaning out the 700-ft. tunnel. W. C. Hoskins is in charge of the work.

Nevada

Esmeralda County—Goldfield

Black Butte—The miners have leased the workings opened by the main shaft and are operating the same on a coöperative plan. Small shipments are being made from the property.

Pittsburg-Nevada-Rialto—A consolidation has recently been effected, and last week two shifts were started on the property of the Pittsburg-Nevada, situated on the south slope of Knickerbocker mountain, about three and one-half miles east of Goldfield.

Nevada Eagles—The new shaft is down to a depth of 300 ft. The compressor and hoist, formerly in commission at the old shaft are being moved to the new shaft, which will be sunk to the 500-ft. level.

Yellow Tiger—Work has been closed down on this property for 30 days during which time arrangements are to be made for the resumption of work on a larger scale. Manager Maurice Starne is now in Denver to attend a meeting of the directors. It is expected that the shaft now 700 ft. deep will be sunk to the 1000-ft. point, at which depth the ledge, encountered in the upper levels, will be thoroughly prospected.

Esmeralda County—Rawhide

There are 10 mines that can ship ore as soon as the mills are in operation: Grutt Balloon Hill, Mint, Marigold, Grutt Hill Truitt, Dayton Toledo, Prosky No. 1, Rawhide Truitt, Miller, Morning Star, Kerns No. 2 and Kerns No. 1.

Mint Lease—The shaft is down to the 390-ft. level, and in a few days the crosscut will be commenced on the 400-ft. level. The country rock in the shaft is the same as on the 150-ft. level where rich ore was found.

Grutt Balloon Hill Lease—During the past few days rich ore has been encountered on the 185-ft. level.

Kerns No. 1—This lease has been in litigation for some time, but all matters are adjusted, and the lease returned to its owners, W. B. Weddell and associates, of Ogden, Utah. It is the intention of the owners to push the work and crosscut to the Prosky No. 1 vein.

Ellendale—A reported strike has been made 30 miles east of Tonopah in the Salisbury wash. The district is called Ellendale. The ore at the surface runs high in gold.

Golden Arrow—It is the purpose of the leasing company to sink to the 500-ft. level before any crosscutting is commenced. The shaft is now 300 ft. deep. Dr. Gordon is the principal financier of the company. The lease is located on the Rawhide Consolidated property.

Dayton-Toledo—This lease on the Coalition estate is now shipping much ore to the small mills on the flat east of Rawhide. The shaft is now down 300 feet.

Marigold—Shipments from this lease for the last two weeks in May exceeded $12,000, the ore being taken from the north and south drifts on the 160-ft. level.

Proskey No. 1—An eight-ton shipment was made last week to the Western Ore Purchasing Company at Hazen, the ore coming from the 100-ft. level. The shaft now 100 ft. deep is being sunk to the 150-ft. level.

Victor Lease—General manager I. H. Cook, of Rawhide, is preparing for the installation of a ten-stamp mill. The company claims to have 20,000 tons of $12 ore blocked out on the 125- and 200-ft. levels.

Esmeralda County—Wild Horse Canon

Rogers Brothers—Work will soon commence on the Wild Horse Cañon property, 22 miles south of Rawhide, owned by the Rogers Brothers, of Chicago. They are now preparing to install a large hoist and compressor on their group of claims.

New York

DUTCHESS COUNTY

American Cement Company—This company has bought 13 acres of land on the river front at Poughkeepsie for the purpose of building a large portland cement plant. It has also bought a large tract of land near that city, on which there are deposits of limestone.

Oklahoma

In the month of May, according to the reports of the *Oil Investor's Journal*, 284 new wells were completed in the Mid-Continent oil districts; of which 255 were oil producers and 29 were dry. There were 207 new wells in progress at the end of the month.

The production of petroleum in May, as reported by the same authority, was 3,532,596 bbl., or 208,702 bbl. more than in April. The shipments in May were 3,374,896 bbl., leaving 157,700 bbl. to be added to stock. The total stocks reported in Oklahoma on June 1 were 55,303,756 bbl. crude oil.

JOHNSTON COUNTY

Chickasha Mineral, Oil and Silica Company—This company has been formed by the consolidation of the Oswald, Kemp & Lewis Silica and the Lytton Mineral companies. Its object is to develop extensive glass-sand deposits near Tishomingo. T. W. Lytton is president and E. D. Reed, secretary and treasurer.

TULSA COUNTY

Brummett Coal Company—This company at Tulsa is preparing to make improvements to its plant. It will build a switch from the main line of the St. Louis & San Francisco railroad to the mine; it will also install an electric mining plant with a daily capacity of 200 or 300 tons. M. S. Stout, Tulsa, is president.

Oregon

DOUGLAS COUNTY

A rich deposit of copper ore containing some gold is reported to have been found recently about eight miles south of Roseburg. The mineral outcrops at the surface a distance of 600 ft. and the vein is from 50 to 60 ft. wide.

LANE COUNTY

Nicodemus Mining Company—This is a newly organized company that has acquired the Star Consolidated Mining Company of Bohemia, with a capitalization of $20,000. One-half of the stock has been sold at par, and the balance will be sold from time to time as money is needed for development work. The officers are Dr. R. G. Black, president; H. G. Colton, vice-president; Charles H. Thompson, secretary and treasurer. All are Portland men.

Twin Rocks—Development work has been resumed. The long cross-cut tunnel will be completed to the ledge, and then the management plans to install a plant. Louis Hartley, of Bohemia, Ore., is manager.

South Dakota

LAWRENCE COUNTY

The mining situation in this section of the Black Hills has improved considerably since the flood of last week. Unusually heavy rains continue to render ore shipments uncertain.

Mogul—The mines ship to the mill over the Burlington while repairing the narrow-gage. The mill is operating at three-quarters capacity.

Golden Reward—Operations will be resumed this week. The shut-down was due to the recent flood.

Homestake—Mining was suspended a few days, but the plant is now running at full capacity.

Reliance—The flood carried away the new tailings dam which will prevent resumption for some time as the company has been restrained from discharging tailings into Little Spearfish creek.

Minnesota Mines—A second low-speed Chilean mill has been installed which will increase the milling capacity from 100 to 200 tons per day. In order to provide this increased tonnage, tracks are being laid from two open cuts to the mill and a 12-drill compressor is being installed.

Texas

Oil production in the southeast or coast districts in May was 822,225 bbl., an increase of 59,585 bbl. over April. Shipments by sea were 289,253 bbl.; by rail, 478,871; total, 768,124 bbl., or 171,826 bbl. more than in April. Refinery consumption is estimated at 150,000; field consumption at 60,000 bbl. There were 52 new wells completed in May, of which 36 were oil producers and 16 dry. There were 67 new wells in progress at the end of the month.

Utah

BEAVER COUNTY

Cedar-Talisman—This property in the North Star district will soon be on the shipping list. It is planned to haul the ore to Milford for shipment to the Salt Lake valley smelters. S. S. Pond, General manager, Beaver, Utah.

JUAB COUNTY

Beck Tunnel—The annual meeting of this company was held in Provo last week, all the old officers, including Jesse Knight, president and general manager, being re-elected. During the year a total footage of 3550 ft. was driven. The report explains the work that is being done to recover the faulted orebody from which $675,000 in dividends were paid.

Tintic Mines—This company, which was recently organized to work the Bradley group of 30 claims in northwest Tintic, is making good headway. The company is also working the American Star group, covering the extension of the Grand Central-Mammoth ore-bearing channel. M. F. Shannon, superintendent, Eureka, Utah.

Sioux Consolidated—The new compressor is now in use. It is of five-drill capacity, and will enable the company to do considerable prospecting in addition to handling the usual amount of ore. The orebody has been opened in such a manner that a steady output of about 14 carloads per week is being maintained.

SALT LAKE COUNTY

Columbus Consolidated—The big station pump is ready for operation, and will be put in use whenever required. The management is now drifting east on the 400 level. The aërial tramway while out of commission was replaced by teams, but is again in working order.

Washington

KING COUNTY

Grand Ridge Coal—After several weeks' preparatory work regular shipments are being made to Seattle. This mine has been idle for a number of years.

SNOHOMISH COUNTY

Nonpareil Consolidated—The second ledge in the crosscut tunnel has been cut, showing 7 ft. of chalcopyrite.

Index Granite Works—This company is now employing 128 men. A tunnel is being run to the lower quarry.

Wisconsin

IRON-GOGEBIC RANGE

Germania—At this mine, formerly the Harmony, Hayes Brothers have resumed work. The mine is being unwatered and the shaft repaired.

ZINC-LEAD DISTRICT

At Platteville all the mills are now in operation, and the improvement in the ore market has brought about the reopening of all the mines in the vicinity. At Benton also there is much activity for the same reason.

Calvert—Madison, Wis., people have bought this mine, which adjoins the Frontier, and is supposed to carry the extension of the rich orebody found in that mine. The new owners will open up the mine and equip it with a mill.

Fox—Another shaft is to be sunk to improve the ventilation. The mine is making a large output, the mill making 33 tons of concentrates daily.

Mills—This mine has been shut down, pending a reorganization of the company.

Vandeventer—The new rotary roaster is in operation and is producing a high-grade of jack. It recently turned out 105 tons of mill concentrates from 345 tons of rock, a result of over 30 per cent.

Canada

BRITISH COLUMBIA—EAST KOOTENAY

Hosmer Mines, Ltd.—The main entry (a cross-cut tunnel) of the Hosmer coal mine, Crow's Nest Pass, is in about 4250 ft., in which distance it has intersected nine seams of coal. Its total section is 22 ft. by 7 ft. 6 in., and it is divided into three compartments—two haulage-ways and a man-way. The present equipment of the colliery is for an output up to 2000 tons of coal a day.

Corbin Coal Mines, Ltd.—This company is opening a coal mine up the south fork of Michel creek, 13 miles from McGillivray station on the Crow's Nest Pass branch.

ONTARIO—COBALT

Ore Shipments—Shipments of ore from Cobalt for the week ended June 5 were: Coniagas, 126,410 lb.; Crown Reserve, 120,613; Cobalt Central, 59,650; Kerr Lake, 62,125; La Rose, 239,128; McKinley-Darragh, 59,460; Nipissing, 325,715; Silver Queen, 127,470; Temiskaming, 60,000; Tretheway, 127,000; total, 1,307,571 pounds.

Chambers-Ferland—The statement presented at the annual meeting on June 9 showed cash in bank, $54,799; value of ore in transit and at smelters, $21,544; value of ore on hand, $15,257. The active liabilities were $14,324 in all.

Kerr Lake—The output for May is reported at 200,000 oz. silver. The main drift on No. 7 vein on the 150-ft. level was run for 72 ft. on a continuous pay streak, averaging 10 in. in width of high-grade ore. A new vein showing good silver contents has been struck by trenching on the east side of the property.

O'Brien—A vein found some time since on the surface near No. 16 shaft has recently been tapped underground by a crosscut driven at the 110-ft. level. It is about 7½ in. wide.

Temiskaming & Hudson Bay—At a meeting held at New Liskeard, Ont., June 4, the stockholders voted to increase the capital stock from $25,000 to $3,500,000. Of the new stock $2,500,000 will be distributed to the present shareholders, each of whom will receive $100 for $1 of his present holdings. The remaining stock will be used for the erection of a concentrator at the plant on the most northerly lot of the company where the mine is at present, and the development of the south end of the property. The increase of the stock was delayed until the disputes with the government were settled and a patent finally issued for the property.

Trinity Cobalt—An order has been granted by the court in Toronto for the winding up of this company on petition of Henry E. Juengling, of Buffalo, a creditor for $8480. The company was incorporated in May last, with nominal capital of $100,000. The company is located at Haileybury.

ONTARIO—GOWGANDA

Bartlett—The first shipment of ore consisting of 3000 lb. of high-grade has been made by canoe over the water route to Latchford. The compressor plant is ready for operation.

ONTARIO—SOUTH LORRAIN

Wettlanfer—Frank Loring, consulting engineer, states that $15,000 worth of silver ore has been taken out of the shaft, which is now 60 ft. down, the showing of silver increasing with depth. A five-drill compressor with two 60-h.p. boilers is in course of installation. Thirty men are at work under Superintendent A. C. Bailey.

ONTARIO—WELLAND DISTRICT

Provincial Gas Company—The attempts to obtain gas or oil in the marsh south of Welland, at a cost of about $25,000, have resulted in failure. The latest venture was a well which was put down to a depth of over 3000 ft., without results.

QUEBEC

Amalgamated Asbestos Corporation—At the organization meeting held in Montreal, May 26, E. B. Greenshields was elected president; Hon. Robert Mackay, first vice-president; H. E. Mitchell, second vice-president; R. H. Martin, general manager. Offices have been taken in the Eastern Township Bank building, Montreal. The various properties purchased were transferred on June 1 to the new company.

YUKON TERRITORY

The complaint that the freight rates on the White Pass & Yukon railway are excessive, preferred by the Dawson Board of Trade, was brought before the Canadian Railway Commission at Ottawa, June 9. F. T. Congdon, M. P. for the Yukon, represented the complainants. He contended that the present freight rates were so high that they were absolutely prohibitive to the exportation of ore, and that, if they were lowered an enormous trade would be developed. The railway, he said, had been represented as costing $8,300,000, whereas the actual cost was $5,000,000, which was excessive for 120 miles. The books of the construction company, he charged, had been purposely destroyed. F. H. Chrysler appeared for the railway. The case was continued.

Yukon Gold—The ditch is now being operated at half capacity. An extension of 10 miles will be made this summer to Gold hill, and the entire line, 70 miles long, will be completed and in operation for mining work next spring. The first work done with this water has been in Lovett gulch. Seven large electric dredges are in operation.

Mexico

CHIHUAHUA

Dolores—The last monthly shipment consisted of 52 bars gold-silver bullion valued at 105,000 pesos.

International Gold Mines Company—It is planned to increase the output as well as the scope of development operations. Shipments of high-grade concentrates are being made. J. H. Pender is manager.

La Fortuna—Shipments of high-grade silver ore are being made from this company's Santa Maria mine in the Neuva Casas Grandes section in the northern part of the state.

San Toy—The work of building a new steel tram terminal station, replacing the wooden structure lately burned down, is now under way, and on its completion the output will be increased.

Yoquivo—High-grade gold ore is being sent out in carload lots from this mine in the Rayon district. The present working force is about 150 men. Qualey Brothers, of New York and Chihuahua, are the owners and operators.

Africa

TRANSVAAL

Gold production in the Transvaal in May is reported at 634,498 oz. fine, being 17,397 oz. more than in April. For the five months ended May 31 the total was 2,824,984 oz. in 1908, and 3,019,430 oz.—or $62,411,618—in 1909; an increase of 194,446 oz., or $4,019,200, this year.

Asia

INDIA—MYSORE

Kolar Goldfield—Gold production in May was 46,514 oz. bullion, being 386 oz. more than in April. For the five months ended May 31 the total was 226,114 oz. bullion in 1908, and 227,650 oz. in 1909; an increase of 1536 oz. The bullion reported this year was equal to $4,234,973, or 204,885 oz. fine gold. The report includes two mines outside of the Kolar district proper—the Hutti Nizam and the Dharwar reefs, in the Deccan.

Australia

NEW SOUTH WALES

Gold production in May was 13,041 oz. fine; for the five months ended May 31 the total was 90,153 oz., or $1,863,467 in value.

WESTERN AUSTRALIA

Gold production in May is reported by the Chamber of Mines at 129,400 oz., being 8355 oz. less than in April. For the five months ended May 31 the total was 690,311 oz. in 1908, and 649,550 oz.—or $13,426,200—in 1909; a decrease of 40,761 oz. this year.

New Zealand

Gold exports in May are reported by cable at 45,017 oz. bullion in 1908, and 46,525 oz. in 1909; an increase of 1508 oz. The bullion reported this year was equal to $901,650, or 43,622 oz. fine gold. Exports of silver for the month were 164,635 oz. in 1908, and 175,958 oz. in 1909; an increase of 11,323 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 16—Little change in condition is to be reported this week. In the West the coal trade is improving slowly. Comparisons from week to week do not show very much change, but there is a great improvement over the corresponding date last year.

Very much the same conditions prevail in the Eastern bituminous trade. The business gains slowly, but still shows a marked advance over a year ago, which is reflected in heavier shipments from mines.

The anthracite trade is quiet and even, with no special feature, and few changes from week to week.

The injunction asked for against the proposed differential rates on West Virginia coal to Lake ports having been denied by the United States District Court, an appeal has been taken to the Circuit Court of Appeals by counsel for the Kanawha & Michigan Railroad Company.

The Commodities Clause—The following circular, dated June 1, shows the plan adopted by the Delaware & Hudson Company for complying with the commodities clause of the Interstate law. The Hudson Company is a subsidiary company, which was organized some time ago: "The Hudson Coal Company has this day arranged to purchase the entire present and future output of coal mined by the Delaware & Hudson Company. The Hudson Coal Company takes over and assumes all contracts and obligations incurred by the Delaware & Hudson Company to deliver coal, and is prepared to accept and fill orders for coal from the former patrons of the Delaware & Hudson Company."

It is reported that the Delaware, Lackawanna & Western will transfer its coal properties to a subsidiary coal company, the stock in which will be issued, in some form not yet determined, to the stockholders of the railroad company.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to June 5, short tons:

	1908.	1909.	Changes.
Anthracite.....	2,366,353	2,267,845	D. 98,508
Bituminous.....	13,781,518	14,913,686	I. 1,132,168
Coke.....	2,932,808	4,246,565	I. 1,313,757
Total.....	19,080,679	21,428,096	I. 2,347,417

The total increase for the year to date was 12.3 per cent.

Coastwise shipments of coal from leading Atlantic ports, four months ended April 30, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	5,825,046	3,327,239	9,162,285	65.2
Philadelphia	758,976	1,391,440	2,150,416	15.3
Baltimore....	82,227	1,129,428	1,211,655	8.7
Newp't News	.....	956,929	956,929	6.8
Norfolk.....	.....	561,311	561,311	4.0
Total.....	6,666,249	7,366,347	14,032,596	100.0
Total, 1908.	6,208,427	7,157,567	13,375,994	.....

New York includes all the harbor shipping ports. The shipments at all ports include bunker coal for vessels in domestic trade. Total increase this year, 656,602 tons, or 4.9 per cent.

Coal tonnage passing through the Sault Ste. Marie canals, season to June 1, short tons:

	1908.	1909.	Changes.
Anthracite.....	145,061	260,060	I. 114,999
Bituminous....	208,088	836,800	I. 628,712
Total.....	353,149	1,096,860	I. 743,711

The May shipments this year were heavier than had been expected. In 1908 the coal movement did not fairly begin until June.

New York

Anthracite

June 16—The anthracite trade remains steady and without any special incident. May shipments showed a falling off from previous months in the year, but that was generally expected.

There is no change in prices. We quote for prepared sizes, $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

Bituminous

Consumers are evidently beginning to take more interest in the market, although they stir themselves rather more slowly than dealers would like to see. It is not to be denied that commercial trade is better, though it can hardly be called brisk as yet. All-rail trade continues the best. New York harbor prices are unchanged, lower grades selling at $2.40@2.50, f.o.b. harbor shipping port, and better grades for $2.60 and upward. Transportation is rather slow, but car supply is good.

In the Coastwise trade vessels are in good supply and freights continue low. For large vessels from Philadelphia rates are 75@80c. to Lynn and Newburyport; [illegible]@65c. to Boston, Saco and Portland; 45@50c. to Providence and the Sound. From New York rates are 60@65c. to points around Cape Cod.

A subject of considerable interest and discussion in the trade is the present coal situation in England. The latest advices are that settlements appear impossible in Wales and in the Scotch districts, and it is very probable that there will be an extensive strike. In case this occurs a considerable business will be done here in export coal; not so much to England directly as to South America and other countries which are now supplied by English coal. Dealers here are looking out for this contingency.

Birmingham

June 14—An improved condition is reported in the coal market. The mines in Alabama are beginning to receive orders that warrant more activity in the operation.

State Mine Inspector Edward Flynn announces that 56 men have lost their lives by accident in coal mines in this State so far this year.

Considerable attention was attracted to the annual convention of District No. 20, United Mine Workers of America, this week in Birmingham. The organization is practically dead; the attendance at the convention not being large enough to warrant the renting of a hall, the meeting was held in the offices of the organization.

Chicago

June 14—Conditions in the coal market are somewhat better for the seller, owing to restricted shipments of the chief supply, Illinois and Indiana fine coals. The ordinary consumer is buying closely, evidently in the expectation that inactivity will force prices down to their lowest point for the year soon. Lump coal is especially inactive, and in some cases brings 15 or 20c. less than standard prices through demurrage sales. Domestic trade is practically at a standstill in bituminous and very sluggish in anthracite.

Illinois and Indiana coals bring, in car lots, $1.75@2.25 for lump, $1.65@1.75 for run-of-mine and $1.40@1.70 for screenings.

Eastern coals share the general condition, the market being light but shipments lessened so that prices are fairly firm. Hocking, which has been in too large supply for several weeks, is somewhat improved as regards the amount on the

market, but receipts are irregular, and occasionally a consignment is sold at 10 or 20c. below the $3@3.15 otherwise obtained. Youghiogheny is in light but steady movement at $3.15 for ¾-in. gas, and Pittsburg No. 8 in ¾-in. brings $2.65.

Anthracite sales are particularly light owing to the June advance of 10c., which is expected to defer most of the buying for the month to its latter end.

Cleveland

June 15—Lake trade is still rather slow, and the demand in the Northwest is not yet such as to indicate a pressing call for coal. Only contract boats are in commission.

Local trade is improving slowly, and there are indications of good demand for steam coal. Prices show little change. Slack is in best demand. Middie district coal brings $1.90@2 for lump; $1.65@1.75 for run-of-mine; $1.25@1.35 for slack. No. 8 district brings about 5c. more, except for slack, which is $1.40 firm.

Pittsburg

June 15—Between 8,000,000 and 9,000,000 bu. coal have been shipped down the river in the past week, pretty well cleaning out the accumulation in the pools and harbor. There are plenty of empties at the tipples and the railroad mines will continue in steady operation for some time. The market remains rather quiet. Nominal prices are $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at mines, these prices being shaded 5 to 10c. Slack is quoted at 60@65c. per ton.

Connellsville Coke—The appraisement of properties expected to be taken into the coke merger continues. The latest information is that while a merger will likely be put through, it will hardly comprise as large a portion of the independent coal acreage and coking capacity as the promoters have lately claimed. A number of important independents in the Connellsville and lower Connellsville fields are known positively as refusing to go in, while the merger will probably involve a larger acreage in Greene county, West Virginia and other fields than has been admitted. Some Connellsville interests, it is alleged, have put in their Connellsville holdings at moderate prices but have asked considerably above market values for outside holdings, and stipulate that all or none must be taken.

Prices remain at $1.50@1.60 for prompt Connellsville furnace coke, contract coke being $1.60@1.75; Connellsville foundry coke remains at $1.80@2 for prompt and $1.90@2.25 for contract.

The *Courier* reports the production in the Connellsville regions, week ended June 5, at 291,686 tons, an increase of 7000 tons, shipments at 3667 cars to Pittsburg district, 5734 cars to points west and 783 cars to points east of Connellsville; a total of 10,184 cars, a gain of 200 cars

Foreign Coal Trade

United States Coal Exports—Exports of coal from the United States—heretofore reported—to which is now added coal supplied to steamships in foreign trade, four months ended April 30, long tons:

	1908.	1909.	Changes.
Exports	3,053,204	2,772,946	D. 281,158
Bunker coal	1,985,706	1,907,307	D. 78,399
Total	5,038,910	4,679,353	D. 359,557

Total decrease in coal sold for consumption beyond the limits of the United States this year was 7.1 per cent.

Austrian Coal Production—Coal production of Austria-Hungary, four months ended April 30, metric tons:

	1908.	1909.	Changes.
Coal	4,797,563	4,652,297	D. 145,266
Brown coal	9,325,169	8,497,733	D. 827,436
Total mined	14,122,732	13,150,030	D. 972,702
Coke made	627,188	600,666	D. 26,522
Briquets made	48,569	60,506	I. 11,937

The greater part of the briquets is made from brown coal, or lignite.

Spanish Imports—Imports of coal into Spain, two months ended Feb. 28 were 354,115 metric tons, an increase of 42,138 tons. Imports of coke 40,199 tons, an increase of 2,400 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on June 5: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, June 16—The iron and steel markets continue generally strong and active. A tendency to advance prices has been apparent in some lines, but no positive action in that direction has been taken.

In pig iron business has been more active and many inquiries have been received in addition to the sales made. Foundry iron is in fair demand, but the greatest activity has been in basic pig. The size of the lots sold shows some increase and orders are being placed farther ahead. Prices are firm as a rule, no general advance being made, but sellers are not making concessions, especially on future deliveries. The increased capacity of the furnaces in blast is a prominent feature in the situation, but does not seem to affect the market at all unfavorably.

In finished material building and bridge work continue to make an active demand for structural material. Sales of wire and wire products are rather smaller, but this appears to result from the fact that jobbers and dealers generally are well supplied, rather than from any diminution in demand. The same thing is the case with bars, but it is noted that store and job bing trade is generally improving. In rails quite a number of small orders have been placed for standard sections, but no large contracts are reported. Trolley rails and light rails show a considerable business.

Pig Iron Production—The statistics of the blast furnaces, as collected by the *Iron Age* show that on June 1 there were 233 coke and anthracite furnaces in blast, having an aggregate weekly capacity of 442,500 tons. This is 30,500 tons more than on May 1, and is the highest capacity reported since Nov. 1, 1907. The recent increase in furnaces in blast has been entirely in the steel-works furnaces; the merchant furnaces show no increase since December last. Making allowance for the charcoal furnaces, the estimated make of pig iron in May was 1,897,000 tons; for the five months ended May 31, it was 9,079,000 tons.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region for the season to June 1 are reported by the Cleveland *Iron Trade Review* as below, in long tons:

Port.	1908.	1909.	Changes.
Escanaba	16,245	384,856	I. 368,611
Marquette	.....	133,097	I. 133,097
Ashland	21,128	240,855	I. 219,727
Superior	132,818	608,515	I. 475,697
Duluth	86,691	1,215,925	I. 1,129,234
Two Harbors	28,433	725,820	I. 697,387
Total	285,315	3,309,068	I. 3,023,753

Last year no considerable shipments were made before June. As compared with 1907, the shipments this year show a decrease of 2,943,193 tons.

Baltimore

June 14—Exports for the week included 1,317,352 lb. scrap tin to Rotterdam. Imports included 1309 tons ferromanganese and 9 casks silico-spiegel from Liverpool; 5400 tons iron ore from Cuba.

Birmingham

June 14—General conditions in the Southern territory have changed for the better. There is a better demand for pig iron, prices have begun to strengthen and plants are beginning to resume operations. No. 2 foundry iron is being quoted at $11.50 per ton, minimum, for delivery during June and July, with $12 for third-quarter delivery. Some iron has been sold already in this section above $12 per ton, delivery during the fourth quarter. Inquiries are being received.

Four of the open-hearth furnaces at the steel plant at Ensley were started up during the past week. An order for 12,000 tons of rails has been received. Announcement is made that the reorganized company taking over the properties of the Southern Steel Company—of which W. H Hassinger, of Birmingham, is president—has $1,500,000 necessary for working capital underwritten and the work of preparing the plants for operation will be begun.

Chicago

June 14—The iron market remains but slightly better than a week ago as regards

sales of pig iron, although inquiries are more numerous, sales of finished materials increasing and confidence more and more apparent. Consumers, to a large extent, are supplied for the third quarter; for the fourth quarter they are buying both Northern and Southern pig iron in lots from a carload up to 500 tons. Large requirements are being figured on in malleable iron. Prices remain firm at $11.50 @12 Birmingham ($15.85@16.35 Chicago) for Southern and $16.50@17 for Northern, for third and fourth quarters. Some sales are made at 25 or 50c. above or below these prices, but not many. The selling interests are apparently firm.

In structural material the market continues active and railroad supplies also are in good demand. Coke is fairly active at $4.70 ($2.05 at ovens) and with the supply large.

Cleveland

June 15—Some sales of iron ore are reported still, but transactions have not been heavy, so far as can be ascertained. Arrivals for May at Lake ports were much larger than last year.

The breaking down of the lock gates in the Canadian canal at the Sault Ste. Marie on June 8, by a steamer running into the gates, will put the Canadian canal out of commission for some time. It does not, of course, affect the American canal, which will be able to pass all the vessels coming, but will be crowded with traffic as the season goes on. In busy times the Canadian canal carries about 20 per cent. of the traffic.

Pig Iron—No large transactions are noted, but many small sales, 500-ton lots and under. Sellers are firmer in their views, and are holding on a basis of $15.25@15.50 for No. 2 foundry, Cleveland.

Finished Material—A good business has been done in bars and structural steel with a fair lot of plates. Structural shapes are quoted at 1.30@1.35c.; steel bars, 1.20@1.25c., Pittsburg basis.

Philadelphia

June 16—The pig-iron market is somewhat quieter but a good deal of business is being done and prices are firm, with many furnaces holding for a little higher range on fourth quarter. A good tonnage of basic has been sold and pipe foundries are taking much iron, principally low-grade Southern. No. 2X foundry may be quoted $16.50 for prompt and $16.75 for third quarter. Basic is about $15.50 per ton in this territory.

Steel Billets—Sales are fair with a good deal of inquiry. Prices are unchanged.

Bars—Business continues fair, demand being mostly for refined iron which sells in this territory at around 1.40c while 1.35c. is asked for steel bars. Store trade is good.

Plates—Sales of boiler and ship plates are reported good.

Structural Material—No large contract is reported this week but a good total of small sales. There is talk of increased prices, but it has not materialized so far.

Scrap—Demand and prices are going up. Dealers are sitting on their piles, afraid to let it go in view of the higher quotations promised. The biggest call is for heavy steel melting scrap, for which $15.50@16 has been realized. Good casting is also in demand.

Pittsburg

June 15—While general buying of iron and steel products is not as heavy as during the recent rush, it is still of fair volume and the buying is amply sufficient to maintain the bullish feeling which has pervaded the trade. Bars, plates, shapes and wire products have been advanced slightly in the past few weeks. Shapes are fairly well held at 1.30c., Pittsburg, and plates at 1.25c., although occasionally these prices are shaded $1 a ton.

In the past few weeks the railroads have been better buyers, but they are still far short of the average of 1906 and 1907. Other consumers are taking as large tonnages as ever, and the only question is as to the permanence of the movement. It is known that a portion of the material now being shipped from mills is going into stocks, but it is believed that the rate of consumption will increase.

Pig Iron—Prices in the local market have advanced again, by fully 25c. The Standard Sanitary Manufacturing Company late last week bought 5000 tons, for third-quarter delivery, divided among No. 2 foundry at $14.50, Valley, No. 3 foundry at $14, Valley, and gray forge at $13.75, Valley. These prices could not be duplicated now. Gray forge has since sold at $14.15, Valley, while No. 2 foundry is held at a minimum of $14.75, Valley. Early last week sales of standard basic were made at $14.25, Valley, but a couple of days later $14.50 was paid for basic somewhat off in analysis, and the minimum of the market is $14.75, which price has been done on third quarter, with $15 and higher asked for fourth quarter. The Republic Iron and Steel Company has just bought 5000 tons of standard bessemer, following its recent operations by which it bought 10,000 tons and borrowed some 20,000 tons. Standard bessemer is at a minimum of $15.25, Valley, most sellers asking $15.50.

Steel—The market on sheet-bars is firmer since the sales in the past few weeks at cut prices, and $25@25.50, delivered in the district, appears to be the best that can be done, while some mills are quoting $26 on prompt delivery. Bessemer billets are firm at $23, Pittsburg, while open hearth billets are scarce and premium of $1 per ton is being asked.

Sheets—Demand has improved slightly and mill operations have increased, the leading interest operating about 70 per cent. of its capacity, while the independents are doing 75 per cent., or better. The Amalgamated Association is holding a "delegate convention" in Pittsburg this week anent the declaration of the American Sheet and Tin Plate Company that after June 30 it will operate all its mills on the open-shop plan. The men will probably try to close the hitherto union plants of the leading interest. This would have little effect in the sheet branch, but would be a serious matter in tinplate. The sheet market remains at 2.20c. for black and 3.2c. for galvanized, 28-gage, these prices being occasionally shaded $1 per ton. The open quotations on corrugated roofing are $1.55 for painted and $2.80 for galvanized, 28-gage, per square, but these prices are being shaded $1 or $2 per ton.

Ferromanganese—The market continues quiet. The regular quotation is $40.50@41, Baltimore, equal to $42.45@42.95, Pittsburg, but the lower price might be shaded 50 cents.

Foreign Iron

German Iron Trade—Exports and imports of iron and steel in Germany, four months ended April 30, metric tons:

	Exports.	Imports.	Excess.
Iron and steel....	1,225,903	128,038	Exp.1,097,024
Machinery	97,309	19,765	Exp. 77,544
Total.....	1,322,371	147,603	Exp.1,174,768
Total, 1908.....	1,275,657	212,342	Exp.1,063,316

Imports of iron ore this year, 2,364,201 tons; exports, 898,442 tons. Imports of manganese ore, 100,820; exports, 794 tons.

British Iron Ore Imports—Imports of iron ore into Great Britain, four months ended April 30, were 1,890,279 long tons in 1908, and 1,850,677 in 1909; decrease, 39,602 tons. Of the imports this year 1,416,557 tons were from Spain.

Metal Markets

New York, June 16—The metal markets continue generally strong, but hardly as active as recently. A good demand for consumption is generally apparent.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
May 1909..	$11,171,265	$ 2,263,721	Exp.$ 8,907,544
" 1908..	26,555,913	3,101,002	Exp. 23,454,911
Year 1909..	55,487,891	17,767,857	Exp. 37,720,034
" 1908..	44,891,257	22,958,223	Exp. 21,933,034
Silver:			
May 1909..	4,428,448	3,857,388	Exp. 571,060
" 1908..	4,028,334	3,389,568	" 638,766
Year 1909..	23,854,629	18,532,453	" 5,322,176
" 1908..	21,077,185	17,688,150	" 3,389,035

Exports from the port of New York, week ended June 12: Gold, $282,550, chiefly to Buenos Aires; silver, $929,623S, to London and Paris. Imports: Gold, $101,631, chiefly from South America and Australia; silver, $152,076, from the West Indies and Mexico.

Gold and silver movement in France, four months ended April 30:

	Imports.	Exports.	Excess.
Gold... Fr.	203,958,000	F.24,462,000 Imp.	Fr.179,496,000
1908...	230,164,000	9,318,000 Imp.	220,846,000
Silver..	52,931,000	41,735,000 Imp.	11,196,000
1908...	45,662,000	54,362,000 Exp.	8,700,000

Imports of copper and nickel coins, 27,000 fr. in 1908, and 26,000 fr. in 1909; exports 305,000 fr. in 1908, and 161,000 fr. this year.

Gold—The price on the open market in London continues unchanged at 77s. 9d. per oz. for bars. There was no special demand, and most of the gold offered was taken by the Bank of England. In New York there were no shipments direct to Europe, but $2,250,000 were taken for export to Japan on London account.

Platinum—Business is rather quiet, but it is usually in that condition through the summer. Prices are unchanged, dealers quoting $22.50@23 per oz. for refined platinum, $25 for hard metal and $18@20 for good scrap.

Silver—The market has been almost stationary through the week, fluctuations being very narrow.

SILVER AND STERLING EXCHANGE

June.	10	11	12	14	15	16
New York....	52⅝	52⅝	52⅝	52⅝	52¾	52⅝
London.....	24⅞	24⅞	24⅞	24⅞	24	24⅝
Sterling Ex..	4.8775	4.8780	4.8775	4.8780	4.8775	4.8785

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to June 3:

	1908.	1909.	Changes.
India.....	£ 3,584,018	£2,216,200	D. £1,367,818
China. .	516,400	1,075,100	I. 558,700
Strait.....	90,200	82,800	D. 7,400
Total..... ..	£ 4,190,618	£3,374,100	D. £ 816,518

Receipts for the week, £2500 from Australia, £5800 from the West Indies and £170,400 from New York; total, £178,700. Exports, £1800 to Egypt and £55,000 to India; £56,800 in all.

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
10	13⅝ @13⅝	13⅝ @13⅛	60⅛	30	4.35	4.27½ @4.32½	5.22½ @5.25
11	13⅝ @13⅝	13⅛ @13⅛	59⅞	29⅝	4.35	4.27½ @4.32½	5.22½ @5.27½
12	13⅝ @13⅝	13⅛ @13⅛	....	29⅝	4.35	4.27½ @4.32½	5.25 @5.30
14	13⅝ @13⅝	13⅛ @13⅝	59⅛	29⅝	4.35	4.27½ @4.32½	5.25 @5.30
15	13⅝ @13⅝	13⅛ @13⅝	59⅛	29⅝	4.35	4.27½ @4.32½	5.25 @5.30
16	13⅝ @13⅝	13⅝ @13⅝	59	29⅝	4.35	4.27½ @4.32½	5.25 @5.30

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The persistent decline in the London standard market has discouraged buying on the part of consumers, both here and abroad. Sellers have been trying to make a market by offering concessions from day to day, but so far they have met with but little success. The actual business transacted has been of a negligible quantity, the market for Lake in particular being quite nominal. The close is weak at 13⅜@13⅝c. for Lake copper; 13⅛@13⅜c. for electrolytic copper in ingots, cakes and wirebars. The average of the week for casting copper has been 13@13¼ cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire is 15c. base, carload lots at mill.

The liquidation of long holdings and short selling, which did not meet with a proportionate inquiry by new buyers, brought about a rapid and uninterrupted decline in the standard market in London. The statistics published for the half month show an increase in the visible supply of 5400 tons. This news is adequate explanation for the weak closing quotations which are cabled at £59 for spot and £59 17s. 6d. for three months.

For refined and manufactured sorts we quote: English tough, £63; best selected, £62@63; strong sheets, £74@76.

The report of the Copper Producers' Association gives the following figures for May and the five months ended May 31, in pounds:

	May.	Five Months.
Stocks, May 1 and Jan. 1	183,198,073	122,357,266
Production in U. S.	118,356,146	564,825,116
Total supplies.....	301,554,219	687,182,382
Deliveries, dom. and exp.	131,706,078	517,334,241
Stocks, June 1 .	169,848,141	169,848,141

Production includes copper refined from all sources. Estimated exports for May, 70,387,520 lb.; for five months, 269,613,120 lb.; leaving for domestic deliveries, 61,318,528 and 247,721,121 lb., respectively. Decrease in stocks in May, 13,349,932 lb.; increase in five months, 47,490,875 pounds.

Owing to an error in transcribing, the May average for Lake copper was printed in our last issue at 13.228c. It should have been 13.238c., as given in the table this week.

Exports of copper from New York and Philadelphia for the week were 0068 long tons. Our special correspondent gives the exports from Baltimore at 1824 tons copper

Stocks of copper in England and France on June 1 are estimated by Henry R. Merton & Co., at 56,854 tons; this including 5850 tons afloat from Chile and Australia. The total is an increase of 5930 tons over the May 1 report.

Tin—The activity in the London market which we reported last week has somewhat subsided. Notwithstanding the reduced transactions, the tone of the market remains steady and the close is cabled at £133 17s. 6d. for spot, and £135 7s. 6d. for three months.

The firmer London market has not had any influence on domestic consumptive buying. Traders also are reluctant in following the advance in London, and business in tin is practically at a standstill. Quotations at the close are 29¼ cents.

Supplies of tin in May, as reported by A. Strauss & Co., were 7734 long tons; deliveries, 6840 tons. The visible stocks June 1 were 19,818 tons, an increase of 894 tons during May.

Exports of tin from the Straits, three months ended March 31 were: United States, 5166; Great Britain, 6722; European Continent, 1360; China and India, 557; total, 13,805 long tons, a decrease of 2235 tons from last year.

Lead—There is a steady business doing in this metal at 4.35c., New York, and 4.27½@4.32½c., St. Louis. Chemical lead has sold at St. Louis at 4.35 cents.

The London market is somewhat lower, and the close is cabled at £13 1s. 3d. for Spanish and £13 3s. 9d. for English.

Spelter—The improvement in this metal has made further progress. Large orders are being placed daily, particularly by the galvanizers. The smelters are reluctant to engage themselves very far ahead, for in addition to the proposed tariff and the advancing ore market in Joplin, they have now to contend with labor difficulties. It is reported that a number of plants in Kansas are on dead fire because they have a strike on their hands on account of refusing the demand of their men for a raise in wages. The smelters are assuredly in a bad way. They are face to face with a scarcity of ores and the price of spelter does not leave sufficient margin as against the current price of ore. The import lists show constant importations of foreign spelter on an increasing scale, which it is understood is being used for drawback purposes. The close is firm at 5.25@5.30c., St. Louis, and 5.40@5.55c., New York.

New York quotations for spelter June 10 were 5.37½@5.40c.; June 11, 5.37½@5.42½c.; June 12 to June 14, inclusive, 5.40@5.45 cents.

The London market is somewhat lower, the close being cabled at £22 for good ordinaries, £22 5s for specials.

Base price of sheet zinc has been advanced ¼c. to 7c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—Sales are only of a retail kind. Prices are nominally unchanged at 8⅜c. for Cookson's; 7⅞c. for U. S.; 7⅜@7⅝c. for other brands. Business is waiting a decision on the tariff.

Aluminum—No change is reported. No. 1 ingots are 22@24c.; wire, 31@32c. base; sheets, 33@34c. base.

Quicksilver—Business is fair only. New York price is unchanged at $44.50 per flask of 75 lb. San Francisco, $44 for domestic and $42 for export. London, £8 7s. 6d. per flask, with 5s. less done by jobbers.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotations 75c. per lb., in 100-lb. lots, at Cleveland, Ohio. In Germany, 450@475 marks per 100 kg. at factory.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Spanish Metal Exports

Exports of metals and minerals from Spain, two months ended Feb. 28, reported by *Revista Minera*, in metric tons:

Metals.	1908.	1909.	Changes.
Pig and manuf. iron	1,772	4,325	I. 2,554
Copper	1,421	2,789	I. 1,368
Copper precipitate	3,474	2,761	D. 713
Lead	26,304	22,052	D. 4,252
Zinc	402	54	D. 348
Quicksilver	422	211	D. 211
Minerals.			
Iron ore	1,062,528	1,075,208	I. 12,580
Manganese ore	8,574	1,020	D. 7,554
Copper ore	192,487	172,339	D. 20,148
Lead ore	686	370	D. 316
Zinc ore	13,283	18,325	I. 5,042
Pyrites	231,343	162,330	D. 69,013
Salt	92,254	89,219	D. 3,035

Imports of phosphate rock were 20,916 tons in 1908, and 15,832 in 1909; decrease, 5084 tons.

Zinc and Lead Ore Markets

Joplin, Mo., June 12—A number of the heavier producers declined to sell zinc ore this week under a base price of $45 per ton of 60 per cent. zinc, and in order to fill shipping orders this price had to be met by purchasing agents. This is in excess of a ratio of $8.50 per ton of 60 per cent. zinc for each $1 per 100 lb. for spelter, which will need to reach $5.65 per 100 lb. before it will be equivalent to a ratio of 8 to 1, the limit at which smelters claim there is a living profit in manufacturing spelter. Outpatting conditions are good, and the reported discovery of 22 ft. of ore under the blanket vein in one of the mines north of Webb City, said to carry a higher percentage of concentrate than the blanket vein, offers new possibilities for this ore area. The highest price paid was $47 per ton, on a base of $42@45. Heavy silicate shipments, selling at $17@24 per ton, lowered the average to $38.96. Lead ore sold as high as $60 for several hundred tons for next week's delivery, $59.50 being the highest settling price reported for this week. The average price, all grades, was $58.42, bidding them stronger on medium-grade purchases.

SHIPMENTS, WEEK ENDED JUNE 12.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,668,080	987,430	$110,104
Joplin	1,662,170	174,710	40,968
Miami	701,230	156,190	16,363
Duenweg	374,930	207,910	13,344
Galena	521,790	51,710	12,514
Alba-Neck	476,640	.....	10,463
Prosperity	376,800	77,550	10,182
Oronogo	398,200	80,470	8,989
Sarcoxie	575,790	.....	7,703
Badger	340,480	.....	7,320
Granby	491,900	8,600	7,145
Aurora	499,320	.....	6,558
Carthage	298,980	.....	5,804
Quapaw	271,240	.....	5,425
Spurgeon	212,690	56,780	4,963
Carl Junction	87,900	.....	1,978
Zincite	79,890	.....	1,717
Stott City	41,020	.....	744
Totals	11,280,640	1,801,350	$272,384
24 weeks	271,173,870	43,825,160	$6,127,096

Zinc value, the week, $219,755; 24 weeks, $4,966,129
Lead value, the week, 52,629; 24 weeks, 1,170,967

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.45	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.60
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.63	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 12—The highest price paid this week for zinc ore was $43; the base price of 60 per cent. zinc was $42@43 per ton. Offerings of $57@58 per ton were made for 80 per cent. lead ore; no sales or shipments are reported. The week's shipment was light, owing to three days' steady rain.

SHIPMENTS, WEEK ENDED JUNE 12.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	528,600	.....	245,000
Strawbridge	385,000	.....	.....
Benton	304,550	.....	.....
Hazel Green	275,350	.....	.....
Galena	240,000	.....	.....
Livingston	89,000	.....	.....
Harker	64,630	.....	.....
Linden	53,370	.....	.....
Total	1,931,500	.....	245,000
Year to June 12	52,212,430	2,316,480	4,391,400

In addition to the above there was shipped to the American Zinc Ore Separating Company 431,200 lb., and to the Joplin Separator Works 130,400 lb. zinc ore.

Petroleum

June 16—Exports of mineral oils from the United States, five months ended May 31, in gallons:

	1908.	1909.
Crude petroleum	38,948,193	56,734,752
Naphthas	13,823,090	27,555,244
Illuminating oils	443,646,151	410,978,912
Lubricating oils	64,294,792	58,675,765
Residuum	25,783,031	40,909,758
Total	586,495,257	594,854,431

Paraffin is included in lubricating oils. The total increase this year was 8,359,174 gal., or 1.4 per cent.

Chemicals

New York, June 16—Deliveries on contracts continue steady and a little more spot business is noted in several lines.

Copper Sulphate—A fair amount of business is being transacted at unchanged prices, $4.25 per 100 lb. for carload lots and $4.50 per 100 lb. for smaller orders.

Nitrate of Soda—Prices are 2.15c. per lb. for spot material and 2.12½c. for futures. A fairly good business is being done at these quotations.

Arsenic—Sales for the week have been light, aggregating only about 75 tons. The market is rather weak, closing at 2¾@3c. for white arsenic.

Mining Stocks

New York, June 16—The general stock markets show little change from last week's report. There have been numerous fluctuations in prices in both directions, but no settled tendency in the market. There has been in some special stocks a good deal of liquidation, but others have held well. Prominent in the latter class are the Steel Corporation stocks which remain very strong. Today there was a considerable reaction, with many drops in prices; but at the close there was some recovery.

On the Curb there was moderately active trading only, and the movement of prices was divided, some stocks showing higher prices and others lower. Miami Copper, which has been quiet for some time, was rather prominent in the trading. The Cobalt stocks are looking up and there is a good deal of trading. Nevada stocks are inclined to be quiet.

It is reported that a controlling interest in stock of the old Quicksilver Mining Company, of California, has been sold to London parties.

Boston June 15—There has been little in price movements the past week to incite public interest in the local mining-share market. North Butte has been

active at times and made a high at $63.37½ with subsequent reaction to below $59, ex-dividend of $1. It is generally believed that control of this company is lodged in hands close to Amalgamated Copper interests. The violent fluctuations in the stock the past month or two have resulted in a change of ownership, according to best authorities.

Mass mining has been less conspicuous with an extreme fluctuation of $2, or from $11 to $9. By official utterance the company admits that the recent mill run was but 18 lb. of mineral to the ton of rock treated. The market end of the stock was almost a battle royal between the bull and bear parties, but the latter won out.

American Zinc and Franklin mining have both been in the limelight. The former stiffened $1.25 to $27.12½ largely on pool orders. About all the stock offered has been taken. Franklin advanced $2.25 to $18.50, but did not hold all of the advance. Copper Range had a smart spurt of $2 to $84.50, but a reaction which set in today took the price back to below $82.

Amalgamated is off $1.75 net for the week to $84.62½, but the decline occurred almost entirely today, and the weakness of the New York market was responsible for it. To a greater or less extent the whole mining-share list weakened.

Price changes on the Curb are slight in net results for the week. Activity continues in the better grade of stocks, which is the encouraging feature.

STOCK QUOTATIONS

NEW YORK June 16		BOSTON June 15	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.17	Adventure	8
Amalgamated	84⅛	Allouez	42
Anaconda	50⅛	Am. Zinc	26¾
Balaklala	12½	Arcadian	4⅝
British Col. Cop.	7⅝	Arizona Com	41¼
Buffalo Mines	13½	Atlantic	9¾
Butte Coalition	26¼	Boston Con	15
Colonial Silver	⅞	Calumet & Ariz	108
Cons. Ely Mining	8 7/16	Calumet & Hecla	665
Davis-Daly	5⅝	Centennial	33¾
Dominion Cop.	7	Copper Range	81¾
Douglas Copper	3⅛	Daly-West	8¾
El Rayo	2¼	East Butte	13½
Florence	3¼	Franklin	16⅞
Foster Cobalt	.32	Greene—Can	10⅛
Furnace Creek	.10	Hancock	11⅛
Giroux	7⅝	Isle Royal	27
Gold Hill	⅛	Keweenaw	4¾
Goldfield Con	7 1/16	La Salle	13⅛
Granby	105	Mass	9¾
Greene Gold	⅛	Michigan	10⅛
Greene G. & S.	9	Mohawk	67
Guanajuato	1⅝	Nevada	23
Guggen. Exp.	196	North Butte*	58⅛
Hanapah	.15	Ojibway	‡12⅛
Kerr Lake	7 1/16	Old Colony	.60
McKinley Dar.	.91	Old Dominion	55
Miami Copper	16⅛	Osceola	137
Mizmac	⅝	Parrot	35
Mines Co. of Am.	⅛	Quincy	92
Mitchell Mining	¼	Rhode Island	14¾
Mont. Sho. C.	‡1½	Shannon	16¼
Nev. Utah M. & S.	2⅛	Superior	42
Newhouse M. & S.	1⅝	Superior & Bost.	16⅛
Nipissing Mines	10¼	Superior & Pitts.	14
Old Hundred	2⅛	Tamarack	71
Silver Queen	.37	Trinity	12⅛
Stewart	¼	U. S. Sing. & Ref	49¾
Tennessee Copr.	10⅛	U. S. Sm. & Ref., pd.	49⅝
Tri-Bullion	⅛	Utah Con	43¾
Union Copper	1	Victoria	4¼
Utah Apex	6⅛	Winona	5⅛
Utah Copper	52	Wolverine	150
Yukon Gold	4⅛	Wyandotte	2⅝

*Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	43
Am. Smelt. & Ref.	94¼
Am. Sm. & Ref., pf.	109¾
Colo. Fuel & Iron	44
Federal M. & S., pf.	‡88¾
National Lead	85
National Lead, pf.	‡108⅝
Pittsburg Coal	‡13
Republic I. & S.	31
Republic I. & S., pf.	106⅝
Sloss-Sheffield	‡83⅝
Standard Oil	685
U. S. Steel	67⅛
U. S. Steel, pf.	124
Va. Car. Chem.	54½

BOSTON CURB	Low.
Ahmeek	172½
Black Mt.	99
Chemung	16
Corbin	9
Globe Con	4¾
Helvetia	5¾
Ray Central	3 1/16
Ray Con	16⅛
San Antonio	10½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS June 12		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	1.75	1.50
Cent. C. & C.	81.00	79.00
C. C. & C. pf.	82.00	80.00
Cent. Oil	110.00	100.00
Columbia	9.00	7.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.20	.20
St. Joe	13.00	12.00

LONDON June 16	
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton'sInd.	0 3 ½
Camp Bird	1 8 9
Esperanza	3 17 6
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 13 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. June 16.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.10
Belcher		St. Ives	.10
Best & Belcher	.41	Triangle	.01
Caledonia	.37	BULLFROG STOCKS	
Challar	.19	Gibraltar	.02
Comstock	.18	Homestake King	.01
Con. Cal. & Va.	...	Mont. Shoshone C.	1.50
Crown Point	.67	Tramp Cons	.05
Exchequer	.40	MISCELLANEOUS	
Gould & Curry	...	Greenwa'r Copper	.06
Hale & Norcross	.15	Nevada Hills	.87½
Mexican	.20	Nevada Smelting	1.25
Ophir	.83	Nevada Wonder	.50
Overman	1.30	Nevada-Utah	1.93¾
Potosi	.20	Penn-Wyoming	...
Savage	.20	Pittsburgh S. Pk.	.49
Sierra Nevada	.17	Ray Central	3.00
Union	.27	Round Mt. Sphinx	.10
Utah	.32		
Yellow Jacket	.03		
TONOPAH STOCKS	43		
Belmont			
Extension	.78		
Golden Anchor	.51		
Jim Butler	.13		
MacNamara	.26		
Midway	.22		
Montana	.68		
North Star	.02		
Tonn'h Mine of N.	7.12½		
West End Con	.24		
GOLDFI'D STOCKS			
Adams			
Atlanta	.01		
Blue Bell	.15		
Booth	.03		
Columbia Mt.	.12		
Combs Ferr.	.34		
Con. Red Top	.57		
Cracker Jack	.01		
Dia'dfield B. B. C.	.02		
Goldfield Belmont	.03		
Goldfield Daisy	.04		
Great Bend	.30		
Jumbo Extension	.07		
Kendall	.10		
Lone Star	.03		
May Queen	.03		
Oro	.04		
Red Hill	.06½		
Roanoke	.08		
Sandstorm	.03		

COLO. SPRINGS June 11	
Name of Comp.	Clg.
Acacia	.07
Black Bell	....
C. C. Con	.03¼
Dante	.05½
Doctor	.08⅞
Elkton	.05¼
El Paso	.51
Findlay	.12
Gold Dollar	.11
Gold Sovereign	.03¼
Isabella	.24⅝
Jack Pot	‡.06¾
Jennie Sample	.07
Jerry Johnson	.06½
Mary McKinney	.39½
Pharmacist	.03
Portland	.89
Un. Gold Mines	‡.05½
Vindicator	.60
Work	‡.06¾

Assessments

Company.	Delinq.	Sale.	Amt.
Black Jack, Utah	June 15	July 8	$0.01
Bullion, Nev	June 14	July 13	0.05
Caledonia, Nev	May 26	June 16	0.05
Challenge Con., Nev	June 22	July 13	0.06
Challar, Nev	June 8	June 30	0.10
Con. Imperial, Nev	May 26	June 17	0.01
Gould & Curry, Nev	June 8	June 26	0.10
Hecla M. & M., Utah	May 15	June 14	0.05
Julia Con., Nev	May 24	June 17	0.03
Mexican, Nev	June 28	July 14	0.10
N Y. Bonanza, Utah	July 10	July 31	0.03
Palmyra G. & C., Utah	June 11	June 30	0.001
Paymaster, Utah	June 12	June 30	0.001
Potosi, Nev	July 9	Aug. 3	0.10
Progressive Utah	June 23	July 14	0.01
Scorpion, Nev	June 14	July 6	0.02
Seg. Belcher, Nev	July 7	July 29	0.03
Seven Troughs Mon., Nev.	June 23	July 10	0.00
Silver King Con., Utah	July 6	July 17	0.10
Union Con., Nev	June 28	July 19	0.10
Yellow Jacket, Nev	July 13	Aug. 5	0.25

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.993	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.561	12.928	12.923	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	.....	.....	12.600	.....
July	4.744	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York 1908.	New York 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.636	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska, Mexican, g.	Alas	180,000	$ 5	$ 2,184,381	April '09	$0 40
Alaska Treadwell, g.	Alas	200,000	25	10,485,000	April '09	0 50
Alaka United, g.	Alas	180,200	5	513,520	April '09	0 25
Amalgamated, c.	Mont	1,538,879	100	70,018,993	May '09	0 50
Am. Sm.&Ref.,com.	U. S	500,000	100	16,500,000	July '09	1 00
Am. Sm. & Ref., pf.	U. S	500,000	100	31,500,000	July '09	1 75
Am. Smelters, pf. A.	U. S	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf. B.	U. S	300,000	100	6,000,000	June '09	1 25
Am. Zinc,Lead&Sm.	Kan	80,000	25	280,000	Nov. '07	0 50
Anaconda, c.	Mont.	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c	Ariz	3,682,520		6,182,520	April '06	0.50
Atlantic, c.	Mich	100,000	25	990,000	Feb. '05	0 02
Bald Butte, g. s.	Mont	250,000	1	1,354,648	Oct. '07	0 04
Beck Tunnel, g. s. l.	Utah	1,000,000	0 10	675,000	Oct. '07	0.02
Bent'a M.&D.,pf.,l.z.	Wis.	496,607	1	‡10,949	Nov. '08	0 01½
Boston & Montana.	Mont	150,000	25	53,400,000	April '09	3 00
Bull.Beck.&Cham.,g.	Utah	100,000	10	2,728,400	July '08	0 10
Bunker Hill & Sull.	Ida	300,000	10	11,016,000	June '09	0 15
Butte Coalition, c. s	Mont	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet&Arizona, c.	Ariz	200,000	10	10,500,000	May '09	1 00
Calumet & Hecla, c.	Mich.	100,000	25	108,850,000	June '09	6.00
Camp Bird, g., s	Colo.	820,000	5	5,707,200	April '09	0 24
Carisa, c. g.	Utah.	500,000	1	55,000	Nov. '06	0 01
Colorado, l. g. s.	Utah	1,000,000	0 20	1,470,000	June '09	0.08
Columbus Con., c.	Utah	285,540	5	226,832	Oct. '07	0.20
Con. Mercur, g	Utah.	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo.	22,000	25	231,000	Oct. '08	0.25
Copper Range Con.	Mich	384,185	100	8,452,070	July '09	1 00
Creede United, g	Colo.	1,625,000	1	214,053	July '06	0 00½
Daly Judge, g. s. l.	Utah.	300,000	1	225,000	April '07	0 37½
Daly West, g. s. l.	Utah	180,000	20	5,785,000	July '09	0 30
De Lamar, g. s	Ida	80,000	5	835,200	Sept. '06	0 24
Doe Run, l	Mo	59,962	100	1,859,893	Mar. '09	1 50
Elkton Con., g.	Colo.	2,500,000	1	2,354,460	June '09	0.01½
El Paso, g.	Colo.	2,450,000	1	1,315,545	Sept. '08	0 01
Fed. Sm., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf	Idaho	120,000	100	4,751,250	June '09	1.75
Findley, g.	Colo.	250,000	1	337,500	Sept. '06	0.01
Florence, g	Nev.	1,050,000	1	525,000	June '09	0 10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0 05
Gemini-Keystone	Utah	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con	Colo	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g.	Nev.	3,546,013	10	2,834,232	July '09	0 30
Grand Central, g.	Utah.	250,000	1	1,321,250	Dec. '07	0 04
Gwin Mine, Dev., g.	Cal.	100,000	10	496,000	April '06	0.05
Hecla, s. l.	Idaho	1,000,000	0 25	1,690,000	Dec. '08	0 01½
Homestake, g	S. D.	218,400	100	24,481,640	June '09	0 50
Horn Silver, g.s.c.z.l.	Utah	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c	Ariz	500,000	10	300,000	June '07	0 20
Inter'l Nickel, pf	N. Y	89,126	100	1,871,646	May '09	1 50
Iron Blossom, s. l.	Utah	1,000,000	0 10	160,000	June '09	0 08
Iron Silver	Colo	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.	Cal.	200,000	10	347,100	April '09	0 02
Jerry Johnson	Cal.	1,500,000	1	86,700	Jan. '08	0 01
Kendall, g	Mont.	500,000	5	1,275,000	Oct. '08	0 02
Liberty Bell, g. s	Colo	130,551	5	130,410	Jan. '07	0 15
Lightner, g	Cal.	102,255	1	253,081	Oct. '06	0 05
Lower Mammoth, g	Utah	190,000	1	57,000	Sept. '07	0 07½
MacNamara, s. g.	Nev.	728,341	1	21,850	May, '09	0 01
Mammoth, g. s. l	Utah	400,000	2.50	2,220,000	Mar. '08	0 05
Mary McKinney, g	Colo.	1,309,252	1	841,093	Dec. '08	0 02
May Day, g. s. l.	Utah	800,000	1	108,000	Sept. '08	0 01½
Mohawk, W.	Mich.	100,000	25	1,850,000	Feb. '09	2 00
Mont. Ore Purch.	Mont.	80,833	25	9,437,274	Jan. '09	0.00
Nevada Hills, s.g	Nev.	746,000	5	373,000	Dec. '07	0 10
New Century, z. l.	Mo.	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah.	600,000	10	300,000	Sept. '07	0 50
New Idria, q.	Cal.	100,000	5	1,080,000	Jan. '09	0 30
New Jersey Zinc	U. S	100,000	100	12,000,000	May '08	4 00
North Butte	Mont	400,000	15	7,200,000	June '08	1 00
North Star, g.	Cal.	250,000	10	2,096,000	Nov. '09	0 40
Old Dominion, s	Ariz	293,243	25	849,332	Mar. '09	0 50
Old Dominion,M&Sc	Ariz	162,000	25	526,500	Mar. '09	1 00
Ophir, g. sz	Nev	201,600	3	1,816,360	May '08	0 10
Osceola, c	Mich	96,150	25	7,420,250	Jan. '09	2 00
Parrot, c. s	Mont	229,850	10	6,807,649	Sept. '07	0 25
Pennsylvania, g.	Cal	51,500	100	284,929	July '05	0 10
Phelps, Dodge & Co	U. S	44,934,660	1	2,245,730	June '09	0 02½
Portland, g	Colo.	3,000,000	1	8,227,080	Jan. '09	0 40
Quartette, g. s.	Utah	100,000	10	375,000	July '07	0 20
Quincy, c.	Mich.	110,000	25	18,560,000	Mar. '09	1 00
Sacramento, g. q	Utah.	1,000,000	1	225,000	Nov. '06	0 00½
St. Joseph, l	Mo.	1,000,000	10	6,308,357	Mar. '09	0 15
Shannon, s.	Ariz	300,000	10	450,000	July '07	0 50
Silver Hill, g. s.	Nev.	108,000	1	81,000	June '07	0 05
Silver King, g. s. l.†	Utah	150,000	20	11,187,500	July '07	0 33½
Silver King Co'l'n.†	Utah	1,224,125	5	1,105,102	April '09	0 15
Sioux Con	Utah	746,389	1	440,089	June '09	0 07
Snowsturm, s. l	Ida	1,500,000	1	735,000	May '09	0 03
Standard Con., g. s.	Cal.	178,394	10	5,194,130	Dec. '08	0 10
Stratton's Independ.	Colo	1,000,000	5	4,895,865	April '06	0 12½
Swansea, g. s. l.	Utah	100,000	5	329,500	Mar. '07	0 05
Tamarack, c	Mich	60,000	25	9,420,000	July '07	4 00
Tennessee, c	Tenn	200,000	25	2,056,250	Sept. '08	1 25
Tomboy, g. s.	Colo	300,000	5	2,016,000	Dec. '08	0 48
Tonopah of Nev.	Nev	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont	Nev.	1,500,000	1	600,000	April '07	0 10
Tonopah Ext'nsion	Nev.	928,433	1	283,030	April '06	0 15
Tonopah Midway	Nev.	1,000,000	1	250,000	Jan. '07	0 05
Uncle Sam, g. s. l.	Utah	500,000	1	205,000	Dec. '08	0 02
United States, com.	Utah.	350,933	50	2,148,099	April '09	0 50
United States, pfd.*	Utah.	485,845	50	5,306,405	April '09	0 87½
United Cop. com.	Mont	450,000	100	5,962,500	Aug. '07	1 75
United, c. pf.	Mont.	50,000	100	1,500,000	May '07	3 00
United, z. l., pf	Mo.-Kan.	19,856	25	312,482	Jan. '08	0 50
United Verde, c.	Ariz	300,000	10	1,385,322	Mar '09	0 75
U. S. Red. & Ref. Pf.	Colo	39,458	100	1,005,501	Oct. '07	1 50
Utah, g. (Fish Sp'gs)	Utah	100,000	10	323,000	Feb. '09	0 02
Utah Con., c	Utah	300,000	5	7,500,000	April '09	0 50
Utah Copper	Utah	727,100	10	1,133,487	July '09	0 50
Victoria, Utah	Utah	250,000	1	177,000	Mar. '07	0 04
Vindicator Con., g.	Colo	1,500,000	1	1,080,000	Jan. '09	0 03
Wolverine, c.	Mich	60,000	25	3,400,000	April '09	5 00
Work, g	Colo	1,500,000	1	17,500	July '07	0 03
Yankee Con	Utah	1,000,000	1	18,750,000	July '07	0 20
Yellow Aster, g	Cal.	100,000	10	958,789	Aug. '07	0 20

*Previous to consolidation, $1,436,250 were divided. †Also consolidated.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Allis-Chalmers, pf.	U. S	101,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag.Chem., pf.	U. S	181,530	100	1,747,620	April '09	3 00
American Cement	Pa.	200,000	10	1,288,000	Jan. '09	0 30
American Coal	Md	50,000	25	2,555,000	Mar. '09	1 25
Bethlehem Steel, pf.	P	150,000	100	900,000	Nov. '06	0.75
Cambria Steel	Pa	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo	51,250	100	2,613,750	April '09	1 25
Central C. & C., pf.	Mo	18,750	100	1,476,562	April '09	1.50
Col.&Hock.C.&I.,pf.	Ohio	69,244	100	383,818	April '08	1 50
Consolidated Coal	Ill	50,000	100	350,000	July '04	1 00
Consolidation Coal.	Md	102,500	100	‡10,431,650	Jan. '09	3.50
Crucible Steel, pf.	P	244,365	100	8,430,593	Mar. '09	1 00
Empire S. & I., pf	N. J	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal	W. Va	120,000	100	1,980,000	Jan. '09	2 00
Gen. Chem., com	U. S	74,103	100	2,297,193	June '09	1 00
General Chem., pf.	U. S	100,000	100	6,405,000	July '09	1 50
International Salt	Penn	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., cm	Pa	15,000	100	330,000	Aug. '05	5 00
Jeff. & Cl'f C. & I., pf.	Pa.	15,000	100	900,000	Feb. '09	2.50
Kern River Oil.	Cal.	20,000	100	84,000	July '08	0 10
Lehigh Coal & Nav	Pa.	382,260	50	15,779,410	May '09	2 00
Maryland Coal, pf.	Md	18,850	100	2,061,122	June '09	2.50
Monon. R. Coal, pf.	Pa	100,000	100	2,324,000	July '08	3 50
Nat. Carbon, com.	U. S	55,000	100	715,000	April '08	1 00
Nat. Carbon, pf.	U. S	45,000	100	3,071,259	Nov. '08	1.75
National Lead, com.	N. Y	149,034	100	3,456,497	July '09	1 25
National Lead, pf	N. Y.	149,040	100	18,155,088	Mar. '09	1 75
Nat'l Steel&Wire,pf.	N. Y	25,778	100	631,561	May '06	1 75
New Central Coal	Md	50,000	20	390,000	Nov. '08	0 40
New River Coal, pf.	W. Va	37,617	100	451,405	Nov. '08	1 50
Pacific Coast Borax	Cal	19,000	100	2,086,500	Aug. '05	1 00
Peerless Oil	Cal.	92,000	10	711,000	June '08	0 06
Penna. Salt	Pa.	60,000	50	15,098,000	Oct. '08	3 00
Penna. Steel, pf	Pa.	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.	Pa	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.	Pa	120,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf	Pa	297,010	100	11,434,962	April '09	1 75
Pocahontas C.C., pf.†	W. Va	28,000	100	252,000	Jan. '09	3 00
Pocah'tasC.C., cm.†	W. Va	45,000	100	‡406,800	Oct. '08	0 15
Republic I.&S., pfd	Ill	204,169	100	6,453,676	July '09	2 00
Sloss-Sheffield, com.	Ala.	100,000	100	2,133,000	June '09	1.25
Sloss-Sheffield, pf.	Ala.	67,000	100	4,338,000	July '09	1 75
Standard Oil	U. S.	970,000	100	652,802,000	June '09	9.00
Tenn. C. & I., com.	Tenn	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf.	Tenn.	2,840	100	390,040	Nov. '07	2 00
Texas & Pacific Coal.	Texas.	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling	U. S	50,000	100	5,875,000	Jan. '09	5.00
U. S. Steel Corp., cm.	U. S	5,083,025	100	83,848,076	Mar. '09	0 50
U. S. Steel Corp., pf.	U. S	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf	U. S	180,000	100	15,010,869	July '09	2 00
Warwick I. & S.	U. S	148,671	10	517,739	Nov. '08	0 30
Westmoreland Coal.	Pa.	60,000	50	8,880,000	Oct. '08	2 50

*Since 1894. †Since 1907. ‡Since 1890. ‡Stock div. $6,130,000 Mar. '09.

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia	Mex.	9,600	50	$417,070	April '08	$1.36
Batopilas	Mex	446,486	20	†55,784	Dec. '07	0 12½
British Columbia, c	B. C	503,000	5	201,000	Sept. '07	0 40
Buffalo, s.	Ont.	900,000	1	444,000	July '09	0 05
Butters' Salvador, g.	Salv	150,000	5	600,000	April '05	0 25
Cobalt Central, s.	Ont.	4,761,500	1	139,845	May '09	0 01
Conlagas	Ont.	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass.	B. C	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s.	Ont.	1,750,000	1	612,500	Mar. '09	0 15
Dolores, g. s	Mex	460,000	5	690,000	Aug. '09	0 15
Dominion Coal, com.	N. S	150,000	100	3,300,000	July '09	1 00
Dominion Coal, pf.	N. S	30,000	100	‡630,000	Feb. '08	3 51
Dos Estrellas, g.s	Mex	300,000	0 50	3,780,000	Jan. '09	1 00
El Oro, g.s	Mex	1,080,000	5	4,980,000	July '08	0 36
Esperanza, s.g	Mex	455,000	5	9,558,770	July '09	0 37
Foster Cobalt, s.	Ont	1,000,000	1	50,000	Jan. '07	0 05
Granby Cun	B. C	135,000	100	3,508,630	Dec. '08	2 00
Greene-Can. Copper.	Mex	864,000	10	6,137,850	Mar. '07	0 40
Guanajuato	Mex	540,000	5	74,270	Oct '06	0 07
Guanajuato D., pf.s.	Mex	10,000	100	30,000	July '08	3.00
Guggenheim Expl	Mex	105,000	100	5,535,000	July '09	2 50
Hinds Con., g. s. c. l	Mex	5,000,000	1	100,000	Feb. '08	0 02
Kerr Lake, s.	Ont	600,000	5	1,108,600	June '09	0 30
La Rose Con., s.	Ont	1,143,368	5	628,252	April '09	0 20
Le Roi, Ltd., g	B. C	200,000	25	425,000	Dec '09	0 48
Le Roi No. 2, g	B. C	120,000	25	889,200	Mar '09	0 48
Lucky Tiger-Com., g	Mex	65,000	10	71,500	Dec '08	0 30
McKinley-Darragh,s	Ont	2,000,000	1	580,000	June '09	0 05
Mex. Con. M &S Co.	Mex	240,000	10	660,000	Mar. '08	0 25
Mex Mill.&Trans.pf.	Mex	12,000	100	35,400	Jan. '08	3 00
Mines Co. of Am	Mex.	2,000,000	1	3,605,000	Aug. '09	0.03
N. Y. & Hond Ros.	C A	150,000	10	2,512,000	June '09	10
Nipissing, s.	Ont	1,200,000	5	2,640,000	April '09	0 25
N. S. St. &Coal, com.	N. S	9,870	100	1,087,856	April '08	1 50
N. S. St. & Coal, pf	N. S	10,300	100	479,130	April '09	2.00
Pendes*	Mex	2,500	100	8,630,000	Dec. '07	20.00
Penoles, pf.s	Mex	10,000	100	538,676	Mar. '09	3.50
Pinguico, pf. s	Mex	20,000	100	240,000	Oct '08	3 00
Reco, g.s.l	B. C	985,000	1	527,082	April '06	0 02
Right of Way	Ont	400,518	1 00	180,822	May '09	0.10
Securities Corp., pf.	Mex	2,000	100	42,600	July '08	3.50
Silver Queen, s	Ont	1,500,000	1	345,000	Nov. '08	0 05
Temiskaming, s	Ont	2,500,000	1	525,000	April '09	0 03
Terrubian Copper	Mex	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c	N. F	89,000	2	405,630	May '08	0.55
Trethewey, s	Ont	945,450	1	111,998	May '09	0.01
Tyee, c.	B. C	180,000	5	201,000	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

A book on blast hole drilling with well drills is being compiled by the Keystone Driller Company, of Beaver Falls, Penn., to be published in connection with the 1909 edition of Catalog No. 4. The editor will be glad to receive from any source drilling records and general information on the subject to be embodied in the text. The book will be distributed freely among reputable engineers and contractors.

Particularly noteworthy of present activity is a contract placed with Allis-Chalmers Company by the Milwaukee Electric Railway and Light Company for two 1500-k.w. motor-generator sets, one 500-k.w. balancer, six 2000-k.w. transformers, two 300-k.w. transformers, two 300-k.w. motor generator sets and a 300-k.w. generator of the water-wheel type, much of this apparatus constituting a "repeat" order.

The Bulger Block Coal Company's mine, at Bulger Station, Penn., is located in what is known as the Pan Handle district, where the conditions with respect to the application of coal-mining machines are notoriously severe, because of the presence of sulphur bands and "nigger heads" at the bottom of the vein where the cutting is done. After a thorough trying-out process two pneumelectric coal punchers have been installed for use in conjunction with electric chain machines.

The department of water supply of the city of New York has been supplied with three 1500-ft. portable drilling machines by the Keystone Driller Company, of Beaver Falls, Penn. The machines are to be used for putting down wells on Long Island for the water supply of the borough of Brooklyn. The rigs are the same as the regular No. 15 oil rig, except that the boiler, which is mounted on a separate truck and located at a distance for oil and gas drilling, is in this case mounted on the machine.

The city of Bellevue, Iowa, has placed an order for a Foos three-cylinder vertical engine with gas producer complete, with the Foos Gas Engine Company, Springfield, Ohio, to replace a steam engine in the city electric-light plant. This will run in parallel with a steam engine, it being anticipated that the remaining steam engine will be displaced by another like engine. This improvement will make a large saving in operating expenses. The Foos Company are doing a large business in these producer plants, both for electrical work and pumping installations, and anyone considering equipment in this line should communicate with them.

The Wood Drill Works has issued a booklet entitled "Glimpses of the Panama Canal," which is a non-technical review of the canal by Warren Wood, proprietor of the Wood Drill Works, and Robert J. Wood, manager of the Chicago offices. It is a 16-page booklet, 9x6, containing cuts of the Gatun Dam, Culebra cut, the old Santo Domingo church, and several cuts of the "Wood" rock drills at work on the Porto Bello quarry, the rock from which will be used in the construction of the Gatun Dam; also a picture entitled "Jumbo and the Brownie," showing the largest and smallest drills made by that concern, Jumbo having a capacity of 50 feet and Brownie four feet. Copies can be obtained at any of the company's sales offices.

Along with other industrial organizations which have reported substantial gains in business during the last two months, the Western Electric Company's April returns make a slightly better showing than March, which was considerably the best month in the fiscal year to that time, and April, 1909, is nearly 50 per cent ahead of the returns for April, 1908. In view of the company's steady expansion during the last ten years and the high record for the peak year of 1906, when sales ran up to $69,245,-3.1, an increase of more than $25,000,000 over the preceding year, it is difficult to determine, in making comparisons, what shall be taken as the normal year, but at the present time the Western Electric is operating at the annual rate of 65 per cent. of the record of 1906 and about 85 per cent. of the record of 1907, which was the second best year in the company's history, with sales totaling $52,724,168.

The American Locomotive Company has recently issued pamphlet No. 10,035 of the above title, which illustrates and describes the joint exhibit of that company and the Atlantic Equipment Company at the exposition now in progress at Seattle, Washington. The exhibit consists of a rotary snow plow, built for the Chicago, Milwaukee & Puget Sound Railway; two locomotives, each representing the builder's new standard design of its type; one, a six-coupled tank or 2-6-2 T-type locomotive for logging service, and the other, a 10-in. by 16-in. four-wheel saddle tank contractors' locomotive; an electric motor and trailer truck, built for the Southern Pacific Company, and a new model, class 45-16-2-½, Atlantic steam shovel. A separate chapter is devoted to each equipment exhibited in which is illustrated the machine itself, and the special features of the design are briefly described. Reference is also given in each chapter to other of the company's publications presenting different designs and types of the same class of equipment, and on page 31 is an index of all the catalogs in print issued to date by the two companies.

The Macbeth Iron Company, of Cleveland, Ohio, and the Bruce-Meriam-Abbott Company, also of Cleveland, were consolidated on June 1, the name of the new company being the Bruce-Macbeth Engine Company. Both of the above companies have been long established in Cleveland, and their amalgamation makes one of the largest and strongest companies of its kind. The Macbeth Iron Company dates from the year 1870, having been known until late years as Macbeth and Company; the Meriam-Abbott Company, predecessor of the Bruce-Meriam-Abbott Company, was organized in 1900, and has been one of the pioneers in the manufacture of the commercial gas engine and its development to the present standard of perfection. It is the purpose of the Bruce-Macbeth Engine Company to continue the business of both of the former companies on a much larger scale than before. The manufacture and development of the gas engine will be continued and the former line of work of the Macbeth Iron Company, building of blowing engines and general machine and foundry work, will be conducted as heretofore.

The Cyclone Drill Company, of Orrville, Ohio, has made the following shipments of machines in the past few days: two complete core drilling outfits for E. C. Hargrave, to be used on his property near Port Arthur, Canada; blast hole drill to the Rio Tinto Company for its railroad construction in Spain; large prospecting machine to W. H. C. Downes, which will be used in western Australia; complete prospecting outfit for the Santa Rita Company in New Mexico, which is the third machine purchased in the past few months; two prospecting outfits to the Rockdale Iron Company, which will be used for prospecting iron ore in Tennessee; complete prospecting outfit for the Napier Iron Company, which will also be used for prospecting iron ore in Tennessee; well drilling machine and equipment to G. A. Amsinck & Co., Columbia, S. A.; also a great many local shipments covering the regular types of machines and a number of gasolene traction outfits. The company reports a splendid business during the spring and an increasing number of inquiries for various kinds of equipment. The factory is running full time and increasing its working force.

In a pamphlet entitled "Automatic Draft Control for Steam Boiler Furnaces," the Green Fuel Economizer Company, of Matteawan, N. Y., describe an improved appliance recently brought out by that concern for so regulating the draft of steam boilers that the pressure within the fire-box is at all times neutral. To accomplish this end just enough pressure is supplied under the grates to force the air through the fuel, while enough draft is applied in the smoke flue to draw the gases of combustion through the boiler. This is said not only to give the ideal proportion of air for perfect combustion at all loads but also to prevent the escape of flame and hot gases of combustion through the open fire-door and through crevices in the brick-setting, as where forced draft is used, while also preventing the drawing in of cold air and the dilution and consequent cooling of the gases of combustion, as where induced draft only is used. This system of draft has an important bearing in connection with the researches which have recently been made by the engineers of the United States Geological Survey with the object of increasing greatly the rate of steam production per sq. ft. of heating surface in steam boilers.

A new booklet of 24 pages, entitled, "The Proper Care of Belts," recently gotten up by the Joseph Dixon Crucible Company, Jersey City, N. J., is divided into three sections, headed respectively: Belts, belt dressings, and hints, kinks, tables. The first section deals with the running condition of belts; the second takes up treatment with various preparations; and the third, as the title indicates, has some general points upon belting and its use. This last section contains a considerable amount of interesting and valuable matter collected from many authoritative sources. It tells what results were secured in a plant where records were kept over a period of years; gives the economical speeds at which leather belts should be run; has some matter telling of the different styles of joints, illustrating three methods of leather lacing; contains rules for calculating speed of pulleys; gives horsepower transmitted by various sizes of single and double belts, etc. Anyone who has any amount of belting under his care should have a copy of this booklet. While it is gotten out in the interests of the traction and solid belt dressings that the Dixon company places on the market, it contains so much matter of general interest as to be valuable to the practical man. Those desiring a copy of this booklet may secure same by writing direct to the home office of the Joseph Dixon Crucible Company, at Jersey City.

Trade Catalogs

Sprague Electric Company, 527 West 34th street, New York. Circular. Electric shovels. Illustrated.

The General Engineering Company, Salt Lake City, Utah. Bulletin. Ore testing. Illustrated, 44 pages, 6x9 inches.

The Watt Mining Car Wheel Company, Barnesville, Ohio. Catalog. Mine car couplings. Illustrated, 16 pages, 5½x8 inches, paper.

C. Harzer & Co., Finsbury Pavement House, London, E. C. Catalog. Freygang patent levigating and leaching apparatus. Illustrated, 10 pages, 6x10 inches, paper.

Izard-Warren Company, 1122 Vine street, Philadelphia, Penn. Catalog. Sterling surveying instruments and drawing materials. Illustrated, 228 pages, 6x9 inches, paper.

Lehigh Car, Wheel and Axle Works, Fullerton Penn. Pamphlet. Hydraulic Properties of Reground Cement Mortars, and also dissertation on Fuller-Lehigh pulverizer mill. Illustrated, 16 pages, 6x9 inches, paper.

American Locomotive Company, 30 Church street, New York. Pamphlet. Exhibit of American Locomotive Company and Atlantic Equipment Company at Alaska-Yukon-Pacific Exposition. Illustrated, 32 pages, 6x9 inches.

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1110. Gates tube mill for wet pulverizing in mining work. Illustrated, 24 pages, 8x10½ inches. Bulletin No. 1438. "Two Notable Milling and Cyanide Plants." Illustrated, 32 pages, 8x10½ inches.

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Operations in the Cobalt District, Ontario

Ore Carrying from 1000 to 8000 Oz. Silver per Ton Mined from Narrow Veins; Product Shipped out for Smelting; Growth of the Camp

BY EDWIN HIGGINS

Cobalt lies in the northeastern part of Coleman township, in the Province of Ontario. It is distant about 330 miles northerly from Toronto, and may be reached by an overnight trip from that city over the Temiskaming & Northern Ontario Railway, a road built and operated by the Canadian government. Cobalt has a population of about 6000, and the town, or camp, stretches along the northwestern shore of Cobalt lake. The chief producing mines of the district lie within 2½ miles of the town. The elevation of Cobalt lake is 968 ft. above sea level.

To those familiar with the mining districts in the western part of the United States, the Cobalt district presents a most striking contrast. Unlike many of the western mining camps where bleak hills and little or no water is the rule, the Cobalt district is well covered with vegetation and timber; the country for many miles around is plentifully supplied with water in the form of rivers, smaller streams and innumerable lakes. The surface presents an uneven appearance, hills with steep faces often rising to a hight of 100 ft. or more.

Geology

There are in and around the Cobalt district a great variety of Pre-Cambrian rocks; also prominent outcrops of the Niagara of the Silurian. Between the Niagara and the Pleistocene there are no formations represented in the district. The oldest series of the district are the Keewatin and Laurentian. The Keewatin is an igneous complex, consisting of greenstones, quartz porphyries and other rocks. It has been more or less folded and disturbed. The Keewatin is cut through by a medium- to coarse-grained granite to which the name Laurentian is applied. The Keewatin rocks, however, were folded before the intrusion of the Laurentian.

After the Laurentian intrusion, the surface was subjected to erosion for a long period and these rocks, together with the Keewatin, were worn down. The oldest fragmental material that lies directly on the eroded Keewatin and Laurentian surface, consists of conglomerates, graywack-slate and impure quartzites. These rocks contain fragments of the granite, greenstone and other representatives of the older series. This formation, the Lower Huronian, contains most of the cobalt-silver veins.

The veins cut through all these series, but the most productive are usually in the rocks which contain more or less coarse fragments. It is believed that the fissures now occupied by these veins were produced at the time of the eruption of the younger, post-Middle Huronian diabases. The Lower Huronian probably has a thickness of at least 500 ft. in some cases. Being laid down on an uneven surface, its depth at different points is quite variable. The Middle Huronian is represented in the series of arkoses, together with conglomerates and quartzites, of the township of Lorraine.

The post-Middle Huronian diabase occupies a large part of the surface of the area. In most cases, where associated with the Huronian, these rocks seem to

RIGHT-OF-WAY SHAFT NEAR RAILWAY TRACKS, SILVER QUEEN IN BACKGROUND

occur in the form of sheets or sills, spreading between or over the layers of the rocks through which they cut. After the eruption of these diabases, whose exact age is not known, erosion of the surface again took place for a long period of time and all the series now exposed in the field, with the exception of the younger Niagara, were worn down. Much of the surface of the area is occupied by boulder clay and loose bedded deposits.

Veins

Most of the cobalt-silver veins occur in the Lower Huronian. Several have been found in the diabase and in the Keewatin. Most of the Keewatin rocks are tougher and do not fracture with the same ease as the overlying series of the Lower Huronian; hence the solutions have not had the same freedom of movement in the former as in the latter. Insofar as the precipitation effects which the rocks of either series may have on solutions working through fissures in them, there seems to be little difference between the two. Many of the pebbles and boulders and much of the cement material in the Lower Huronian, have been derived from the underlying Keewatin. Hence one would think they would have about the same influence in precipitating substances from solution, as the rocks in the latter formation.

The more important veins so far found in the Lower Huronian lie in what may be called two parallel belts. Although these two belts have a strike approximately northeast and southwest, this direction is not maintained throughout. The veins on the Trethewey and Coniagas strike east and west. The main veins on the La Rose and McKinley Darragh strike approximately northeast and southwest, while that in the northwest corner of the Nipissing location, on the southeastern border of lake Cobalt, strikes northwest and southeast. The vein in the southwest corner of this location strikes east and west, which is the direction of strike of the majority of the veins. The veins vary in width from 1 to 14 in., the majority being not over 6 in. in width. In some cases there occurs what may be called a system of veins, three or four roughly parallel fissures sometimes making a mineralized width of about 20 to 30 in. The veins usually stand practically vertical. There are examples of veins that run from the Huronian conglomerate into the underlying Keewatin; there are veins *e. g.*, one on the Lawson property, that run horizontally from the Keewatin into the diabase; the Nova Scotia vein runs downward from the Keewatin into the underlying diabase.

The Ores

The more important ores in the veins are native silver (associated with which is usually some dyscrasite, argentite, pyrargyrite and other compounds of the metal), smaltite, niccolite and related minerals. Many of the minerals are intermixed in the ores, and for this reason some of them have not been clearly identified. Calcite forms the chief gangue, but some of the veins contain only a small amount of this material. Quartz and fragments of wall rock are often found intermixed with the ores. The minerals making up the vein filling have, in all likelihood, been deposited from highly heated and impure water which circulated through the cracks and fissures of the crust and were probably associated with the post-Middle Huronian diabase eruption. It is rather difficult to predicate the original source of the metals—silver, cobalt, nickel, arsenic and others. They may have come up from a considerable depth with the waters, or they may have been leached out of what are now the folded and disturbed greenstones and other rocks of the Keewatin.

Discovery and Growth of the Camp

Cobalt's growth, since its discovery a few years ago, has been remarkable. The first discovery of mineral was made on Aug. 15, 1903, during the building of the Temiskaming & Northern Ontario railway, on what is now the McKinley-Darragh property; the second discovery was made Sept. 15 of the same year, on the La Rose property. These discoveries, however, aroused little interest, and it was not until October, when a sample of the mineral was given to T. W. Gibson, director of the Bureau of Mines of Ontario, that outside attention was directed to the discovery. Mr. Gibson recognized the mineral as niccolite, and forwarded it to Willet G. Miller, provincial geologist. Mr. Miller immediately visited and examined the district, and published his first report in November, 1903. For some reason, probably the failure of previous mining booms in other districts, little enthusiasm was awakened until 18 months later, when the public began to learn of the rich shipments of ore being made from the Cobalt district. The real rush of prospectors and investors began about the middle of 1905. Since that time the progress made has been almost without parallel. In 1908 the mines had been developed to such an extent that Cobalt supplied nearly 9 per cent. of the world's production of silver. The principal shippers during 1908 were Nipissing, La Rose, Coniagas, O'Brien, Kerr

LOOKING NORTH ON COBALT LAKE—RIGHT-OF-WAY MINE ON THE RIGHT

Lake, Trethewey, Silver Queen, Temiskaming & Hudson Bay, Townsite, Right of Way and Crown Reserve; in addition to these there were about 30 other properties from which varying tonnages of ore were shipped. Several shippers have been added to the list in the present year. The accompanying table, compiled from different reliable sources, will give an idea of the growth of the Cobalt district since 1904. Up to the second quarter of 1909, over $10,000,000 had been paid in dividends by Cobalt silver mines. Among these, Nipissing, La Rose, Temiskaming & Hudson Bay, Crown Reserve and Kerr Lake furnished a large percentage of the total.

SILVER PRODUCTION OF COBALT COMPARED WITH OUTPUT OF THE UNITED STATES AND THE WORLD.

	Production of Cobalt District.				Silver Production of United States.		Silver Production of the World, Ounces.
	Producing Mines.	Ore Shipments, Tons of 2000 lb.	Silver Contents, Ounces.	Commercial Value.	Ounces.	Commercial Value.	
1904	5	159	206,875	$111,887	57,786,100	$33,515,938	182,262,336
1905	17	2,336	2,451,356	1,360,503	56,101,600	33,858,438	181,267,583
1906	19	5,837	5,401,766	3,667,551	56,517,900	37,748,757	182,738,896
1907	29	14,851	10,023,311	6,155,391	56,514,700	37,299,699	183,386,268
1908	0	25,362	17,000,000	8,200,000	51,798,053	27,382,640	200,655,384

LOOKING SOUTH ON COBALT LAKE—MCKINLEY-DARRAGH MINE AND MILL TO RIGHT OF HIGHEST POINT OF HILL; PART OF DUMP OF NIPISSING MINE SHOWS ON EXTREME LEFT

Mining

In the early days of the camp all of the ore was won by open-cut mining. At present the bulk of the ore is mined through vertical shafts with levels at various intervals; open-cut operations, however, are still to be found on a few of the properties.

Following are the approximate depths attained by some of the more important operations: Nipissing, 200 ft.; LaRose, 325; Crown Reserve, 200; Temiskaming, 300; Kerr Lake, 425; Cobalt Central, 400; Coniagas, 150; Buffalo, 200; Trethewey, 175; Temiskaming & Hudson Bay, 225; O'Brien, 300; Chambers-Ferland, 150; McKinley-Darragh, 250; Townsite, 100; City of Cobalt, 175; Right-of-Way, 180; Nancy Helen, 175; Nova Scotia, 350; Silver Queen, 175.

Owing to the fact that the silver ore is not confined entirely to the narrow veins, but is found more or less disseminated in the wall rock on either side, no attempt is made to mine the vein matter separately. Everything is shot down to a stoping width and sent to the surface.

The practice of picking and cobbing is general in the camp. As carried on at several of the mines, the practice is as follows: The ore is dumped from the skip onto a coarse grizzly or screen, the material passing through being sent to the concentrator, although in some cases it is rich enough for shipment to the smelter. All overs from the grizzly pass slowly down a slightly inclined bumping table. Before starting on its course down the table the rock is washed by means of a spray of water, this process enabling the pickers, who stand on either side of the table, to more readily recognize the rich ore. High-grade ore is picked out and sacked for shipment; mixed pieces are also picked out, the lean portion cobbed, and the resulting high-grade ore sacked for shipment. All material passing over the table goes to the concentrator. This practice is varied in certain minor details at some of the mines.

Concentration

In the concentration of the ore the general practice is to crush to from 20- to 30-mesh, following this by classification and treatment on various tables and slimers. The average concentration is about 40 into 1. The variations in arrangement depend on the nature of the ore to be treated. The Buffalo concentrator reduces its ores with crusher and rolls, sizes in trommels and sends the different sizes to five jigs. A Chilean mill is used instead of stamps. Sands are treated on four Deister tables, while the slimes go to Callow settlers; the overflow from the settlers goes to a cyanide plant, the remaining material being treated on three Deister slimers.

At the Coniagas concentrator the rock is broken in crushers and rolls and fed to three trommels. The ⅜- and ¾-in. sizes are jigged, the undersize going to a classifier. The overflow from the classifier goes to a settling tank, the material from which is treated on a Frue vanner. The sands from the classifier are treated on a Wilfley table. Thirty stamps are used here.

The Nipissing Reduction Company's concentrator crushes to ½ in. and reduces the rock to 16-mesh through rolls. The material is then sized to 16-mesh, which goes to a Wilfley table; 40-mesh, which goes to a James table; 90-mesh, which also goes to a James table; and slimes, which are treated on a James slimer.

The following seven concentrators are now in operation at Cobalt: Buffalo,

capacity 80 tons, Cobalt Central, 100 tons; Coniagas, 125 tons; King Edward, 40 tons; McKinley-Darragh, 80 tons; Northern Customs Concentrator, 80 tons; Nipissing Reduction Company, 80 tons. The capacity of the Northern Customs Concentrator will soon be increased to 120 tons. The New O'Brien concentrator will probably be completed before the end of July; its capacity will be 120 tons. The Colonial Mining Company is building a concentrator; this is expected to be completed in August. The Temiskaming & Hudson Bay company will also erect a concentrator.

ORIGINAL DISCOVERY ON LA ROSE

NIPISSING CONCENTRATOR ON EDGE OF COBALT LAKE

PRINCESS MINE OF LA ROSE COMPANY

LA ROSE SHAFT AND PART OF DUMP

Output and Value of the Ore

As may be noted in the accompanying table, the production of the Cobalt mines was 25,362 short tons in 1908. This output is greater than the combined production of the four previous years. Some idea of the probable production in 1909 may be gained from the statement of shipments during different periods up to the present time. The following shipments were made during the week ending on the dates stated: Feb. 27, 1,056,490 lb.; March 20, 1,182,360 lb.; April 17, 1,197,513 lb.; May 1, 1,013,196 lb.; May 29, 1,078,978 lb. Unless the production increases or decreases appreciably, the output for 1909 will probably be between 26,000 and 28,000 tons, a slight increase over that of 1908. The chances are that the above estimate will prove too low. The average silver content of the ore shipped during 1908 was 725 oz. per ton. This compares with 677 oz. in 1907, and 1013 oz. in 1906.

Smelting

Most of the low-grade ore of the camp, which contains from 100 to 150 oz. silver per ton, goes to the Denver, Colo., plant of the American Smelting and Refining Company. The high-grade ore, which carries as high as 8000 oz. silver per ton (average from 2000 to 2500 oz.) is treated principally at the Deloro Mining and Reduction Company's works, at Deloro, Ont., and at the Canadian Copper Company's smeltery at Copper Cliff, Ont. In addition to the plants mentioned above, ore is shipped to the following works: American Smelting and Refining Company, Perth Amboy, N. J.; Balbach Smelting and Refining Company, Newark, N. J.; Pennsylvania Smelting Company, Carnegie, Penn.; United States Metal and Refining Company, Chrome, N. J.; Consolidated Mining and Smelting Company, Trail, B. C.; Coniagas Reduction Company, of Canada, Thorold, Ont.; Beer, Sondheimer Company, Hamburg, Germany; Anglo-French Nickel Company, Swansea, Wales.

Treatment charges vary from $7 to as high as $40 per ton, depending entirely on the grade of the ore and, in some cases, on the content of cobalt, arsenic and nickel. The Canadian Copper Company and the Deloro Mining and Reduction Company pay for over 6 per cent. cobalt in the ore, provided, however, that the nickel content is lower than the cobalt. The Anglo-French Nickel Company pays for cobalt on a sliding scale, the price ranging from 35c. for 8 per cent. to 55c. per lb. for 16 per cent. and over. Nickel is not paid for, its presence being considered detrimental. Although the arsenic in the ore is saved and marketed in the form of white arsenic by several smelters, few, if any of them, allow anything for the arsenic present in the ore.

Labor, Power and Costs

Labor at Cobalt is made up of Canadians, some Frenchmen from the lower province, Italians and a few Americans and Finns. There is no set wage scale. The union scale of wages is as follows: Drillers, $3.50 per day; helpers, $3; muckers, $2.75; surface men, $2.50; shaft work, 25c. advance. A small proportion of the miners are union men, and the wages in general may be said to be about 15 per cent. less than the above figures. The cost of producing silver varies greatly. The average, however, may be said to be between 9 and 10c. per ounce.

The boiler plants of the Cobalt district represent a total of approximately 10,000 horsepower; there are over 60 compressors, with a maximum capacity of about 40,000 cu.ft. of free air per minute. The cost of power is, approximately, $125 per horsepower-year. On the completion of the two power plants now building on the Montreal river, it is expected that the cost of power will be reduced to at least $75 per horsepower-year. The plant at Hound Shoot will furnish electrical power, while that at Ragged Shoot will furnish compressed air. The compressed-air plant will utilize the Taylor system, by which pressure is secured without moving machinery. This system is fully described in the Journal of Jan 19, 1907, page 125.

The geology of the Cobalt district has been fully and ably covered by Willet G. Miller, provincial geologist of Ontario, and appears in Vol. XVI, Part 2, of the report of the Bureau of Mines, 1907. I have quoted freely from Mr. Miller's report in the part of this article dealing with the geology of the district. The balance of the notes were gathered on a recent brief visit to Cobalt.

CHAMBERS-FERLAND MINE ON LEFT; O'BRIEN MINE ON RIGHT

AT KERR LAKE—LAWSON SHAFT TO LEFT, CROWN RESERVE ON EDGE OF LAKE, KERR LAKE NO. 7 TO RIGHT

Carbon Dioxide in Producer Gas

Bulletin No. 30, on "The Rate of Formation of Carbon Dioxide in Gas Producers," by Dr. J. K. Clement, I. H. Adams and Dr. C. N. Haskins, has just been issued by the Engineering Experiment Station of the University of Illinois.

The problem attacked by the writers of this bulletin was the determination, so far as possible, of the factors that govern the production of carbon dioxide in gas producers. The chemical reaction expressed by the equation

$$C + CO_2 = 2\ CO,$$

which is fundamental in the action of the gas producer, was studied and a differential equation for the reaction-velocity derived. From this equation the velocity constants and the equilibrium constant were calculated from observed values of the percentage of CO formed in given time intervals. The rates of variation of these constants with the temperature were determined, and these were found to agree with van't Hoff's laws. From the constants thus determined it becomes possible to calculate the percentage of CO formed for any time of contact of carbon and CO_2 and at any temperature.

In the experiments performed, CO_2 gas

was passed through a porcelain tube filled with either charcoal, coal, or coke and heated in an electric furnace. The time of contact could be varied at will and by changing the current a temperature range from 700 deg. to 1300 deg. C., was obtained. Analyses were made by the Hempel method, both CO_2 and CO being absorbed.

It was found that the production of CO formed depends upon (1) the temperature, and (2) the time of contact of gas and carbon. With ordinary depth of fuel bed a high percentage of CO requires a high temperature—1300 deg. C. or above.

In an appendix, Dr. Charles N. Haskins has given a method solving the reaction-velocity equation and has established a criterion for the applicability of the general differential equation to the reaction under investigation. He has also shown that the same general method of solution may be applied to various other types of equations of reaction-velocity.

Slag Granulation and Explosions

By Richard Hutchinson

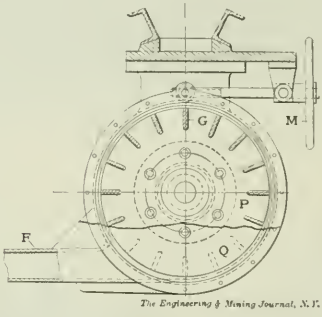
If a thin stream of molten furnace slag is poured into cold water the slag breaks into small pieces. This operation, termed granulation, is due to the small thermal conductivity of the slag. When the slags are not clean but contain small quantities of metal, speiss or matte they may cause an explosion when poured into water. It is well known that when molten lead is poured into wet molds an explosion will occur that scatters the hot lead in all directions; it is not, however, so well known that molten copper will float the water and not cause an explosion when treated in the same manner.

At first my opinion was that the phenomenon was due to latent heat; but since the latent heat of copper is 43 calories and that of lead 5.37 calories, it is evident that if this were the only cause the copper should create the greater explosion. The next assumption was that latent heat and thermal conductivity were both involved, but this theory was not entirely satisfactory, from the fact that if copper is allowed to fall 12 or 15 ft. and strike on a wet iron floor it too will explode, whereas it will not explode in a wet mold. I, therefore, settled on the theory that since all bodies cool from the interior outward, and only chill on the exterior when they have lost a quantity of heat, the phenomenon must be due to the thermal conductivity of the metals.

If the thermal conductivity of silver is 100, then copper is 74, iron 11.9, lead 7.9 and slag about 0.18. Owing to the diffusivity of copper being 3.6 times as much as lead, it is able to transmit its heat to surrounding objects without forming a crust that will confine the water between it and the sides of the mold; at the same time the steam will bubble up through the molten copper. This is not the case with lead which chills almost immediately, forming a crust that confines the water and then converts it into steam which, expanding quickly, throws the lead out of the mold.

It is possible that the lead crust cracks and the water coming in contact with the molten interior generates the explosion as in the case of metal in slag when that is poured in water; in any case, however, the diffusivity of lead is so slow that the outer portion is chilled before the inner portion has lost its latent heat, thus reversing the natural condition of cooling from the interior outward. In the case of copper falling some distance, the metal has transmitted its heat to the surrounding atmosphere and has reached the stage where it has little heat to transmit and consequently chills, but still has sufficient latent heat remaining to cause an explosion.

Diffusivity, as defined by Hastings and Beach, is the velocity of the temperature change of a metal and is the ratio between the conductivity of a metal and its specific heat. By calculation, the diffusivity of lead is 219 and that of copper 777, giving the 3.6 factor mentioned. The practical deductions are that metals with low-heat conductivity cannot be safely poured in wet molds, and that metals of high conductivity can only be poured in wet molds when the speed of pouring exceeds their diffusivity. Matte which has low conductivity cannot be poured into wet molds. The lack of literature on this subject was first called to my attention in 1903.



RETORT-CHARGING APPARATUS

Apparatus for Charging Zinc Retorts

The difficulty of charging zinc retorts by hand and the excessive wear of drum casings in most of the mechanical devices are claimed to have been eliminated in the apparatus, described by Emile Dor-Delattre in his British Pat. 13,822 of 1908. The apparatus is to be carried by a traveling crane and consists essentially of a rotary propeller or conveyer, rotating within a casing having a tangentially-disposed charging tube *F*. The propeller or conveyer consist of two disks, *P* and *Q*, connected by the blades *G*. The disk *P* is attached to the shaft of an electric motor, while the disk *Q* has a circular opening in the center, through which the ore from the hopper discharges. The feed is controlled by a valve operated by the hand-wheel *M*. The disks *P* and *Q* are not parallel, but incline toward their periphery, so as to facilitate the entrance of the material and its immediate gravitation to the shallow blades *G*. In order to eliminate the effect of centrifugal force and obviate as much as possible the friction of the ore on the blades and walls of the casing, the blades are made short, and being away from the central intake the material does not become involved in the rotation of the wheel immediately on entering the apparatus, and is, therefore, not projected centrifugally against the walls of the casing, but falls by gravity to that part of the periphery of the conveyer which is passing the charging tube, and is at once projected into the latter by the propelling effect of the blades.

Tin in Australia

Alluvial tin has been discovered recently near Pine creek in the Northern territory. According to a description in the *Mining Journal*, May 8, 1909, furnished by the chief warden, E. C. Playford, this discovery is in a large granite area in the Pine creek slate and sandstone belt. The tin ore is found about 13 miles southwest of Pine creek, in the channel of one of the main branches of Spray creek. The granite area of this particular place forms a basin, bounded on the northwest and south by sandstone-capped tablelands, and partly inclosed to the east by table-topped hills from 150 to 200 ft. high. The branch of Spray creek referred to has formed a rough, deep, gorge with precipitous cliffs on each side, over 100 ft. high. Alluvial tin is found from near the entrance of this gorge to the head of the main branch.

At present 15 men are working on this alluvial deposit and are obtaining about 25 lb. of tin per day, each. This tin ore is black, with a little brown, ruby, amber and wood tin. In the lower regions of the main branch it is exceptionally fine, but higher up and in some of the smaller creeks is much coarser. Mr. Playford considers that this field will yield a large amount of alluvial tin, but is not favorably impressed with the possibility of finding payable tin-bearing veins. All the rock consists of a gray granite and sandstone, with a little quartz that can be classed as destitute of any valuable minerals. A small amount of monazite has also been found with the tin.

The Mineral Production of New York in 1908

By D. H. Newland*

The year 1908, which will be remembered as an after-panic year, witnessed a marked reversal of conditions in the mineral industries of New York. Prosperity and steady expansion, that had so long prevailed in these industries, was succeeded by general depression and contraction, which continued with little or no relief throughout the 12 months. There were few mines or quarries that did not curtail operations, and many of them were closed down for at least a part of the year. The decline in productive activity was out of proportion to the rate of growth in the preceding years, so that the outputs of most materials were well below the totals recorded for 1907. Though the setback will doubtless prove only a temporary feature, it is certain that some time must elapse before the former activity is fully restored.

The statistics of mineral production in New York for the past year have been compiled by the State geologist's office in coöperation with the U. S. Geological Survey. The accompanying table (1), reported by the New York State Museum, gives the production of the more important minerals in New York for a period of years; table 2 gives the 1908 production of sundry minerals in the State. Though the 1908 figures for clay products, stone, sand and natural gas, which are totals from a large number of producers, are subject to further revision, they are believed to be substantially correct as they stand.

The total value of the output reported for 1908, based upon the materials in their crude or first marketable forms, was $29,517,942. Compared with the total of $37,140,606 recorded in 1907, this showed a decrease of $7,622,664, or about 20 per cent. The output in 1907 was the largest ever made in the State, though it did not greatly exceed that of 1906, which was valued at $37,132,832. The corresponding total for 1905 was $35,470,897 and for 1904, $28,812,595, or a little less than the total for last year.

Effect of the Financial Depression

Among the different departments of the mineral industry, iron mining was one that experienced the full measure of the depression, as it also had been among the first to respond to the prosperous conditions of the preceding years. The output amounted to 703,473 long tons, against 1,018,013 tons in 1907. The production was made by 10 mining companies, as compared with 13 reported active in 1907. The loss was shared by all the districts, though in larger portion, by the mines on the Clinton hematite belt, which had been under recent development, while the Adirondack magnetite mines made the most favorable showing. The value of the iron produced in 1908 was $2,098,247.

The production of clay materials aggregated in value $8,918,863, as compared with $12,688,868 in the preceding year. The decrease of about 30 per cent. was due both to a smaller output by the plants and to a reduction in market values. The combined output of brick, tile fireproofing and terra-cotta used for building purposes was valued at $6,071,850, against $8,909,392 in 1907. In 1906 these materials represented a value of $11,063,133. The number of building brick made last year was 1,066,533,000, of which 817,459,000, or about three-fourths represented common brick from the Hudson river region. Along with the decline in building materials there was a large decrease in the ceramic industry, the value of pottery manufactures amounting to $1,653,241, as compared with $2,240,895 in 1907. The number of plants that were engaged in clay manufacturing of all kinds was 240, or two less than in 1907.

The value of the quarry products for 1908 was $6,615,614, against $7,890,327 in the preceding year, a falling off of 16 per cent. The total was divided according to the various uses into: Building stone, $1,264,403; monumental stone, $139,077; curb and flagstone, $928,511; crushed stone, $2,659,016; other uses, $1,640,275. The output of slate, millstones and limestone used in making hydraulic cement is not included in the figures. Of the different kinds of stone, granite was the one to show a gain and this was accounted for by its increased use for paving blocks and crushed stone. The quarries of the State are able to supply almost every variety of rock for building and other purposes, though there is a large importation from other States.

The manufacturers of hydraulic cement contributed in 1908 a production valued at $2,254,759. In 1907 the value amounted to $2,971,820. Of the product last year 1,988,874 bbl., valued at $1,813,623, consisted of portland cement and 623,618 bbl., valued at $441,136, of natural rock cement. The latter industry has shown a steady decline for a number of years, due to general conditions in the trade. On the other hand the situation in the portland-cement industry may be expected to improve and there is every prospect that the State will soon have a much larger share in the domestic production than at present.

From the salt mines and wells there were obtained last year 9,005,311 bbl., valued at $2,136,736. The showing was better, relatively, than in many other branches of the mineral industry; as compared with the figures for 1907 (9,657,543 bbl., valued at $2,449,178), there was a falling off in production of less than 7

TABLE 1. MINERAL PRODUCTION OF NEW YORK.

Year.	Carbon Dioxide.		Cement, Portland.		Cement, Nat. Hyd.	
	Pounds.	Value.	Barrels.	Value.	Barrels.	Value.
1904	4,000,000	$280,000	1,377,302	$1,245,778	1,881,630	$1,207,883
1905	4,000,000	280,000	2,117,822	2,046,864	2,257,698	1,590,689
1906	5,000,000	350,000	2,423,374	2,766,488	1,691,565	1,184,211
1907	5,000,000	350,000	2,108,450	2,214,090	1,137,279	757,730
1908	5,000,000	350,000	1,988,874	1,813,622	623,618	441,136

Year.	Emery.		Feldspar and Quartz.		Garnet.		Graphite.	
	Short Tons.	Value.	Long Tons.	Value.	Short Tons.	Value.	Pounds.	Value.
1904	1,148	$17,220	8,703	$28,463	3,045	$104,325	3,132,927	$119,509
1905	1,475	12,452	17,000	48,500	2,700	94,500	3,897,616	142,948
1906	1,307	13,870	13,660	44,350	4,729	159,298	2,811,582	96,084
1907	1,223	13,057	8,723	36,230	5,709	174,800	2,950,000	106,951
1908	690	8,860	18,125	66,304	2,480	79,890	1,932,000	116,100

Year.	Gypsum.		Iron Ore.		Metallic Paint.		Natural Gas.	
	Short Tons.	Value.	Long Tons.	Value.	Short Tons.	Value.	1000 Cu.Ft.	Value.
1904	151,455	$424,975	619,103	$1,328,894	4,740	$55,768	2,399,987	$552,197
1905	191,860	551,193	827,049	2,576,123	6,059	70,090	2,639,130	607,000
1906	262,581	685,053	905,367	3,393,609	2,714	29,140	3,007,086	766,579
1907	323,323	1,038,355	1,018,013	3,750,493	5,269	59,521	3,052,145	800,014
1908	318,046	760,759	703,473	2,098,247	5,750	54,500	3,860,000	987,775

Year	Petroleum.		Pyrite.		Salt.		Talc.	
	Barrels.	Value.	Long Tons.	Value.	Barrels.	Value.	Short Tons.	Value.
1904	1,036,179	$1,709,770	5,275	$20,820	8,724,768	$2,102,748	65,000	$455,000
1905	949,511	1,566,931	10,100	40,465	8,575,649	2,303,067	67,000	469,000
1906	1,043,088	1,721,095	11,798	35,550	9,013,993	2,131,650	64,200	541,600
1907	1,052,324	1,736,335	49,978	162,430	9,657,542	2,449,178	59,000	501,500
1908	1,160,128	2,071,533	23,675	104,799	9,005,311	2,136,736	70,739	697,390

*Assistant State geologist, Albany, N. Y.

per cent. For many years the output of the State increased very rapidly, and it now amounts to about one-third of the total for the entire country. Onondaga county, where salt making was first introduced more than a century ago, still held the leading place last year, though most of its product was not put into marketable form, but was consumed for the manufacture of soda products. Livingston and Wyoming counties led in the production of rock and brine salt, respectively, for the trade.

The mines and quarries of gypsum contributed an output of 318,046 short tons, or nearly the same as in 1907, when it amounted to 323,323 short tons. The value of the different gypsum materials, including plaster of paris, wall plaster and gypsum sold in crude condition was $760,759 in 1908, against $751,556 in the preceding year. The gypsum industry has grown remarkably in the last few years, the output of the State having increased nearly ten-fold in the decade from 1898. With the inexhaustible supplies afforded by the local deposits and the unrivaled facilities for reaching the principal eastern markets, there is every prospect that the production will soon reach even greater proportions.

The combined value of the petroleum and natural gas produced in the State last year was $3,059,308 against $2,536,349 in 1907. The quantity of petroleum taken from the wells amounted to 1,160,128 bbl., valued at $2,071,533, as compared with 1,052,324 bbl., valued at $1,736,335 in the preceding year. The natural gas production was valued at $987,775 against $800,014 in 1907; the volume of gas amounted to 3,800,000,000 cu.ft. against 3,052,145,000 in the preceding year. The exhaustion of both the petroleum and natural gas pools does not seem to be imminent, judging from the records of production for recent years.

A product of which the State has almost a natural monopoly is fibrous talc, which is found in St. Lawrence county in extensive deposits of superior quality. The material is consumed mostly in the paper trade and is shipped to all parts of the country as well as to foreign mills. The output of ground talc last year amounted to 70,730 short tons, valued at $607,300, and showed a good gain over the total for 1907 which was reported as 59,000 short tons with a value of $501,500.

The garnet mines in the Adirondacks were worked last year on a much reduced scale. The output of 2480 short tons, valued at $79,890, was less than half that for 1907, when 5709 short tons, with a value of $174,800, were reported. The decline may be ascribed to the smaller demand for abrasive materials during the year.

Crystalline graphite was mined in Warren and Saratoga counties. The output amounted to 1,932,000 lb., valued at $116,100, against 2,950,000 lb., valued at $106,951, in 1907.

The mineral springs of the State reported sales last year of 8,007,092 gal., valued at $877,648, or about the same as in the preceding year. Saratoga county with the famous Saratoga and Ballston springs, contributed about $175,000 to the total value.

Among the other mineral products of New York last year were apatite, carbon dioxide, clay, diatomaceous earth, emery, feldspar, marl, millstones, metallic paint, slate pigment, pyrite, quartz, slate, sand and sand-lime brick, the aggregate value of which amounted to $1,902,628, as compared with $2,317,384 in 1907.

TABLE II. SUNDRY MINERAL PRODUCTION OF NEW YORK IN 1908.

Product.	Unit.	Quantity.	Value.
Building brick	Thousands	1,065,533	$5,200,951
Pottery			1,653,241
Other clay products			2,064,671
Crude clay	Short tons	4,697	11,605
Millstones			18,341
Slate pigment	Short tons	922	7,376
Mineral waters	Gallons	8,007,092	877,648
Sand and gravel			1,130,291
Sand-lime brick	Thousands	8,239	55,688
Slate			111,217
Granite			367,564
Limestone			3,119,835
Marble			692,857
Sandstone			1,711,585
Trap			723,773
Other materials (a)			333,648
Total value			$29,517,942

a Includes apatite, carbon dioxide, diatomaceous earth and marl.

Anglo-Siberian Company, Limited

At a recent meeting, in London, of the shareholders of the Anglo-Siberian Company, Limited, which owns extensive timber, iron and copper interests in eastern Russia, Thomas Blair Reynolds, chairman of the company, in reviewing its work said in part:

"Early in 1907 the company secured an interest in an option for purchasing the Kyshtim Mining Works, owning large estates in the region of the Ural mountains. During the option period the proving of recently discovered copper lodes was undertaken, but it was found that the period of the option was not long enough to determine the value of the deposits of copper and an extension of the option was obtained and further capital provided.

"The Perm Corporation was thereupon formed for the purpose of taking over the rights and obligations of the option contract. Subsequently it was decided that the results of the investigations justified the exercise of the option, and accordingly the Perm Corporation formed in November, 1908, a new company to be called the Kyshtim Corporation, with provision for the necessary capital to carry on the timber, iron and copper industries of the estates.

"The Anglo-Siberian Company's assets consist of shares in the Perm Corporation and shares and debentures in the Kyshtim Corporation. The company holds about 43 per cent. of the issued capital of the Perm Corporation, which owns 521,574 Kyshtim Corporation shares. Therefore, this company has an interest equivalent to 224,000 shares of the latter corporation. There is a heavy debt on the estate, but the sale of timber with due regard to the proper system of forestry which is now enforced, is a permanent source of revenue for the payment of interest and amortization, and the charges on the estate are entirely provided for by the agricultural land and forests, leaving the working of the iron and copper deposits as free as if they were upon an unencumbered estate.

"The iron industry at Kyshtim has an output of various classes of fabricated products amounting to about 30,000 tons per year. Improvements in manufacture have reduced the costs and combined with alterations in methods will obviate the necessity of holding such large stocks of raw material, and consequent lock-up of capital, as has heretofore been necessary. The grading for the light railway connecting the copper mines at Soimonovsk with the main line at the town of Kyshtim is under way and the foundations are being prepared for the new buildings required for our copper-smelting plants. At one time it was intended to rush this work so as to start it at the beginning of next year, but it is now thought more prudent for technical and other reasons to defer the actual erection of the plant until the railway is completed, so that the material may be transported by it. The smelter, however, will start well within the period originally estimated by the engineers.

"The electrolytic plant started work in March, 1909, and is now converting into cathode copper and wire bars our own production of copper. A bore hole which has been driven on the Koniukhoff copper property has cut the lode 650 ft. on the dip below the line on which our engineer based his estimate of tonnage. The lode was found to be 9 ft. thick and will add materially to the reserve of the company, which was previously estimated at 500,000 tons. Another matter of much interest to the company is the proposed extension of the government railway from north to south through the whole of our western estate and touching the principal sheet-iron works at Niazepetrovsk, to which it will be of the utmost benefit."

Only 50 tons of tin ore, valued at $12,500 were produced in the United States in 1908. In 1907 the output was 63 tons valued at $15,200. The above data is from statistics of THE MINERAL INDUSTRY.

Notes on Various Applications of the Elmore Vacuum Process

By A. Stanley Elmore.*

As the successful development and introduction of a novel process for the treatment of ores is a matter of general interest to metallurgists it is thought that the following notes may be of some value to those contemplating the erection of ore concentration plants. No detailed description of the process is called for here as full particulars appeared in the Journal of May 11, 1907.

The scheme of treatment for a given ore is as follows: The ore is crushed wet to such a mesh as will reasonably liberate the particles to be recovered from the associated gangue. The pulp is then agitated with small quantities of oil and acid. The oil adheres to the metallic particles, leaving the gangue free from oil.

The pulp so prepared is then subjected to a vacuum (usually corresponding to about 20 to 27 in. of mercury), when the mineral will be found to have floated to the surface, leaving the gangue at the bottom of the vessel in which the operation was conducted; thus a very sharp separation is secured yielding a clean concentrate.

Like every other metallurgical invention the Elmore vacuum process has its limitations; however, its field of application is much wider than has been supposed by some engineers. Furthermore, it was supposed in the early days of its introduction that the apparatus for carrying the process into effect was necessarily complicated, expensive and delicate in working. Several years' experience in mills, treating large tonnages of ore under usual working conditions, with ordinary labor, has totally disproved some of these erroneous impressions.

Continuous workings, in some cases for periods of two years, have shown that the plant is practical, simple and substantial. The Elmore invention has found a wide application. Although much time has been occupied in establishing confidence in the process, it would doubtless have been much longer had not the company controlling the patents, placed a well equipped testing works at the disposal of likely users. These works are equipped with automatic samplers, as well as floors for hand sampling, and in all cases of testing, either on a small or large scale, the supervision of independent engineers has always been invited. In this way accurate data under working conditions are secured for the satisfaction of intending licensees.

It is interesting to note that in every one of the working plants quoted below, the orders were secured as a result of trials carried out at the testing works

*Chairman, the Ore Concentration Company, Ltd., 4 Broadstreet Place, London Eng

Elmore Process Installations

Dolcoath Mine, Cornwall.—In certain parts of this mine the ordinary tin ore is found impregnated with varying proportions of sulphides, principally of copper. This ore is crushed in the usual Cornish stamp battery and passed direct to one unit of an Elmore plant. By this operation most of the sulphides are floated out and recovered as a high-grade copper concentrate, which contains, approximately 2 to 3 lb. of tin per ton. Practically all of the tin oxide is left in the tailings from the Elmore plant. These tailings are subsequently treated by Frue vanners in the ordinary way for the recovery of the tin oxide. The oil and acid used in the Elmore apparatus in no way injuriously effects the subsequent recovery of the tin. This plant was supplied to the Dolcoath company in March, 1907, and continues to yield satisfactory results, giving an extraction of over 90 per cent. of the copper contents of the ore.

Ramsley Mine, Devonshire.—The ore treated consists of a mixture of chalcopyrite and bornite with some chalcocite in a slaty micaceous gangue, containing about 2½ per cent. copper. It is crushed in stonebreakers, high-speed rolls, and Huntington mill in the usual way. The pulp is sent direct to one unit of the Elmore plant. The concentrates produced assay about 12 per cent. copper. The plant has been in operation about seven months and is to be enlarged shortly.

Dolgelley Mine, North Wales—The ore consists of chalcopyrite with varying proportions of pyrite in a schistose gangue. The grade of the ore operated upon is usually about 1.2 per cent. copper, 0.08 oz. gold and 0.8 oz. of silver per ton. The ore is crushed by a reciprocating stonebreaker, followed by a California 20-stamp battery (1050 lb.) reducing it to 6-mesh. The pulp from the battery is sized on a 16-mesh screen and the oversize recrushed in a grinding pan. The pulp is then sent direct to three units of the Elmore plant and yields a concentrate of about 12 per cent. copper, 0.7 oz. gold and 7 oz. of silver per ton, the tailings assaying about 0.25 per cent. copper with small amounts of gold and silver.

Prior to the installation of the vacuum plant much money had been spent at this mine on various forms of water concentration machines. Owing to the extreme softness of the copper sulphides and the unusually tough character of the rock the loss in fines was always prohibitive, and such attempts were finally abandoned in favor of the vaccum plant which has been in continuous operation for two years.

The Zinc Corporation, Broken Hill.—The material is a zinciferous tailings from the lead dressing mills treating the well known Broken Hill ore. The gangue consists largely of garnet and rhodonite and has practically the same specific gravity as the zinc blende with which it is associated. Separation by ordinary water concentration is not possible on this material. The tailings on the dump are already fine enough for direct treatment in the Elmore plant; that portion which is too coarse is crushed in 12 grinding pans, and sized on improved revolving screens; the oversize is recrushed on six additional grinding pans. The average assay of the material operated on in this plant so far is zinc, 20 per cent.; lead, 5.75 per cent. and silver 8 oz. per ton. This yields concentrates assaying zinc, 43 per cent., lead 11 per cent. and silver, 17 oz. per ton. It has been found that if these concentrates be dried and subjected to a sufficiently high temperature to drive off the small quantity of oil which it contains, the de-oiled concentrate may then be mixed with water and passed over Wilfley tables yielding a zinc product assaying zinc, 46.5 per cent. Lead, 7.35 per cent.; and silver 16 oz. per ton; and, a lead concentrate assaying lead, 58 per cent.; zinc, 15 per cent. and silver 39 oz. per ton. The value of the final residues from this Elmore plant depends to a great extent upon the more or less oxidized condition of the mineral in the material operated upon (much of the material on these dumps has been exposed to atmospheric oxidation for many years). The following may be taken as fairly representative: Zinc, 3.5 per cent.; lead, 2.2 per cent. and silver 2.2 oz. per ton.

Careful determination has shown that a large part of the metal contents is present in the form of oxidized compounds. The actual recovery secured by the Elmore plant at the Zinc Corporation may be taken as follows: Zinc 90 per cent.; lead, 73 per cent. and silver, 85 per cent.

The 16-unit plant was installed only after most exhaustive trials had been carried out with one unit. The mill handles about 18,000 tons per month and produces about 7000 tons of concentrates. This mill, which has been in continuous operation for 15 months, gives a higher capacity, better grade of concentrate and greater percentage of extraction than was indicated by the trials with the one unit plant.

Edmundion Copper Mine, Africa.—The ore consists of chalcopyrite very finely disseminated through a feldspathic gangue. It is crushed by stonebreakers and Holman pneumatic stamps and passes directly to a two-unit Elmore plant. The ore assays about 2.5 per cent. copper and yields a concentrate assaying about 22.5 per cent., with a recovery of 85 per cent. of the copper.

Garpensberg Mine, Sweden.—The ore consists of a quartz gangue with magnetite, chalcopyrite and pyrite. It is low grade, assaying about 1 per cent. copper.

The crushing plant consists of a stonebreaker followed by rolls, the product going to jigs and tables in the ordinary way. The table tailings, together with the jig tailings after recrushing in wet ball mill, are treated in the vacuum machines. One unite was tried first; later two more were installed, and one more is about to be erected.

Traag Mine, Norway.—The ore carries both zinc and lead associated with a heavy gangue. After crushing in stonebreakers and Huntington mills the pulp is treated on Wilfley tables for the production of a lead concentrate. The tailings from the Wilfley table go to the single unit Elmore plant which yields a concentrate assaying about 58 per cent. zinc. The zinc sulphide in the ore is a friable, resin blende and, in consequence of excessive sliming coupled with heavy gangue, was found to be practically impossible of collection by ordinary water concentration appliances.

Hadeland Mine, Norway.—The ore consists of zinc blende associated with a large proportion of magnetite and some spathic iron. Trials with various water concentration appliances had all proved quite unsatisfactory. The ore is crushed in Krupp ball mills and sent direct to the Elmore plant. It yields a high grade concentrate with a very satisfactory extraction. The company, after having operated the one-unit plant for about six months, has ordered three additional units.

Telemarken Mine, Norway.—The ore consists of chalcopyrite and bornite in a gangue composed of hornblende, micaceous schists and hard quartz. The crude ore from the mine is hand sorted. The ore thus enriched contains about 4.5 per cent. copper. It is crushed in a No. 5. Gates crusher, followed by Ferraris wet ball mills. The pulp is sent direct to a three-unit Elmore plant, from which concentrates assaying about 26 per cent. copper are obtained, the final tailings containing only 0.20 per cent., thus giving a recovery of about 95 per cent. of the total copper content.

Sulitelma Mine, Norway.—The ore carries copper in the form of chalcopyrite, associated with a large proportion of pyrite, the gangue being micaceous schist. As the ore comes from the mine it is crushed in large stonebreakers and carefully hand sorted. The clean lump pyrite is sold to suphuric acid works where it is roasted for its sulphur. The cinder is subsequently treated for its copper contents. The low-grade ore left after hand sorting is crushed with rolls and passed to jigs, tables, and vanners.

This water concentration plant is of first class design, operated with good labor and under excellent technical supervision and control. Nevertheless, the loss of copper in the tailings is heavy owing to the particularly friable nature of the copper pyrites. The residues from this water concentration plant vary in grade from 1 to 1¼ per cent. copper, associated with pyrite and some magnetite. The water concentration mill handles about 800 to 900 tons a day and produces about 500 to 600 tons a day of tailings. These tailings are an unusually dilute pulp, the proportion of water to solids being about 100 to 1. At present about 400 tons of solids per day with the above proportion of water, are sent to the twelve-unit Elmore plant for the recovery of the copper. Arrangements are being made which will enable all of the tailings from the water concentration plant to be sent to the Elmore plant.

The small part of the tailings, too coarse for treatment direct in the Elmore process, are recrushed by Heberle ball mills. The pulp, which as before stated is associated with an immense amount of water, is run into large settling tanks to get rid of the excess of water. Concentrates varying from 6 per cent. up to 11 per cent. of copper (the grade depending upon the proportion of iron pyrites) are produced. The final tailings assay 0.2 per cent. copper. The great bulk of the material handled by the vacuum machines consists entirely of slimes. An average of about 150 tons of concentrates per week are produced from waste material which had previously been discharged direct to the tailings dump.

Saxberget Mine, Sweden.—The ore is a mixed zinc-lead-silver material which, after crushing in stone-breakers and wet Gröndall ball mills, is treated on tables for the recovery of the lead. The lead recovery by this means, however, is not good, and consequently the tailings from the tables, in addition to the zinc, contain notable proportions of lead and silver. Various attempts have been made previously to treat these tailings but without success. The Elmore plant is now producing mixed lead-zinc-silver concentrates which are subsequently smelted in an electric furnace.

Each unit of the plants represented above may be assumed to be treating 40 tons of ore per 24 hours equal to more than half a million tons per annum. It is interesting to note that in every instance these plants are working with the ordinary class of labor available at the several mines. They have been in operation for periods of time up to two years, and in each case are operating independent of any supervision by the company controlling the patents. It may therefore be reasonably assumed that the Elmore vacuum process has now taken its place definitely among recognized methods of ore treatment.

Attention is particularly directed to the variety of ores which are being treated regularly on a large scale, and to the still much greater variety of ores which have been tested both on a large and small scale at the testing works. Special emphasis is laid on the great variety of crushing machinery which is employed with different ores in the various mills in connection with the Elmore process, and to the fact that plants are in regular operation in such extremes of climate as are found between Broken Hill, New South Wales, where the summer temperature reached 110 deg. F. and the Sulitelma mine which is 180 miles north of the Arctic circle where a winter temperature as low as —37 deg. F. is usually recorded.

Antimony in China

According to a recent report by the British consul at Changsha, the increase in the export of crude antimony and the decrease in the export of ore in 1908 were both noteworthy. The local notables who control the antimony works are in touch with London, and are kept fully informed as to the prices ruling in the London market. It seems probable that the export of ore will continue to decrease, owing to the erection of new machinery and the better handling locally of the ore, and that the export not only of crude, but of refined antimony will steadily increase.

The increase in the export of crude is, no doubt, due to the presence of a foreign buyer in Changsha. The old difficulty still exists of inducing the sellers to realize the binding nature of a contract, but constant personal contact between the native seller and the foreign buyer ought, with patience, to remove this serious obstacle to a satisfactory working basis, and it seems likely that in the future contracts will be more punctually fulfilled.

The price of crude, Changsha sales, varied from £10 13s. 4d. to £11 6s. 8d., and of ore from £4 13s. 4d. to £6 13s. 4d. It is hoped with the new machinery to produce refined antimony containing at least 99.6 per cent. and possibly 99.8 per cent. antimony. The relative value of refined to crude will be about £26 13s. 4d. to £10 13s. 4d. per ton.

During the past years the ore in Changsha has been so crudely smelted that waste ashes have been found to contain 30 per cent. antimony; many thousands of tons of such ashes have, from time to time, been thrown away, and money has been made by at least one enterprising foreigner who bought up all the ashes he could. This form of speculation is, however, now at an end.

Another point should be noted. In the past low-grade ores have been rejected owing to the imperfect furnaces in use, but with the improved machinery all low-grade mines should also become valuable and the export of antimony be greatly increased. A foreigner, well qualified to give an opinion, states that the richer ore found in Human is only equaled by one mine in France.

Geology of the Yellow Aster Mine, California

Remarkable Ore Deposits in Granite at Randsburg, Kern County, That Have Produced about $6,000,000 in Gold. Discovered in 1895

BY WILLIAM H. STORMS*

The consolidation of mining claims owned by the Yellow Aster Mining Company, of Los Angeles, Cal., constitutes one of the most important gold-mining properties of the West. The mines are situated in the Mojave desert, Kern county, California, about one-half mile south of Randsburg.

The discovery of gold in the district was made in 1895 by C. A. Burcham, Fred M. Mooers and John Singleton, who came into the region from the dry placer camp, at Goler, where they had met with indifferent success. The first discovery of gold was made in the dry sand of a gulch which cut the outcrop of the gold-bearing veins of the Yellow Aster hill. The dirt was concentrated in a dry-blowing machine. Soon after this the veins were discovered and development proceeded as rapidly as the isolated situation of the property would permit.

The output of high-grade ore from the various mines about Randsburg early attracted much attention. For the most part, the veins proved to be rather short and narrow fissures in micaceous and hornblendic schists, and the first few years of active mining rapidly depleted the smaller veins on the ridge, north of town, known as Butte hill. The group of claims to the south, on Yellow Aster hill, developed year by year until the consolidated claims, known as the Yellow Aster mine, became an important and productive gold- mine.

A Region of Horizontal Schists

For several miles about the village of Randsburg, the rocks consist chiefly of a series of granitoid schists, comprising both micaceous and hornblendic varieties. In some parts of the region typical amphibolite schist occurs. The hornblende schists are often fissile at and near the surface, having distinct schistose structure. These typical schists are found interbedded with layers of granite rock 4 to 5 ft. in thickness, possessing little or no trace of schistosity. These bedded schists extend in a northeast-southwest direction, a southwestern extension of the Slate range, although wholly detached from the latter range of mountains.

Origin of the Flat Schists

That horizontal schists extending over any considerable area are unusual, will be readily admitted. Several theories to account for those about Randsburg have been advanced by prominent geologists. Among these theories is the possibility that the rocks comprising the schists were, at one time, buried so deeply that the tremendous pressure of the superincumbent mass induced a condition of schistosity.

Another theory, and a more probable one is that schistose conditions have been produced by the proximity of a huge batholith (probably granite) that may underlie the region. Still another theory conceives that the schistose and semi-schistose structure is due to the rocks having originally been deposited as a series of flows. This latter supposition seems improbable, as none of the rocks are of volcanic type, but of granitic character.

FIG. 1. YELLOW ASTER HILL FROM THE NORTH; 100-STAMP MILL AT THE RIGHT; 30-STAMP MILL AT THE LEFT

The only remaining tenable theory is that the schistose structure may, to some extent, represent original sedimentation; and, that these, now crystalline schists, were originally horizontal sedimentary beds, which have been brought to an extreme state of alteration by pressure, still preserving traces of their original horizontality.

Personally I favor the theory of the batholith, which, in my opinion, lies at no very great depth beneath the present surface. To some extent the topography of these hills is influenced by the character of the rocks, the slopes of some of the hills conforming to the dip of the schists.

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The Surrounding Region

Northeast of Randsburg, 3 or 4 miles, is an eminence known as Red mountain, which consists entirely of volcanic rocks—rhyolite, tufa and tuffaceous-breccia, but so far as known, no ore deposits of any description exist in this volcanic area. Less than a mile east of Randsburg, are large intrusions of granite, in which are included several irregular masses of limestone. These were probably torn from an older formation lying beneath, but which is unknown elsewhere in the vicinity of Randsburg. There are limited occurrences of quartzite and dense jasperoid rocks nearer town, particularly on the north slope of the ridge known as Butte hill, which, with the limestones, indicate sedimentary origin. Four miles east of Randsburg, dikes of pegmatite cut the schists. These dikes have, among other constituents, ores of tungsten—notably scheelite, which has been profitably mined in the Atolia mine.

West of the Randsburg district is a desert valley about six miles in width, on the farther side of which is Goler, the noted dry placer camp. Several deep wells sunk here, on what is presumed to be an ancient gravel channel, furnish the principal water supply for the Yellow Aster mine; a further supply being obtained from other deep wells sunk six miles northeast of Randsburg. Goler lies at the mouth of a cañon cutting a north and south range of rugged hills, which consist mainly of schist. These schists are of a different type from those at Randsburg and vicinity, being evidently the result of the alteration of various greenstones. Igneous intrusions of huge dimensions are not uncommon in these hills.

South of Randsburg schistose rocks extend for many miles, and in them are known to be numerous gold-bearing veins, some of which have been profitably exploited.

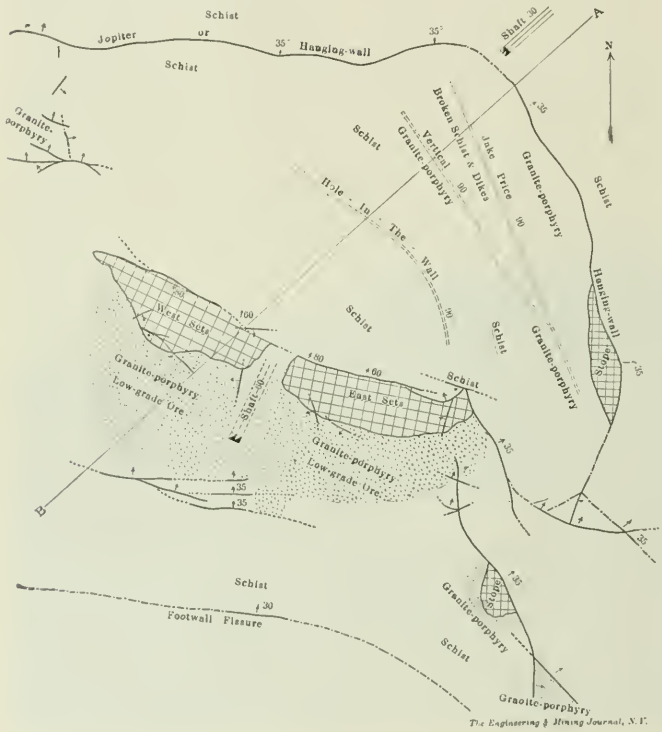


FIG. 2. SKETCH-MAP SHOWING FISSURE SYSTEM ON THE RAND LEVEL OF THE YELLOW ASTER MINE

Yellow Aster Hill

The hill in which the Yellow Aster mine is situated is among the highest of the range. This hill is the result of a domelike uplift of the flat schists previously described. The schistose rocks, originally nearly horizontal, have been intruded by numerous dikes, large and small, and these intrusions have caused the older rocks to be lifted into a dome, the effect extending for thousands of feet in all directions from the center of disturbance. Not only have the intrusive masses lifted the schists from their flat position into a dome, but they have thrown them into a series of sharp folds, some of which appear near the northern base of the hill, east of Main street, and others in the cañon west and southwest of Randsburg. These folds afford additional relief from the tremendous compressive stress resulting from the repeated intrusion by a series of remarkable fissures occurring in Yellow Aster hill, along all of which a greater or less amount of movement has taken place.

The accompanying sketch map, Fig. 2, of the Rand level, which is at present the main working level of the mine, shows the distribution of the most of these fissures, and the relations to one another, and also, to some extent, to the various orebodies.

The footwall fissure—seemingly the only one that is absolutely continuous, so far as known—at the west end of the property in Olympus claim, has a strike a few degrees north of west, dipping about 30 deg. to the north. It runs easterly, gradually turning in a broad, sweeping curve to the south, until in a distance of 3000 ft. it strikes directly south, dipping 35 deg. east. This fissure is indicated on the map, and is found at several points in the mine workings and in surface cuts. It is generally accompanied by one or two feet of tough, putty-like gouge. The sweeping curve of its strike from nearly east-west to due south is somewhat unusual.

There are other fissures in the southern area of the property, the more important of which are indicated on the map, but these fissures seem to be a series of fractures following a common direction and overlapping each other, rather than continuous fractures.

What is commonly called the hanging-wall fissure is not such in reality, for orebodies occur both above and below. This fissure, known as the Jupiter, is also indicated on the map. In the west end of the mine the strike is nearly east-west, almost parallel with the footwall fissure, dipping north 20 to 25 deg., but becoming somewhat steeper toward the east, and with depth. Its dip is 35 deg. on the Rand level. This fissure and the footwall fissure are not over 30 ft. apart at the surface, in the west end of the mine. They separate rapidly eastward.

Proceeding along the Jupiter fissure, there may be observed numerous subsidiary fissures, which are part of the system of fractures due to the stress that produced the main fissures. Going eastward the Jupiter fissure also swings around to the southward, finally taking a more abrupt bend than the footwall fissure, eventually having a strike somewhat west of south, and uniting with some of the more important fissures in the interior portion of the area. The dip of this fissure is almost uniformly 35 deg. on the Rand level, but is somewhat less both above and below. At 400 to 500 ft., on the incline, below the Rand level, the dip

is 20 deg. In this respect it is similar to some important fissures elsewhere, notably the footwall fissure of the Comstock lode.[1]

Intrusive Rocks

The several dikes which cut Yellow Aster hill vary somewhat in strike, but all approach an east-west direction. About midway between the mine and the town a dike of greenstone is seen intersected by one of quartz-porphyry, at an angle of about 20 deg. No ore-deposits are known to accompany either of these dikes. In and about the mine itself the dikes dip from vertical to 60 deg., except where locally disturbed by movement subsequent to their intrusion.

These dikes comprise a variety of rocks, nearly all of which are acidic. They probably represent a differentiation of the granitic batholith, presumed to underlie the region. One of the most prominent dikes of the vicinity extends from the east side of the dome easterly a distance of two miles. It varies from 4 to 40 ft. in width and is nearly vertical. At the east end it spreads into a great mass of quartz-felsite 100 ft. or more in diameter. Near the Yellow Aster hill this dike is a typical quartz porphyry. At one place only in the mine workings was a dike found which appeared to be identical with this particular intrusion, but as it is not known to be in any manner associated with ore deposition, little exploration has taken place in its vicinity.

Among the other intrusions are several large dikes of felsite which are exposed both on the surface and in the mine workings. Some of these felsite intrusions are more than 100 ft. wide and several hundred feet in length. Where crushed and altered the felsite is usually gold-bearing, but always, as far as known, low grade.

Syenite occurs on a hill north of the summit of the dome, but it is not known to have any direct relation to the ore deposits below. Near this large outcrop of syenite is found a dark-greenish, much altered boss, which was probably originally diabase.

There are other large granitic dikes occurring at various places within the limits of the domal uplift. These rocks also, along crushed zones, are gold-bearing, being as a class somewhat better than the felsites, but not sufficiently rich to form ore of commercial value.

The Granite Porphyry

The main ore-bearing rock is granite porphyry. Ore occurs in it principally in three forms: As distinct vein-like masses usually adjacent to a fracture or fissure; as impregnations of the rock mass itself, and, more rarely, in cracks or seams traversing the granite. The first type has resulted from a more or less complete silicification of the granite, forming a dense quartz rock resembling dirty, yellowish-gray hornstone. The second is merely the result of impregnation of masses of crushed granite porphyry by gold-bearing solutions. This rock presents the appearance of a partly decomposed, medium-textured granite, slightly iron-stained, with occasional evidence of the deposition of secondary quartz. The third type is merely a series of irregular cracks, following a common direction through the granite-porphyry, and in these cracks or seams coarse gold is found.

The granite-porphyry occurs, like most of the other intrusions here, in great dikes having a strike approximately north 85 deg. west, dipping north. Several of these granite-porphyry dikes may be seen on the surface, cutting the nearly flat schists. They can be readily traced to the Jupiter fissure; but to indentify any particular dike below that plane of movement is most difficult, if not impossible, owing to the lack of definite knowledge of the amount of displacement that has occurred, as well as to the complex geological conditions in the region inclosed within the triangular section between the footwall and hanging-walls. Large masses of schist are found torn from their original beds, which are twisted and shattered between great irregular dikes of igneous rock. Not only this, but large sections of older dike rocks have also been broken from the earlier intrusions, and these are now found mingled with the schist in a chaotic mass between the later dikes. Moreover, the line of demarkation between schist and igneous rock is not always clearly defined, even where both rocks are exposed to daylight inspection in the great open cuts. They merge, one into the other, by a gradual transition.

All of the great orebodies of the mine have resulted from the infiltration of gold-bearing solutions into masses of crushed granite-porphyry. This is also true of many of the smaller, and sometimes isolated orebodies, but all of the granite-porphyry is not gold-bearing. Nor is it always, or even often, possible to distinguish, by its physical appearance, the pay rock from that which is poor. One of the chief duties of the shift bosses is to take samples of new faces of rock as fast as they are exposed. The ore occurs in zones of greatly varying width, from 2 or 3 ft. up to masses more than 200 ft. thick, and 40 to over 600 ft. long.

Striations along the Jupiter fissure indicate that the movement has not been uniform; they show that some blocks have moved horizontally, whereas others have moved in various directions, and in some instances the same rock has been shifted first one way and then another.

The largest stope in the mine has been opened on the Rand level. It is more than 600 ft. long, over 100 ft. wide in places, and nearly 100 ft. high. These dimensions do not indicate the total extent of this great mass of ore; but at the time it was mined they practically outlined the pay

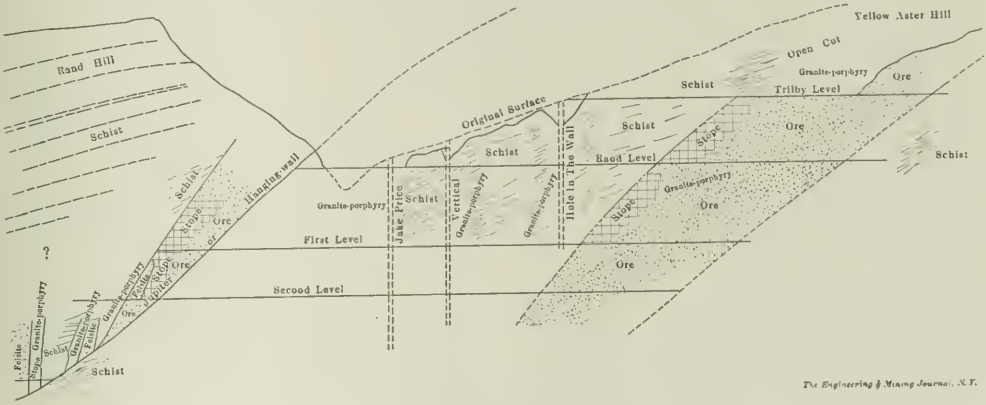


FIG. 3. SECTION THROUGH YELLOW ASTER MINE

[1]George F. Becker, *Geology of the Comstock Lode*, Monograph No. III, U. S. Geol. Surv

ore. Great stopes have been opened on the extension of this orebody, both above and below the Rand level.

About 100 ft west from the west end of the stope just referred to, begins another large orebody, but belonging to an entirely different series of oreshoots. Huge stopes have been opened on the Rand level, also above and below it. In all of these stopes the limitation of stoping has generally been determined by commercial considerations, excepting where the ore limit has been sharply defined by a fissure or abrupt change in the character of the rock, clearly discernible by the eye. The east stope on the Rand level, for instance, is sharply defined on the hanging side by a wall, although this fissure is one showing little or no movement. Over most of the area covered by the exposure of this wall there is little or no gouge, while on the footwall side the gold contents stops with no apparent change in the appearance of the rock. Throughout the mine there still remain large blocks of ore in the immediate vicinity of the principal stopes which will admit of little or no profit if mined by stoping and square-setting, timber costing over $40 per M as delivered, and over $50 per M set up in the mine. However, there is little doubt that much of this ore could be profitably mined if the open-cut system were applied to it. Development is resulting in the discovery of new orebodies in various parts of the mine, the diamond drill having been found particularly useful in searching for new masses of ore.

Distribution of the Ore

To the casual observer the distribution of ore in the Yellow Aster mine appears to be extremely erratic and haphazard. Yet when the general map of the mine workings is studied it is found that nearly all of the most important orebodies belong to one of several systems or groups, each following an independent trend. Then there are orebodies apparently isolated, but which may later be found to belong to separate systems, the relations of which will be better understood by more extensive development, although there are already over 16 miles of underground workings in the mine.

Of the two important oreshoots mentioned, the most extensively mined is that lying to the east of a line striking about north 25 deg. east and approximately through the two shafts indicated on the sketch map, Fig. 2. This oreshoot, or more properly, series or succession of oreshoots, outcrops at the surface on the south slope of Yellow Aster hill near the west end of the property, where it forms a large body of low-grade ore. In its downward d/p and trend it lies east of the line mentioned, its trend being about north 60 deg. east. Much of the ore mined from this succession of orebodies was very profitable.

The other large orebody appears, or did appear, at the surface near that just described, but the upper portion has since been removed in the open cut or "glory hole." This orebody has a trend about north 15 deg. east, so that with depth these two great ore shoots became widely separated. In many respects these two orebodies are similar, particularly as to their size, form and manner of occurrence.

At least three other separate series of orebodies have been developed in the vicinity of the Jupiter wall. These are known as the Midway, the Buffalo and the Homestake. Most of the ore in the Midway series lies above the Jupiter wall, though some of it occurs underneath. At the Buffalo the greater part of the ore thus far developed lies underneath the fissure. In the Homestake-Hunt series is the Christmas stope above the Jupiter wall, but near the surface, on the Rand level, a rich shoot was found under and in close proximity to the wall. This shoot is in direct line with the Homestake and Christmas and may very properly be considered as belonging to the same series. It should be understood that none of the orebodies mentioned as connected with the Jupiter wall have any relation to, or connection with, the large masses of ore in the central portion of the mine.

In the southeast part of the mine and entirely separate from the orebodies already mentioned, are several other shoots, some of which have been very profitable. In this part of the mine, and also toward the west end are extensive bodies of low-grade ore which undoubtedly will be mined at a profit at some time in the future.

An interesting fact in connection with this mine is that if a cross-section were taken every 100 ft., no two of the sections would be alike, even those at adjoining stations. Most remarkable changes take place often within a few feet.

In the northeast part of the mine, and about 300 ft. below the surface is a stope known as the Hobo. On the 200 level the ore is about 4 ft. in width. The hanging side is defined by a good wall; the footwall is irregular. The hanging-wall is nearly vertical. The footwall slopes back with varying angle, until, 60 ft. above the level, the stope is about 20 ft. wide. Just above this the schist swings over the granite-porphyry from the hanging-wall, and the ore following it, rapidly thins out and becomes a mere seam a few feet above the next level.

Vertical Zones of Impregnation

In addition to the large ore-deposits already referred to, there also occurs, in the granite-porphyry, a series of nearly vertical zones of gold-bearing rock which have no walls. These are indicated on the map, Fig. 2, and section, Fig. 3, by the name—the Price, Vertical and Hole-in-the-Wall. These peculiar occurrences are in no sense veins or orebodies of definite form, being merely a series of reticulated cracks or seams occurring along a common direction, such as may be observed in granite. A slight brownish stain of iron oxide is about the only indication of mineralization noticeable in this rock, and much of it shows little sign of oxidation. Occasionally a little secondary quartz and sometimes pyrite is present. The granite in these zones presents no evidence of movement or shearing, but coarse gold occurs in these zones of fracture and impregnation, and they have proved very profitable, the Price and Vertical being particularly high grade. These veins, as they are called, have been stoped in the ordinary manner, from 4 to 12 ft. wide, and square sets placed in the wider portions.

Ore in the Schist

Ore rarely occurs in the schist. In almost every instance where the gold-bearing granite-porphyry is interrupted or cut off by schist the gold disappears. A remarkable exception occurred near the summit of the dome where a small fissure cut the schist. This vein carried much limonite and was rich in gold. The rock was soft and decomposed at the surface, and was run through a dry-blower with most satisfactory results. This place is known by the peculiar name "Instinct," the discoverer claiming that it was by instinct he found the orebody.

A Problem in Mining

The orebodies do not always reach the surface, some of the larger ones being overlaid by the horizontal schist from 20 to 80 ft. in thickness.

Some of the older stopes have caved and the ore remaining can be recovered only by stripping the overburden which is, generally speaking, on the south side of the cut.

By doing this much ore would become available at a cost which will admit of a profit on the operation. Late accounts from the mine state that stripping operations have actually been commenced, and the great cut will consequently be broadened and later deepened.

China is showing much interest in mining affairs, according to the *Far Eastern Review*. The government at Peking has directed the governor of Chinese Turkestan to investigate and report on the copper deposits of Kucha and Paichang with a view to developing them along modern lines.

The output of vanadium in the United States, according to statistics of THE MINERAL INDUSTRY, increased last year. In 1908 the production was 64,800 lb. ($162,000), while in 1907 it amounted to 41,000 lb. ($102,500).

The production of tin in Queensland during 1908 (*Queensland Gov. Min. Journ.*, April 15, 1909) was 4825 tons, valued at £342,101. This is a decrease of 315 tons, as compared with the production of 1907.

Automatic Dumping Skip for Vertical Shafts

Design and Operation of a Self Dumping Skip for Hoisting Either Rock or Water. Hoisting Mine Water Compared with Pumping

BY GEO. C. MC FARLANE*

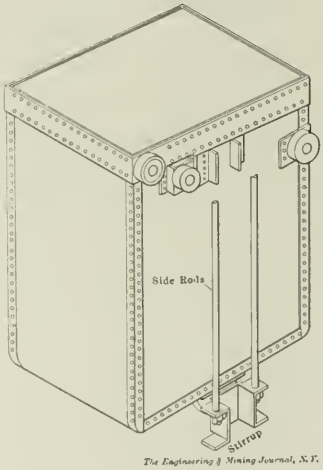
In the accompanying sketches, Fig. 1 illustrates a skip that can be used for hoisting rock and water from a vertical shaft. The body of the skip rests on a bottom axle, swung from stirrups that fit the guides and are suspended from the draw-head by side rods on either side of the guide strips. A couple of short angles riveted to the sides and just below the top binder form guide shoes to keep the skip vertical.

In case the skip only has to dump at one landing stage on top, two dumping rollers on a side and a dump track similar to that shown in Fig. 4 are all that is required. If it is desired to dump ore, rock and water at different landing stages at the surface, a three-roller dump and a cross-over style of dump guides like that shown in Fig. 2 will be required at all except the top dump.

The front and rear roller and the shoe angles project 2½ in. beyond the sides of the skip and the middle or outboard roller projects 4½ in. The side rods clear the sides of the skip 3 in. and at the dump the shaft guides are cut away to a depth of 2¾ in., so the shoe angles and rear roller can swing through side rods and shaft guides at the dump. If not used for hoisting men the skip can be coupled up short to the draw-head, but if it is desired to hoist men also, long side rods can be used so the men can stand upright on a light wood grating thrown across the top of the skip and grasp a hand rail bolted to each cross piece of the draw-head. Covers and safety dogs that dig into the inner face of the guides can be readily attached to the draw-head to make the skip safe for hoisting the men.

The object in designing this skip was to obtain a skip that would dump rock and water and also dump quickly. In this respect the skip is faster than the skip used in inclined shafts because the dump is positive and can be negotiated at high speed, throwing the load out square and clean and not slopping back in the shaft. In a sense it is a modification of the Russell type of self-dumping cage which has been used with good success in the Saginaw field for nine years. This type of cage is outlined in Fig. 5. The principal feature is the hook for raising the car doors as the car is tipped into the dump. The hook is pivoted between two pieces of flat iron about 5 or 6 ft. long suspended from a light cross-arm one end of which projects into the cageway. As the cage throws the car into the dump a roller on the hood of the cage strikes the cross-arm and raises the hook which has just entered a loop in the car door. The hook and cross-arm are steadied in place by light chain side guys. Should a car door jam and refuse to raise, the shank of the hook will swing through the flat bars that grip it and release the hook.

A self-dumping cage has only to swing through an angle of about 50 deg. to discharge its load; a skip, on the other hand, has to be swung at least 135 deg. to dump rock readily. By the addition of the outboard roller to the skip, it is prevented from swinging back in the shaft when it swings down below the horizontal. As the skip tips into the dump the outboard roller slides in under the guard rail and as the skip kicks back, the roller is canted up high enough to catch the outboard track and ride up it. With this device the skip can be over-wound 8 or 10 ft. without causing trouble.



The Engineering & Mining Journal, N.Y.

FIG. 1

Hoisting Mine Water

Where conditions are suitable, this kind of hoisting gear can be used for raising the mine water as well as the ore and waste. To bail water cheaper than it can be pumped, the rigging should be put in at the start of a new operation, and only in case it was reasonably certain that the shaft could be run down vertically and the workings laid out to drain the water to the shaft bottom by gravity. If it is necessary to put in field or auxiliary pumps to collect the water at the main sump there would be little economy in running bailers in the shaft.

In opening up steep pitching lode mines by vertical shafts the water could of course be easily drained to the main sump by gravity and in such cases the money usually spent in buying pumps, pipe, and a geared hoist, could be invested in a larger first-motion hoisting engine and balanced skips. The compartments should be large enough for 5¾-inch guide strips, i.e., a 6 x 6 in. strip, dressed on four sides. White pine or a similar fine straight-grained wood is perhaps the safest for guides, as the safety dogs have a better chance to gouge in and catch if the cable breaks. Hard maple wears smooth and is more durable than pine. The shoes and stirrups should fit the guides with not more than an ⅛ or 3/16 in. clearance. When the strips wear away ¼ in. new guides should be put in. If the guides are badly worn the skip will oscillate and wabble and not strike the dump square. As there is a good deal of side pressure on the stirrups as the skip is dumping, it is a good scheme to put 6-in. channels back of the guides at the dump. The guides should be given good alinement and preferably should be bolted through shims or spacing blocks so they can be easily straightened in case any of the sets take a slight squeeze.

Fig. 2 shows a cross-over arrangement of dumping guides, which permits of the skip discharging water just above ground level and by throwing the switch, ore or rock can pass through to a dump higher up in the shaft-house. When the switch is thrown back the skip is carried over the cut-away portion of the guides by two of the rollers, the outboard roller passing between the legs of the channel shown in the sketch. If it is desired to hoist a large volume of water, balance tandem skips can be used and unloaded in a two-way dump similar to the arrangment shown in Fig. 4, or longer bottom side rods can be used and both skips thrown one way. The lower skip can be fastened to the stirrups of the upper one by keying through the side rods and fastening the keys with cotter pins; then the bottom skip can be quickly detached and left in the sump and ore hoisted with the top skip. The horns of the water dump shown in Fig. 4 can be hinged to swing out of the way; then, by slipping in a filler in the cut-out of the guides, the

*Mining engineer, 312 Bearinger building, Saginaw, Mich.

ore loads can pass through to the ore dump.

Fig. 3 shows a sump arrangement by which single skips can be tipped and filled in the sump. To accommodate this layout the sump must be about 4 ft. wider than the rest of the shaft. Tandem bailers are ideal because they have enough weight to sink and fill over the rim, and they fill in a second, where a valve bottom bailer requires anywhere from 3 to 8 sec. to fill.

All the dumping tracks or guides shown in the sketches, except the switch, which is cast iron, are made of hardwood, ironed off with ¾-in. flat iron and securely bolted to the girths and buntons of the cageways. The patterns are struck off on a floor. First chalk down a line for center line of guide, then lay off a front dump circle of any desired radius, say from 12 to 20 in. Then make a templet of the skip showing axle, guide rollers and shoe angles. The back curve can now be scribed by rolling the templet on the front circle while keeping the axle center on the chalk mark that defines the shaft-guide center line. Care must be taken that the shoe angles clear the front circle.

Hoisting Water vs. Pumping

It is conceded that a water hoist is rather more economical of power that the average run of small mine pumps. This was brought forcibly to my mind a couple of years ago at a little mine in California. A pump was lifting water from the 300 level. When firing for the pump alone, I found it took a cord of dry pine wood, evaporating 1000 gal. of feed water, to pump 22,000 gal., or 92 tons of water. After resuming hoisting, I had the engineer of the night shift (on which no pumping was done) keep tab of the wood used, and found we were hoisting 80 to 90 tons of muck and ore from the 300 and 400 levels with a trifle over half a cord of wood; showing that the little hoist was nearly twice as efficient a machine as the mine pump.

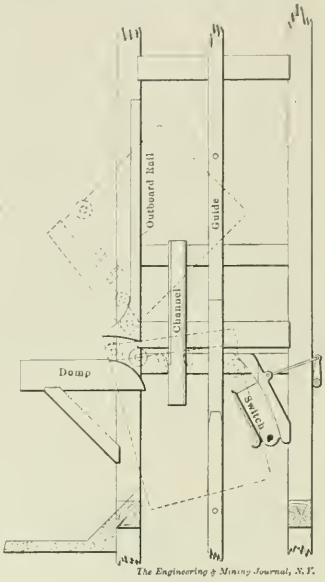


FIG. 2

A good hoisting engine, properly handled, has several advantages over a pump for lifting water. In the first place it has a small coefficient of internal friction. I have often noticed that the weight of a couple of men on one cage will start a (20-x 30-in.) first-motion balanced hoist when the brake is thrown off and the throttle is closed. As the cages alone weigh nearly two tons apiece, the friction loss must be very low. The engine, being close to the boilers, gets fairly dry steam. On the other hand, a pump has a big friction loss in the barrel, because the barrel gets scored more or less with even moderately dirty water, and the segments have to be screwed up tight against the packing to hold 10 or 15 ft. of vacuum. There is quite a loss in the long steam line both from pipe friction and condensation. In a long steam line with several elbows and other obstructions, the globules of condensed water also drag down the pressure of the steam, for every time they bunt into an elbow they nearly stop until again whipped up by the steam. Besides, there is a small per cent. of loss in the friction of the water column and more or less leakage through the valves.

In a mine depending on pumps to handle the water, one pump at least must

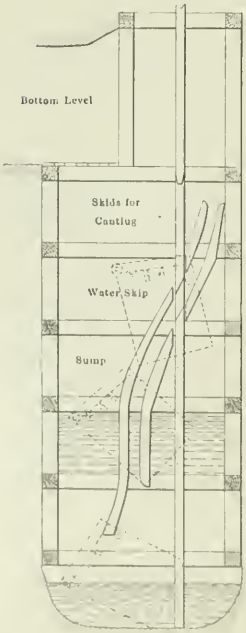


FIG. 3

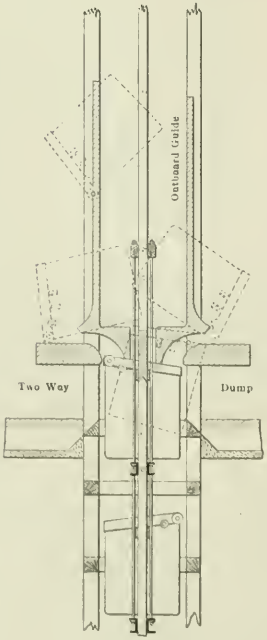


FIG. 4

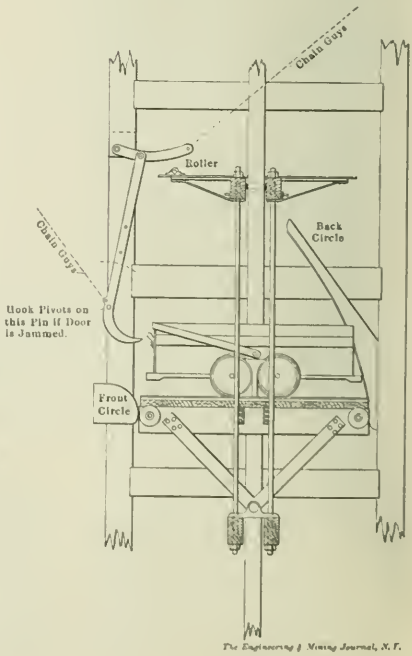


FIG. 5

always be kept in reserve, so that one of the others can be repacked and repaired.

If mine pumps are dispensed with, and the water raised with automatic bailers in connection with the regular ore and rock hoisting, there should be quite a reduction in the fuel used. The best feature of a water-hoisting plant, in my opinion, is that there need be no worry over flooding the mine should a big body of water be tapped or should the pumps be submerged by any accidental stoppage, such as the playing out of a boiler or a temporary interruption of the fuel supply. If the water temporarily gets the start of the water hoist, the engine can soon bring it down to the sump. Should the emergency arise, I am satisfied a good first-motion hoist with tandem bailers could pull water at a tremendous rate, because the skips will fill and dump almost in a second and as there is plenty of leeway on which to stop, the engine could be run at high speed.

I have occasionally timed engineers, who could pull a car of coal from the bottom and put it into the dump in from 9 to 11 sec., a distance of 250 to 275 ft., and there would be only about 12 in. to play on at the dump. I noted one hoist runner a few years ago who handled the engine almost entirely with the reverse lever when the coal was coming fast. At the tap of the bell he would throw it over and hook it on center before the cage shot into view above the ground level. As the tipple floor was 50 ft. above the ground the cage traveled on its own momentum possibly 60 or 70 ft. Of course the descending empty cage helped it along some, but even allowing for the velocity of the falling cage, the load must have been traveling at the rate of 40 ft. per sec. in the middle of the hoist.

In these shafts the guides did not vary ¼ in. from the perpendicular in their entire length. If the shaft is crooked or has a couple of short kinks in it, it would not be advisable to attempt high-speed water bailing. When a hoist is operated at a fairly high speed and handled mainly with the reverse, it is a very efficient machine. Wire drawing the steam with the throttle and chocking the engine off with the brake and stopping 15 or 20 sec. between winds, allowing the cylinder to cool off, cuts its efficiency down quite perceptibly.

Sampling Ores from the Cobalt District

A. A. Cole (*Can. Min. Inst.*, 1908) describes the sampling of the silver-cobalt ores from the Cobalt district, Ontario, as practised at Copper Cliff. The difficulty in sampling these ores is caused by the occurrence in them of large amounts of metallics composed of native silver or silver-arsenic alloys. The ore is usually shipped from the mines in bags and is weighed in drafts of 10 bags each as it is unloaded from the cars. The contents of the bags are dumped into a Buchanan jaw crusher and the bags weighed for taring purposes.

One small shovelful representing each sackful is taken of the crushed ore as a moisture sample. This moisture sample is coned and quartered to about 100 lb., and then crushed with a small Allis-Chalmers laboratory jaw crusher. Four samples of about 11 lb. each are then cut out and dried in a steam oven for about 20 hours at a temperature of about 80 deg. Centigrade.

All of the moisture sample is returned to the main portion and the whole passed through an Allis-Chalmers ball mill. In case the ore is wet it undergoes a preliminary drying on steam-drying plates before being fed to the ball mill. The balls in this mill are of hardened steel and have a weight of 1¾ tons. The ore is ground until it passes a 20-mesh screen, sieving tests showing that 50 per cent. will pass a 100-mesh screen and 80 per cent. a 50-mesh screen. The capacity of the mill is 1.5 tons per hour.

One-tenth of the ore as it is discharged from the ball mill is cut out by a 27-in. Snyder automatic sampler. The sampler is chain driven to prevent slipping and makes 25 r.p.m., giving 3000 cuts per hour for 1.5 tons of ore, or one cut for every pound of ore. The sample and rejected portion are weighed and this weight less the moisture is used in settlement. The original weight less moisture should check this latter weight and as a rule does. The moisture sample on the milled ore is obtained by taking a portion from each pailful of the sample by means of a tube sampler.

The main sample is mixed on the concrete floor of the sample room by shoveling it over twice. After coning and quartering once, the two halves obtained are treated as independent samples. Each of these samples undergoes the same treatment. They are first cut down by coning and quartering to about 100 lb. From this point the cutting down is done with a Jones sampler until two portions of about 20 lb. each are obtained. One of these portions is sealed up as a reserve sample and the other thoroughly dried and ground in a Sturtevant disk grinder until the fines pass through a 100-mesh screen, leaving the metallics bright and clean on the sieve. Sometimes an Abbé pebble mill and a Hance drug mill are used to assist in the grinding. The metallics and fines are weighed and sampled separately, the fines being first mixed by an hour's revolution in the pebble mill. The large metallics that remain in the large ball mill are removed at the end of the run, weighed and melted into bullion. The resulting bullion, slag and speiss are weighed and sampled, the slag and speiss being sampled together.

The time of sampling is three days for a 30-ton lot. The results should be accurate as the method is based on the best practice.

London's "Kafir Boom"

"The revival in Kafir shares," writes a Stock Exchange correspondent to the London *Economist*, "which has led to the present boom among nearly all the sections of the South African market, may be ascribed in part to the East Rand Proprietary Mines, Ltd. It is less than a year ago that the East Rand consolidated the six subsidiaries, Driefontein, Angelo, New Comet, Cason, Cinderella and New Blue Sky Companies, together with the H. F. Company, the Angelo Deep, the Hercules, part of the Driefontein Deep and various other claims and interests. This necessitated the increase of the capital to £2,500,000, of which £2,405,897 was issued, the total number of shareholders being something like 16,000 people.

"The amalgamation, pioneer of the many which have since become so popular, rather staggered the market, and the advantages claimed for it were by no means generally conceded. But the monthly output from the consolidated company left no room for doubts, at any rate, as to the immediate wisdom of the policy. The profits for each of the past four months, from January to April, have been returned at £101,064, £101,666, £103,892 and £104,289, a total of £410,911, or at the rate of £1,232,733 for the year, without taking into account progressive expansion, such as the character of the figures just quoted may justify.

"That such statistics have had a great effect in assisting in the production of the Kafir boom nobody will question. The successful carrying through of the East Rand amalgamation gave the signal for the launching of various other similar schemes, which have certainly played their part as factors in the market revival. The boom progresses, and the coming settlement will be one of the heaviest the Kafir market has been since the pre-peace days of January-June, 1902. The provinces have been large buyers, the Germans and the French even larger, and the Continental purchases are mostly lifted from the market—not carried over—thereby affording very material support.

"Members and their clerks declare they are worked to death. Small fortunes are amassed by jobbers in a week, although the dealers bewail that prices are so close nowadays that their former profits of 1905 have shrunk to sixty-fourths of what they were in that year of famed, if notorious, memory. Yet money can be lost quickly, even now. A dealer, making a shilling price to a broker in a couple of thousand shares in which there is a very free market, lost £400 over the transaction, the price moving against him before he had time to undo the bargain."

Coal Mining in Central West Virginia

A Brief Study of General Conditions, and Details of Operation at the Coalton Mine, Which Plant Is Typical of Mines of the Region

BY FLOYD W. PARSONS

During the recent midsummer session of the West Virginia Coal Mining Institute, held at Elkins, W. Va., the members present were afforded an opportunity to visit the Coalton plant of the Davis Colliery Company, situated on a branch of the Coal and Coke Railroad, a few miles south of Elkins. Although the general operation of this plant does not differ greatly from the general working of many other bituminous mines, the development here carried on is typical of conditions existing throughout this central district, so that a brief description of prevailing conditions and methods will not be out of place.

Because of the lack of adequate transportation and the general inaccessibility of the country, central West Virginia was the last portion of that State to undergo development. The presence of a thick seam of coal in the "Roaring creek" region was known before the Civil war. A block of coal from this district was exhibited at the Centennial in Philadelphia, in 1876. This last mentioned coal was hauled by wagons from a point located about two miles from the Coalton plant. The exact spot from which the block came, is, in fact, within a rod of the cabin in which General McClellan made his headquarters during the Rich Mountain battle. The coal exhibited at the Centennial was in two blocks, each 5 ft. thick, and many were incredulous that a seam of coal 10 ft. thick existed in the Roaring Creek region.

While the presence of this field was known to some and rumored among others, the country was inaccessible until the completion of the Belington branch of the West Virginia Central Railroad. At that time, Senator Henry G. Davis and his associates owned the West Virginia Central. The first commercial mine in the roaring Creek region was at Junior. This mine was started by H. G. Davis, Jr., being known as the Junior Coal Company, with 84 acres of coal land. The name, Junior Coal Company, was used until about six years ago, when the title was changed to the present one of Davis Colliery Company.

The Davis Colliery Company now owns more than 20,000 acres in the heart of

GENERAL VIEW OF 1800-TON STEEL SLACK BIN, INCLINED STRUCTURE FOR ROBINS BELT CONVEYER, AND CHAIN-HOIST LEADING TO TIPPLE AT THE COALTON MINE

the Roaring Creek field, as well as being the operating company for the holdings of the Coal and Coke Railway, which amounts to 100,000 acres.

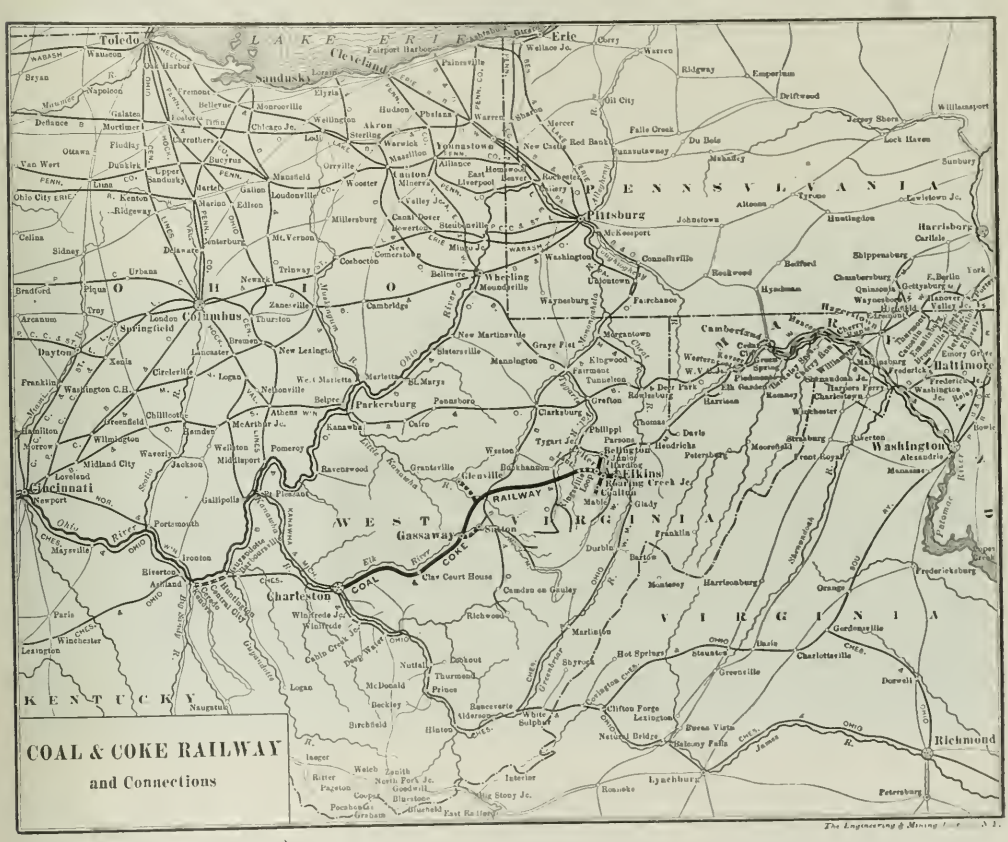
The Coal and Coke Railroad

The entire line of the Coal and Coke Railroad was completed and put in operation June 30, 1907. The road extends from Charleston to Leiter, a distance of 166 miles; and from Belington to Mabie, W. Va., 17.7 miles. The company was incorporated May 14, 1902, under the laws of West Virginia, and on Aug. 11, 1903, purchased the Charleston, Clendennin and Sutton Railroad, extending from Charleston to Otter, W. Va., 63.6 miles. The accompanying map shows the connections of the Coal and Coke Railroad, and the general location of the Elkins and Roaring creek field, with reference to Eastern, Northern and Western markets.

In reaching the Western market, the coal mined by the Davis Colliery Company is generally shipped to Charleston and proceeds from there west over the Chesapeake & Ohio railroad. The Eastern outlet is over the Western Maryland (formerly the West Virginia Central). Some coal is shipped to distant points over the Baltimore & Ohio Railway

In this connection, a brief history of the Western Maryland Railroad may be of interest. This road was incorporated by special act of the General Assembly of Maryland, May 27, 1852, under the name of Baltimore, Carroll & Frederick Railroad Company, which name was changed to Western Maryland Railroad Company in March, 1853. In 1902 the company acquired control of the West Virginia Central and Pittsburg Railroad Company, operating railroads and extensive coal properties in West Virginia.

The West Virginia Central retains the ownership of all its coal properties and mining operations, but its entire capital stock is owned by the Western Maryland Railroad Company. This latter company, therefore, owns or controls about 135,000 acres of coal land, 107,000 acres of which are located on the lines of its West Virginia division, and about 30,400 acres on the lines of the Baltimore & Ohio Railroad. On these lands there are some 26 mining plants and more than 1000 coke ovens; also administration buildings, department stores and more than 600 dwellings. The Davis Coal & Coke Company is the operating and sales agent for the Western Maryland coal properties. The amount of the authorized capital stock of the Western Maryland Company is $60,000,000. The preferred stock has been canceled.



SHOWING LOCATION OF ELKINS AND THE ROARING CREEK COALFIELD WITH REFERENCE TO EASTERN, WESTERN AND NORTHERN MARKETS

Character of the Coal

The coal seam that is being generally developed in the Roaring Creek region, is known as the Lower Kittanning. According to Dr. I. C. White, of the West Virginia Geological Survey, there is little doubt that this seam is identical with the Lower Kittanning bed of the Pennsylvania section. The coal mined at Coalton is typical of that produced in other parts of the district. An average analysis of a number of samples shows the following:

Moisture	0.70
Volatile matter	29.30
Fixed carbon	61.19
Ash	8.81
Total	100.00
Sulphur	1.48
Phosphorus	0.032
B.t.u.	13,850

An average analysis of the coke made at the Coalton ovens, after burning 48 hours, shows:

Moisture	0.11
Volatile matter	0.82
Fixed carbon	83.44
Ash	15.63
Total	100.00
Sulphur	1.13
Phosphorus	0.038

A. P. Brady, of the West Virginia Geological Survey, reports the following structure for the Lower Kittanning coal near Coalton:

	Ft.	In.	Ft.	In.
Coal	0	1		
Bone coal	0	2		
Coal	2	2		
Slate	0	1½	7	7½
Coal	3	4		
Slate	0	3		
Coal	1	6		

The butts run south 80 deg. east; faces, south 10 deg. west, and the greatest rise of the seam in this district is south 30 deg. east.

Production of a Clean Coal

The great problem at the Coalton mine as well as at other plants in central West Virginia is to produce a fuel having a small ash content. Thousands of dollars have been spent in experimenting with this end in view. This does not mean that the coal here mined is inferior in quality; on the other hand, if the coal here developed were located in certain Western States, it would be considered an unusually valuable fuel; however, having to compete with such coals as those produced in the New River and Pocahontas fields, the operators who mine the Kittanning and Freeport seams in central West Virginia have a task that is not easy. Coal washeries are not as generally used in northern and central West Virginia as the nature of the coal here mined justifies. Two causes are responsible for this condition: First, the fuel produced answers very well, without washing, for the specific purposes to which it is put; second, there is an excessive productive capacity causing fierce competition which has placed the industry on a basis where only unavoidable expenditures are possible.

Conditions that have existed in southern West Virginia are largely responsible for the present depressed state of the coal trade and its slow recovery. In this latter district a quality of coal unsurpassed anywhere in the world lies practically at tipple hight, and is mined at a minimum cost. However, from the very beginning, the operators in southern West Virginia have been practically unorganized and have fought bitterly for the business of all accessible markets. The coveted trade has been practically controlled by the large consolidated interests in older fields, and the aggression of the small independent operators in southern West Virginia has been hotly contested. As a consequence while wages and the price of commodities in general have advanced during a period of years, the price of coal has either remained stationary, or been held at a level that not only prevents any preparation, such as washing and picking, but also has caused operators to mine their coal in the quickest and most reckless manner.

The severe depression in business that we have just passed through has taught a lesson that will not be forgotten immediately, and it is to be hoped that one result will be a better organized coal industry, with prices raised to a basis that will net operators a fair return on their investment, thus permitting the adoption of sensible and efficient mining methods, and making possible the introduction of such safety precautions as have been proved of practical benefit.

West Virginia, with a productive coal area of nearly 16,000 sq.m., and an estimated coal supply of more than 60,000,000,000 tons receives a return in net profit that is ridiculously small when compared with the value of her rich heritage. Large coal companies in this State have recently made long contracts to deliver coal at their mines for 60c. per ton. With an actual labor cost approximating 45c. per ton, it is not hard to figure where the coal operator is going to get off.

Mining men in the United States are now evincing an interest in the methods used abroad and the equipment of European mines, and some have gone so far as to suggest that American mines could be made to compare favorably with those in Europe, however, such plans cannot be consummated here while present conditions exist. Tiled floors and stained-glass windows in the power house of a Continental colliery are possible with coal at $2.30 per ton, but not possible in the

VIEW OF COMPANY HOUSES AT THE COALTON MINE OF THE DAVIS COLLIERY COMPANY. THESE HOUSES RENT AT $6 TO $9 PER MONTH

United States with our product selling at the mines for 70 or 80c. per ton.

The Coalton plant of the Davis Colliery Company is one of the best equipped porperties in central West Virginia. This mine was purchased by the present owners from other interests who knew the property as the Wormelsdorf plant. The early owners did not develop the mine in a systematic manner, and, as a consequence, the left side of the underground workings was subjected to a number of squeezes which resulted in the loss of considerable coal.

Surface Equipment at Coalton

The Davis Company has provided 102 houses for its Coalton employees. These houses are of the five- and six-room variety; 78 are ceiled, and 24 plastered. A few of the plastered houses are built of brick. The rents vary from $6 for a five-room wooden-ceiled house to $9 for a six-room plastered brick house. The general design of these buildings may be noted in the accompanying illustration. The company's department store is of the usual type common to coal mines. Scrip is issued and is accepted as cash for all purchases.

A Unique and Simple Arrangement

The mine barn is a substantial and commodious structure, far better than the average mine stable. The most unique feature in connection with the barn is a simple arrangement for mechanical feeding. The grain and hay are kept in bins on the second floor; on this upper floor and directly over the feed box of each stall is a bucket-shaped metal vessel having a horizontal-slide bottom. The bottom of each of the feed buckets is connected to a cable running on pulleys in such a way that the slide bottom remains open when no mechanical force is exerted. The stableman can close all of the boxes by pulling down on the cable which runs over a pulley and hangs down alongside a post. A ring is attached to the end of the cable, and when the latter is pulled down a sufficient distance to close the bottoms of the feed buckets, a long steel pin is extended through the ring on the cable, and the end of the pin, which is pointed and straight, is placed underneath a nail driven in the side of the post.

Directly alongside this same post and on a shelf at about the same elevation as the nail which catches the pin and holds down the cable, an ordinary alarm clock is placed. The other end of the pin, that holds down the cable, is fastened to the key that is used to wind the alarm on the back of the clock. This alarm can be set for any specified time, so that at the desired moment the alarm starts to ring, the key on the back of the clock revolves, the pin is pulled away from contact with the nail in the post, thus releasing the cable and allowing the bottoms of the feed buckets to slide open, dropping the grain into the manger in the stall below. This simple arrangement enables the stableman to set his alarm for any hour, then fill his feed buckets and leave the stable, feeling sure that at the proper time the feed will be dropped to the animals in the stalls below. It is stated that the moment the alarm rings, all of the mules quickly step back, knowing that the feed is going to drop from above.

The Coke Ovens

At the Coalton plant there are 200 ovens, arranged in two blocks of 100 each. These ovens are of the ordinary beehive type, with the floor in the ovens falling to the front on a slope of 7 in. in 12 ft. The bottoms of the ovens formerly were built with an incline to the front of 5 in., but this slope was found insufficient to insure a quick drainage of the water used for cooling the coke. The net tonnage of each oven is about 3.8, while the coke output averages 73 per cent. Everything that goes through a 1¼-in. screen is crushed by a Williams hammer crusher, and is used in the manufacture of coke. The Williams crusher has given excellent service. This machine takes anything up to 1½ in. in diameter, and although small pieces of steel go through almost every day, the crusher has not been disarranged or broken.

GENERAL VIEW OF COKE OVENS AT THE COALTON MINE, ALSO SHOWING THE STEEL SLACK BIN, TIPPLE AND POWER HOUSE DURING CONSTRUCTION

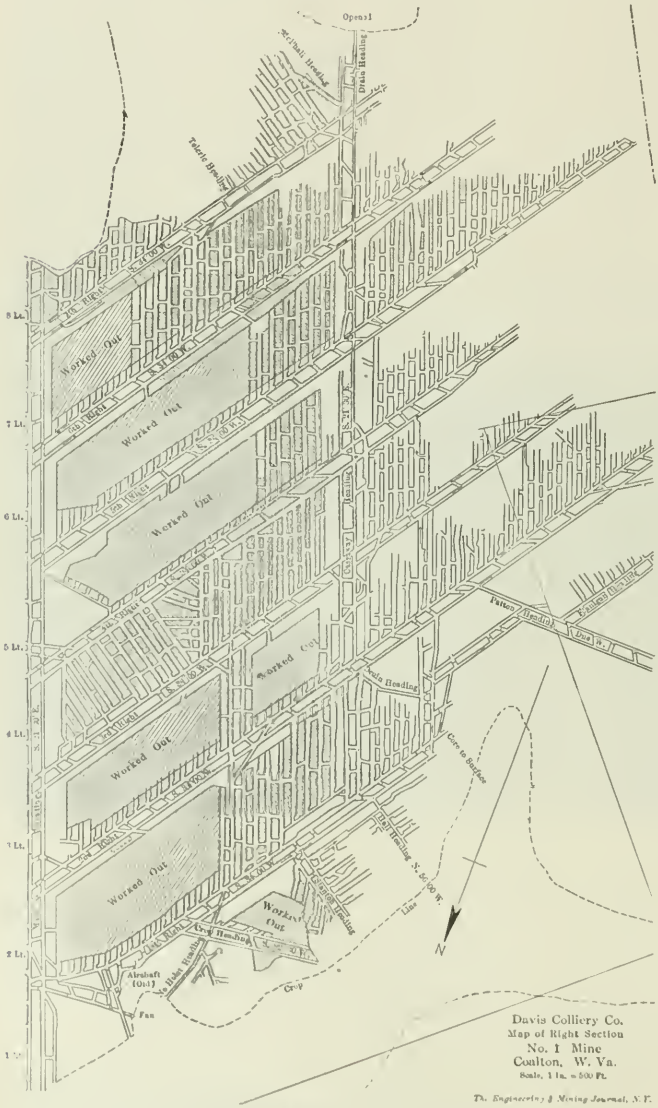
The Steel Bin

The most interesting feature at the Coalton plant is the 1800-ton steel bin that was manufactured and installed by the Fairmont Mining Machinery Company. This bin is made entirely of steel and is shown in the accompanying illustration. The bin feeds into a 7-ton electric larry which supplies the ovens located nearby.

The underground development carried on by the Davis Colliery Company, at this mine, has been carefully planned and well executed, as is shown by the accompany-

ing mine map. All entries and rooms are driven on centers, so that an effort has been made to leave uniform pillars, and thus prevent a loss of coal through the occurrence of any unnecessary squeezes.

The average thickness of the seam is reported by the superintendent as 10 ft.; in some places, the coal shows a thickness of 14 ft.; as a general rule, only about 7 ft. of the seam is mined. The nature of the coal is such that up to the present time, all mining has been done by pick, and no machines used. It is probable that in the near future experiments will be made to see whether machines cannot be successfully introduced. Electric underground haulage is used and two General Electric, 7½-ton locomotives and one 13-ton locomotive of the same make, are employed. On the main entry 60-lb. rails are used, while 40-lb. steel is placed on cross entries. A current of 500 volts is carried in the mines. Such a voltage in some districts would be considered dangerous but it is common in many West Virginia coal mines. No serious accidents have happened from shock.



AN EFFORT IS MADE TO ROB PILLARS IMMEDIATELY, SO THAT PRACTICALLY ALL THE COAL IS SECURED ON THE ADVANCE

Mining Methods

The underground problems that have so far been encounterd are simple in the extreme. The mine is fairly damp and non-gaseous, so that the constant problem of eliminating dust and gas explosions is not the uppermost question. Notwithstanding the fact, however, that such safety prevails, the ventilation is carefully conducted and is said to be ample at all times. A 20-ft. Robinson fan provides the air circulation at present. This ventilator is 8 ft. wide, and is steam-driven, running at 60 r.p.m. This same fan was formerly driven at 100 r.p.m., and delivered no more air at the face than it does at present. The improved conditions that now exist resulted from the management having had all inside stoppings carefully looked after and repaired. These stoppings are now built 5 to 8 in. thick, and are made of a material, composed of 20 per cent. cement and 80 per cent. coke cinders.

The dip of the seam is such that all drainage is natural and is accomplished by a network of ditches. The rooms are driven on about 50-ft. centers, and are 20 to 28 ft. wide. The entries are protected by small barrier pillars; these latter are not as large as is usually the case in a coal of this character and they are not kept intact, as is shown on the accompanying map.

The prevailing method is to take the pillars back immediately, drawing them on an angle of about 45 deg., and the general scheme at Coalton is to secure as high a percentage of extraction as is possible on the advance, rather than to develop the mine and extract the pillars retreating. Although in a majority of cases this plan is ill-advised and results in a final loss of coal, conditions here are somewhat different, and it must be remembered that only about two-thirds of the seam is mined, which provides a coal roof of considerable strength.

Preparation of the Coal

After the coal is mined and hauled to the room partings by mules, it is then made up into trips and hauled by motors to the foot of the slope near the mouth of the mine. The cars are here dropped, one by one, to a swag at the bottom of the incline, where each car is engaged by a dog on the chain-haul which hoists the coal to the tipple floor above; from here each car runs by gravity to the Phillips cross-over dump where the coal is shot onto the screens, and the empty car runs by gravity through a spring-latch switch and is lowered back into the mine.

The mechanical hoist that raises the cars from the mine to the tipple was also built by the Fairmont Mining Machinery Company, and has given good service.

The dogs on the chain are arranged at 16-ft. centers; the car hoist is 70 ft. long, with a 21-ft. lift. The hoist is driven by a General Electric 30-h.p. motor.

After the coal is dumped onto the screen, all sizes greater than 1¼ in. go over other screens and the coal is further separated into nut, lump, etc., or the entire product is shot into the railroad cars without any additional screening, and is then sold as screened run-of-mine. As before stated, the undersize (all under 1¼ in.) goes to the Williams crusher and is pulverized. This fine product is then elevated on a belt conveyer (the housing and incline of which are shown in the illustration) to the top of the 1800-ton steel slack bin. This belt conveyer carries the slack satisfactorily, but is too steep to carry nut coal. The belt conveyer here used is of the Robins type, 360 ft. long, with a lift of about 130 ft. A 60-h.p General Electric motor drives this conveyer.

COAL TIPPLE AT THE HARDING MINE OF THE DAVIS COLLIERY COMPANY. A STYLE OF DESIGN COMMON TO WEST VIRGINIA

The design and erection of the steel tipple at the Coalton mine was also executed by the Fairmont Mining Machinery Company. The arrangement of the shaker screens does not differ materially from the general run of tipple installations. The screens are driven by a 30-h.p. General Electric motor.

The miners at this and other plants in the district are principally foreigners, and, as in other West Virginia fields, they are unorganized. Wages in Central West Virginia do not differ materially from those paid in other parts of the State. A miner receives 80c. for a 2-ton car, which is practically the same as that paid in the Fairmount region.

All members of the West Virginia Coal Mining Institute who visited the Coalton plant are greatly indebted to C. S. Robb, general manager of the Davis Colliery Company; J. F. Healy, general superintendent, and F. C. Cornet, chief engineer.

There are few engineers at present who contend that direct-current is as safe as three-phase current in gassy mines.

Aluminum in Japan

W. T. Preston, Canadian trade commissioner in Japan, reports to the Canadian Department of Trade and Commerce that though an aluminum factory was started in Osaka recently, practically all the aluminum used in Japan comes from foreign countries. The importation of aluminum has increased from 83,879 lb., valued at 36,703 yen in 1901 to 2,445,403 lb., valued at 1,803,217 yen in 1907. Ten years ago the demand for this metal was quite limited, the sudden increase being caused by the adoption of military equipment made from aluminum, by the army authorities seven years ago, followed by its use for cooking utensils. If the cost of material continues to be as moderate as at present the prospects are favorable for a great expansion in the manufacture. An active demand for aluminum ware exists in China, and large orders have been received for soldiers' conveniences for the Chinese army.

The duty on sheets and manufactured wares being high as compared with the duty on slabs and ingots, it is more profitable to manufacture sheets and wire in Japan from the imported raw material. There are many small manufacturing establishments now engaged in turning out sheets and wire, as well as a couple of large factories in Osaka engaged solely in manufacturing aluminum wire. Under these circumstances it may safely be said that the demand for ingot aluminum will increase, while the importation of sheets and wire will undoubtedly decrease. The ingot must be composed of aluminum 98.5 cent. pure. The imports of aluminum under the heading of ingots, slabs and blocks in the customs statistics for 1907 show that Belgium headed the list with 511,469 lb., valued at 387,659 yen ($193,829), closely followed by Germany with 502,1[illegible]8 lb., valued at 348,984 yen ($174,[illegible]92); the third being Great Britain with 233,276 lb., valued at 167,251 yen ($83,625). Canadian exports of aluminum in bars, blocks, etc., for the fiscal year 1907, amounted to 4,981,000 lb., valued at $1,048,533. Mr. Preston points out that the largest customers for the Canadian output —Belgium and Great Britain—are extensive sellers to Japan, and that there is a wide difference between the prices at which Canada sold and those which Japan paid. The export price from Canada in 1907 was $18.79 per 100 lb. The cost of aluminum imported into Japan the same year was $39.57 per 100 lb., the difference of $15.78 per 100 lb. being too large to be swallowed up in freight and other importation charges.

The Namaqua Copper Company

The report of this South African company for 1908 states that operations were conducted without profit to the shareholders owing to the low price of copper ruling throughout the year. In previous years the company has paid good dividends, having distributed as much as 40 per cent. on the capital in 1899.

During 1908 there were 46,200 tons of ore from the mines and dumps dealt with, producing 2335 tons of fine copper, against 42,400 tons of ore in 1907 producing 2432 tons fine copper. The reserves of ore in the mines and at surface are estimated at 115,204 tons, carrying 7985 tons of fine copper. There is also a reserve of slimes and tailings suitable for retreatment estimated at 84,729 tons, value not stated.

The two furnaces at the smelting works were kept in regular operation except during November and December, when the wreck of a coke ship caused a shortage of coke and the furnaces had to be shut down.

All fines from the ore, as well as concentrates, slimes and a portion of old jig tailings, are now briquetted and a much larger portion of this class of material has been charged in this form, whereby a reduction in loss by dust is secured.

The Elmore vacuum oil plant was in operation up to June 27, when it was shut down, the results obtained not warranting the running of the plant under the conditions then prevailing. The quantities treated by this process were 1630 tons of 2.81 per cent. copper, which produced 83.5 tons of concentrates containing 31.71 per cent. The extraction, therefore, was slightly over 57 per cent.

In the Tweefontein mine No. 1 shaft was deepened 233 ft. to a total depth of 1140 ft. No. 2 shaft was deepened 114 ft. to a total depth of 750 ft., with more encouraging results than in No. 1. Development work and stoping were also carried on in the Wheal Julia mine. Work in the new Prospect mine was closed down at the end of March, as reduced price of copper made it inadvisable to continue working on the narrow lode and low-grade ore that were met

Colliery Notes

One volume of firedamp is sufficient to reduce the whole of the oxygen present in nine volumes of air to carbon dioxide and water, and less than 6 per cent. will propagate a flame.

Power gas is produced by passing quantities of air and steam through incandescent fuel. This gas consists largely of carbon monoxide and is used for power and heating purposes.

It should be remembered that it requires no more than 3 grams of coal dust per cubic foot of air to give the requisite quantity of carbon to reduce the whole of the oxygen present to carbon monoxide, or a proportion by weight of 1 of dust to 13 of air.

Coke that is to be used for the manufacture of iron or for other metallurgical purposes, should be firm, tough and light, and should have not more than 1 per cent. of sulphur. For blast-furnace purposes, dense coke is not so good as those varieties possessing large cell structure and hard cell walls.

At one colliery where it was decided to experiment with water, as a means for preventing dust explosions, a large spray was thrown right across the roadway. The officials expected that this spray would dampen the air sufficiently to insure the dust being laid for a considerable distance. They were surprised, however, to find that the effect of the spraying was lost after the air had traveled 1500 feet.

Coal gas, such as is manufactured and used in various towns and cities for lighting purposes, is produced by the distillation of coal out of contact with the air. This gas is composed of the following elements or compounds, in about the proportion named: Carburetted hydrogen, 40 per cent.; hydrogen, 30 to 35 per cent.; carbon monoxide, 6 to 8 per cent.; carbon dioxide, 3 to 4 per cent.; oxygen, 3 to 5 per cent.; nitrogen, 7 to 8 per cent.

It was formerly the general opinion that the dust lifted by the ventilation and lodged on the bars and other ledges in a mine was the most readily combustible and dangerous; however, more recent observations have shown by analysis that the dust lodged on the higher ledges, near the roof, generally contains a much greater proportion of ash, as compared with that either from the screens or from the roadways, and less volatile combustible matter.

According to a bulletin, recently issued by the United States Office of Public Roads, the application of calcium-chloride solution to a macadamized road near Washington resulted satisfactorily in laying the dust. Of the commercial salt, 600 lb. were used, dissolved in water in the proportion of 1 lb. to 1 gal. of water. The solution was applied five times during the summer over 1582 sq.yd., at a total cost for the season of about 2c. per sq.yd. The bulletin states that although much traversed by motor cars, the treated roadway was kept free from dust and became smooth and compact.

It is estimated that a cubic foot of certain varieties of bituminous coal yields: 7 cu.ft. of gas (occluded); 350 cu.ft. of coal gas (on distillation); 54 lb. of coke. The total volatile matter in a cubic foot of coal is estimated to weigh 26 lb.; in this latter estimate, the coal gas is figured at 10 lb. If steam and air are passed over the 54 lb. of coke in a producer-gas retort, the result is to generate 4122 cu.ft. of producer gas. It is further estimated that one ton of coke, 90 per cent. carbon, yields 171,000 cu.ft. of producer gas. Acetylene gas is made by fusing the coke with lime in an electric furnace. By this means calcium carbide (CaC_2) is formed.

There has been considerable discussion concerning the relative merits of salt, as compared with calcium chloride for the treatment of dust on the roadways and chambers of coal mines. Salt of itself has not the power of attracting moisture, but owes what little power it does possess to a small amount of impurity which it contains in the form of magnesium chloride; what little moisture salt does attract is again yielded up at a very few degrees rise in temperature above the normal. On the other hand, calcium chloride retains its moisture at temperatures considerably above 350 deg. F., as this temperature is much exceeded in its manufacture. It holds moisture most tenaciously, even at the above temperature.

Coal is a compound, but a very complicated one; in fact, each variety of coal is really a different compound. Every variety of coal should be regarded as the combination of a number of elements and compounds existing in different proportions, some of them being present always, and some only occasionally. When coal burns, most of the elements combine to form a compound with the oxygen in the air and are given off in gaseous form. Those which do not combine with oxygen, or which form a solid compound, remain behind as ash. In the combustion of coal the oxygen of the air alone enters into combination with it, and so far as is known, the nitrogen of the air has little or no effect on the composition of the products of combustion.

It has already been stated in these notes that calcium chloride (especially when used in the form of a finely ground powder) does not affect the roof of coal mines in such a deleterious manner as does water. It may be further stated in this connection that the action of calcium-chloride liquor upon iron and steel is not one-third so vigorous as the rusting action of plain water. Henry Hall, of England, who is an authority on this subject, recently stated that iron exposed alternately to dampness and air rusts far more quickly than iron exposed to calcium-chloride liquor and air alternately. He says: "This is confirmed by the fact that the bogie rails in the calcium-chloride manufactory, where they are saturated with the article, are as good as new; but in one or two places where water has dropped on them, they are rusting badly and show signs of great wear."

In some mines where an explosion has been largely due to dry coal dust, the investigators have been puzzled because there were no evidences of coked dust on props and on the sides of the entries. Professor Galloway recently stated that this absence of coked-coal dust in certain parts of the workings through which the explosion must necessarily have traveled, was due to the impure nature of the coal dust contained in them; that the dust contained a sufficient proportion of shale-dust to prevent it from forming a coherent coke, or adhering to the timbers and other objects against which it was thrown in a molten condition during the passage of the explosion. In discussing this same problem, Victor Watteyne, inspector general of mines in Belgium, suggested that this absence of coked-coal dust was due to the much higher velocity of the explosion in those parts of the workings, rather than to the impurity of the dust.

In drawing conclusions as to the cause and action of coal mine explosions, the average investigator in this country often ignores well known principles that have been proved beyond doubt. Two European authorities on coal-mine explosions, after carrying on examinations at several collieries where disastrous explosions had occurred, gave the following closely-reasoned analysis of the phenomena observed:

1. In several instances it was found that there was an entire absence of any evidence of the presence of firedamp immediately prior to the occurrence.

2. That the parts of the mine, such as main intake, where it is hardly possible for gas to lodge, are often the scene of the greatest destruction.

3. That the blast sweeps along in a particular direction and leaves other roadways unaffected, whereas the sudden explosion of an accumulation of firedamp and air might be expected to follow the line of least resistance.

4. That the last working-places of a district, and the returns, which, as is well known, are liable to be contaminated with firedamp, hardly ever appear to have played any part in the explosion.

5. That at or near the point of initiation of an explosion, violent effects are seldom found, and everything suggests a gradual increase of force, fed by some agent as the blast travels along and rapidly develops a tornado rushing to the extreme limits of the workings.

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*Illustrated.

The Consumption of Lead in 1908

The matter of estimating the consumption of lead in the United States in 1908 is one that we approach with some diffidence owing to the absence of complete, or even fairly complete, data as to the stock in first hands at the beginning and end of the year. In this respect the lead industry is highly deficient as compared with copper and spelter. The reason is obvious. The marketing of lead is so largely in the hands of a single company that it is disinclined to communicate information as to its accumulation of metal even at a late date.

We estimated the stock on Dec. 31, 1907, at 50,000 tons, on the basis of partial reports and some other information. Adding stock, production of refined lead, and imports of refined, and deducting stock and exports, the deliveries in 1907 were computed at 330,738 tons, and the latter figure was taken to be also the consumption. We had reports from domestic manufacturers accounting for 294,029 tons. The same manufacturers in 1908 reported 257,759 tons, indicating a consumption of 87½ per cent. of the amount in 1907. If, then, the total consumption in 1907 was 330,738 tons, the total in 1908 was probably about 290,000 tons. This would imply a total accumulation of about 94,000 tons.

The refiners probably had no such stock as 94,000 tons, sold and unsold, in their hands at the end of 1908. However, their aggregate accumulation was clearly larger than what has been commonly believed, and we are inclined to estimate it at 75,000 tons, leaving about 20,000 tons to be accounted for in second hands, including manufacturers, some of whom are known to have been in an overbought condition during the year. The statistical position of lead was consequently analogous to that of spelter, which we have previously described. We have summarized the data in the following tables:

DELIVERY OF LEAD.
(IN TONS OF 2000 LB.)

	1907.	1908.
Production desilverized	289,399	269,642
Production Missouri lead	127,133	131,117
Production antimonial lead	9,614	13,109
Imports of refined lead	9,277	2,759
Stock, domestic, Jan. 1	4,000	50,000
Foreign in bond, Jan. 1	5,691	12,897
Total supply	445,114	479,524
Re-exports of foreign lead	51,424	76,328
Exports of domestic lead	55	nil
Stock, domestic Dec 31	50,000	75,000
Foreign in bond, Dec. 31	12,897	18,462
	114,376	169,790
Delivery	330,738	309,734

CONSUMPTION OF LEAD.
(IN TONS OF 2000 LB.)

Purpose.	1907.	1908.
White lead and oxides	115,000	117,500
Pipe	41,000	33,800
Sheet	21,500	16,400
Shot	28,000	31,600
Other purposes	125,238	90,700
Totals	330,738	290,000

PERCENTAGES OF CONSUMPTION.

	1917.	1908.
White lead and oxides	34.8%	40.5%
Pipe	12.4	11.6
Sheet	6.5	5.7
Shot	8.5	10.9
Other purposes	37.9	31.3
Totals	100.0	100.0

The above figures are deficient through their omission to take into account the production of lead from scrap and junk. In 1907, according to the U. S. Geological Survey, this amounted to 9990 tons. In 1908, according to our figures, the amount was 14,323 tons. Probably there was no actual increase, the larger figure for 1908 being attributable to a more complete statistical enumeration. The actual consumption was by so much greater in each year.

Terminating the Life of a Company with the Mine

It is a common practice among English mining companies—though not as usual in this country—to accumulate a surplus, as the mine approaches exhaustion, for the purpose of purchasing a new property. Sometimes the property acquired is situated in the vicinity or in the same district as the mine which is at the end of its life, but several instances could be given of companies that have gone further afield and have embarked in new mining ventures in other parts of the world. When the new property is situated in the same district, there is a good deal to be said for the adoption of this policy. The experience and knowledge that have been acquired should go far to make the selection of new ground a wise one, and there is the advantage of having an organized staff for the new undertaking, fully acquainted with the local conditions.

When, however, a mining company looks for a new mine outside its own district, it is not so easy to defend this policy. Those who invest their money in a mine do so in the expectation that the mine will be worked to the best advantage and that the profits will be distributed to them and not risked in new ventures. It may be assumed that in buy-

ing shares in any mine for investment they have done so because they believe in that particular property, or in that district, or perhaps in the mineral that is being won. If they had known that their investment were to be changed at the will of the directors and that the profits earned were not to be fully distributed, but were to be re invested in some other mine of which they had no knowledge and in which they take no special interest, it is probable that they would not have invested at all. This, of course applies to persons who buy a stock for investment, not to those who buy because they hope to sell at an advance, and who look at the stock exchange, not the mine.

The powers of directors are, of course, regulated by the articles of association and shareholders could, if they wished, prevent their directors from speculating in this way. But, as a rule, the average shareholder knows nothing about the articles of association, which are usually drawn up in such a way as to give the directors power to acquire fresh interests without consulting the shareholders. If the sanction of the majority of the shareholders is obtained at a general meeting, nothing more can be said, but without that sanction it does not seem justifiable for directors, although protected by articles of association, to take upon themselves the responsibility of withholding the profits of the shareholders and investing them in some new undertaking. The adoption of this policy is also open to the objection that the directors and other officials are interested in the continuation of the company and, therefore, cannot help being biassed in favor of the acquisition of new ground.

A recent instance of a company that is embarking in fresh fields is the Oroya-Brownhill of Western Australia. According to the report for the year 1908, the mines of this company are approaching exhaustion. Every effort appears to have been made to acquire extensions in the vicinity of the present mines and it is hoped in this way to continue profitable operations for some years to come But to safeguard the existence of the company, the policy of acquiring a new mine, in whatever quarter of the globe it might be found, has been adopted. After examining a number of mines in different parts of the world the directors have acquired La Leonesa mine in Nicaragua, as well as an option on the Babilonia mine in La Libertad district in the same country. Both of these properties have been favorably reported on by C. S. Herzig. In this case it is important to point out—having regard to what has been said above—that the policy of going into fresh fields was explained to the shareholders at the annual general meeting held a year ago and met with formal acceptance. Against their particular action, of course, nothing is to be said.

From the information given by the chairman at the general meeting, held in London recently, it appears that it is no easy matter to find a promising property at a reasonable price. The directors have perused and considered the reports on 60 properties in the Malay States, on 65 in Western Australia, on 22 in Burma and on 125 in other countries. H. C. Hoover, one of the directors, also gave some interesting information as to the difficulty of finding a good mine; which, however, was not due to any scarcity of mines for sale in London. No less than 680 mining properties were offered; of these about 400 were turned down at once, 150 were rejected after some negotiation, 130 were looked into on the ground to some extent, 20 had been exhaustively examined, one had been purchased and three taken under working options. Such statistics as these are creditable to the managers of the company, since they show that care has been exercised in selecting a property. They also indicate the risk that a company runs, which is not advised by cautious and competent engineers.

Mining Stocks as Investments

There has been much interest of late over the listing of some of the stock of the Steel Corporation on the Paris Bourse. The purpose of this listing is, of course, to effect a distribution of this security among French investors, whose accumulations are very attractive to financiers. We are not going to take up the special matter of the listing of steel, but refer to it in order to point out the favorable attitude of French investors, whose caution is well known, toward mining and industrial enterprises. The Bourse at Paris differs from the stock exchanges at New York and London by being to a large extent a national affair, over which the minister of finance has much control. The favorite security upon the Bourse for a long time has been a copper-mining company, the Rio Tinto. After this, the interest of French investors is now centering in the stocks of the Rand gold-mining companies, in the distribution of which great houses are engaged.

The prominent position of these mining stocks in Paris is widely different from that of similar securities in the United States, where trading in them is largely relegated to the unregulated "Curb market," and even the best are regarded askance by the banks. Yet there are very few forms of property that are so secure as the shares in mining companies that have 10 to 20 years' supply of ore developed ahead. The purchase of a share in such an ore reserve is more analogous to the purchase of real estate than anything else. It is property that actually exists. Unfortunately the number of mining companies that can make such showing is limited.

The thing that has brought most discredit upon mining investments is the impressible vaporing of the "get-rich-quick" men. How best to curb them has long been the attention of many students. The most practicable plan was suggested by Governor Hughes' commission on speculation, which said: "A large part of the discredit in the public mind attaching to 'Wall Street' is due to frauds perpetrated on the small investor throughout the country in the sale of worthless securities by means of alluring circulars and advertisements in the newspapers. To the success of such swindling enterprises a portion of the press contributes. Papers which honestly try to distinguish between swindling advertisements and others may not in every instance succeed in doing so; but readiness to accept advertisements which are obviously traps for the unwary is evidence of a moral delinquency which should draw out the severest public condemnation. So far as the press in the large cities is concerned, the correction of the evil lies, in some measure, in the hands of the reputable bankers and brokers who, by refusing their advertising patronage to newspapers notoriously guilty in this respect, could compel them to mend their ways and at the same time prevent fraudulent schemes from deriving an appearance of merit by association with reputable names." This is precisely what the JOURNAL has previously urged.

The Ooregum Gold Mine

SPECIAL CORRESPONDENCE

The report of the Ooregum company, operating in the Kolar goldfield in India, for the year 1908 shows a record output of gold, the value being £329,317, derived from 121,886 tons, equal to a value per ton of 5s. The mine has now been a gold producer for 20 years, the total gold won amounting in value to £4,866,656. Judging from the favorable report of the directors recently issued, the mine promises to continue its prosperous career, the outlook for the present year being more encouraging than it has been for some years past.

The main vertical shaft, Bullen's shaft, has been sunk to a vertical depth of 3210 ft. The intersection in this shaft of the principal reef, assaying over 1 oz. gold to the ton at 3141 ft. from surface, is an important feature, as it proves the existence of good ore in this reef 200 ft. below the present bottom level of the mine. The ore reserves, estimated at 154,281 tons, for which no value is given, are none too large for a mine of this size, being equivalent to little more than a year's run of the present mill.

Besides the ore reserves in the mine, there is an asset of 80,000 tons of tailings, slimes and concentrates available for treatment. The working costs of the past year amounted to £165,974, classified as follows:

	£	Per Ton Milled.
Administration	£5,768	$0.240
Mining cost	112,036	4.416
Milling cost	13,462	0.528
Tailings cyanide treatment	8,804	0.336
General	25,904	1.008
Total	£165,974	$6.528

As is customary with the Indian mines under the control of John Taylor & Sons the whole of the capital expenditure for the year is charged against profits. Including amounts for depreciation of buildings and machinery the sum deducted from profits in this way was £53,465. In spite of this large deduction it was possible to pay dividends during the year 1908 at the rate of 32½ per cent. on the preference shares and 22½ per cent. on the ordinary shares; dividends which the shareholders will no doubt consider satisfactory, although the rate has been exceeded in former years.

The mine superintendent's report contains a large amount of detail as regards the underground development, most of which, however, must be of interest and intelligible to few. The report would be improved if the working costs were shown on a tonnage basis and if the ton used were that of 2000 lb., as recommended by the Institution of Mining and Metallurgy, instead of 2240 lb. The change from the long ton to the short ton might make some confusion in the statistics of the mine, but this difficulty might be overcome by having the figures worked out side by side on both standards. The metallurgical department seems a little behind the times, the plant for treating slimes being still in an experimental stage. The sands plant treated 108,869 tons of an average assay of 2 dwt. 19 grains; the recovery was 1 dwt. 21.5 grains or 68.5 per cent.

Although there was only one case of plague during the year the labor supply was interfered with by a mysterious sickness, much resembling cholera, from which there were 44 deaths. The disappearance of plague is attributed to the destruction of rats and mice, of which 17,328 were destroyed on the company's property.

The Distribution of Transvaal Gold

SPECIAL CORRESPONDENCE

In the JOURNAL of May 15 there was a notice of a paper by Dr. T. Kirke Rose, written for the Chemical, Metallurgical and Mining Society of South Africa, in which the distribution of the gold produced on the Rand was discussed. In the April number of that Society's JOURNAL, Dr. Rose publishes some correction in the figures originally given. His figures for the imports of gold bullion into the United Kingdom did not account for the gold contained in imported ore, which for the five years 1903 to 1907 amounted in value to £4,137,334. The gold is extracted and converted into bullion in England, and must be counted as part of the available supplies. The revised figures for the total amount of bullion (apart from coin, old material, imported gold-leaf, imported watch cases, etc.) used in the industrial arts in the United Kingdom in the years 1903-1907 are £8,400,000 or £1,680,000 per annum. Hence about 5.4 per cent. of the Rand gold was used in the industries in these years and 30 per cent. for coinage, instead of 4.2 and 31.3 per cent. as given in the original paper.

Copper in Russia

SPECIAL CORRESPONDENCE

A report from the French Ministry at St. Petersburg, published in the *Moniteur Official du Commerce* in Paris, gives a statement of copper production in Russia. The output by districts for two years past is given below, the Russian measures being reduced to pounds:

	1907.	1908.	Changes.
Ural	16,529,033	18,863,715	I. 2,334,682
Caucasus	11,198,661	10,698,393	D. 500,268
Altai	101,072	190,917	I. 89,845
Siberia	2,388,069	5,408,305	I. 3,020,236
From chemical works etc.	2,355,438	1,971,472	D. 383,966
Total	32,572,273	37,132,802	I. 4,560,529

Production is lessening considerably in the Ural owing to the temporary closing of the Demidov works and the competition of new producers elsewhere. It has also gone down in the Caucasus, chiefly at the Siemens works, where the output in 1908 was only 3,087,124 lb., against 3,924,321 lb. in 1907. The same may be said of the last group, including copper from works operating by chemical process and of the refineries.

Production in Siberia and the Kirghiz district showed a large increase. The reports of the two principal companies show the following output, in pounds:

	1907.	1908.	Changes.
Yenissei	523,154	1,857,010	I. 1,333,856
Spassky	1,864,915	3,551,295	I. 1,686,380

In 1907 the Yenissei company worked only for six months. In 1908 the company worked the full year, the average production being 214,127 lb. per month. The Spassky company in 1908 averaged 479,296 lb. per month, or 262,914 lb. more than in the previous year.

In the Altai work was carried on for seven months in 1907, but for only two months in 1908. Nevertheless there was an increase last year. It may be noted that these mines are only in the development stage, and that a great growth in production may be expected.

The consumption of copper in Russia is estimated as follows, for two years past, in pounds:

	1907.	1908.	Changes.
Production	32,572,273	37,132,802	I. 4,560,529
Imports	10,829,100	10,865,197	I. 36,097
Total supply	43,401,373	47,997,999	I. 4,596,626
Exports	3,934,573	252,679	D. 3,681,894
Consumption	39,466,800	47,745,320	I. 8,278,520

The production in 1908 showed a gain of 14 per cent. The gain in the approximate consumption was 21 per cent., the exports having fallen to a very low figure.

A Transaction in Radium

According to the New York *Sun*, the largest order for radium ever given has just been placed jointly by Lord Iveagh and Sir Ernest Cassel, who will donate it to the Radium Institute for the foundation of which they have provided the funds. The quantity ordered is 7⅛ grams—about ¼ oz. avoirdupois—and the price is $150,000. The largest amount previously bought at one time was 1 gram. The order was given to the British Metalliferous Mines Company, which will obtain it from the Cornish pitchblende deposits under the superintendence of Prof. Giesel, the company's chief chemist.

Metallic chromium is now a commercial article (*Brass World*, May, 1909) and can readily be obtained of high purity and at a reasonable price. As far as known, it has not yet become a constituent of the non-ferrous alloys, although it has long been used in making very hard and tough steels

The Kilker Matte Tapping Car

By F. T. Havard*

The Kilker matte-tapping car is an example of one of those simple machines which affect such an appreciable saving in the working costs of a smelting plant, that we must wonder at the tardy development and application of the idea in what we are pleased to call the rapid progress of modern metallurgical enterprise.

It has long been recognized that the method, adopted by most of our lead smelteries, of tapping matte from the receiver or forehearth into the small matte pots of 300 or 400 lb. capacity, and subsequently breaking and transporting the matte cones to the railroad cars or hoists, was costly, clumsy and inefficient. But the most unpleasant feature lay in the periodic "runaways" of matte from the receiver, which accompanied the use of the small pots, particularly if the matte fall was at all considerable, that is, above 23 or 24 per cent. of the charge.

It was on account of the vexatious delays in stopping the furnace and the disagreeable work of cleaning up the floor plates, which invariably resulted when the tapper failed to plug the matte hole, that a foreman in the American Smelting and Refining Company plant at East Helena, Mont., sought a safe and efficient method of coping with the task of tapping and transporting the matte. Mr Kilker conceived the idea of using a horizontal wheel as a carrier for a number of pans which should revolve and cast the matte in thin layers, one to every revolution, so that on the subsequent dumping of the pans the matte should fall to pieces of a suitable size for the sampling mill or the furnace.

This original idea has developed under the auspices of the able master mechanic and the smelting staff at East Helena into the type of the machines now used at Selby, East Helena and elsewhere, which combine strength and simplicity with thorough efficiency. In fact, Kilker's car embraces all the essentials required to insure its adoption as a standard vehicle for the tapping, molding and transport of matte in all the silver-lead and in many of the copper smelteries of the world.

One safeguard, however, is necessary in working with the car: the lead in the receiver must be kept below the level of the matte tap. Should it be allowed to run with the matte into the car, it will splash and be lost or burn the operators.

Construction of the Car

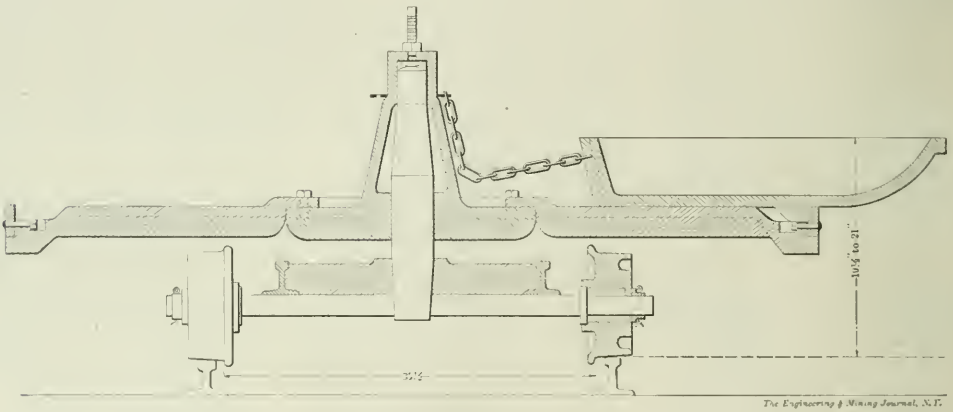
In tapping matte into the Kilker car, it is usual to place the car in position on the rails on the short side of the receiver. A curved spout leads from the matte hole to the car. Instead of a curved spout alone such as the illustration shows, a small brick-lined cast-iron box on wheels may be placed directly in front of the matte hole, and from this box a curved spout leads the matte to the car. The use of this curved spout enables the matte tapper to work with his bar or plug directly in front of the receiver without the danger of being burnt by the hot matte.

The car is known as the "merry-go-round," and the receiving box as the "baby carriage." The wrought-iron frame of the "merry-go-round" is made of I beams and mounted on roller-bearing cast-iron wheels. On the framework is an upright steel pin, on which revolves the spider that carries the pans. In the more recent machines the spider is a solid steel piece and 10 pans, every one an equal segment of the circle, sit in position on the spider. These pans are cast with a lug on the bottom in such a position that they are prevented from slipping on the car and from falling when the pans are dumped in the manner shown in the accompanying picture. In fact, the nice balance of the pans on the spider is the key to the successful manufacture and operation of the "merry-go-round." A wrought-iron yoke revolves around the pin and the top of the pan strikes against this when being dumped. The pan is held in position at an angle of about 60 deg., with the lug resting on the outside rim of the spider.

Tapping Operations

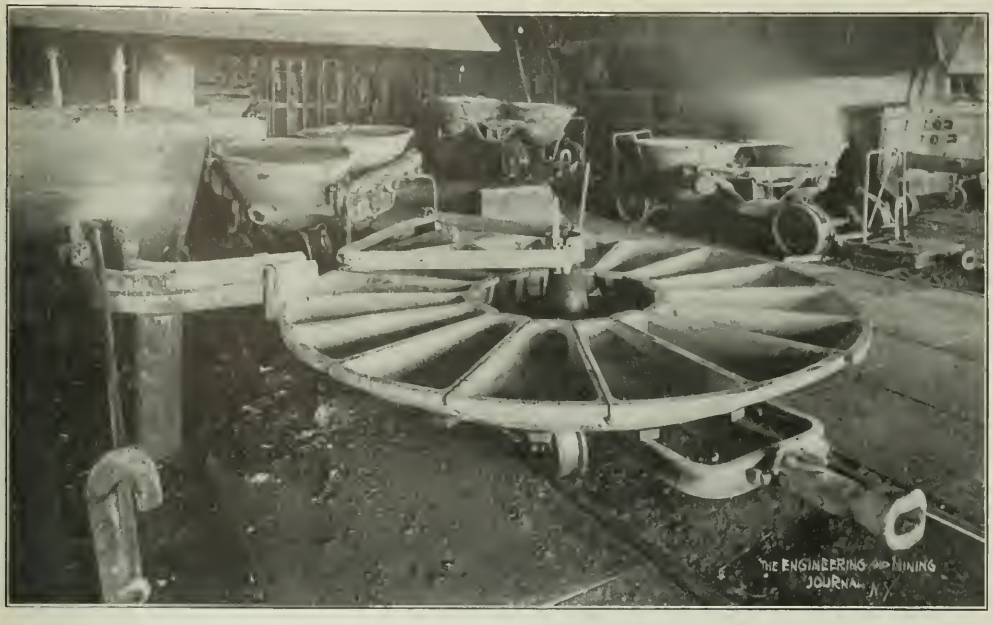
The 10 pans hold between 3000 and 3300 lb. In East Helena two are in use at each furnace. The method of procedure is as follows: When the car is placed beside the receiver it is slowly set revolving and kept in motion during the tapping until the furnace man plugs the hole. It is at once hauled out toward the dump about 50 yd. by an electric locomotive, and uncoupled; it then runs by gravity to the track above the box cars. An empty "merry-go-round" from the previous tap stands on a side track ready to be hauled beside the receiver. After standing 30 minutes the matte contents are dumped into the box car by raising the small end of the pans; three pans are tilted at a time against the wrought-iron stay bar and then knocked back into position. The "merry-go-round" and the stay bar are then revolved in opposite directions and three more pans are dumped until the matte is all unloaded. The whole operation takes only a few minutes. The pans are then "washed" with adobe clay and the car is ready for the next tap.

In one of the appended sketches no stay yoke is seen, but in its stead is shown a chain which was formerly used to keep the pans from swinging too far when being dumped. The life of the pans is good, particularly if care is taken to warm them all over before tapping into them. It is estimated that the use of the car has reduced the cost of working the matte by about 15c. per ton. This represents a very considerable saving of money in a plant smelting 400 or 500 tons of ore per day and producing about 100 tons of matte.



SECTIONAL ELEVATION OF KILKER CAR—CHAIN REPLACED BY YOKE IN LATER MODELS

*Mining engineer, Helena, Mont.



THE KILKER MATTE-TAPPING CAR DEVELOPED AT EAST HELENA, MONT.

DUMPING MATTE FROM THE [illegible] TO RAILROAD CARS. HAND SLUDGING ELIMINATED

Practical Test of a Tunnel Boring Machine

The Machine Chips away Entire Face of Tunnel with Chisel Bit Drills; Advanced 3 1-2 Inches in 10 Minutes During Recent Test

BY JOHN TYSSOWSKI

Many efforts have been made to solve the problem of designing a machine to rapidly cut tunnel headings. Since 1853 over 30 machines have been tried and proved failures, in every case some practical consideration or vital principle in construction having been overlooked. Recently the Karns, Sigafoos, Proctor, and Granger designs have attracted attention. The Terry, Tench & Proctor tunneling machine, the joint production of O. S. Proctor, of Denver, and E. F. Terry, of the Terry & Tench Company, contractors, New York, is now receiving a practical test in excavating a drain tunnel for the New York Central excavation near Forty sixth street, New York. At a trial run made June 3, 1909, this machine succeeded in advancing an 8-ft. heading 3½ in. in 10 min., chipping away the entire face of the rock, a fairly tough and compact mica schist. The machine was operated under 80 lb. air pressure, whereas the designers claim it should have 100 lb. of air. The tunneler ran without any hitch, and was stopped only when a stringer of quartz was encountered on the outer rim of the heading and was found to hold the machine back. Two more drills or groups of hammers will be added to cover the outer portion of the circle excavated, thus doubling the number on the outer circumference of the circle; this will allow the entire face to advance at a more uniform speed.[1]

Description of Tunneler

Fig. 2 shows the machine in position at the start of the tunnel in the New York Central excavation. Fig. 1, reproduced from *Engineering News*, Nov. 19, 1908, shows diagrammatically the construction of the tunneler. It weighs 15 tons, is about 25 ft. long over all, and cuts a tunnel 8 ft. in diameter. At the rear, the mechanism is carried on a four-wheel truck running on a 22-in. track of light T-rails; the front end is carried on two conical wheels that fit the surface of the excavation. A 20-in. I-beam laid flatwise forms the frame of the machine. The forward end of the beam rests on the front truck while the rear end bears a yoke casting carried adjustably on the rear truck. The tunneler is fed forward and kept up to its work by a double (staggered) spur gear, journaled on the truck, which engages a line of duplex rack rails laid midway between the rails upon which the machine is carried. The feed is operated by means of a compressed-air engine and worm gearings on the truck, the reduction being 5000 to 1, the length of feed 14 ft., and the maximum speed at which the machine can be moved 8 in. per min. At the rear end of the main hollow shaft are adjusting screws by means of which the yoke bearing the rear end of the frame is moved, thus regulating the horizontal and vertical directions of advance. The head of the machine is rotated by another compressed-air engine and train of gearing. During the trial run, the head made one revolution every 13¼ min., the drills traveling at speeds ranging down from a maximum of 0.25 ft. per sec.

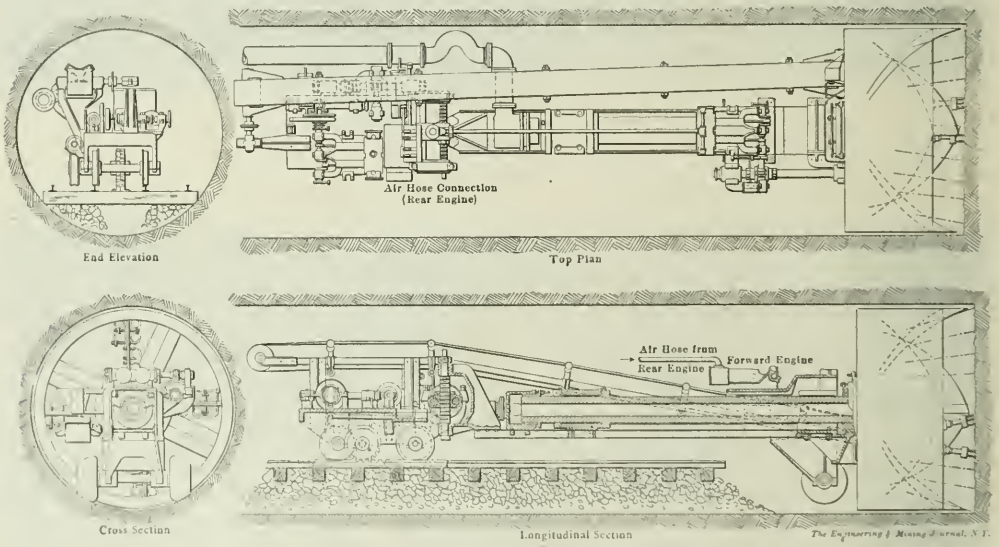


FIG. 1. DIAGRAMMATIC REPRESENTATION OF MACHINE

From the hub of the main head radiate four arms which connect to the outer casings of the head and four bars that carry the pneumatic drills. Air is conveyed to the drills from the central bore of the main hollow shaft, by air-hoses connected to valved branches on the forward end of the shaft.

The hammers are arranged so as to chip away the entire face of the entry. At present there are 25 of these drills each carrying four chisel bits on the machine, but as stated above, two more will be added in order to insure the outer periphery of the circular heading being cut as rapidly as other portions. The drills

[1]Since this article was written it has been found necessary to remove the machine in order to make the necessary changes

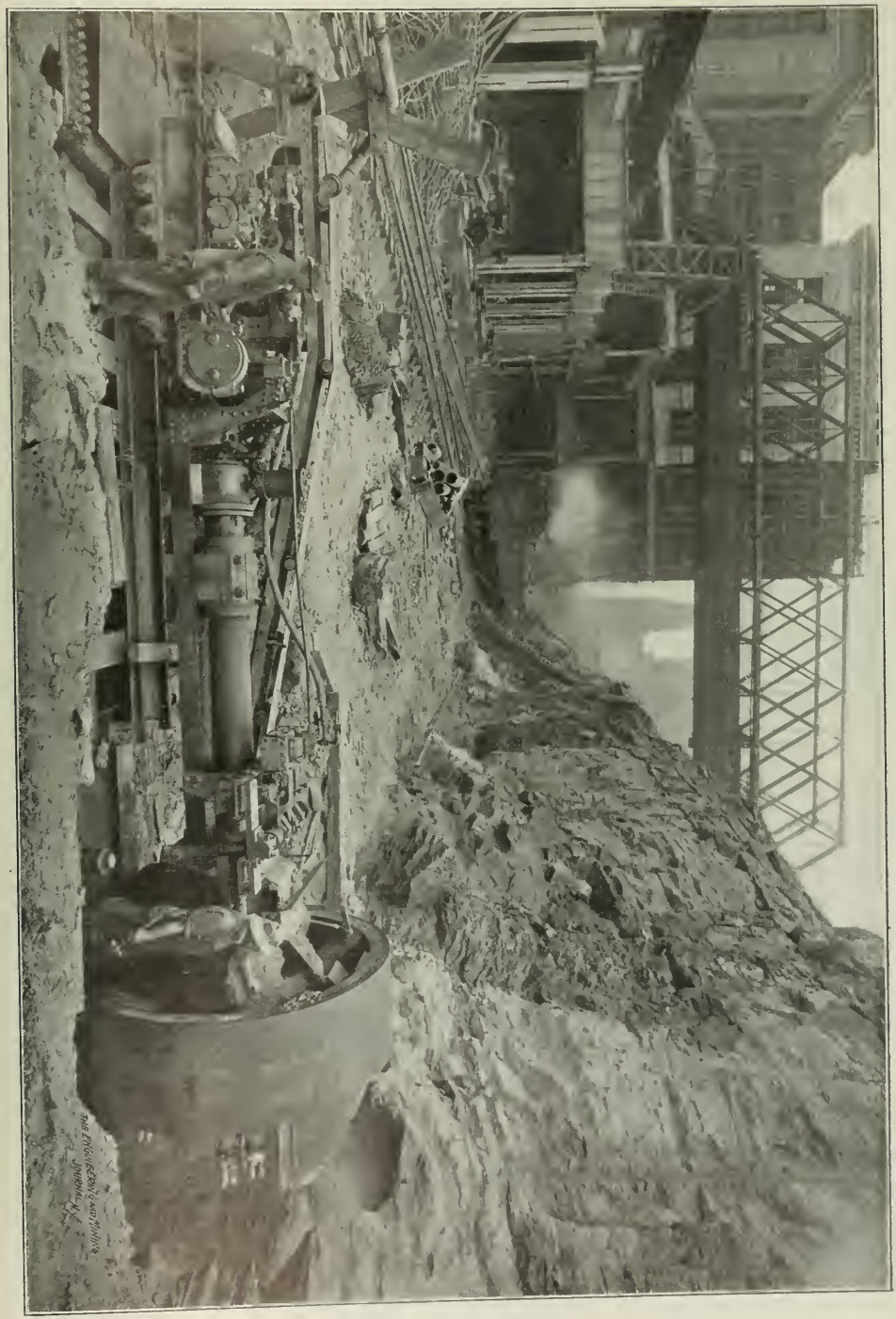


FIG. 2. THE TUNNELER IN POSITION FOR TRIAL IN NEW YORK CENTRAL EXCAVATION

have spool valves, and are air cushioned at either end of the cylinder, a very important consideration in work of this class where portions of the headings may be of soft material while others are hard rock. Fig. 3 shows in a general way the form of air tool used on the tunneler. The chuck has been slightly modified, however, and the air cushions are merely indicated as occupying the spaces formerly used for springs.

Handling the Debris

Steel plates placed between the hammers form pockets into which the chippings are caught; these pockets discharge into a hopper at the rear of the rotating head. The débris is carried to the rear of the machine by a conveyer belt driven by the forward air-engine. Four rails will be laid behind the machine, the central two being spaced 22 in. so as to carry the rear truck of the machine while the outer two, spaced at 18 in. gage, form tracks for muck cars. Switching facilities will have to be provided. A waterspray plays on the face of the heading, thus keeping down the dust.

In the test one engineer and three helpers were employed but when the device for handling the chippings is perfected the designers claim that only one helper will be required. Providing that the machine operates 20 hours out of the 24 and maintains the speed attained in the recent test, it would make an advance of 35 ft. per day. However, it must be borne in mind that this machine must cut away over 100 times as much as is ordinarily cut by drills in driving a tunnel, and that the opportunities for breakage and disablements of the machine are multiplied many times. Only a practical working test covering a long period of time (such as is now being started) will serve to demonstrate the future usefulness of this machine. The great advantages to be derived from the successful operation of such a tunneler would be in the rapid rate of advance attained, at a probable lower cost than is now possible, and the desirable form of tunnel cut. With the circular cut, in a natural arch, comparatively little timbering would be required in good ground.

The designers claim an air consumption of 3000 cu.ft. per min., and estimate that the machine can be operated at a cost of $300 per day. They also hope to excavate from 1256 to 3768 cu.ft. of rock per day, which means an advance of from 25 to 75 feet.

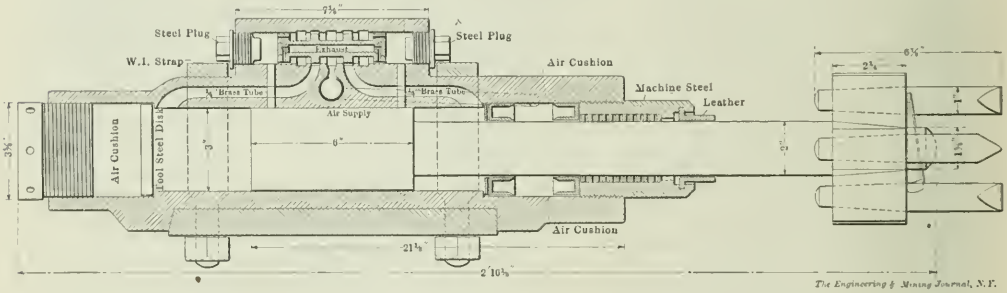


FIG. 3. GENERAL FORM OF THE AIR DRILLS

Power Development in Colorado

A great work, and a still greater boon to the miners of the State, is that of the Central Colorado Power Company, which has been quietly spending millions in controlling and developing the power contained in the streams of the State and delivering it to the mines, thus lowering the costs of mining and milling, and increasing the production by enabling an immense tonnage of low-grade ores to be marketed at a profit, which otherwise would not pay to extract or treat. This will be more readily realized when it is stated that the above company is supplying power at $75 per h.p. per annum which would cost the mines from $100 to $150 to make by steam. An additional advantage, as proved by the past severe winter, lies in the fact that a great many of the mines were idle through inability to get their supplies of coal to the mines, whereas those which obtained their power from the electric power company worked along steadily.

The benefits which will accrue to other industries are enormous, but these being outside the province of the JOURNAL, need not be here enumerated. In the category of benefits conferred on the mining industry, however, must be included the supplying to Denver the great mart of supplies and machinery of part of the power for the Denver Gas and Electric Company, a contract for which was signed last December involving a sum of $200,000 yearly. It is expected that the Central Colorado Power Company will begin supplying this power in a few days.

The hydroelectric generating plant at Shoshone, near Glenwood Springs, on the Grand river, has been so far completed that 4000 h.p. are being transmitted to Leadville and Summit county mines, mills and dredges, and several thousand horsepower are also sent to the Boulder county mines. At this plant, the water is conveyed from the intake at the diverting dam through a tunnel 11x16 ft. in the clear, and 12,700 ft. in length, the bottom and sides being lined with concrete. It has a capacity of 1250 cu.ft. per sec. and gives a head of 165 ft. The power house is equipped with two 9000-h.p. turbines, each direct connected to a 5000-k.w., three-phase, 60-cycle, alternating current generator, giving a total of 18,000 h.p. It is the purpose of the company to extend the tunnel later on, and the ultimate resulting capacity will be from 30,000 to 40,000 horsepower.

On Middle Boulder creek, about thirty miles northwest of Denver, another plant is under construction. This consists of a reservoir with a capacity of 500,000,000 cu.ft., the water to be conducted 12 miles through a concrete pipe 36 in. in diameter, to a terminal reservoir, from which the water will be sent to the power plant through a steel pressure pipe 9500 ft. long, the resulting head being about 1850 ft. The power house will contain two impulse waterwheels, with a total capacity of 21,000 h.p., each of which wheels will be connected to a generator of about 10,000 h.p. This plant is expected to be completed this year.

Still another development is at Gore cañon, on the Moffat road, about 120 miles west of Denver. This will have a diverting dam on Grand river, a tunnel 5 miles in length, giving a head of 350 ft., and a capacity of from 20,000 to 30,000 h.p. The Leadville, Boulder, Breckenridge, Georgetown, Idaho Springs, Dillon and other mining camps in the northwestern portion of the State will be supplied from the above plants. At the beginning, the management of this great enterprise left much to be desired, but its ultimate successful construction is due to the skill and efforts of Frederick A. Abbott, chief engineer, and G. H. Walridge, general manager, both of New York.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COAL AND COKE

COKE—Means for Supplying Air to Coke-Ovens. John H. Hillman, Pittsburg, Penn. (U. S. No. 924,462; June 8, 1909.)

COKE-DRAWER. Harvey Cory, Pittsburg, Penn. (U. S. No. 923,410; June 1, 1909.)

COKE—Process of Obtaining Ammonia and Tar. Heinrich Koppers, Essen-on-the Ruhr, Germany. (U. S. No. 12,971; June 8, 1909.)

COKE-DRAWING APPARATUS. Charles M. Clarke, Pittsburg, Penn., assignor to Hebb Coke Drawer Company, Uniontown, Penn., a Corporation of Pennsylvania. (U. S. Nos. 923,139 and 923,140; June 1, 1909.)

COKE-OVEN. George W. Thompson, Collinsville, Ill. (U. S. No. 924,293; June 8, 1909.)

MINING-MACHINE—Electric Coal-Puncher or Mining-Machine. John H. Thompson, Charleston, W. Va., assignor to Johnson Electric Machine Company, Charleston, W. Va., a Corporation of West Virginia. (U. S. No. 922,736; May 25, 1909.)

PEAT—Improvements in Elevators Applicable to Apparatus for the Production of Peat Fuel. Andrew Kesson, Lynedock, Scotland. (Brit. No. 23,392 of 1907.)

COPPER

PURE COPPER—Process for Obtaining Pure Metallic Copper from a Solution of a Salt of Copper. Lucien Juman, Paris, France. (U. S. No. 924,077; June 8, 1909.)

PURE COPPER—Process for Obtaining Pure Copper. Lucien Juman, Paris, France. (U. S. No. 924,076; June 8, 1909.)

GOLD AND SILVER

ALLUVIAL MINING—Method of Recovering Values from Alluvial Deposits. Ole T. Crosby, Nome, Alaska. (U. S. No. 923,116; May 25, 1909.)

FILTER-PRESS. Samuel K. Bebrend, Denver, Colo. (U. S. No. 924,131; June 8, 1909.)

PAN-RIFFLE. John M. White, Selma, Ore. (U. S. No. 923,392; June 1, 1909.)

PULP-AGITATOR. William C. Paterson, Denver, Colo., assignor, by direct and mesne assignments, to the Rapid Cyanide Extraction Company, a Corporation of Colorado. (U. S. No. 923,571; June 1, 1909.)

IRON AND STEEL

ELECTRIC FURNACES—Improvements in or Relating to Electric Furnaces for the Manufacture of Steel. Adolphe Hugot, Firminy, France. (Brit. No. 12,258 of 1908.)

ELECTRIC TEMPERING-FURNACE. Vernon Royle, Paterson, N. J. (U. S. No. 924,109; June 8, 1909.)

MANUFACTURE—Method of Consolidating Fine-Dust for Use in the Manufacture of Steel. William Thomlinson, Seaton Carew, West Hartlepool, England. (U. S. No. 923,605; June 1, 1909.)

SLAG—Machinery for Conveying Blast-Furnace Slag. Edward A. Uehling, Passaic, N. J. (U. S. No. 923,218; June 1, 1909.)

TREATMENT OF STEEL—Process for the Treatment of Steel for Industrial Purposes. La Société Schneider & Cie. Le Creusot, France. (Brit. No. 24,244 of 1908.)

NICKEL

ORE TREATMENT—Process of Treating Nickel Ores. Anson G. Betts, Troy, N. Y. (U. S. No. 923,005; May 25, 1909.)

MINING—GENERAL

BORE HOLES—Improvements in or Relating to Waterproof Lining for Bore Holes. Maurice Bodart and the Deutsche Solvay-Werke Aktiengesellschaft, Prussia, Germany. (Brit. No. 21,197 of 1908.)

FIRE EXTINGUISHING—Method of Extinguishing Fires in Mines. Frank T. Byers, Mount Pleasant, Penn. (U. S. No. 924,599; June 8, 1909.)

SHAFT SINKING—Sinking Shafts and the Like. Daniel E. Moran, Mendham, N. J. (U. S. No. 923,984; June 8, 1909.)

VENTILATION—Gas-Extractor and Mine-Ventilator. George Laws, Philipsburg, Penn. (U. S. No. 922,603; May 25, 1909.)

ORE DRESSING—GENERAL

CLASSIFIERS—Improvements in, or Relating to Classifiers or Separators for Minerals of Different Specific Gravities. Creighton Churchill, Brookline, Mass. (Brit. No. 7841 of 1908.)

CONCENTRATION—Method for Concentrating Ores. Albert H. Stebbins, Little Rock, Ark. (U. S. No. 923,455; June 1, 1909.)

CONCENTRATORS—Improvements in Ore Concentrators. Communicated from Charles W. Eccleston, Los Angeles, Cal. (Brit. No. 19,163 of 1908.)

CRUSHING-ROLLS. Arthur E. Hogue, Toronto, Ontario, Canada. (U. S. No. 924,352; June 8, 1909.)

ELECTROSTATIC SEPARATING PROCESS. Lucien I. Blake, Lawrence, and Lawrence N. Morscher, Neodesha, Kan., assignors to Blake Mining and Milling Company, Denver, Colo., a Corporation of Maine. (U. S. No. 924,032; June 8, 1909.)

ORE-PULVERIZER. George P. Good, Detroit, and William L. McCullough, Ypsilanti, Mich., assignors to the W. L. McCullough Company, Ypsilanti, Mich., a Corporation of Michigan. (U. S. No. 922,577; May 25, 1909.)

ORE-JIGGER. William M. Williams, Gridley, Cal., assignor of one-half to J. L. Miots, Gridley, Cal. (U. S. No. 923,917; June 8, 1909.)

ORE-SEPARATOR. Charles M. Mullen, Baker City, Ore. (U. S. No. 923,988; June 8, 1909.)

ORE-SEPARATOR. Elmer A. Ross, Ticonderoga, N. Y., assignor of one-fourth to Dorus C. Bascune, Ticonderoga, N. Y. (U. S. No. 919,246; April 20, 1909.)

WATER-JIG. Gelasio Caetani, Kellogg, Idaho. (U. S. No. 923,328; June 1, 1909.)

METALLURGY—GENERAL

BRIQUETTING—Improvements in the Process of Briquetting Ore with Blast-Furnace Slag. Wilhelm Lessing, Troisdorf, Germany. (Brit. No. 18,680 of 1908.)

PHYSICAL PROPERTIES—Improvements in and Relating to Processes for Improving the Physical Properties of Metals and Their Alloys. David Lamon and Theodore H. Thomas, Denver, Colo. (Brit. No. 12,452 of 1908.)

PRECIPITATION—Method of Thionous Precipitation of Copper or Silver from Their Solutions. (U. S. No. 923,916; June 8, 1909.)

REFRACTORY ORE TREATMENT—Method of Reducing Ores. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, New York, N. Y., a Corporation of West Virginia. (U. S. No. 924,130; June 8, 1909.)

MINING MACHINERY AND APPARATUS

AIR-COMPRESSOR. Electric Air-Compressor. Augustine J. Pocock and Richard E. Allgire, Dayton, Ohio, assignors to the Platt Iron Works Company, Dayton, Ohio, a Corporation of Ohio. (U. S. No. 918,149; April 13, 1909.)

CONVEYING MACHINERY—Improvements Relating to Conveyer Apparatus, More Particularly for Conveying Ore and Stuff from Shallow Lodes. Paul Tönges, Berlin. (Brit. No. 25,640 of 1908.)

DRILL. Martin Hardsocg, Ottumwa, Iowa. (U. S. No. 923,513 and 923,514; June 1, 1909.)

HEWING APPARATUS for Open-Air Mining. Emil Wischow, Luebeck, Germany. (U. S. No. 919,105; April 20, 1909.)

MINE CAGES—An Improvement Applicable to Pit Cages and Hoists. James Harrison, Clayton; Richard Oliver, Beswick, and Edward Peters, Manchester, Eng. (Brit. No. 1395 of 1909.)

MINE-CAR BRAKE. Isaac Glen, Trafford City, Penn. (U. S. No. 923,260; June 1, 1909.)

MINER'S CANDLESTICK. Charles J. Ramstead and Peter J. Johnson, Ouray, Colo. (U. S. No. 922,950; May 25, 1909.)

MINERS' LAMPS—Reflector for Miners' Lamps. Zachariah Hough and Leslie P. Weaver, Banning, Penn. (U. S. No. 923,655; June 1, 1909.)

MINERS' LAMPS—A Stand for Miners' Lamps. John Hardy, West Hartlepool, Eng. (Brit. No. 17,766 of 1908.)

MINING TOOL—Combined Mining and Track Tool. William L. Groom, Coal Valley, Ala. (Brit. No. 23,391 of 1908.)

ROCK DRILLS—Improvements Relating to Rock Drills. George H. Rayner, Nether Edge, Eng. (Brit. No. 25,626 of 1908.)

TIMBERING—Reinforced Concrete Mining-Timbers. John A. Elliott, Butte, Mont. (U. S. No. 924,153; June 8, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

ELECTRIC FURNACE. Frédéric M. Chaplet, Laval, and Alexandre Rémond, Paris, France. (U. S. No. 923,018; May 25, 1909.)

ELECTRIC FURNACES—Improvements in Electric Furnaces. Charles E. Knowles, Holmdale, Eng. (Brit. No. 13,502 of 1908.)

ELECTRIC FURNACES—Improvements in Electric Furnaces. Erik Cornelius, Trollhaten, Sweden. (Brit. No. 10,378 of 1908.)

FURNACE for Gasifying Coal, Roasting Ores and the Like. Hans Ries, Munich, Germany. (U. S. No. 922,042; May 18, 1909.)

FURNACE—Revolving Furnace for Volatilizing Ores. Harry H. Hughes, Springfield, Mo. (U. S. No. 922,906; May 25, 1909.)

ORE-TREATING FURNACE. Chauncey C. Medbery, New York, N. Y. (U. S. No. 922,609; May 25, 1909.)

POWDERED FUEL—Improvements in or Relating to Apparatus for Supplying Fuel in Powdered or Similar Form in Furnaces. Otto Trossin and Mrs. I. E. Robinson, London. (Brit. No. 4256 of 1908.)

PRECIPITATION—Apparatus for Use in Solution and Precipitation Processes. Woldemar Hommel, London, England, assignor to Metals Extraction Corporation, Limited, London, England. (U. S. No. 918,749; April 20, 1909.)

PRECIPITATION—Improvements in, or Relating to Apparatus for Use in Solution and Precipitation Processes. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 24,017 of 1907.)

REVERBERATORY REGENERATIVE Furnace. Thomas S. Blair, Jr., Elmhurst, Ill., assignor to the Blair Port Company, New York, N. Y., a Corporation of New York. (U. S. No. 12,939; reissue; April 13, 1909.)

ROASTING FURNACES—Improvements in, or Relating to Mechanical Roasting Furnaces. Roman von Zelewski, Engis, Belgium. (Brit. No. 15,192 of 1908.)

ROASTING FURNACE—An Improved Rotary Roasting Furnace. John R. Down and Frederick J. Morgan, Swansea, Wales. (Brit. No 12,825 of 1908.)

ROASTING-FURNACE. John E. Greenawalt, Denver, Colo. (U. S. No. 919,000; April 20, 1909.)

ROASTING-FURNACE. Frank E. Marcy, Salt Lake City, Utah, assignor to Frank Klepetko, New York, N. Y. (U. S. No. 920,971; May 11, 1909.)

ROTARY ORE-EXTRACTOR. Jesse O. Blackburn, Chloride, Ariz. (U. S. No. 923,319; June 1, 1909.)

SMELTER SMOKE—Apparatus for Condensing and Purifying Smoke, etc. Selden J. Clawson, Salt Lake City, Utah. (U. S. No. 922,260; May 18, 1909.)

SMOKE PREVENTION—Improvements in Smoke Consuming Devices for Furnaces. Imanuel Bausch, Karlsruhe, Germany. (Brit. No. 18,859 of 1908.)

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A. F. Kuehne is in New Mexico on professional business.

Frederick H. Morley, of Denver, Colo., is visiting New York.

Charles G. Yale, of San Francisco, is in New York on a visit.

Arthur James, of New York, has been visiting Morenci, Arizona.

W. G. Trethewey, of Toronto, is inspecting mining properties in the Sturgeon lake area.

Prof. William P. Blake has been reappointed territorial geologist of Arizona for another term.

President J. H. Plummer, of the Dominion Iron and Steel Company, has sailed for England.

F. F. Sharpless is at Placerville, Cal. He will go thence to Nevada before returning to the East.

Pope Yeatman has gone to Alaska and will not return to New York until the middle of September.

O. H. Fairchild, of Denver, has gone to Arizona to examine mining claims near Hot Springs Junction.

Kirby Thomas, of Mexico City, is examining a quicksilver property in the southern part of Mexico.

Robert Schorr has removed his office to the Postal Telegraph building, Market and Battery streets, San Francisco.

H. F. Fay, president of the Allouez and the Centennial copper companies of Michigan, is a visitor at these properties.

Robert H. Richards, of Boston, is devoting two or three weeks to professional work in and about Denver, Colorado.

J. A. Skeene has been appointed superintendent of the Pan Silver mine at Cobalt, Ont., in place of M. McCallum, resigned.

J. Morgan Clements, of New York, has gone to New Mexico on professional business. He expects to be absent about three weeks.

James W. Myers has returned to Golden, Colo., after a year and half visit to New Zealand, in the interests of a large mining company.

B. Leyson has resigned as manager of the City of Cobalt Mining Company at Cobalt, Ont., and will develop some claims in the Montreal river country.

Dr. Henry M. Ami retires at the end of June from the Geological Survey of Canada after a continuous service of 28 years, on account of failing health.

Herbert S. Crocker and Milo S. Ketchum have formed a partnership under the title of Crocker & Ketchum, as consulting engineers, with offices at 811 Seventeenth street, Denver, Colorado.

C. B. Ireland, of Georgetown, Colo., has been appointed general manager and superintendent of the Atlantic Mining and Milling Company, operating in the Atlantic district in Clear Creek county, Colorado.

Morton Webber has been engaged as consulting engineer for the firm of Weir Brothers & Co., New York, for a period of two years. He has had experience in several countries in the examination of mines.

Arthur K. Adams, for the past two years professor of geology at the New Mexico School of Mines, Socorro, N. M., is now a mineral inspector for the General Land Office, with headquarters at Huron, South Dakota.

Hon. William Templeman, head of the Mines Department of Canada, has gone to the Pacific coast, and during the summer will visit the Yukon, accompanied by R. W. Brock, director of the Canadian Geological Survey.

Selwyn Goldstein, formerly manager and engineer of the Great Boulder Proprietary mine in Western Australia, is in Mexico representing British interests. His address is care Banco de Londres y Mexico, Mexico City.

S. E. Bretherton has returned to his office in San Francisco from a trip of several weeks on business in connection with the Friday-Lowdon Copper Company and the Afterthought Copper Company, of Shasta county, California.

Alfred Campion has been appointed lecturer on iron and steel metallurgy at the Technical College of Glasgow, Scotland, and John S. G. Primrose lecturer on assaying and treatment of the precious metals. They succeed Professor Sexton, who has resigned.

Charles H. Clapp, who during the season of 1908, commenced a geological and topographical survey of the southern portion of Vancouver island, has returned to the island to continue this work, which is under the auspices of the Geological Survey of Canada.

W. J. Sutton, of Victoria, has been authorized by the Geological Survey to report on the rocks of the east coast of Vancouver island. As geologist for the Dunsmuirs, chief owners of large coal mines, Mr. Sutton has already done much geological work on the island.

Obituary

Colonel Charles C Mattes died at Scranton, Penn., June 8, aged 51 years. He was for a number of years connected with coal interests in the Wyoming valley, and was general manager of the Lackawanna Coal and Iron Company.

Guy C. Barton, at one time president of the Omaha & Grant Smelting Company, died at Omaha, Neb., June 15. He was prominent in the organization of the American Smelting and Refining Company, but held no office in that company.

Captain Johnson Vivian, one of the pioneers of the Lake Superior copper district, died at his home at Houghton, Mich., June 17, at the age of 80 years. Captain Vivian was born in Cornwall, England, in 1829, and spent his early life in the mines in that county. In 1853 he came to the United States and located in Keweenaw county, Mich., where he worked as a miner. His rise was rapid; he had been chief mining captain and agent for several of the mines in the Lake Superior district, among which were the Copper Falls, the Hancock, the Franklin and the Huron.

D. V. A. Williams died in Los Angeles, Cal., May 16, as the result of hardships incurred while lost on the California desert some months ago. He was 56 years old. He was born in New York, but removed to Joliet, Ill., when a young man. In 1879 he went to Leadville, Colo., and engaged in mining. Later he was 16 years in Mexico, where he had charge of the development of several mining claims. After leaving Mexico he went to southern California, making his headquarters at Johannesburg. For some time he had been president and general manager of the Sydney Group Mining Company.

Societies and Technical Schools

Western Association of Technical Chemists and Metallurgists—A dinner will be given July 2 at the Brown Palace hotel, Denver, in honor of Professor and Mrs. Robert H. Richards, of Boston, who will both speak on subjects relating to their work in chemistry and metallurgy.

Engineers' Society of Pennsylvania—At the meeting held in Harrisburg, June 12, it was decided to form a general State society of engineers, to be recognized by the legislature of Pennsylvania with authority to restrict practice to men of competence in their lines. The convention was held under the auspices of the Engineers' Society of Pennsylvania, having headquarters in Harrisburg, and was attended by delegates from the Engineers' Club of Philadelphia, the Engineers' Society of Western Pennsylvania, and the Engineering Society of Northwestern Pennsylvania. Resolutions were adopted providing that each of the societies participating should name a committee of three to form a general committee to meet in Harrisburg prior to October next and organize for the purpose of framing a code to be submitted at a convention to be held in the summer of 1910. Engineers of all branches in the State will be invited to become members.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Salt Lake City, Goldfield, Colbalt, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

June 18—A company has been formed in San Francisco to furnish electric power for mining districts in Sierra county. A dam has been built two miles above Downieville, which is 21 ft. high and stood the flood waters of last winter. The water rights are mainly on the south fork of the North Yuba river between Downieville and Sierra City these having been taken up by W. A. Lotspeich and Con. York, of Downieville. The site for a power-house on Durgan Flat has been selected. Foreign capital has agreed to take the bonds. A power line from this plant will soon be built to Forest and Alleghany, where such rich development among the mines has lately taken place.

Interest in the gold discoveries in reopened old mines at Alleghany and Forest, Sierra county, still continues. L. P. Woodbury, of the Rainbow has financed his mine in Colorado and is now starting in on a large scale. More rich ore is being taken out than at first. The Red Star ledge, also handled by Mr. Woodbury, will be actively developed. A tunnel is being driven ahead to intersect the Tightner vein. The El Dorado is still turning out jewelry ore, as is the now namous Sixteen-to-One. The old Wm. Irelan claims have been bonded to C. C. Ward and will now be worked after over a quarter of century of idleness. They paid well as far back as 1853 when they were located. At Forest, in the same county, many claims have lately been placed under bond to different parties. Good ore has been found in the Lucky Point and in the Davis & Phippen claim. The Hunch vein, parallelling the Plumbago and Rainbow mines, is to have a tunnel started for the yein. At Perry Bixby's mine below Forest, a 2-ft. vein carrying ore running up into the hundreds per ton has been found.

In Yuba county also there is quite a mining revival. For a long time this county produced millions from its hydraulic mines, but when they were closed down mining languished for years. Then came the dredge men who have developed an extensive industry along the river and one which is increasing in importance yearly. At Brownsville and Browns Valley several promising quartz mines are being operated and some others of the old mines are being reopened. In these places, as well as at Smartsville, Indiana ranch and Camptonville, scores of prospectors have gone to work this summer.

Butte

June 17—The report of the Amalgamated Copper Company for the fiscal year ending April 30, 1909, has recently been published. The report states that electrical power is being used for operating the mine pumps and that experiments are now being made to ascertain the feasibility of operating the hoisting engines by compressed air generated by electricity. The net income is stated to have been $3,633,980, as compared with $6,670,557 for 1908, and $14,154,400 for 1907. The dividends were $3,077,758 as compared with $6,155,516 in 1908, and $11,926,312 in 1907. The surplus was $586,222, as against $525,041 in 1908 and $2,228,088 in 1907. The liabilities are as follows: Capital stock, $153,887,900; accounts payable, $22,565; dividends payable in May, $769,439; surplus and reserve, $12,595,045.

In the suit of the Butte Water Company against the Reins Copper Company, a default judgment against the mining company was recently entered for the sum of $598. The Columbia-Butte Mining Company has begun action against Henry T. Heyder to recover $60,000 damages. In its complaint the company states that in 1908 it paid to defendant $50,000 for the Morning Star, Evening Star, Columbia, Germania and Washington lode claims, which were deeded to it by defendant, but that the defendant never in fact was the owner of the Evening Star and Washington claims and owned only one-fourth of the Columbia. The complaint states that the value of the property for which the defendant was unable to give a title was $30,000 and that, owing to its inability to put through a deal with all of the property it was damaged to a further sum of $30,000.

In the adverse suit of Allen Giberson against the Tuolumne Copper Mining Company, the local district court has decided that the plaintiffs own the quartz claim in dispute. The plaintiff claimed the ground under the Merrimac location and the defendant under the Smoky Moke location. In the case of the Milwaukee Gold Extraction Company against George W. Gordon and C. A. Brooks for the possession of the Big Bill quartz claim located in Granite county, Judge H. L. Meyers, of the local district court, has decided that the claim belongs to the defendants. The latter part of last week the new stack at the Boston & Montana smelter, at Great Falls, was put in use. The stack is 506 ft. in hight and is the largest in operation in the world. It has been in course of construction since the fall of 1907.

Denver

June 19—The Golden Cycle company operating the mine of the same name in the Cripple Creek district and the mill at Colorado City has paid the final instalment for assuming control of the Pike's Peak Fuel and the Central Fuel companies. The former corporation owned the Pike View, Danville and Williamson coal mines, north of Colorado City, comprising 2500 acres and furnishing most of the coal output for the immediate vicinity. The Golden Cycle company also controls about 11,000 acres farther east held in the name of the East Colorado Coal and the East Colorado Springs Land companies and it will now be in a position to proceed with the construction of the projected electric power plant near the Pike View mine. It is stated that $200,000 will be spent in the initial unit and that power will not only be furnished for the Golden Cycle mill but that a franchise will be asked from the city with the purpose of entering the local public lighting and power field. Through its coal companies, the Golden Cycle company will sell coal to the mines in the Cripple Creek district.

The Modern Smelting and Refining Company, which is constructing a copper-smelting plant, two miles beyond Argo, at Utah Junction, will double the capacity of the plant as soon as the first unit is put in operation. The identity of the interests behind this plant has been a matter of some speculation in this vicinity. The plant is being constructed under the direction of Henry C. Reno and the company is incorporated for $2,500,000. The plant will have railroad connections with the Moffatt road, the Colorado & Southern and the Burlington.

Last Spring the Cleveland shaft at Leadville was sunk to a depth of 825 ft and drifts started north and south from the shaft to cut the vein. The flow of water was so heavy that work was temporarily abandoned and drifts started at the 690-ft. level. After driving about 125 ft., in the Cambrian quartzite, the vein has been opened, showing 4 ft. of mineral, with the hanging-wall not yet exposed. Since the opening of the vein the work of timbering to secure the ground has been in progress; when this is completed the vein will be thoroughly explored. The character of the ore is similar to that found above in

the porphyry, and is of smelting grade. The opening of this fissure in the Cambrian quartzite is the most important event of the season in this camp.

Salt Lake City

June 18—The Daly-West company has posted the second quarterly dividend of 30c. per share and amounting to $54,000. The reports show a surplus of $391,283 at the end of the first quarter. A station is now being cut on the 1700-ft. level, and a crosscut to the vein will soon be under way at that point. It will require about 900 ft. of work to reach the ore. The drift to the drain tunnel should reach the ledge within the next 400 ft., while about 200 ft. will make connections in the shaft. It is expected that this work will be finished in about 90 days.

The litigation in connection with the Daly-West company is creating much interest. The Otto Hanke, John J. Daly, and H. R. McMillan interests have applied to the District Court for an alternative writ of mandate to examine the Daly-West books and the management now charges that this faction is not acting in good faith but for the interests of the Daly-Judge, a rival company, which owns adjoining ground in Park City. The charge is made that Hanke, Daly and McMillan are stockholders in the Daly-Judge, and it is alleged that they are planning to get this information for the purpose of seeking to control the company for the interests of the Daly-Judge company.

The Colorado, Sioux Consolidated and Iron Blossom companies, owning properties in the Tintic district, posted dividends on June 10 aggregating $210,000. The Sioux Consolidated announced a dividend of 7c. per share, and the Colorado and Iron Blossom will pay 8c. each on the shares issued. The latter company passed its dividend in May and the present dividend of 8c. amounting to $80,000 was something of a surprise. It is understood, however, that the company is now producing a good tonnage of high-grade ore, some of which is of better grade than the mine previously produced.

The shares of the Tintic Humboldt Mining Company were recently listed on the exchange. The company is capitalized for $100,000 and owns 10 unpatented claims in the North Tintic mining district three miles from the railroad. Thomas J Pierpont is president of the company, and the development on the property consists of 80 ft of shaft and 75 ft. of tunnel work, together with surface improvements. The stock of two other Tintic companies, the McKinley Mining Company and the Eureka Mining Company, was listed on the Exchange last week. The latter company has eight claims in the East Tintic district and is headed by Robert A. Brown, superintendent of the Centennial Eureka mine

Goldfield, Nevada

June 16—The authorities of Esmeralda county are making a strong effort to rid the county of "wildcat" miners and grafters. The district attorney, August Tilden, formerly of San Francisco, is looking into everything and seeing that all business for the county is conducted on a fair and square basis. Many of the county officials have been indicted and are out on bonds. The county commissioner from Rawhide, as well as the officials of the defunct bank are implicated.

It is rumored that the district attorney's office has evidence which will amply support the alleged indictments against the officials and directors of certain mining companies, and that this evidence shows a criminal conspiracy on the part of the company to defraud the county and State of their bullion tax.

Cobalt

June 19—The Nipissing Central Railroad Company, which has the franchise for building an electric line between the towns of Cobalt and New Liskeard, has started work on construction. The contract has been let to the Nova Scotia Construction Company, of Sydney, C. B., and it is estimated that the cost will be $125,000. Power will probably be obtained from one of the companies bringing it into the camp. This road will be a great boon to the towns of Haileybury and New Liskeard, as numbers of people now living in Cobalt, will move to the former places, where the natural advantages are much greater.. The construction of the line was strongly opposed by Cobalt.

Considerable uneasiness was caused in the early part of the week by bush fires which were burning near the town. At one time the magazines of the Hamilton Powder Company and the Buffalo mine were in danger and also the buildings of the Temiskaming & Hudson bay. A change of wind, however, averted the danger.

Charles Clinton, of New York, has disposed of his interest in the Clinton property, west of the Cobalt Gem, to New York parties.

The Station Grounds Mining Company, owning a narrow strip of land along the right of way of the Temiskaming & Northern Ontario railroad has, up to date, located 18 surface veins, in some of which a little native silver can be seen. The property is seven-eighths of a mile long and varies in width from 90 to 256 ft. As soon as the hydraulic air is in camp two shafts will be started. It will be necessary to purchase the land on which the shafts are to be sunk, as the Railway Commission will not allow them to be sunk on the right of way. The company was purchasing power from the Cobalt Lake and operating one of the shafts, but owing to the expense, these operations have been suspended

The Monarch claim, west of Sasaginaga lake, has been taken over by New York parties and a force of men will start work on development in a few days' time.

The Temiskaming & Hudson Bay directors have definitely decided to increase the capitalization to $3,500,000, although the final details have not yet been arranged. During the summer a concentrator of about 30 tons capacity will probably be erected.

The Davis Mines, Ltd., owning 170 acres in South Coleman, is following the lead of the Peterson Lake Company and leasing the property in small lots. Three leases have already been executed to the Shamrock, Armstrong and Jacobs parties, while negotiations are under way for others.

Gowganda, Ontario

June 18—There has been a good deal of disappointment in the Gowganda district this spring, as the number of people going into the country was not so great as anticipated. More attention is being paid to the Miller, Everett and Shanty Lake sections, and so far they appear to be the most promising of the new districts. The Everett Silver Cobalt Syndicate, has erected two permanent camps at Everett Lake and is employing 100 men. This company owns 21 claims. A find of silver was made on the Cartwright claim, adjoining the Blackburn, at Everett Lake and the vein was traced from the latter property. The Blackburn is one of the best mines in the district and now has a complete plant running. On McRae's property at Shanty Lake, there is silver showing in 11 veins and considerable development has been accomplished. The German Development Company, has a force of men engaged on its claims. On the Burns claim in the same section, a new 2-in. vein of high-grade silver has been encountered.

Toronto

June 19—The Ontario government has disposed of 15 parcels of land, aggregating 283 acres, out of 870 acres of the Gillies Limit adjourning the Cobalt district, recently offered for sale. In all 116 tenders were received, but 100 were rejected as being too small. The total sum received is $74,643. There was no information given as to the value of the land or as to present condition and prospects of the Provincial mine on the limit, so that the sale excited but little interest among mining men. The land is sold subject to a royalty of 10 per cent. on the output and under working conditions.

The Temiskaming & Northern Ontario Railway Commission proposes to make several extensions of the line, including industrial spurs at New Liskeard and Haileybury and has ordered plans and estimates to be prepared for an extension to Elk Lake and Gowganda.

Mexico

June 19—The Mexican Institute of Mining and Metallurgy will hold its first meeting July 12, at Mexico. A charter membership of 100 has been accepted by the provisional council for full membership. A program of technical papers will be submitted at the first meeting and permanent officers chosen by the charter members.

There is revival of talk of zinc smelting in Mexico since the prospect of the loss of the United States market through the pending tariff on zinc ores has arisen. Several concessions have been granted, and the subject is being investigated in the interests of the zinc producers and from an industrial standpoint. Some of the concessions granted contemplate the use of the new electrical processes. It is likely that the zinc smelter, if situated in Mexico, will be in the northern part where there is an abundance of ore and coal. Mexico imported in 1906, which may be taken as a normal year, zinc in the form of ingots, dust and shavings, 293,280 kg.; in the form of perforated sheets for use in cyanidation, 718,376 kg.; and sheets, 701,071 kg. The zinc for cyanidation is admitted free. This importation summary does not take into consideration the amount of zinc coming into the country in the form of galvanized products. The largest importation of zinc is from the United States. If the zinc-ore tariff results in establishing zinc smelters in Mexico, the United States will lose not only the admitted advantage of the docile Mexican zinc ores but also a good market for the zinc products.

The Magistral smelter at Zacatecas has closed after one month's fitful trial. It is alleged that it was defective in construction and costly in operation. The future plans as to the smelter are not yet made known. The independent operators had looked to this smelter as a buffer for better terms than those now offered by the Aguascalientes and San Luis Potosi smelters.

That the Mexican people intend to do everything in their power to control the oil situation in their country is indicated by the formation of a 25,000,000 pesos company, to be known as the Compania Mexicana de Petroleo El Aguila, S. A. (The Mexican Eagle Oil Company, Limited), and of which Guillermo Landa, governor of the Federal district, is president. The company has acquired all the concessions for the development, exploitation and marketing of native crude and refined oils, as well as other kinds of products held by the firm of S. Pearsons & Sons, Limited.

London

June 14—The 50th general meeting of the Institution of Mining Engineers was held in London recently. The president, Dr. B. T. Moore, delivered a presidential address, selecting the production of coal as his subject. The output in Great Britain in 1907 was 267,000,000 tons and in the United States 428,000,000 tons or 40 per cent. of the total production of the world. The largest exporter of coal was Great Britain, the exports in 1907 being 85,000,000 tons. On the question of the exhaustion of the coal supplies, it was stated that the last Royal Commission assumed a quantity in 1901 of 101,000,000,000 tons in Great Britain, which would be worked out in 300 years. Four new papers were presented at the meeting, namely, (1) on "Electricity in Coal Mines," by Robert Nelson, a paper which drew out a good discussion; (2) "Comparison between the Value of Surplus Gas from Regenerator By-product, Coke Ovens and Steam Produced by the Waste Heat from By-product Coke Ovens; with Special Reference to the Evence-Coppée New By-product Ovens," by Mansfeldt H. Mills; (3) "The use of Concrete for Mine Support," by Prof. W. R. Crane, and (4) "Mining in British Columbia, by Mrs. Rosalind Young.

Paris

June 15—The Mokta-el-Hadid company has published its report for 1908. The output of the African iron mines was practically the same as in 1907, a reduction at the Tenez mine being counterbalanced by the Djebel-Hadid mine and the newly opened quarries of Beni-Saf. Outside of these properties this important company is interested in many others. At Ain-Allega, which is a lead-zinc mine worked with the Ouasta-Mesloula company, the new ore-dressing plant was started in the second half of 1908 and milled about 4200 tons. The Djebel-Djerissa company, managed by Mokta-el-Hadid, produced 115,000 tons of iron ore during the first year of exploitation; the Compagnie de Kroumirie et des Nefzas, also managed by Mokta-el-Hadid, is awaiting the completion of a railway to work its iron deposits. The Mokta-el-Hadid has also large investments in the Compagnie des Phosphates de Gafsa (Tunis), in the Compagnie des Minerais de Fer de Krivoï-Rog (Russia), and in the Société de la Mourière, an iron mine of the Briey district in France. The profits were close to $800,000, and the company has declared a dividend of 50 fr. per share.

The Compagnie Industrielle du Platine did not declare any dividend for 1908. The capital of this company was increased from $3,200,000 to $4,000,000 in order to buy the shares of the Platinum company, and thus assist in securing the control the company hopes to have over all the platinum mines of Russia.

Johannesburg

May 15—A paper was read by Malcolm Fergusson, a government inspector of mines, at the May meeting of the South African Association of Engineers on the "Relation of Safety to Economy in Mining." Some important points were raised and good service will be rendered to the industry by their open discussion. The aim of Mr. Fergusson's paper was to demonstrate that the supervision exercised over underground work upon the mines is inadequate, and that more officials should be employed below to insure safety. Summarizing his views, the author contended that "mine accidents are due to lack of discipline owing chiefly to the fact that there are insufficient officials to supervise the men properly and that the obvious remedy would be not an added expense but actually a great financial advantage to the mine by reason of the increased efficiency.

The principle advocated throughout the paper of throwing maximum responsibility upon the shoulders of the shift bosses does not meet with general approval. Under present systems it is, as a rule, possible for the energetic shift boss only to visit all the working places under his control once a day in accordance with the demands of the mines and works regulations. It is consequently necessary to rely upon the gangers in direct charge of the hammer "boys" or the machinemen to see that the requirements of safety are properly observed. These latter alone can see that the Kafirs do not drill into sockets or misfired holes, or commence work under dangerous hanging for in the majority of places the day's work must necessarily be far advanced before the mine official puts in an appearance. The mine captain or shift boss should, of course, be responsible for the employment of men capable of judging these matters and should ascertain as far as possible that the proper precautions are taken, but it is unreasonable to expect shift bosses, with duties as falling to them at present, to make the initial inspections themselves before the commencement of work. Mr. Fergusson apparently opposed his own arguments when he urged that "the safety of a mine depends, from hour to hour, it might he said almost from minute to minute, upon the care and attention bestowed upon every portion of it by the mine officials." It is true that much reliance cannot be placed upon the perspicuity of the Kafir laborers—though often very trustworthy judges of their personal security—but it is too much to hope that a sufficiently large staff of mine officials can be provided for our large mines, with workings stretching for half a mile or more along the strike of reef and on many levels to relieve the individual worker from the responsibility of protecting his "boys," or even his fellows from danger. There is already too great a tendency to make the Rand miner an automaton and to rob him of all opportunities of doing good work as a thinking man of independent responsibilities.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

NOME

The fleet of steamers from Seattle reached here earlier than last year, reporting less ice than in previous years.

VALDEZ

An automobile stage service for the benefit of mining interests between Valdez and the Summit, 30 miles distant, via the Valdez-Fairbanks wagon road will be inaugurated August 1. The cars will carry freight and passengers.

Arizona

GILA COUNTY

Superior & Boston—A battery of two 150-h.p. boilers, and a Nordberg hoist and compressor are being installed. The McGaw 3-compartment shaft is now 400 ft. deep, and is to be equipped with double-deck cages.

Old Dominion—The May production of copper is reported as 3,088,000 pounds.

Two Queens—In the Federal Court at Kansas City, Horn Brothers, Raymond P. May and S. H. Niger, were charged with using the mails to defraud in promoting the "Two Queens" group of mines at Wilhleman, Ariz. James B. Lynch of Philadelphia, produced letters, circulars and newspapers sent to him by the promoters. These stated that the mine was in operation and that ore was being shipped in paying quantities. Lynch bought 1100 shares of stock on representations made in the advertising matter.

J. H. Deaner, of Saginaw, Mich., testified that he bought stock on the instalment plan, paying $2 a month. District Attorney Van Valkenbergh offered as evidence a printed circular describing the mining property. Frank H. Horn, S. H. Snyder and Raymond P. May, were sentenced to serve a year and a day in the United States prison at Leavenworth and to pay a fine of $500 each, while John E. Horn was fined $500 in the Federal court. Appeal bonds in each case were filed.

GRAHAM COUNTY

Shannon—An important strike of ore was made recently at the Little Coronado on the 400-ft. level. A new 60-h.p. engine is to be installed.

Shannon-Arizona Railway—The directors of the company are Nathan L. Amster, E. B. Clough, both of Boston; John W. Bennie, R. D. Roberts and Jas. A. Campbell, of Clifton. The company is capitalized at $50,000 divided into 500 shares of par value $100 each.

Detroit Copper—A flume has just been completed from the concentrator around Longfellow hill to the gulch southeast of Morenci. This is to take care of the tailings and prevent them from going into the San Francisco river. An oil-burning boiler of the Morenci smelter exploded last week. Five men were badly injured.

Messabe-Morenci Development Company—The directors of the company are Richard Lakenau, president; Dan Grant, vice-president; I. H. Knapp, secretary and treasurer; and C. E. Muir, all of Morenci. Hon. F. H. Hereford, of Tucson, is general counsel; Frank Rathbun, mining engineer; M. Danenhauer, of Clifton, is statutory agent.

County Road—The board of supervisors of Graham county has asked for bids for the construction of a public highway leading from East Clifton to Patterson's addition on the east side of the San Francisco river. Office at Solomonville.

Fumarole—The mine is being developed by the National Mining Exploration Company, of which F. A. Woodward is general manager.

California

SHASTA COUNTY

El Dorado—This mine, at Tower House, has been sold by Sherk Brothers to W. H. Roller. There is a small mill at the mine.

Mammoth—About $50,000 worth of improvements will be made in July, in enlarging the blast furnace building and changing the converter crane.

SISKIYOU COUNTY

High Muck-a-Muck—The claims owned by Charles and Henry Herzog, near Etna Mills, are being opened. The railroad company opposed the patenting of the claims on the ground that they were not on mineral land, but the commissioner of the general land office has decided in favor of the Herzog brothers

TRINITY COUNTY

Trinity River—This company, at Lewiston, has recently completed a long tunnel, and is now hauling in the heavy machinery for a hydraulic elevator.

TUOLUMNE COUNTY

The United Mines Corporation and Albany Pacific Mining Company have leased to E. N. Baker, of Cleveland, O., the Dead Horse, Eureka, Lady Washington, Golden West, California, Grizzly, New Albany and Mill Site. The lease is for 10 years and the lessee is to pay $40,000 of debts on the properties.

Ralph—Operations will be resumed, the mine having been sold by the Bagdad-Chase Mining Company to San Francisco men.

Colorado

BOULDER COUNTY

Golden Message—A new hoisting plant is being installed on the property, near Sunshine, by Dr. Curtis Brown as trustee for the stockholders. A large body of milling ore is reported to have been opened.

John Jay—Under the direction of J. A. Bentley, of Denver, the mill near Jamestown will be overhauled. A roaster is to be installed and cyanide tanks added.

CLEAR CREEK COUNTY

Columbia and Eureka—Chicago people have become interested in this property, and are planning extensive development. Manager E. J. Butts, Georgetown, Colo., will later make arrangements for the installation of machinery.

Philadelphia—This company has leased the Dover-Brighton mill on Fall river and will start milling during the coming week. J. W. Boyd, Idaho Springs, Colo., is manager.

Lamartine—The dump has been leased by Oxley & Noonan, Idaho Springs, Colo., and will be hauled to the Jackson concentrating mill at Idaho Springs for treatment. There is estimated to be 50,000 tons in the dump.

Josephine—It is reported that electric drills are to be installed at this property. L. W. Partridge, manager, Georgetown, Colo.

Astor-Stewart—The company will install an air compressor and drills for use in its Scepter tunnel on Democrat mountain near Georgetown.

GILPIN COUNTY

Pine Cone—E. Shoush, of Macon, Mo., has taken a lease on this property near Black Hawk, Colo., and will install machinery.

Evergreen Gold and Copper—Manager Etienne A. Ritter, of Colorado Springs,

is having an 80-h.p. boiler installed in the mill which is to be overhauled to handle the dump and determine the treatment for the bornite ores. The property is situated in the Pine creek district.

Decatur—The company holdings in Moon gulch were sold this week at sheriff's sale to satisfy a judgment of $4325. Decatur, Ill., people are interested and it is understood that they will reorganize and carry on active development on the property, near Rollinsville, Colo.

Sea Bird—Oklahoma people have become interested in this group in the Pine district and it is reported that machinery is to be installed. G. W. Hines, Rollinsville, Colo., is to be in charge.

Hawley-Gardner—William Dickerson, of Bald Mountain, Colo., has started work at this property in the Nevada district; the machinery is being overhauled and arrangements made for active developments.

Aurora—A deed has been recorded conveying from E. E. Clark to H. G. Shuck this claim in the Russell district for $16,000. Pittsburg people are reported to be the new purchasers. P. R. Alsdorf, Central City, Colo., will be superintendent.

A. K. R—Decatur, Ill., people interested in the Smuggler mine have opened up between 5 and 6 ft. of ore in the lower workings which is running high by amalgamation and the concentrates carry much better than average values. The Smuggler retort gold sells to the Denver mint at $19.50 to $19.80 per oz. The company during the past week has purchased claims adjoining their own, giving them 3000 ft. on the line of the Smuggler vein. G. M. Ashmore, Rollinsville, Colo., is manager.

Pearl Tatum—A 5-drill Rand compound compressor is being installed at the Sleepy Hollow mine, and deeper development will follow. Floyd Weed, Black Hawk, Colo., is superintendent.

Cashier—This company controlling the Pittsburg-Meeker mine is figuring on the installation of an electric compressor and pumps. W. Auger, Central City, Colo., is superintendent.

Gladstone—Eastern people are reported to have assumed control and E. H. Crabtree, Central City, Colo., is to have charge of this mine.

Penobscot—This company contemplates adding another compressor plant for driving their tunnel. P. J. Hamble, Rollinsville, Colo., is manager.

Lake County—Leadville

Birdella—The breast of the tunnel is in 400 ft., and another 100 ft. is to be driven to cut the President vein.

Pyrenees—After several mishaps the pumps are again at work and the unwatering of the lower levels is only a question of a few weeks. The company, in unwatering the lower levels, is also draining the Greenback and the Mahala.

Summit County

Robinson—At this old mine, at the town of Robinson, a 150-ton concentrating plant will be installed. The usual concentrating machinery, such as tables, jigs, etc., will be employed; also magnetic separators. The work is in charge of O. H. Fairchild, mining and metallurgical engineer, 202 Exchange building, Denver, Colo.

Indiana

Greene County

The Pea Fry mine has made a contract with a large steel concern at Gary to take the output of the mine for the entire summer season. This will give steady employment to about 200 men.

Sullivan County

Keystone—The fire which started four weeks ago is still burning, but is being gradually smothered and within a week or 10 days is expected to be out entirely. The fire does not interfere with work in any other part of the mine.

Vermillion County

Deering—Falling slate in Deering mine No. 8, in the Clinton field, killed two Polish miners on June 13. As the result of a visit by mine inspectors, Joseph Robinson, mine boss and George Kyle a shooter in the same mine No. 8, paid fines for violating the mining laws. Robinson was charged with failing to provide a separate current of air for each 50 men, and Kyle pleaded guilty to having "drilled on the solid," this term refering to the practice of making the hole into the coal deeper than the distance undermined by the machines.

Kansas

Zinc-lead District

A tract known as the Happy Hollow mining land, southeast of Galena, has just been sold by Rains Brothers to Decker & Co., of Joplin, who will take up the work of developing the land at once.

Michigan

Copper

Michigan—Over 300 ft. of drifting has been done in the adit on the Bee tract and about half the distance high-grade rock was exposed. This lode has also been cut by means of crosscuts from the "C" shaft, which is 650 ft. east of the adit opening. This lode has also been exposed at the 9th and 11th levels and at these points it was found richer than at the level above. The openings throughout are of a most encouraging nature. At the 17th level of the "A" shaft a crosscut was driven to cut the Calico lode and at the point of intersection was found about 4 ft. wide and highly mineralized.

Tamarack—Rock shipments of about 350 tons daily are being made from No. 5 shaft to the Calumet & Hecla stamp mills. In this way a comparative test can be made on the character of the rock, stamping methods, and tailing losses.

Wyandot—Drifting has been started on the recently opened copper-bearing formation. This lode carries but a small amount of copper. Its further opening will be awaited with interest.

Osceola—This company continues to maintain its increased production. During the month of May about 122,000 tons of rock were stamped, yielding nearly 2,622,000 lb. of mineral.

Allouez—No. 2 shaft of this company is now sinking on the formation. This shaft was put down about 2300 ft. through barren ground before the vein was encountered. Work on the two-head addition of the stamp mill, which is owned jointly by this and the Centennial is nearing completion.

New Arcadian—Robert H. Shields, president, has returned from a visit to the east, and while there perfected all the details in connection with the transfer of the Arcadian to the new company. Active operations are to start about July 1. This company owns 3200 acres of land in the mineral zone, and a complete equipment. The old shaft is down about 200 ft., and will be reopened. A drilling outfit will be rigged up at the bottom to ascertain the condition of the formation at depth. The tract will be thoroughly prospected by drilling.

Aztec—A meeting will be held early next month, when plans will be formulated for the beginning of active exploratory work. This tract contains 320 acres located between the Adventure and Lake properties.

Iron—Gogebic Range

Colby—Work has been suspended at this mine and the Ironton, near Bessemer, both owned by Corrigan, McKinney & Co. It is said that trouble with the local authorities about taxation is the cause.

Coppo—The Whiteside Exploration Company is drilling at this old mine and on the adjoining lands, near Marenisco.

Iron—Marquette Range

Volunteer—This mine in the Cascade district is being thoroughly tested by drill.

Menominee Range

Baker—Development is well advanced, and some shipments will be made this year from this mine, which is at the western end of the range.

Channing Gibbs—This property at Red Rock, near Amasa, is approaching the producing stage, and a half-mile spur is being built to connect with the Chicago, Milwaukee & St. Paul road.

Stansbaugh District—Testing work and drilling are being carried out on several

forties by the Cleveland-Cliffs Iron Company. The Buffalo & Susquehanna Company is reopening the old Chicagon mine and sinking the shaft 200 ft. deeper.

Minnesota

Iron—Cuyuna Range

Much exploration is going on this season, and it is hoped that the value of some of the properties will be definitely established. So far, the interest in the range has been largely of a speculative kind.

Interstate Mining Company—This company has been adding considerably to its holdings on the range. It is controlled by the Jones & Laughlin Steel Company.

Iron—Vermillion Range

Section 30—Active work on this property is being carried on under direction of George A. St. Clair and Alfred Merritt, of Duluth. The showing is very good in No. 1 shaft which is now down 700 ft. In No. 2 good hard bessemer ore has been found.

Missouri

Howell County

Carson—The Frisco Ore Mining Company has abandoned this mine. The machinery is being torn down and a portion of it shipped to St. Louis. The mine has been operated by this company for seven years, and during that time about 3000 cars of ore have been shipped to the St. Louis Blast Furnace Company.

Joplin Zinc-lead District

The large area of disseminated ore ground west of Joplin is now assured of four more mills. Much drill work is being done. Three large mining properties were recently sold at handsome figures. The Elking, north of Webb City, for $100,000; the Keystone, south of Webb City and High-grade mine at Central City, price not stated.

Big Fly—The erection of this mill on the lease of the Louisville Lead and Zinc Company, of Joplin, just west of Chitwood camp, is proceeding rapidly and the building is almost completed.

Barefeet—This Joplin company is taking out a good tonnage of rich ore from the old Cardinal ground at the Midway tract.

Kalitan—R. K. Pitkin has sold his control of this company to John T. Robertson, of Joplin.

Knights Station—Four exceptionally rich zinc prospects have been drilled at depths ranging from 125 to 185 feet.

On adjoining land, to the West, there has been developed one of the greatest silicate prospects ever seen in the southwest. The ore is found under the surface at about 4 ft. The earth is removed with scrapers and the silicate is blasted out as one would blast limestone from a ledge.

Maltese Lead and Zinc Company—This Joplin company will begin operations west of Joplin in the Central City district.

Midnight—Dr. George E. Ladd, of Wilburton, Okla., is making arrangements to resume operations on his property at Zincite. A 5-in. steam pump was installed recently.

Lone Star—Articles of incorporation were filed at Carthage. The company owns mining property near Knights' station. C. J. Tobins, of Carthage, is one of the principal owners.

Integrity—Work has begun on a 250-ton milling plant to take the place of the one destroyed by fire last year.

O.K.—After a shutdown of 5 months, the mill began operations last week. The mill has been remodeled, and has a capacity of 100 tons daily.

Sampson—The mill is to be operated by electric power, and has a capacity of 250 tons per day. It is a new plant and will begin treating ore soon.

Herald—The 300-ton plant resumed operations June 18.

Montana

Butte District

Amalgamated—At the Pennsylvania mine an air shaft has been constructed down to the 1600-ft. level and has materially improved the ventilation. At the 1200-ft. level in the air shaft a blower with a capacity of 60,000 cu.ft. per minute forces the air downward. The shaft is now down 1800 ft. and the principal work is being done on the 1400-, 1600- and 1800-ft. levels. Between 1000 and 1200 tons are being hoisted daily. At the Mountain View mine a 400-gal. electric pump has been installed. On the 1200-ft. level of the Leonard mine two Nordberg pumps with a capacity of 600 gal. each are in use. At the Badger State mine sinking on the shaft has been resumed. The shaft at present is 1200 ft. deep and will be sunk to the 2000-ft. mark. At the Red Bower mine the shaft is now being sunk from the 300- to the 600-ft. level. Those in charge of the Amalgamated properties in Butte state that its operating companies, together with the North Butte, are producing at the rate of 14,000 tons of ore daily. Of this amount the Washoe smelter, at Anaconda, treats 10,000 tons and the Boston & Montana smelter at Great Falls treats 4000.

Jefferson County

Alta Montana—C. C. Titus, formerly superintendent of the independent smelter at Ponderay, Idaho, has been placed in charge of the work at the Alta mine.

Assets Gold Mining Company—The company has recently been incorporated under the laws of Montana with a capital stock of $3,000,000, with 600,000 shares of the par value of $5. The incorporators are W. W. Barr, of Seattle, George Northup, of Grand Rapids, Mich., and James A. Barr, of Houghton, Mich. The company will operate the Farlow group of claims situated four miles from Jefferson City.

Lewis and Clarke County

Gold Crown—The new 80-ton mill has been put in operation under the direction of W. J. Heiber. The mill is thoroughly equipped with a Blake crusher, Fraser & Chalmers rolls, revolving screen, hydraulic classifier, six-compartment jig, elevators, Wilfley tables, a 70-h.p. boiler and 50-h.p. Atlas engine. The main shaft is down 250 feet.

Nevada

Esmeralda County—Goldfield

Florence Goldfield—A new discovery of high-grade ore was made last week on the Engineer's vein on the fourth level from the main shaft. The foundations are under way for the extension to be added to the mill. The tube mill and extra tables are expected about July 1, which will increase the capacity to about 175 tons per day. The old Reilly Lease workings are now being put in shape for production of ore. At the meeting held in Denver June 7, a dividend of 10c. per share, amounting to $105,000 was declared.

Nancy Donaldson—A hoist is being installed on this Red Mountain property, about eight miles northeast of Goldfield. The property, consisting of four claims, is managed by J. C. MacCormack, of Goldfield, and the work will be in charge of John T. Hawkins, who is also manager of the James Burns interests in Goldfield.

Esmeralda County—Lucky Boy

Mitchell Fairfield Lease—A 100-h.p. hoist and 10-drill compressor are being installed on this property. The shaft is now 200 ft. deep and shows ore of a good grade.

Hubbard Lease—About 70 tons of ore are being shipped daily. The lease has less than 60 days to run.

Esmeralda County—Rawhide

Rawhide Queen—The Grutt Balloon lease recently struck good ore on the 185-ft level. The ledge is 7 ft. in width, and will average about $48 in gold per ton. This is the best strike that has been found in the camp.

Original Rawhide—The Kerns No. 1 lease on the Queen Estate has struck ore on the 150-ft. level, assaying $18 to $20 per ton. Not enough work has been done to determine the size and value of the strike.

Rawhide Coalition—The Coalition Crown lease is now installing a 12 h.p. hoist and a 40-ft. gallows frame. The shaft is down about 90 feet.

Bovard Swastika—Extensive operations on the Buckskin group of claims will

begin soon. The property is about 22 miles south of Rawhide. The main office is at 181 La Salle street, Chicago.

LINCOLN COUNTY

Alunite—It is reported that the Alunite Mining Company has purchased three fractional claims from "Jack" Hayes and associates. The price is said to be $25,000.

LYON COUNTY—YERINGTON

Wabuska Copper—Recent development work on the 500-ft. level of this property has disclosed promising orebodies, the copper content being in excess of 3 per cent. The property is to be equipped with a compressor, pump and larger hoist, and it is reported that the company intends building a smelter.

NYE COUNTY—BONNIE CLARE

Bonnie Clare—This recently reorganized company is leasing its mining properties and for the present will operate the mill only on company account, working over the tailings of which there are about 4000 tons. Later a tube mill and additional concentrators will be added and the mill operated as a custom mill. A. J. Trumbo, of Bonnie Clare, is in charge of the work.

NYE COUNTY—BULLFROG

Montgomery-Shoshone—The final clean-up for the month of May showed a production of $50,000. At present the mill is treating between 200 and 220 tons of ore per day. Approximately 5000 tons of good milling ore have been developed on the 500-ft. level. The stope on the 300-ft. level is 100 ft. long and 12 ft. wide.

National Bank—J. C. Kennedy and others have secured a two years' lease on this property, and intend to push development work as fast as possible.

Mayflower—The output for May was $10,700, from 390 tons of ore treated. A saving of 92 per cent. was made. The ore is from the stope between the 200- and 300-ft. levels.

Rickard-Garburg Lease—Ore of a high shipping grade was broken into last week in the winze 15 ft. below the tunnel level. The ledge shows from 4 to 5 ft. in width. Average samples taken across the entire vein return values from $50 to $200 per ton. A shipment comprising about 30 tons is sacked and will be sent out this week. The main shaft is being pushed down by three shifts, and a crosscut will be run to cut the ledge at the 200-ft. level.

Tramps Consolidated—A carload shipment from the Jingles & Clothier lease, valued at $25 per ton was made last week, to the smelter at Needles.

Bullfrog Pioneer—Shipments from this property are now being made at the average of 75 tons per day. A car of high-grade ore was shipped last week, which netted the company in excess of $10,000 for the car. The entire product of the mine is being handled by the Western Ore Purchasing Company.

NYE COUNTY—TONOPAH

Belmont—The old Belmont shaft has been unwatered and preparations are now being made to connect with the east crosscut on the 1000-ft. level, 450 ft. below. A hole 6 or 8 in. in diameter will first be made with a churn drill to afford better ventilation in the work of raising the three-compartment shaft from the 1000-ft. level. Extremely good-grade ore 4 ft. thick has been exposed on the 1000-ft. level.

MacNamara—A new body of high-grade shipping ore was opened last week in the winze from the west drift on the 200-ft. level. The vein is 6 ft. wide and of shipping grade across its entire width. The new compressor which is to be installed should reach the mine about June 25.

Tonopah Mining—A less amount of development work than usual is now being performed, due to the lack of compressor capacity. The shaft is still being sunk, and is now below the 1400-ft. point. The month of May showed the best record ever made at the mill, 14,480 tons of ore being crushed which returned over $230,000 in bullion and $50,000 in concentrates.

New Mexico

SOCORRO COUNTY

Top Development Company—The Top Mining Company has been reorganized into a development company, capitalized at $650,000. The property is in the Mogollon district. E. A. Wayne is principal stockholder.

Oklahoma

There will be an investigation conducted during the summer on the mineral resources of Oklahoma by the Oklahoma Geological Survey. The plans now developed will consist largely in the investigation of portland cement and clay products in the northern and eastern parts of the State, and a study of the asphalt deposits in several of the southern counties. Prof. D. W. Ohren, L. L. Hutchinson and Ben C. Bolt will have charge of the field-work.

Oregon

LANE COUNTY

West Coast—The clean-up made June 1, after six days' run resulted in obtaining $2500. Superintendent Ryan states that the mill will be closed down for a short time in order to make some necessary adjustments and improve the ore-transportation system.

Mayflower—W. P. Ely, of Kelso, manager, reports that the mill was started May 1, and that he expects to put 500 tons of ore through, as a trial run, using the cyanide process. This is the first cyaniding done in the Bohemia district.

Combination—Rich silver ore has been discovered in one of the lower tunnels. Milling operations will begin soon and the concentrates will be shipped to the Tacoma smelter.

Pennsylvania

ANTHRACITE COAL

Ferndale Colliery—This colliery is to be closed down in consequence of a decision recently rendered. The miners at the colliery, which is owned by the Hillside Coal and Iron Company—the Erie railroad—appealed to the Board of Conciliation, their complaint being that the company was not paying sufficient wages for rock work. The board after hearing the case decided against the company and held that the price for rock work should be $2.20 per yd. The company, of course, accepted this decision and paid the men at that rate up to date, but decided to close down the mine on the ground that it was too expensive to work. This is said to be the first case since the Board of Conciliation was appointed in 1903, when one of its decisions resulted in closing a colliery.

Kingston Coal Company—The new coal breaker No. 2 of this company last week passed all records for a day's work. In one day 1410 cars were raised through the shaft and slope and all the coal passed through the breaker, making a total of 4300 tons over the screen. The breaker was recently overhauled and rebuilt, being furnished with all the latest improvements, such as spiral conveyers, Emery slate pickers and others. The work was done under the direction of F. E. Zerbey, general manager of the company.

BITUMINOUS COAL

Pittsburg Terminal—All the coal mines in the Pittsburg district along the West Side Belt railroad, which belong to the Gould interests and which were formerly operated by the Pittsburg Coal Company, have been placed in operation under the management of the Pittsburg Terminal Railroad and Coal Company. The mines have been idle for some weeks, during which time new machinery for loading cars has been installed, and other improvements to facilitate the handling of coal over the Wabash lines were made. B. F. Bush, receiver of the Western Maryland railroad, is president and J. J. Keefer, formerly general manager of mines of the Monongahela River Consolidated Company, is vice-president and general manager in charge of operation.

The 500 steel hopper cars ordered some time ago by the Wabash-Pittsburg Terminal railroad are being delivered at the rate of 25 per day by the Standard Steel Car Company, and a large number of them have been placed in service to handle the output of the West Side Belt mines.

Utah

Beaver County

Cupric Mines—The shaft has been penetrating bunches of copper ore for some time but at a depth of about 300 ft. the ore showing became more favorable and has continued to improve as the work progressed. L. Morris, general manager, Beaver, Utah.

Cave—A car of copper ore was recently marketed, averaging 17.5 per cent. copper. The management now plans to ship copper ore regularly and to take out at least one car of iron ore per day.

Juab County

East Tintic—The latest strike made in the Ralph claim of this company is in the shaft at a depth of 314 ft. At that point 14 in. of high-grade silver ore has been cut. It is of different character from that which has been opened in the cave 60 ft. farther east; it is quartz ore running lower in lead but higher in silver content than the cave ore.

Salt Lake County

Utah Copper—The record output at the Utah Copper mine at Bingham was made on June 13. On this day this company handled the greatest tonnage of ore in its history. During the day 249 cars of 55-ton capacity amounting to 13,700 tons of ore left the mine for the mill at Garfield.

Ohio Copper—The first section in the new mill of the Ohio Copper will be ready to go into commission in about two weeks but it is probable that the management will defer operation until the mill is sufficiently completed to treat 3000 tons of ore per day. This would only be about two months longer and in that time the mine could be completely opened down to the 1400-ft. or Mascotte-tunnel level and a large and steady output easily maintained.

Tooele County

Western Utah Copper—Superintendent J. E. Bergh reports having driving 100-ft. on the 300-ft. level since operations were taken up at that point. Work has also been started on the 600-ft. level

Washington

Ferry County

Blacktail—The fourth car of ore was shipped to the Tacoma smelter last week

Skagit County

Anacortes—T. F. Thomas, Ballard, Wash., and associates of Seattle have purchased a tale mine from Thomas Sharp, seven miles west of Anacortes for $75,000, the first payment of $10,000 having been made, the balance to be paid in monthly installments

Wisconsin

Zinc-lead District—Platteville

A company of 30 shareholders has been formed to drill for lead and jack on the Weigle and Billmeyer tracts southwest of the Klar-Piquatte.

Badger—The Galena Iron Works have contracted to construct a small milling plant for this company four miles southwest of Dodgeville; Geo. Lindsey, of Dodgeville, is in charge of the mine.

Dark Horse—A 50-ton mill is to be put up.

Ellesworth—W. N. Smith, of Platteville, has purchased the Empress mill for removal to this mine, at Livingston.

Optimo—Foundations are being laid for a 50-ton mill at this mine, at Linden; Jas. Billingsly, of Galena, Ill., is general manager.

Wisconsin—A new shaft is being sunk on the Longhenry land by The Wisconsin Zinc Company. This company has obtained options on the Kennedy mine, at Hazel Green, and the Pittsburg-Benton, at Benton.

Weigle—This has been re-organized as the Standard Zinc Company, and a force of men put to work at the mine.

Canada

British Columbia—Queen Charlotte Islands

Small quantities of placer gold are being recovered by miners working on the east coast of Graham island.

Preparations are being made to take in a diamond drill to prospect coal measures occurring in the Yakoun district of Graham island.

A 2-ft. vein of gold quartz is being prospected on the Gold Harbor claim, west coast of Moresby island.

British Columbia—Rossland

Consolidated Mining and Smelting Company—Another copper furnace, described as the largest in Canada, has been blown in at Trail. There are now four copper furnaces at these works, having a total treatment capacity of about 1800 tons of Rossland ore per day.

Le Roi No. 2—For the purpose of developing the extension of one of Le Roi lodes, which dips into the Annie claim of Le Roi No. 2 group, a shaft is to be deepened from 900 to 1200 ft. Present dimensions of the shaft—6x16 ft.—will be maintained to the 1200-ft. level. It is estimated the cost of the work will be about $18,000 and that it will take eight months.

Quebec

Two distinct booms are in progress in the southern part of the Province. One is in asbestos, and is largely due to the formation of the Amalgamated Asbestos Company. Property in the asbestos district—and anywhere near it—is held at high figures, in some cases out of all season.

The other boom is in placer gold in the Beauce and Compton districts, where placer mining on a very small scale has been carried on for years, but there has never been any production of importance.

Compton Gold Dredging Company—This company's agents having failed to come up to their agreement to provide funds for a dredge by May 1, Kennedy & House, of Beebe, the owners, have demanded the surrender of the property.

Eastern Canada Mines Company—This company, it is stated, has arranged to sell the Chat Noir placer.

Eastern Canada Smelting Company—This company is sinking a shaft on the McDonald copper claim at Weedon, on which it has an option.

Mexico

Chihuahua

Midland—D. M. Evans, manager, reports that development work is opening bodies of high-grade lead-silver ore.

Rio Plata—D. W. Shanks, general manager, reports an important strike in the Santa Barbara mine. Only 15 out of 25 stamps are in operation, due to lack of water.

San Toy—The management announces that the balance of the floating debt has been paid. The amount of this debt, Jan. 1, was $215,653. The funds for this came from the net profits on the ore sold since that date.

Mexico

Mexico Mines of El Oro—Report for May: Mill ran 22 days and crushed 7334 tons of ore, yielding bullion valued at $100,760; working expenses $32,990; development $5000; net profit of $60,870.

El Oro—Report for May: Mill No. 1 ran 25 days and mill No. 2 operated 23 days, crushing 20,927 tons of ore, yielding bullion valued at $186,480; working expenses, $100,020; development $22,600; net profit $63,800; profit on railway $6000; expenditure on permanent improvements $7000

Sonora

Greene-Cananea—A concession has been granted for building a railroad from Imuris, on the Sonora railway, east, through northern Sonora, to a point on the Mexican Central in Chihuahua. Chas. S. Henning, with an office at Douglas, Ariz., is chief engineer.

Australia

Victoria

The gold production for the five months ended May 31 is reported at 268,000 oz. fine, or $5,558,340 in value

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 23—The bituminous coal trade in the East continues to show an improvement which is not marked, but rather steady. Steam coal is in better demand, which indicates an improvement in business generally.

The anthracite trade is a little more active than it has been, and most of the companies are running their collieries at a nearer approach to full time.

Fair reports come from the trade in the West. Steam coal is in better demand and the large consuming centers are calling for more shipments. In part, perhaps, this is a result of the recent policy of keeping shipments down closely to avoid demurrage sales, but in part it is due to a real increase in demand.

The Lake trade is looking up and shipments have been increasing. Up to this date they are considerably above those of last year; sufficiently so to promise a good season total.

Tariff on Coal—Much interest is taken in the question of the tariff on coal, and especially on the question of a reciprocal arrangement with Canada. Many Pennsylvania shippers favor such an arrangement because they have a large trade with Canada; but West Virginia men are opposed because they are cultivating the New England trade and do not want to come into competition with Nova Scotia coal. A similiar local division of opinion exists in Canada itself. Nova Scotia miners are opposed to reciprocity, fearing to lose Canadian trade; Ontario favors it as a means of getting cheaper coal; while British Columbia also favors it owing to its large trade on the Pacific Coast.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to June 12, short tons:

	1908.	1909.	Changes.
Anthracite	2,469,413	2,347,762	D. 121,651
Bituminous	14,419,474	15,613,741	I. 1,194,267
Coke	3,051,632	4,444,043	I. 1,392,411
Total	19,940,519	22,405,546	I. 2,465,027

Increase for the week, 117,610 tons. Total increase year to date, 12.4 per cent.

Coal tonnage passing the locks on the Monongahela river, four months ended April 30, was 2,584,820 short tons in 1908, and 3,206,720 in 1909; an increase of 621,900 tons.

Coal passing Davis island dam on the Ohio, four months ended April 30 was 961,215 short tons in 1908, and 1,756,345 in 1909; increase, 795,130 tons.

Coal receipts at St. Louis, four months ended April 30 were 2,374,541 short tons in 1908, and 2,267,188 in 1909; decrease, 107,353 tons.

Coal shipments by water from Seattle and Tacoma, Wash., four months ended April 30, were 212,180 tons in 1908, and 95,554 in 1909; decrease 116,626 tons. These shipments are mainly to California and Alaska.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, four months ended April 30, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	6,434,050	1,302,873	7,736,923
Buff., Roch. & Pitts.	1,849,644	147,557	1,997,201
Buff. & Susqueh'na	484,838	107,161	591,999
Penn. lines, N. Y. C.	2,503,959	29,908	2,533,867
Pitts. & L. Erie	2,239,786	1,325,911	3,566,697
Norfolk & Western.	3,870,163	835,823	4,705,986
Ches. & Ohio	3,826,493	155,932	3,982,425
Total	21,208,933	3,906,165	25,115,098
Total, 1908	18,890,852	2,596,113	21,486,965

Total increase this year, 3,628,133 tons, or 16.9 per cent. In addition the Baltimore & Ohio carried 281,493 tons of anthracite in 1908, and 322,459 in 1909; an increase of 40,966.

Coal tonnage of railroads in Ohio Coal Traffic Association, four months ended April 30, short tons:

	1908.	1909.	Changes.
Hocking Valley	741,635	883,090	I. 141,455
Toledo & Ohio Cent.	306,283	326,008	I. 19,725
Baltimore & Ohio	637,275	345,887	D. 191,388
Wheeling & L. Erie	784,542	875,044	I. 90,502
Cleve., Lorain & Wh.	755,525	616,338	D. 139,187
Zanesville & Western	373,305	348,283	D. 25,022
Toledo Div., Pen. Co.	550,890	582,575	I. 31,685
L. Erie, Alliance & Wh.	328,427	331,304	I. 2,877
Marietta, Col. & Clev.	22,399	21,430	D. 969
Total	4,400,281	4,329,959	D. 70,322

The total decrease in shipments this year was 1.6 per cent.

Coal tonnage of Chesapeake & Ohio railway, 10 months from July 1 to April 30, short tons:

	Coal.	Coke.	Total.
New River	5,378,470	221,038	5,599,508
Kanawha	4,195,853	24,498	4,220,351
Kentucky	287,784	.....	287,784
Connecting lines	200,789	69,795	270,584
Total	10,062,896	315,331	10,378,227
Total, 1907-08	8,957,603	295,513	9,253,116

Deliveries this year to points west of mines, 4,987,388 tons coal and 179,400 coke; points east, 1,278,800 tons coal and 135,931 coke; tidewater, 3,606,317 tons coal; anthracite to line points, 7598 tons.

New York

Anthracite

June 23—The anthracite trade is looking up and business has been rather more active. This is partly to be explained by the approach of another 10c. rise which will be due next week. The Reading company is reported to be running all its collieries five days during the week, and some other companies are running on full time.

Until July 1 there will be no change in prices. We quote for prepared sizes, $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

Bituminous

A little more interest has been shown in the market, notwithstanding the general hot weather of the week. Manufacturers are evidently needing more coal and are beginning to think of laying in winter stocks, especially in the far Eastern ports. Inquiries from that section are coming in and the Sound is also buying more coal. New York harbor continues a weak spot, but matters are looking up even there. Prices remain the same at $2.40@2.50, f.o.b. harbor shipping port, for lower grades and $2.60 up for better coal. All-rail trade is improving a little. Cars are plenty, but transportation still rather slow.

The English coal troubles are still attracting atention. The recent sharp advance on export coal at Cardiff, it is thought, may be the means of throwing some South American trade this way, and some shippers are negotiating for vessels to be ready for such a movement.

In the Coastwise trade vessels are still in good supply and there is little or no change in rates. From New York cargoes are taken at 60@65c. to points around Cape Cod.

Birmingham

June 21—Coal mining in Alabama shows improved conditions and the output is better than it has been for some time, with a steady demand coming in. Recent orders placed indicate that consumers are looking this way for their needs. The Central of Georgia railroad will need something like 80,000 tons of coal from this section between now and the end of the year.

Chicago

June 21—Buying of steam coals continues quiet but steady; the summer demand for fine coals makes itself strongly felt, and lump from Illinois and Indiana

mines is very weak. Domestic buying is very light. Shipments of western lump to this market are too large and should be curtailed. Eastern coals are again too plentiful and show old-time conditions of demoralization of prices to escape demurrage charges. Competition is keen for any good order of either eastern or western, with the result of further lowering of prices. The summer business, it should be borne in mind by shippers and prospective shippers, is in this market essentially of fine coals.

Illinois and Indiana lump, when it sells, brings $1.75@2.15; run-of-mine, $1.60@1.75 and screenings, $1.50@1.70. Contract sales of these coals are at low figures and some new contracts are made at still lower prices, especially on run-of-mine.

Of coals from east of Indiana smokeless is 15 or 25c. off from circular prices, selling for $3.05@3.30 for lump and $2.75@2.95 for run-of-mine. Hocking is 10 to 25c. off the circular price of $3.15; Pittsburg No. 8 and Youghiogheny have a light open market at $2.65 and $3, respectively, for ¾-in. lump.

The anthracite market is dull and even the approach of the end of June with the less discount for July fails to stir activity.

Cleveland

June 22—Trade is steady, and the demand for steam fuel, chiefly slack, is improving: The quotations for Middle district coal are: Lump, $1.85@2; run-of-mine, $1.65@1.75; slack, $1.25@1.35. For No. 8 district lump, $1.90@$2.05; run-of mine, $1.70@1.80; slack, $1.40, all f.o.b. Cleveland. A circular just issued puts prices of Massillon coal for domestic use at $2 for lump and washed nut; $1.85 for run of mine and $1.75 for slack, all f.o.b. mines; these prices to hold until Aug. 31 next.

Indianapolis

The tendency is still toward improvement and the mining conditions have developed satisfactorily during the past week. While the coal prices are not attractive, the future indications seem to promise much. The present prospect for work at the Indiana mines in general is better than it has been for several years. This condition extends over nearly all the State. The Gary Steel Works are contracting for much coal.

Pittsburg

June 22—Coal production continues at fairly steady gait, and preparations are being made for the general resumption of Lake shipments after July 4. The market is not very active. Nominal prices remain at $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at the mines, these prices being shaded 5 to 10c. Slack is quoted at 60 to 65c. per ton.

Connellsville Coke—The appraisements in connection with the proposed merger of independent operations will be completed this week. A formal announcement of the properties to be included and the identity of the backers is promised for about July 15. It is admitted that some of the high-priced properties may be dropped, but the claim is, nevertheless, made that two-thirds of the independent acreage in the Connellsville field will be merged.

The market shows a slightly firmer tone, some operators having advanced prices, but the market, as a whole, can hardly be quoted more than 5c. a ton higher on furnace coke. Furnace coke, prompt, is $1.55@1.60; contract, $1.65@1.75; foundry, prompt, $1.80@2; contract, $1.90@2.25.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ending June 12 at 299,486 tons, an increase of 8000 tons over the previous week; shipments as 4138 cars to Pittsburg, 6213 cars to points west of Pittsburg and 730 cars to points east of Connellsville, a total of 11,081 cars, an increase of 900 cars.

Foreign Coal Trade

German Coal Trade—Imports and exports of fuel in Germany, four months ended April 30, metric tons:

Imports:	1908.	1909.	Changes.	
Coal	3,360,489	2,992,131	D.	368,358
Brown coal	2,977,992	2,583,140	D.	394,852
Coke	169,081	207,866	I.	38,785
Briquets	62,693	61,292	D.	1,401
Exports:				
Coal	6,357,242	6,934,991	I.	577,749
Brown coal	7,903	9,562	I.	1,659
Coke	1,196,219	1,099,710	D.	96,509
Briquets	548,701	442,737	D.	105,964

Coke exports this year included 8308 tons to the United States.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on June 12: Best Welsh steam, $4.14; seconds, $3.96; thirds, $3.84; dry coals, $4.08; best Monmouthshire, $3.60; seconds, $3.48; best small steam, $2.70; second, $2.58. All per long ton, f.o.b. shipping port. There has been a sharp advance, ranging from 12 to 24c. per ton.

Iron Trade Review

New York, June 23—Business in the iron and steel markets continues fairly active, especially when it is considered that the month of July is approaching, when trade is usually slack. Orders continue to come in well—not quite with the rush that was evident in the latter part of May, but still on a fairly good scale; and it is noted that specifications on contracts are coming in regularly and freely. Most of the mills have no complaint to make.

In finished material structural steel continues to lead and the volume of small contracts reaches a large total. Only a few heavy contracts are pending at the present time, but more projects are coming up and others will soon be in a position for tenders. It is noted that the fabricating companies are inclined to ask prices a little higher than they have been accepting. The railroads are still rather backward, although there is now considerable placing of bridge work and some orders for cars. The only heavy orders for rails have come from the Harriman lines. It is said that American makers have secured an order of 50,000 tons of rails for South America.

In pig-iron foundry orders have been inclined chiefly to moderate quantities. A few large contracts both for foundry and basic has been placed for fourth-quarter delivery; most of them at a slight advance on current prices. Furnaces are inclined to be rather firm in their views of prices and to ask advances on all orders for future delivery.

Wage Increases—The Jones & Laughlin Steel Company, of Pittsburg, the Cambria Steel Company and Pennsylvania Steel Company on July 1 will restore wages to the rates prevailing before a 10 per cent. reduction was made last April. The same action will be taken by the Thomas Iron Company, one of the largest merchant-furnace interests, and by several less important companies.

Baltimore

June 22—Exports for the past week included 143,038 lb. zinc dross and 3,787,200 lb. steel billets to Liverpool. Included in imports were 6200 tons manganese ore from Vizigapatam, India.

Birmingham

June 21—Optimism prevails among the pig iron and steel manufacturers. The demand is equal to the output and the inquiries that are coming in are satisfactory. The sales are still in small lots with occasionally a large quantity. The quotations show but little change. No. 2 foundry is being held at $11.50 per ton, delivery during the third quarter at the latest. Iron during the latter part of the year is being quoted at $12 per ton with some tentative orders in hand. The make promises to be kept up. The Birmingham Coal and Iron Company announces that as soon as No. 2 furnace goes out of blast for repairs, No. 1 at Vanderbilt, will be started up.

The appointment of receivers for the Woodstock Iron Company, upon a petition filed in the United States court, in involuntary bankruptcy, during the past week, promises to be temporary. J. M. Barr, president of the company, is one of the receivers and W. E. Leake the other.

Chicago

June 21—The iron market shows no signs of weakening so far as sales or prices of pig iron generally are concerned, and iron and steel products are increasing in demand week by week. Foundry iron

is still selling in small lots, with prices practically unchanged from last week. The demand for Northern iron seems to be increasing somewhat at $16.50, generally quoted and obtained on fourth-quarter business. For Southern iron $11.50, Birmingham ($15.85, Chicago), is standard, with some interests very strong for 25 or 50c. more. Lake Superior charcoal is in good demand at $19.50.

Aside from a few purchases of long-deferred requirements, the market continues to have transactions of only a few hundred tons each. The average consumer is buying, as heretofore, only a short time ahead, but continues also feeling the market with inquiries for good-sized amounts, with the expectation of rushing in quickly should a turn toward higher prices appear. With the heavy consumption of iron and steel that is beginning to appear, this attitude seems destined soon to disappear. That the number of small purchases is large and increasing shows generally diffused improvement in the melter's business.

Railroad supplies and structural material continue to lead the market for iron and steel goods, with other products in good and increasing demand. Coke is somewhat more active and firm at $4.70, Chicago.

Cleveland

June 22—The strike of lake seamen is making less trouble, and all the vessels needed are moving. The longshoremen voted against the proposed sympathetic strike. Ore is moving freely. Some sales are reported.

Pig Iron—A moderate business only has been done, chiefly in small lots, with one or two up to 5000 tons each. Prices are firm around $15.25@15.50 for No. 2 foundry and $15.75 for bessemer pig.

Finished Material—Several contracts for structural steel are reported, including one large one. Bars are quieter, most buyers being supplied for the present. Specifications on contracts are coming in well.

Philadelphia

June 23—The pig-iron market continues strong and sales foot up a pretty large total. Foundry-iron orders are not very large, but there has been considerable business in basic and quite a call for low-grade iron for pipe foundries. Sellers are pretty firm in their views and No. 2X foundry may be quoted at $16.50@16.75; No. 2 plain, 50c. less. Gray forge is more active than it has been, around $15.25. Some Virginia iron is selling, but not much Alabama.

Steel Billets—There is a better demand for small lots but no large sales. Advances are being asked and at least $2 per ton more is wanted than a few weeks ago.

Bars—The market is stronger and mills are asking $1 or $2 more per ton for refined iron, and $1 more on steel bars. Store trade is improving considerably.

Sheets—A big business is being done in small orders for prompt shipment.

Scrap—Sales have not been large, but dealers are not regretting this. They are holding on to their piles, looking for a big profit soon. Heavy steel scrap is being gathered in wherever it can be found.

Pittsburg

June 22—Railroad buying continues to furnish the chief activity in the steel trade. The buying of steel cars by leading roads is on quite a liberal scale, while locomotives and track materials are being taken and rail orders are averaging a large tonnage. The largest single purchases are those of the Harriman lines, about 150,000 tons, while the Argentine order, 40,000 tons, is the best export rail order taken for some time.

While new buying of steel products by manufacturers and jobbers is on a reduced scale, orders and specifications on old contracts are on a liberal scale, and June will probably prove to be the record month of the half year. Specifications have been so liberal that some of the mills have gotten behind, and in extreme cases rolling schedules are being made up 30 days in advance.

Pig Iron—The market has continued to show an advancing tendency, and while prices are not quotably higher on all grades, there is a distinctly firmer tone in every direction, and some sales have been made at higher prices than formerly. Some small lots of foundry iron, for instance, have sold at $15.25, Valley, for early delivery, while the minimum for such delivery is $15, Valley, $15.25 being demanded for delivery over the third quarter or second half, an advance of fully 25c. in the week. While basic might be obtained for early delivery at last week's quotation of $14.75, Valley, the market is generally held to be $15 for extended delivery. Bessemer is firm at $15.25, Valley, and it is doubtful if much iron could be picked up at this price. Forge is quotable at $14.15, Valley.

Steel—The scarcity of open-hearth steel has become more pronounced. Open-hearth billets are quoted at 50c. or $1 above the nominal market of $23, which still prevails on bessemer billets. Open-hearth sheet-bars are also scarce, being quoted at $26, with bessemer at $25. The nominal market is $25.50, delivered, but this price was shaded a few weeks ago to $24 or less. It is understood that these low-priced sales were of bessemer steel only, the sellers not being able to furnish open-hearth bars, and that the present scarcity of open-hearth is due to buying by consumers who must have a proportion of open-hearth, but covered on bessemer only. Plates are not as strong as structural shapes, and 1.25c. is occasionally done on attractive business, the regular market being quotable at 1.30c., the same as on shapes.

Sheets—Demand has improved somewhat, and the market is slightly firmer. Capacity continues to be but indifferently employed, but this is almost a permanent feature of the sheet trade, since even in 1906 and 1907 there was frequently some idle capacity, while several new mills have been built since then, and there are further projects under consideration at the present time. The market can be quoted at 2.20c. for black and 3.20c. for galvanized, but occasionally on attractive business these prices are shaded $1 per ton.

Ferromanganese—The market has shown a slightly firmer tone, although transactions are not large, and is quotable for early delivery at $41, Baltimore, or $42.05, Pittsburg; contracts for next year commanding about $42, Baltimore.

Sault Ste. Marie Canal

The total freight passing through the Sault Ste. Marie canals for the season to June 1 is reported as follows, in short tons:

	1908.	1909.	Changes.
East-bound	1,049,313	3,845,433	I. 2,796,120
West-bound	618,829	1,339,529	I. 720,700
Total	1,668,142	5,184,962	I. 3,516,822

In 1907 the total was 8,922,877 tons. The number of vessel passages this year was 2130, giving an average cargo of 2434 tons. The mineral freights included in the totals were as follows, in short tons except salt, which is in barrels.

	1908.	1909.	Changes.
Coal	453,121	1,096,860	I. 643,739
Iron ore	263,882	3,028,609	I. 2,764,727
Pig and man. iron	50,820	65,000	I. 14,180
Copper	14,264	21,613	I. 7,349
Building stone	.....	450	I. 450
Salt, bbl	163,534	164,340	I. 806

In 1908 ore traffic did not fairly begin until June. Iron ore formed 58.4 per cent. of the total tonnage this year; coal, 21.2 per cent.

Metal Markets

New York, June 23—The metal markets have shown a tendency to recede rather than to advance; sales have not been so active, and there is less speculative business.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
May 1909	$11,171,265	$ 2,263,721	Exp. $ 8,907,544
" 1908	26,555,913	3,101,002	Exp. 23,454,911
Year 1909	55,487,891	17,767,857	Exp. 37,720,034
" 1908	44,891,257	22,958,223	Exp. 21,933,034
Silver:			
May 1909	4,428,448	3,857,388	Exp. 571,060
" 1908	4,028,334	3,389,568	" 638,766
Year 1909	23,854,629	18,032,453	" 5,822,176
" 1908	21,077,385	17,688,150	" 3,389,035

Exports from the port of New York, week ended June 19: Gold, $50,000 to South America; silver, $772,846, chiefly to London and Paris. Imports: Gold, $896,418, from the West Indies and South America; silver, $52,084, from the same countries.

Gold—The price on the open market in London was unchanged at 77s. 9d. per oz. for bars. The gold arriving went chiefly to the Bank of England. In New York exchange rates were high but no gold has been actually shipped to Europe.

Platinum—Business shows the usual summer quiet and prices are unchanged at $22.50@23 per oz. for refined platinum, $25 for hard metal and $18@20 for scrap. The price of iridium has been raised and most dealers anticipate an advance in platinum.

Our special correspondent reports from St. Petersburg, under date of June 10, that sales have been a little better but this has had no influence on prices, which remain unchanged. Platinum is quoted at Ekaterinburg at 4.50@5 rubles per zolotnik for crude metal, 83 per cent.; and at St. Petersburg at 18,000@19,000 rubles per pood. These prices are equivalent to an average of $17.11 and $18.13 per oz. respectively.

Silver—The bullion supplies in the East are large, so we are informed, and there is no lack of silver. At the same time the price remains comparatively steady, while Indian advices as to rain are reported as encouraging for trade and for prices for silver bullion.

SILVER AND STERLING EXCHANGE

June.	17	18	19	21	22	23
New York....	52⅝	52⅝	52⅝	52⅝	52⅝	52⅝
London.....	24⅛	24	24⅛	24⅛	24⅛	24⅛
Sterling Ex..	4.8785	4.8790	4.8800	4.8805	4.8815	4.8810

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to June 10:

	1908.	1909.	Changes.
India.....	£ 3,698,158	£2,311,900	D. £1,386,258
China.....	516,400	1,075,100	I. 558,700
Strait.....	90,510	82,800	D. 7,710
Total.....	£ 4,305,068	£3,469,800	D. £ 835,268

Imports for the week, £205,500 from New York. Exports, £1500 to Egypt and £95,700 to India; £97,200 in all.

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
17	13⅝ @13⅝	13 @13⅛	58⅝	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½
18	13⅝ @13⅝	13 @13⅛	58⅛	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½
19	13⅝ @13⅝	13 @13⅛	.	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½
21	13⅝ @13⅝	12⅞ @13⅛	58½	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½
22	13⅝ @13⅝	12⅞ @13⅛	58⅝	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½
23	13⅝ @13⅝	12⅞ @13⅛	58⅝	29⅝	4.35	4.27½ @4.32½	5.27½ @5.32½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The weakness on the Stock Exchange in the early part of the week June 17-23 had a pronounced influence on the temper of the holders of speculative copper both here and in Europe, and the market became deluged with offerings from these sources at lower prices. When the level for electrolytic had come down to the parity of the standard market, consumers showed more interest and a fair amount of business is reported as having been done in this country and abroad. There was no open market for Lake copper, sellers being disinclined to lower their prices in proportion to the decline in electrolytic, and for that reason such transactions as were reported appear to have been for special purposes.

The market has been very much mixed. The United Metals Selling Company has continued to ask 13⅞c. for Lake and 13¾c. for electrolytic, delivered, 30 days, but is doing no business at those figures, and is maintaining former asking prices simply because it has no present wish to meet the market. Calumet & Hecla is also understood to be temporarily out of the market. On the other hand the majority of the large selling agencies have been taking, at the declining prices, such business as has been offered, and certain first hands have manifested some pressure to sell. A good deal of speculative copper has been offered by second hands and some transactions have been made by them at prices below those which represent the bulk of the business, sales netting as low as 12¾c. having been made. The market for Lake has held up better than for electrolytic, because there is but little of this grade that is pressed for sale, and some consumers who have been obliged to buy have paid as high as 13⅝c. for relatively small quantities. Sentiment as to the market in the immediate future is mixed. There remains some of the optimism of a little while ago, which is expressed in the idea that there will be a rally from present prices, especially if the London market takes a turn upward. In other quarters ideas are pessimistic in view of the continued large production. The market closes at 13⅜@13⅝c., nominally, for Lake, and 12⅞@13⅛c. for electrolytic. The average of the week for casting copper has been 12¾@13 cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire is 15c. base, carload lots at mill.

Some new prices on brass products were put in effect June 21. The base price on high brass sheets is now 14½c.; on high brass wire, 14¾c., and on high brass rods, 14¾c. per lb. The base price on brazed brass tubing remains 20⅜c. per pound.

The London market on Thursday and Friday bordered on demoralization, spot at one time reaching £58 and three months, £58 15s. Supporting orders as well as bear covering stayed the decline. The close is higher and the tendency better at £58 12s. 6d. for spot and £59 10s. for three months.

For refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £61 10s.@£62 10s.; strong sheets, £73 10s. @ £75 10s.

Exports of copper from New York and Philadelphia for the week were 7857 long tons. Our special correspondent gives the exports from Baltimore at 1215 tons copper.

Tin—In sympathy with copper, tin has shown a declining tendency in London. Shipments from the Straits are reported as being larger than anticipated, while consumption in the United States leaves much to be desired. The close is cabled at £133 for spot and £134 10s. for three months.

In the domestic market, consumers are holding off and cannot even be tempted by offers below the import basis, at which some dealers are trying to dispose of spot material. The market at the close is quoted at about 29¼ cents.

Lead—Business has been quiet and prices are unchanged at 4.27½@4.32½ St. Louis, and 4.35, New York, for ordinary brands. Chemical lead has sold at St. Louis at 4.35 during the week.

The London market is neglected, the close again being a trifle lower at £13 for Spanish, and £13 2s. 6d. for English.

Spelter—The Senate on June 16 adopted the zinc ore schedule proposed by the Finance Committee, which provides for 1c. duty on the full zinc contents of all ores containing over 25 per cent. Lower duties are assessed on ore containing less than 25 per cent. which, however, means nothing to the smelters as they cannot treat ores for the purpose of making spelter containing less than 30 per cent. zinc, and besides the high freight charges make it impossible to import lower grades at a price which would permit of profitable mining.

The spelter market has shown persistent strength and while the extreme activity has subsided now that the worst is known, there is an inflow of orders and the close is firm and higher at 5.42½@5.47½c. New York, 5.27½@5.32½c. St. Louis.

New York quotations for spelter were 5.42½@5.47½c. for June 17 to 23, inclusive.

The London market is a shade lower in sympathy with the other metals there, the close being cabled at £21 17s. 6d. for good ordinaries, and £22 2s. 6d. for specials.

Base price of sheet zinc is 7c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—The market continues dull with only small sales. Prices are nominally unchanged at 8⅛c. for Cookson's, 7⅞c. for U. S.; 7⅜@7⅝c. for outside brands. Some sales are made subject to tariff should a tax be imposed.

Aluminum—No. 1 ingots are quoted 22 @24c. base; wire, 31@32c. base; sheets 33@34c. base. Business is rather quiet.

Quicksilver—There has been a slight improvement in business, but no change in prices. New York quotation is $44.50 per flask of 75 lb. San Francisco, $44 for domestic and $42 for export. London price is £8 7s. 6d. per flask, but jobbers continue to offer at 5s. less.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotations 75c. per lb., in 100-lb. lots, at Cleveland, Ohio. In Germany, 450@475 marks per 100 kg. at factory.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, five months ended May 31, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	54,128	27,984	Imp. 26,144
Copper, 1908....	64,935	27,400	Imp. 37,535
Tin, long tons....	15,846	17,193	Exp. 1,347
Tin, 1908.....	18,624	17,368	Imp. 1,256
Lead, long tons..	91,615	19,430	Imp. 72,185
Lead, 1908.....	99,198	23,488	Imp. 75,710
Spelter, l'g. tons.	45,279	2,713	Imp. 42,566
Spelter, 1908....	44,808	8,262	Imp. 36,546
Quicksilver, lb...	1,717,168	418,982	Imp. 1,298,186
Quicksilver, '08	2,129,327	754,965	Imp. 1,374,362
Ores:			
Tin ore and con.	9,686	.....	Imp. 9,686
Tin ore, 1908...	10,527	.....	Imp. 10,527
Pyrites.....	328,597	.....	Imp. 328,597
Pyrites, 1908...	366,162	.....	Imp. 366,162

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 128 tons copper matte, 14,203 tons fine copper and 15,086 tons lead. The lead was chiefly Mexican, refined in this country.

British Iron Trade—Exports and imports of iron and steel and of machinery in Great Britain, five months ended May 31, as valued by Board of Trade returns:

	Exports.	Imports.	Excess.
Iron and steel	£15,227,591	£ 3,090,849	Ex. £12,136,742
Machinery...	11,595,901	2,000,790	Ex. 9,595,111
New ships....	2,799,954	.....	Ex. 2,799,954
Total..... ..	£28,623,455	£ 5,091,639	Ex. £23,531,817
Total, 1908..	33,601,827	5,377,208	Ex. 28,224,619

Decrease in exports, £4,978,371, or 14.8 per cent.; decrease in imports, £285,569, or 5.3 per cent. The quantities of iron and steel of all kinds were, in long tons:

	1908.	1909.	Changes.
Exports.....	1,741,392	1,651,440	D. 89,952
Imports.....	420,887	460,792	I. 39,905

The increase in quantities imported was mainly in billets, blooms and other half-finished material.

Iron Ore Imports—Imports of iron ore into Great Britain for the five months ended May 31 were 2,402,147 long tons in 1908, and 2,345,119 in 1909; decrease, 57,028 tons. Of the imports this year 1,800,246 tons were from Spain.

Zinc and Lead Ore Markets

Joplin, Mo, June 19—The highest price paid for zinc was $47 per ton, the base offerings for heads of sulphide ore ranging from $43 to $45 per ton of 60 per cent. zinc; slimes sold as low as a base of $40; silicate prices ranged from $16 to $23; the average price, all grades, was $40.68 per ton. The highest price paid for lead was $60, medium grades commanding from $57 @59.50. The average price, all grades, was $58.04 per ton.

Only one bin of zinc ore was known to have sold on a base price of $45; the bins of the producers in the north part of Webb City, who are holding for a $45 base were passed by the purchasing agents, for some who were not demanding so high a figure.

Several large bins of zinc ore were purchased on a base of $44.50, the smelters curtailing their purchases to 550 tons less than the previous week.

Platteville, Wis., June 19—The highest price paid this week for zinc ore was $45; the base price of 60 per cent. zinc was $44 per ton. The top price paid for lead ore was $59 the base price, 80 per cent., was $57@58 per ton.

SHIPMENTS, WEEK ENDED JUNE 19.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Strawbridge.....	640,000	.....	.....
Benton..... ...	434,340	.....	.....
Platteville	428,490	.....	151,200
Hazel Green.....	412,400	77,700	.....
Cuba City	388,445	.....	79,000
Livingston	150,000	.....	.....
Harker.....	64,580	.....	.....
Linden.....	63,370	.....	.....
Total.....	2,681,625	77,700	230,200
Year to June 19.....	54,794,055	2,393,480	4,621,400

In addition to the above there was shipped to the American Zinc Ore Separating Company, 1,150,770 lb. and to the Joplin Separator Works, 66,000 lb. zinc concentrates.

SHIPMENTS, WEEK ENDED JUNE 19.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,236,810	872,810	$ 93,481
Joplin.....	2,089,910	334,190	55,752
Galena	684,320	57,770	16,017
Duenweg.....	586,320	104,710	15,371
Prosperity.....	379,310	132,040	11,827
Miami	333,870	136,680	9,638
Carthage	425,360	.....	9,357
Aurora	567,800	.....	9,149
Alba-Neck	390,220	12,970	8,960
Spurgeon.....	271,040	117,940	7,942
Badger	325,630	4,420	7,127
Granby	514,790	10,000	7,006
Carl Junction.....	90,530	.....	2,036
Oronogo ...	110,580	2,120	2,027
Stott City.....	63,000	.....	1,323
Sarcoxie..... ...	53,460	.....	1,123
Quapaw.....	55,240	.....	1,104
Totals	10,177,190	1,785,650	$259,240
25 weeks.....	281,351,060	45,610,810	$6,386,336

Zinc value, the week, $207,078; 25 weeks, $5,163,207
Lead value, the week, 52,162; 25 weeks, 1,223,129

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1908.	1909.	All Ores. 1908.	1909.	Lead Ore. All Ores. 1908.	1909.
January.....	$37 60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April.....	35.40	38.63	34.08	37.01	52.47	55.63
May.....	34.19	40.06	33.39	37.42	56.05	56.59
June.....	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	69.90	.....
August	36.63	.....	33.42	.....	60.34	.....
September ..	37.63	.....	34.44	.....	54.69	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November...	39.13	.....	35.02	.....	54.63	.....
December...	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, June 23—Business is improving a little both on spot and contract deliveries and dealers are looking forward rather hopefully to the fall trade. In a few lines, however, trade is backward.

Copper Sulphate—The market has been rather quiet and prices have been shaded a little. Current quotations are $4.22½ per 100 lb. for carload orders and $4.32½ @4.35 per 100 lb. for smaller parcels.

Nitrate of Soda—A good business continues to be done in this article at current prices which are unchanged at 4.15c. for spot and 4.12½c. for futures.

Arsenic—The market is rather quiet, with few sales, and prices quoted are 2¾ @3c. per lb. for white arsenic.

Mining Stocks

New York, June 23—The feature of the general stock market this week has been a marked reaction which carried down prices of a number of stocks. Steel Corporation issues receded, although the loss was not as marked as in some other stocks. Business was active and many shares changed hands.

On the Curb the copper stocks showed more or less weakness, with one or two exceptions. Nevada Consolidated was strong and reached its highest price at a little above $24, notwithstanding the break in other shares. The dealings in this stock were large. Nevada gold stocks sold well and seem to be attracting more attention than they have been, which is rather unusual for a hot-weather week.

The Cobalt stocks are gaining both in prices and in the volume of dealings.

Boston, June 22—There has been a gradual weakening in copper-mining share prices due to the lack of public interest. The market is almost entirely professional. The declines have been general and not confined to any particular class of stocks. No unfavorable mining developments are heard.

Amalgamated has broken almost $7 during the week to $77.75 with no recovery. The movement is entirely professional and is the result of the general decline in the New York.

One thing in favor of copper-mining shares is that they have had no prolonged upward movements, so that the decline cannot go very far. A buying movement in Nevada Consolidated for New York account caused a $1.50 advance to $24.12½. Shannon rights are off to 10c., but there has been a large business in them.

Gossip of the week tells of an amalgamation of the Boston Consolidated and the Utah Copper Company on a basis of 2½ shares of the former for one of the latter. Application has been made to list the new Arcadian Copper Company's stock on the Exchange as 76,000 shares of the old company have been exchanged for the new stock. In Mexico Consolidated affairs a former director is said to have sold some 15,000 shares in the market recently and put a part of the proceeds into Davis Daly. The Alvarado silver mines will soon be floated by an issue of 200,000 shares of treasury stock.

STOCK QUOTATIONS

NEW YORK	June 23
Name of Comp.	Clg.
Alaska Mine	.15
Amalgamated	78¾
Anaconda	47¼
Balaklala	12½
British Col. Cop.	7½
Buffalo Mines	3½
Butte Coalition	21¾
Colonial Silver	.30
Cum. Ely Mining	8
Davis-Daly	5 1/16
Dominion Cop.	7
Douglas Copper	3½
El Rayo	2
Florence	3¼
Foster Cobalt	.32
Furnace Creek	.10
Giroux	7½
Gold Hill	⅛
Goldfield Con.	7 1/16
Granby	104
Greene Gold.	¼
Greene G. & S.	9
Guanajuato	1½
Guggen. Exp.	196
Hauapah	.15
Kerr Lake	7⅞
McKinley Dar.	.93
Miami Copper	15⅞
Micmac	⅝
Mines Co. of Am.	⅝
Montezu. of C. R.	34
Mont. Shoe. C.	1½
Nev. Utah M. & S.	2
Newhouse M. & S.	1¾
Nipissing Mines	10½
Old Hundred	⅝
Silver Queen	35
Stewart	⅛
Tennessee Cop'r	37¾
Tri-Bullion	1/16
Union Copper	¼
Utah Apex	6¾
Utah Copper	49
Yukon Gold	4½

NEW YORK	June 23
Name of Comp.	Clg.
Adventure	7⅝
Allouez	‡40½
Am. Zinc	27⅞
Arcadian	4⅝
Arizona Com.	39½
Atlantic	9⅛
Boston Con.	14¾
Calumet & Ariz.	102
Calumet & Hecla	650
Centennial	31
Copper Range	79⅞
Daly-West	‡8
East Butte	12
Franklin	16½
Greene—Can.	10
Hancock	11
Isle Royal	25⅛
Keweenaw	4⅝
La Salle	13
Mass.	8¾
Michigan	10
Mohawk	65
Nevada	23¼
North Butte	56
Ojibway	10¾
Old Colony	‡.60
Old Dominion	51⅞
Osceola	135
Parrot	30
Quincy	88
Rhode Island	14¼
Shannon	10⅛
Superior	41⅛
Superior & Bost.	14⅛
Superior & Pitts.	13⅞
Tamarack	70
Trinity	10⅛
U. S. Sing. & Ref.	48⅛
U. S. Sm., & Re., pd.	49¾
Utah Con.	12
Victoria	4⅛
Winona	13⅛
Wolverine	148
Wyandot'e	2¾

‡Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	42
Am. Smelt. & Ref.	88¾
Am. Sm. & Ref., pf	109
Colo. Fuel & Iron	41¼
Federal M. & S., pf.	‡88¾
National Lead	83
National Lead, pf.	107
Pittsburg Coal	11¾
Republic I. & S.	29⅞
Republic I. & S., pf.	103⅜
Sloss-Sheffield	81
Standard Oil	685
U. S. Steel	65
U. S. Steel, pf.	122¾
Va. Car. Chem.	52

BOSTON CURB	Low.
Ahmeek	160
Black Mt.	1
Chemung	17
Corbin	‡8
Globe Con.	4
Helvetia	5½
Ray Central	3
Ray Con.	‡17⅛
San Antonio	10⅛

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	June 19	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	2 00	1.50
Cent.C.& C.	83 00	80 00
C.C. & C. pf.	82.00	80 00
Cent. Oil	110 00	100 00
Columbia	8.00	5 00
Con. Coal	20 00	19 00
Doe Run	110 00	100 00
Gra. Bimet.	.22	.22
St. Joe	12 00	11 00

LONDON	June 23
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton'sInd.	0 3 1½
Camp Bird	1 8 6
Esperanza	2 15 7½
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 13 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. June 22.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.38
Best & Belcher	.36
Caledonia	.22
Challenge	.19
Comstock	.30
Con. Cal. & Va.	.78
Crown Point	.40
Exchequer	.28
Gould & Curry	.18
Hale & Norcross	.22
Mexican	.91
Ophir	1.52½
Overman	.23
Potosi	.20
Savage	.21
Sierra Nevada	.27
Union	.47
Utah	.04
Yellow Jacket	.48
TONOPAH STOCKS	
Belmont	.89
Extension	.48
Golden Anc'	.51
Jim Butler	.09
MacNamara	.25
Midway	.22
Montana	.60
North Star	.02
Tone'h Mine of N.	7 12½
West End Con.	23
GOLDFI'D STOCKS	
Adams	.01
Atlanta	.14
Blue Bell	.03
Booth	.13
Columbia Mt.	.10
Comb. Frac.	.54
Con. Red Top	‡ .57
Cracker Jack	.02
Dia'dfield B. B. C.	.03
Goldfield Belmont	.04
Goldfield Daisy	.27
Great Bend	.06
Jumbo Extension	.12
Kendall	.03
Lone Star	.04
May Queen	.04
Oro	.06
Red Hill	.06½
Roanoke	‡ .08
Sandstorm	.09

Name of Comp	Clg.
Silver Pick	.12
St. Ives	.10
Triangle	.01
BULLFROG STOCKS	
Gibraltar	.02
Homestake King.	.01
Mont. Shoshone C.	1.50
Tramp Cons.	.05
MISCELLANEOUS	
Greenwa'r Copper	.06
Nevada Hills	.87½
Nevada Smelting.	1.00
Nevada Wonder	.50
Nevada-Utah	1.93¾
Ponn-Wyoming	...
Pittsburgh S. Pk.	.48
Ray Central	2.87½
Round Mt. Sphinx	.10

COLO. SPRINGS	June 18
Name of Comp.	Clg.
Acacia	.06⅞
C. C. Con.	.03½
Dante	.05½
Doctor	.08½
Elkton	.64⅞
El Paso	.51
Findlay	‡.12
Gold Dollar	.10⅛
Gold Sovereign	.03⅛
Isabella	.22
Jack Pot	.06⅛
Jennie Sample	.07⅝
Jerry Johnson	.06¼
Lexington	.04
Mary McKinney	‡ 39⅛
Pharmacist	.02⅞
Portland	.88
Un. Gold Mines	.05¾
Vindicator	.60
Work	.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Black Jack, Utah	June 15	July 8	$0.01
Bullion, Nev	June 14	July 13	0.05
Challenge Con., Nev	June 22	July 13	0.05
Choliar, Nev	June 8	June 30	0.10
Con. Imperial, Nev	May 26	June 17	0.01
Gould & Curry, Nev	June 8	June 26	0.10
Julia Con., Nev	May 24	June 17	0.03
Mexican, Nev	June 28	July 14	0.10
Mountain Dell, Utah	July 19	Aug. 5	0.01
N. Y. Bonanza, Utah	July 10	July 31	0.03
Palmyra G. & C., Utah	June 11	June 30	0.001
Paymaster, Utah	June 12	June 30	0.001
Potosi, Nev	July 9	Aug. 2	0.10
Progressive, Utah	June 23	July 14	0.01
Scorpion, Nev	June 14	July 6	0.02
Scottish Chief, Utah	July 7	Aug. 4	0.01
Seg. Belcher, Nev	July 7	July 29	0.03
Seven Troughs Mon., Nev	June 23	July 10	0.00
Silver King Con., Utah	July 6	July 17	0.10
Union Con., Nev	June 28	July 19	0.10
Yellow Jacket, Nev	July 13	Aug. 5	0.25

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.429	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.561	12.928	12.932	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.949	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908.	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	.....	.....	12.600	.....
July	4.744	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York 1908.	New York 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.891	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.